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Digital TV Antenna Systems

2013

Handbook

Non-Mandatory Document

DIGITAL TV ANTENNA SYSTEMS

INFORMATION HANDBOOK

2013

Important Notice and Disclaimer

This Handbook on Digital TV Antenna Systems is one in a series of Information Handbooks produced by the Australian Buildings Codes Board (ABCB) with the aim of providing construction industry participants with best practice advice and guidance on specific topics. This Handbook is not mandatory or regulatory in nature and is provided for general information only. It should not be taken as advice in relation to any particular circumstances.

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National Construction Code (NCC)

The NCC is an initiative of the Council of Australian Governments (COAG) developed to incorporate all on-site construction requirements into a single code.

The NCC comprises the Building Code of Australia (BCA), Volume One and Two; and the Plumbing Code of Australia (PCA), as Volume Three.

- Volume One: pertains primarily to Class 2 to 9 buildings.
- Volume Two: pertains primarily to Class 1 and 10 buildings.
- Volume Three: pertains primarily to plumbing and drainage associated with all classes of buildings.

All three volumes are drafted in a performance format allowing a choice of Deemed-to-Satisfy Provisions or flexibility to develop Alternative Solutions based on existing or new innovative building, plumbing and drainage products, systems and designs.

To assist in interpreting the requirement of Volume One, the ABCB also publishes a non-mandatory Guide to Volume One each year. For Volumes Two and Three, clearly identified non-mandatory explanatory information boxes are included in the text to assist users

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Preface

The Inter-Government Agreement (IGA) that governs the ABCB places a strong emphasis on reducing reliance on regulation, including consideration of non-regulatory alternatives such as non-mandatory guidelines, information handbooks and protocols.

This Information Handbook is one of a series produced by the ABCB. The series of Information Handbooks is being developed in response to comments and concerns expressed by government, industry and the community that relate to the built environment. The topics of Information Handbooks expand on areas of existing regulation or relate to topics which have, for a variety of reasons, been deemed inappropriate for regulation. The aim of the Information Handbooks is to provide construction industry participants with best practice, non-mandatory advice and guidance on specific topics.

The Digital TV Antenna Systems Information Handbook has been developed to prepare for the switchover to digital television. This Handbook was developed by industry to assist those who live in or are associated with multi-dwelling units (unit or apartment blocks, townhouses etc.) or other buildings with shared antenna systems such as public buildings and hotels.

Acknowledgements

This Handbook was developed by industry, coordinated by the Digital Switchover Taskforce in the Department of Broadband, Communications and the Digital Economy (DBCDE) with support from the Australian Communications and Media Authority (ACMA) and issued as a Handbook by the ABCB to assist in disseminating information to building and construction practitioners.

Acknowledgements:

- The Digital Switchover Taskforce in the Department of Broadband Communications and the Digital Economy (DBCDE).
- The Australian Communications and Media Authority (ACMA).

This Handbook could not have been developed without the assistance and technical expertise of MATV consultants, installers and system integrators; and antenna installers, manufacturers, suppliers, retailers and wholesalers; the subscription television industry; and the following broadcasters:

- Australian Broadcasting Corporation (ABC)
- Special Broadcasting Service (SBS)
- Channel 7
- Channel 9
- Channel 10
- Prime
- Southern Cross Austereo
- GWN7
- WIN
- Imparja
- NBN Television

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1 Introduction

Reminder:

This Handbook is not mandatory or regulatory in nature and compliance with it will not necessarily discharge a user's legal obligations. The Handbook should only be read and used subject to, and in conjunction with, the general disclaimer at page ii.

The Handbook also needs to be read in conjunction with the building legislation of the relevant State or Territory. It is written in generic terms and it is not intended that the content of the Handbook counteract or conflict with the legislative requirements, any references in legal documents, any handbooks issued by the Administration or any directives by the Building Control Authority.

1.1 Background

Free-to-air (FTA) TV in Australia has been broadcast using analog signals since 1956. These analog TV signals are in the process of being replaced by more efficient digital transmissions that are already on air in most locations.

On 19 October 2008, Senator the Hon Stephen Conroy, Minister for Broadband, Communications and the Digital Economy, announced the timetable for areas to switch to digital-only television transmission, which began in 2010 and will be completed by the end of 2013.

“The digital TV revolution is in full swing and Australians now know when they will need to be digital-ready,” Senator Conroy said.

Many areas of Australia have seen the successful transition to digital-only signals and there is a high level of awareness and readiness in the remaining switchover regions.

In June 2010, Senator Conroy announced that a digital dividend of 126 MHz would be realised. This spectrum is currently used for the transmission of television services on channels 52 to 69. The digital dividend is made possible by the move to digital-only television broadcasting under the Digital Switchover program.

While the switch to digital-only television will be completed by the end of 2013, the final step in the move to digital-only television will involve a significant number of digital television services moving to new frequencies or channels to make way for the dividend and the new services that it will be able to support, such as wireless broadband.

This process will involve a major reorganisation (or ‘restack’) of digital television services across Australia, with some equipment at affected transmission sites being retuned, replaced or otherwise modified. Generally, this will take place in an area after it has switched to digital-only television. Viewers will generally need to retune their receivers to retain access to digital television services that have undergone a channel change under restack. The government expects that restack will be completed by the end of 2014.

Households and building owners/managers in areas yet to switch need to consider whether their reception equipment and antenna systems are ready for digital and the restack of digital television services. Any necessary work should be planned and undertaken where practicable prior to switchover to ensure continued reception of TV services and to benefit from the additional services available for digital TV.

While most homes may not require any significant modification as a result of the switch to digital-only television or restack, some may need relatively modest upgrades to their antenna systems. Buildings which have shared or Master TV Antenna (MATV) systems may require more complex upgrades.

This Handbook was developed with industry to assist those who own or manage multi-dwelling units (MDUs) prepare their property for all stages of the switchover process. MDUs include unit or apartment blocks, townhouses, or other buildings with shared antenna systems such as public or commercial facilities and hotels.

If you are an architect, designer, developer, owners' corporation representative or strata or facilities manager, this information will help you prepare for the switchover from analog to digital FTA TV and restack. It is also a helpful tool for people involved in supplying or maintaining TV antenna and distribution systems.

1.2 Scope

This Handbook is written in general terms. It has been developed on issues relating to antenna systems for digital TV in buildings which have MATV systems. It has been written principally for a general audience.

In planning the installation or modification of antenna systems you should always consider other relevant requirements, including those relating to workplace or occupation health and safety, structural integrity, fire and electrical safety and both State/Territory and local government planning regulations or policies.

1.3 Limitations

This Handbook is not intended to:

- override or replace any legal rights, responsibilities or requirements; or
- provide users with the specifics of the NCC.

This Handbook is intended to make users aware of provisions that may affect them, not exactly what is required by those provisions. If users determine that a provision may apply to them, the NCC should be read to determine the specifics of the provision.

2 Definition of Terms

2.1 Analog TV

The analog TV system we are all familiar with commenced as black and white in 1956 and changed to colour in 1975. In Australian capital cities the common stations are ABC, SBS and channels 7, 9 and 10. In regional areas throughout Australia these are ABC, SBS and the affiliated TV networks are Prime, Southern Cross Austereo, WIN, GWN, NBN and Imparja.

Analog TV is subject to interference such as ghosting and impulse noise. Australian analog broadcasters use the Phase Alternating Line (PAL) system of analog encoding and modulate this signal onto a VHF or UHF radio carrier. In an analog system the signal is continuous and varies in sympathy with the source signal.

2.2 Amplifier

An amplifier device is used to boost the strength of TV signals received by the TV antenna. The most common form of amplifier used for TV reception is the Masthead amplifier, which should only be used to boost signals in weak signal reception areas. Distribution Amplifiers are also used in MATV systems to compensate for loss in the cabled distribution system and ensure the strength of the signal being received by each dwelling is correct.

2.3 Connectors

Connectors are used as a method of connecting coaxial cable. Compression connections are recommended because of the greater consistency of performance of the finished connection. The compression connector uses a conical compression that encircles the entire circumference of the RG cable, thus maintaining the integrity of the cable structure. This method provides excellent pullout strength and reduces signal ingress/egress providing superior connection and impedance matching.

2.4 Datacasting Services

Datacasting services are enhanced options offered with some digital programming to provide additional program material or non-program related resources, allowing viewers the ability to download data (video, audio, text, graphics, maps, services) to specially equipped computers, cache boxes or set-top boxes.

2.5 Digital TV

Digital TV is the sending and receiving of moving images, sound and other data by means of digital processes on radio of discrete (digital) signals, in contrast to the analog processed signals used by analog TV. Digital TV allows for greater consumer choice through more services - e.g. extra channels, wide-screen pictures, high definition, surround sound, etc. In the future, digital FTA services may include interactive services which will significantly enhance the user experience. However, it is important for the digital receiver to have good quality signals, as unlike analog TV, the picture and sound will suddenly breakup if the quality falls below a threshold (i.e. the digital 'cliff' effect). Picture breakup can also be caused by interference generated by electrical equipment, especially with those with arcing contacts, such as motors in hair driers, electric fences, etc. This is known as electrical impulse noise.

2.6 Digital Program Channel Numbers

As FTA broadcasters can send extra program channels in their digital TV transmissions, they can also assign a program number to those channels that a digital TV receiver uses so a viewer can press that number on their remote control to access a particular channel. For example, in many capital cities, the main Standard Definition (SD) programs are usually 2 (ABC), 3 (SBS), 7 (Seven Network), 9 (Nine Network), 10 (Network Ten); while correspondingly, the High Definition (HD) program channels would be found on 20, 30, 70, 90 and 1. In many regional areas the commercial broadcasters' SD program channels would be found on 5 (Southern Cross Austereo – Ten affiliate), 6 (Prime – Seven affiliate) and 8 (WIN or NBN – Nine affiliate). These program numbers are referred to as Logical Channel Numbers or LCNs.

2.7 Electronic Program Guide

An Electronic Program Guide or EPG is an application available on some digital receivers that provides an on-screen listing of programming and content available to digital TV viewers.

2.8 Flooded Cable

This type of coaxial cable is intended for use in a moist environment. It has a viscous sealing fluid under the outer protective plastic sheath, which in the case of a minor puncture, will reduce the likelihood of water getting in and the subsequent corrosion of the metallic components of the cable.

2.9 Free-to-Air (FTA) TV

FTA TV is delivered by broadcasters using transmitted radio signals in the air. These signals can be received within a given broadcast transmission area (e.g. Perth, Canberra, etc.) without charge by anyone with a TV connected to an appropriate indoor or outdoor antenna.

2.10 Headend

A headend is a piece of equipment connected between receiving antennas, or other signal sources, and the remainder of the cabled distribution system, to process the signals to be distributed. The headend might include amplifiers, frequency converters, combiners, diplexers, PAL modulators and transmodulators. An MATV headend is normally the initial distribution fan-out point in MDUs or other locations where many TVs need access to the digital TV channels and possibly other required services (e.g. FM radio or the new digital radio services).

2.11 High Definition (HDTV)

HDTV is currently the most superior video picture available in digital TV. The 1080i and 720p formats in a 16:9 wide-screen aspect ratio are the two commonly accepted high definition formats. Not all digital TV program channels are high definition. Both Standard Definition (SD) and HD program channels are carried together in FTA broadcasters' signals. If SD channels can be received, there is no need to upgrade an antenna system to receive HD, but a receiver that is capable of decoding HD is required.

2.12 Interactive Services

These are services which allow viewers to interact with their digital television through a set-top box or a television with an in-built digital tuner. Some common forms of interactivity allow viewers to change television show camera angles, participate in polls and provide other forms of audience responses to a program. An example of a more complex interactivity is the ability to order products through the television. The availability of interactive services depends on the capability of the digital tuner and of the television broadcaster to adopt this functionality into their transmissions.

2.13 Master Antenna TV (MATV) System

An MATV system can combine a variety of video media sources at a "headend" facility and distribute that video information from one source throughout a multi-dwelling unit environment (i.e. via cabling carrying the FTA TV signals from the roof to each dwelling). Other video media sources can be from a satellite dish, VCR, broadband connection, personal computers, or any other audio/video device.

2.14 Parental Guidance Rating

Broadcasters are required to include a Parental Guidance Rating for each program that is included in the Electronic Program Guide in their digital signal. There is now a Government requirement for manufacturers and suppliers of TV receivers or set-top-boxes with a FTA digital tuner to have a 'lock-out' feature that responds to the Parental rating of a program. Parents may then choose to activate it to their desired level to prevent their children watching programs rated

above the level they choose. This is one of the reasons that a TV distribution system should not alter the composition of the received FTA digital signal.

2.15 Parental Lock

Parental lock capabilities are the technical capabilities that will alone, or in conjunction with any other capability on domestic reception equipment, block a television program or datacasting content with a particular classification code from being shown unless the correct personal identification number (PIN) code is entered into the domestic reception equipment.

2.16 Quad-Shielded Coaxial Cable

This antenna cabling has four layers of shielding to prevent leakage or interference of TV signals.

2.17 Satellite Master Antenna TV (SMATV) system

An SMATV system extends the MATV system above the previous 862 MHz limit to encompass the satellite intermediate frequency of 950 – 2150 MHz. This allows for access to satellite and FTA TV services at the user's wallplate.

2.18 Subscription TV Services

Subscription digital TV services are provided by cable and satellite. A regular monthly fee is usually paid to maintain access to these services.

3 Switching to Digital TV

3.1 About this Handbook

The Digital Switchover Taskforce has worked with industry to develop two Handbooks that are designed to address issues surrounding the conversion of antenna systems to digital. The Handbooks are:

- Digital TV – Antenna Systems for Homes Handbook - addresses the conversion of TV systems in buildings with single antennas, such as free-standing homes.
- Digital TV – Antenna Systems Handbook – this Handbook – addresses the conversion of TV systems in buildings with shared antenna systems.

Both Handbooks are available from the Australian Building Codes Board (ABCB) website at www.abcb.gov.au and the Digital Ready website at www.digitalready.gov.au.

This Handbook has been developed to provide guidance on the conversion of FTA analog TV systems in MDUs and other buildings with shared antenna or MATV systems. It is intended to be a useful resource to use when contracting the services of MATV consultants, installers and system integrators, as well as antenna manufacturers, suppliers, retailers and wholesalers.

The Handbook provides information for those involved in the design, construction maintenance and operation of new and existing buildings and their in-building TV distribution systems.

3.2 About digital TV

The switch-off of analog TV signals began in Australia in 2010 and by the end of 2013 all TV channels will be broadcast in digital-only. Digital TV is already available in most areas of Australia.

It may take some time to plan the installation or upgrade of MATV systems to receive digital TV. You may need to factor in availability of skilled installers and equipment, such as headends and amplifiers. It is best to start considering what changes may be necessary as early as possible to ensure your property is ready for the switch to digital-only television in your area and, where applicable, for restack. Your installer will be able to assist you in setting up a system that prepares for restack at the same time as getting the property ready for digital TV. For more information refer to the Restack and the Digital Dividend section on in this Handbook.

The digital switchover timetable available at Appendix B shows the schedule for the switch-off of analog TV signals, region by region, across the country.

Information about the television channel changes necessary for restack is available from the ACMA website at www.acma.gov.au/WEB/STANDARD/pc=PC_312417.

Further information on the restack schedule is available from the Department of Broadband, Communications and the Digital Economy's website at www.dbcde.gov.au/restack.

The *mySwitch* tool on the Digital Ready website provides detailed information about the switch to digital-only television based on individual addresses, including what services are available and when the area will make the switch. Go to www.digitalready.gov.au.

The Antenna Systems eToolkit (ASeT) provides access to detailed information about antenna equipment, cabling and installation, including cost estimates for the various technical solutions, to help ensure adequate digital television reception and system distribution. ASeT is available at www.digitalready.gov.au/mdu.

3.3 Converting to digital TV

Not all antenna distribution systems will need to be replaced to receive digital TV. Existing equipment including antennas, satellite dishes, headends and cabling may be able to be reused. In many cases, only one or two of the elements of an installation may require an upgrade.

To find out if an MATV system is capable of distributing digital signals, select a sample of residents in an MDU who have installed a high definition set-top box, digital Personal Video Recorder or a TV with a built-in digital tuner and see whether they can view digital services. It is important to include residents in the sample who live in different parts of the building or property as it is possible that digital signals are being carried reliably to some parts and not to others.

You should get a list of the available digital channels from *mySwitch* and scan across the services to see if they are all present. You only need to look at one digital service from each network to confirm if the MATV system is digital ready. For example, in a metropolitan area residents should be able to receive Seven Two, Nine Go, Ten One, ABC two and SBS HD. If all of these services can be viewed (and the resident does not have subscription TV[1]) the system is likely to be digital ready.

Residents who indicate they do have digital reception should be asked if the picture breaks up (pixellates) regularly, as this may point to the digital signal being marginal (see the information about the “digital cliff” in this Handbook). If this is the case, the MATV system may require an upgrade.

In some locations new TV transmitter sites may be established to improve the digital signal reception within that area. In these cases, a suitable antenna will need to be pointed towards that location in order to take advantage of the improved signal. Use *mySwitch* to find out the direction to the most suitable transmission site to point the antenna to.

[1] Subscription TV services may carry some but not all of the digital FTA services available in an area.

If any of the residents who have upgraded their TV equipment to digital are unable to receive some or all of the available digital channels reliably, the property's antenna system should be inspected by an antenna installer specialising in MATV systems. The Australian Government has set up the Antenna Installer Endorsement Scheme (AIES) to help ensure that consumers have access to knowledgeable and experienced antenna installers to assist them to get ready for digital TV. For more information about the AIES refer to the relevant section in this Handbook.

Costs associated with the upgrade process may include:

- changing the roof-top antenna/aerial
- buying a satellite dish
- running new cabling
- buying new amplifiers, multi-switches and channel processors
- labour costs associated with the design and installation of the system.

The ASeT online facility available from the Digital Ready website, includes calculators which provide estimates of installation and labour costs for MATV systems in multi-storey and high-rise buildings and in townhouses groups and retirement villages. To access ASeT go to www.digitalready.gov.au/mdu.

The existing infrastructure and the complete audio visual and communications requirements of the property should be taken into account when upgrading the MATV system. This includes allowing for any subscription TV services and provision of analog services during simulcast periods. Any new MATV system that has been installed following the Australian/New Zealand Standard[2] should be able to carry all digital TV signals available in an area to all of the residents' wall outlets.

You should take into account any changes to the available services that will occur at restack. For instance, a single UHF service you currently receive may move to another lower frequency. This may require an adjustment of an antenna systems' headend amplifier at the time the change occurs, or it may require more modules or filters to be added. Your antenna installer should be able to assist with this.

Where services are being simulcast prior to switchover, residents who have not yet converted all of their TVs to digital may wish to continue to watch the analog signals. However, upgrading an MATV system for digital TV may change the analog channel distribution. Building managers should advise residents who may be affected, as they may choose to upgrade their TVs ahead of the switchover in their area.

[2] Australian/New Zealand Standard AS/NZS 1367:2007 Coaxial cable and optical fibre systems for the RF distribution of analog and digital TV and sound signals in single and multiple dwelling installations

3.3.1 When is a system ready for digital TV?

A system is capable of receiving and distributing FTA digital transmissions from a roof-top antenna when:

- The system for FTA reception and distribution is installed in accordance with the design specifications and meets the requirements of the *Australian/New Zealand Standard AS/NZS 1367:2007, Coaxial cable and optical fibre systems for the RF distribution of analog and digital TV and sound signals in single and multiple dwelling installations.*

- A confirmation of performance is done by testing every wallplate outlet for all digital FTA signals to ensure they are within the level ranges specified in the Standard and free from interference. If there is a short term requirement for analog FTA signals this should also be checked. The complete unaltered digital television signal needs to be fed to the TV outlet. This ensures that a receiver has access to the whole signal required to find which services are available, as a broadcaster may add or change services from time to time.

3.4 Characteristics of digital TV

Digital TV provides an improved picture, better sound quality, more channels and a range of other features such as electronic program guides and parental lock.

3.4.1 The Digital Cliff

One of the benefits of digital TV is its ability to correct disturbances in the signal to keep the picture perfect, but as the disturbances become greater due to a weak signal, noise or other interference, there comes a point where the digital correction cannot cope. This means, that unlike analog TV reception quality which gradually fades when signal strength/quality decreases, a relatively small degree of change is required to shift digital TV reception from being perfect to disappearing completely.

This behaviour is known as the “digital cliff”. As the digital signal gets closer to the digital cliff, the sound distorts and the TV picture may break up into small blocks (known as pixellation). As the signal gets worse the picture may freeze, go blank and/or display a message such as ‘low signal’ or ‘weak signal’.

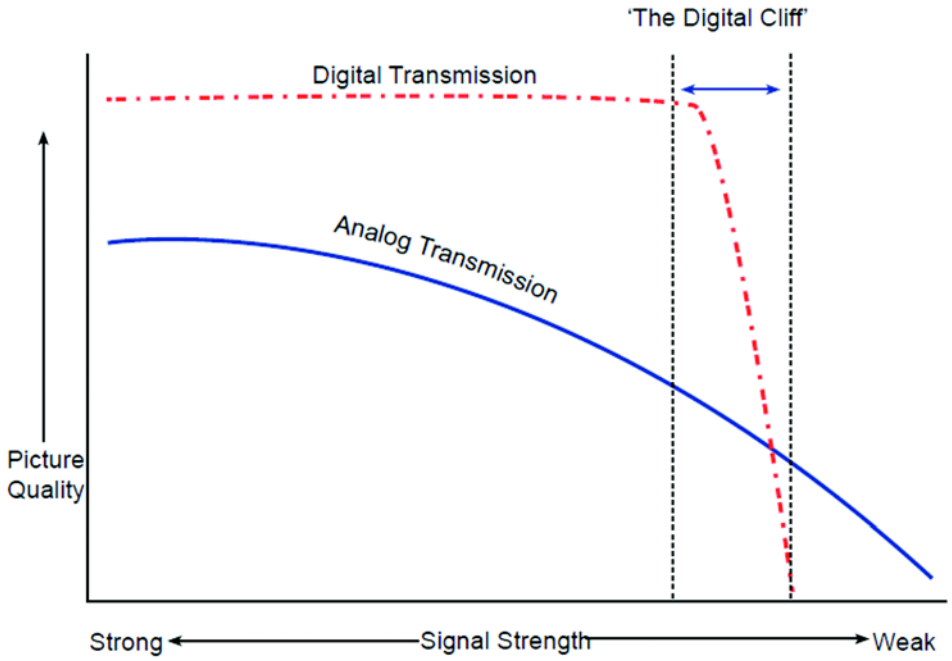

Figure 1: Comparing analog and digital transmissions

3.4.2 What does this mean?

When designing or upgrading a system, antenna installers need to consider the level and quality of the available signals, as well as the signal level and quality margins. These margins determine the robustness of the digital TV reception or how close the reception is to the digital cliff. If good quality digital TV pictures are received most of the time, with occasional picture break-up on one or more channels on rainy or windy days, this might be a sign that the signal level is less than adequate and is close to the 'cliff edge'. For more information, refer to the Measuring digital TV signal section in this Handbook.

A location that previously received a poor but watchable analog picture from a distant analog transmitter, may not be able to receive a digital picture from the same transmitter site. In some locations new gap-filler re-transmitter sites are being established to boost the signal. Antennas usually need to be re-pointed towards the new site for viewers in the coverage area to take advantage of it. In some cases, a new antenna may be needed because the signals will be transmitted on a different frequency band. In weak signal areas, masthead amplifiers and/or an antenna with greater gain may assist in achieving a satisfactory signal.

To prepare for restack, consideration should be given to the final channels on which services will be received as some antennas and equipment may need to be adjusted or replaced. For more information about the restack refer to the Restack and the Digital Dividend section of this Handbook.

For those who live outside the coverage area of terrestrial services or are otherwise unable to receive adequate digital terrestrial signals, a new FTA satellite TV service is available to ensure that they are able to enjoy the same benefits of digital television as other Australians. For more information refer to the Viewer Access Satellite Television section of this Handbook.

3.5 Receiving and distributing terrestrial digital FTA signals

The following criteria must be met to ensure that FTA signals are effectively received and distributed:

1. Each TV wallplate provides all the FTA off-air digital signals broadcast in that area so that all services offered by each broadcaster may be accessed by a digital TV receiver (e.g. a set-top box or an integrated digital tuner in a receiver with a TV screen display). To achieve this:

    - Each broadcaster's digital TV signal at the outlet must be complete (unaltered).
    - Each digital TV signal at the outlet must be within the specified voltage and signal quality levels.
    - Signals should not be adversely affected by interference – i.e. meet an adequate signal quality level[3]. Refer to the "Terrestrial signal" specifications in this Handbook for recommended signal levels.

2. TV signal levels at all outlets in the system are in the range specified:

    - in the Standard AS/NZS 1367:2007 for those installed in 2007 or later, or
    - in the Standard AS/NZS 1367:2000 for those installed between 2000 and 2007.

Note: Installations that have digital receivers at the headend which convert some of the broadcasters' programs to analog for distribution to analog receivers may be acceptable for motels and other commercial buildings, but should not be used for residential properties.

[3] Signal quality should be measured with an appropriate digital signal strength meter which is able to measure Carrier to Noise Ratio (C/N), signal level in dBµV and a parameter of signal quality – Modulation Error Ratio (MER) in dB.

3.6 Receiving and distributing satellite digital FTA signals

The following criteria must be met to ensure that Viewer Access Satellite Television (VAST) signals are effectively received and distributed:

1. Each TV wallplate provides the VAST signal so that a VAST approved set-top box can receive the full suite of services the consumer is entitled to receive. Each digital TV signal at the outlet must be within the required levels as detailed in the “Satellite signal” specifications in this Handbook.

2. Transcoded signals that are offered at the wallplate in DVB-T must meet all requirements listed in “Receiving and distributing terrestrial digital FTA signals” above.

3. Systems that provide the full VAST signal unaltered to the wallplate must meet the MER and C/N requirements detailed in the “Satellite signal” specifications in this Handbook.

Note: Installations that have digital receivers at the headend which convert some of the broadcasters’ programs to analog for distribution to analog receivers may be acceptable for motels and other commercial buildings but should not be used for residential properties.

3.7 Components of an MATV system

MATV systems are made up of a number of components. Below is an example of an FTA MATV system typically used in an MDU.

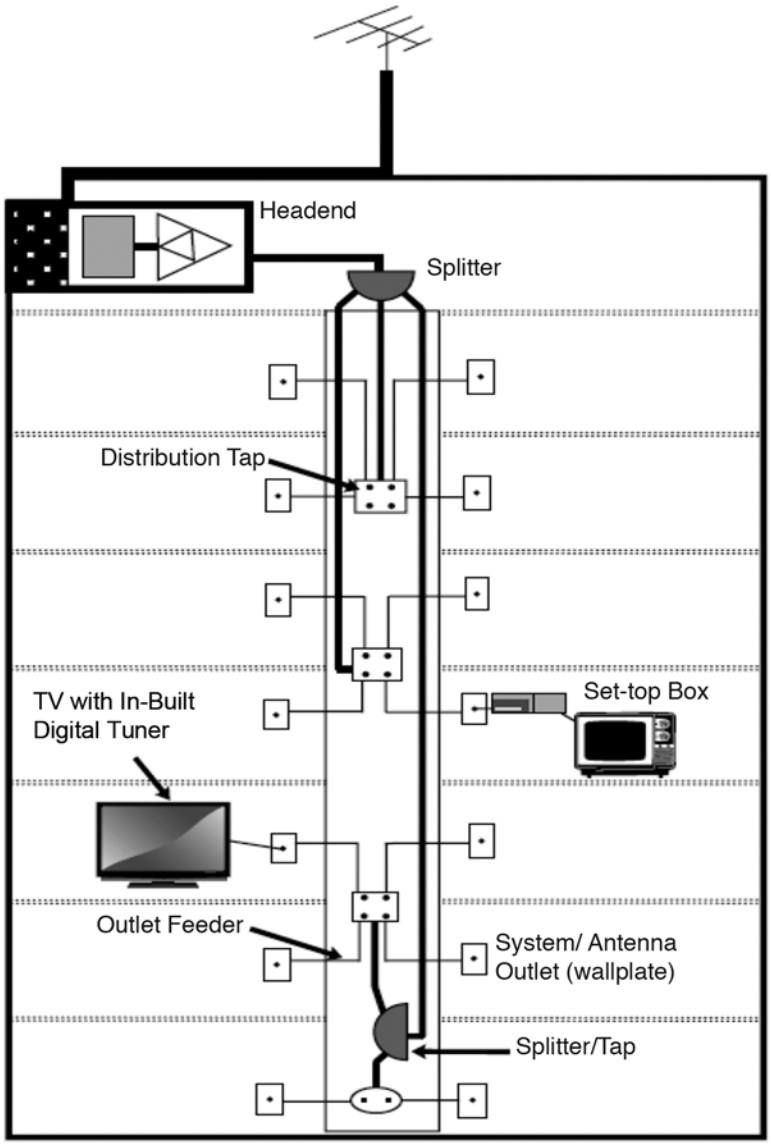

Figure 2: Example of a Multi-Dwelling Unit MATV System

Note: Some buildings may also have a satellite dish on the roof or underground cabling carrying subscription TV services. Other buildings may have a satellite dish instead of an antenna for carrying FTA satellite TV signals from the VAST service.

Following are recommendations regarding the main components of an MATV system to ensure the best possible digital TV reception.

3.7.1 Antennas

A roof-mounted, outdoor antenna will provide the strongest and most reliable digital TV signal. The antenna should be well secured and in good repair and have adequate bandwidth for all local services. It should also be capable of receiving, where applicable, the channels those services may be restacked to prior to end 2014.

It is unlikely that an indoor antenna will provide signals of a sufficient strength and quality to ensure reliable digital TV reception. Indoor antennas are also more susceptible to interference from the home environment. The movement of people can cause reception problems when an indoor antenna is being used. The biggest issue is likely to be the availability of all digital channels with the same orientation of the indoor antenna. However, there may be situations (i.e. in areas of very high signal strength) where indoor antennas may be sufficient.

Australian Communications and Media Authority (ACMA) planning for digital television services assumes that a roof-mounted, outdoor antenna is used for receiving signals.

Domestic receive antennas come in three basic designs:

- Yagi
  This is the most common design and has multiple bars attached to a central support bar. It is usually very directional and is available in low to high gain (i.e. with more elements), and in multiple Bands. Old designs that include very long back elements (designed for Channel 2 analog), should not be used for digital reception on VHF Band 3.

- Log-periodic
  This antenna is similar appearance to a Yagi, except that the elements are cross-connected and gradually get shorter towards the front. It usually has a broader pick-up beam and a more uniform response across the reception channels, but does not have as much gain as a Yagi with similar dimensions.

- Phased array
  This antenna has a shallow design, with large square or rectangular back mesh. The UHF version usually has a number of metal ‘bow-ties’ at the front. It is best used where the location is a long way away from the transmitter and the signal is weak.

The following parameters need to be taken into account when choosing the best antenna for an area:

- Frequencies (digital TV Band VHF or UHF) and restack frequencies
- Gain
- Front to back ratio
- Position and height above roof level, and
- Signal polarisation.

Taking frequencies into account when choosing an antenna will help ensure that digital TV reception is reliable at the time the installation takes place. It will also allow for future re-assignment of channels.

The table below shows the best type of antenna for the channels being used in an area for the transmission of digital television services. For details on what the channels are, check the *mySwitch* facility on the Digital Ready website (www.digitalready.gov.au). *mySwitch* shows coverage for each transmission site that may reach the address where the installation is taking place.

Restack will generally result in all digital television services in a local area being transmitted on channels located in one of five blocks of six channels: Block A (Channels 6-8 and 10-12); Block B (Channels 28-33), Block C (Channels 34-39), Block D (Channels 40-45) and Block E (Channels 46-51).

Examples of antenna choices							
Antenna Type	**Model A** Old VHF Band III	**Model B** VHF Band III	**Model C** VHF/UHF Wide Band	**Model D** VHF/UHF Combo	**Model E** VHF/UHF Combo	**Model F** UHF Band IV+	**Model G** UHF Wideband
Channels covered by Antenna	**0-10**[1]	**6-12**	**1-12**[1] **28-69**[2][3]	**2-12**[1] **28-40**	**6-12 28-36**	**28-52**[2][3]	**28-69**[2][3]
Pre-restack digital channels[4]							
VHF Band III (6-12)	✗	✔	✔	✔	✔	✗	✗
UHF Band IV (28-35)	✗	✗	✔	✔	✔	✔	✔
UHF Band V (36-69)	✗	✗	✔	**suitable up to 40**	✗	**suitable up to 52**	✔

Suitability for restack							
Block A (6-12)	✗	✔	✔	✔	✔	✗	✗
Block B (28-33)	✗	✗	✔	✔	✔	✔	✔
Block C (34-39)	✗	✗	✔	✔	✗	✔	✔
Block D (40-45)	✗	✗	✔	✗	✗	✔	✔
Block E (46-51)	✗	✗	✔	✗	✗	✔	✔

✔ suitable ✗ unsuitable

Table 1.1: Antennas Suitable for Restack

Notes:

1. Selecting a VHF antenna that receives the smallest range of channels required for the area will reduce the potential for reception of noise, electrical impulse or other interference that may severely degrade the digital signal quality. This antenna may need replacing or additional filters fitted if noise is encountered after the switch to digital-only television or restack.

2. Choosing a UHF Band IV+ antenna where possible could reduce the amount interference introduced by devices such as pagers and mobile telephones. This antenna may need replacing or additional filters fitted if noise is encountered post switchover or post restack.

3. New antennas that fit the new restack bands exactly may also be available. Model C (or G for UHF) offers the best initial solution but, depending on local conditions, models B and F in combination may give greater protection from interference.

4. For UHF, current digital television channels range from 28 to 69. After restack, only channels 28 to 51 will be in use for television in this band.

3.7.1.1 Gain

The gain required depends mainly on the predicted coverage from a transmitter site and any local obstructions. If the coverage is predicted to be “Good” on *mySwitch*, a standard gain antenna may be sufficient. However, if the installation is in a “Variable” coverage area, a high gain antenna is recommended.

The coverage prediction map on *mySwitch* does not include obstructions around the location of installation. These may include man-made structures, such as sheds, houses and wheat silos, and natural obstructions such as trees and other vegetation. Where there are such local obstructions, a higher gain antenna may be required, even where “Good” coverage is predicted.

3.7.1.2 Front to back ratio

Along with the gain, the front to back ratio determines the ability of the antenna to block out unwanted TV transmissions from other sites behind the antenna. Antennas with a high front to back ratio and a medium to high gain may be useful in single frequency networks[4] or situations where interference is present.

3.7.1.3 Position and height above roof level

The position of the antenna on the roof and the height of the antenna above the roof are critical factors in ensuring the best digital TV reception. Local obstructions need to be avoided in order to get the best signal available, therefore it is advisable to use a hand-held antenna with a variable length pole and a digital signal meter to try different positions for all services before choosing the final place for the installation.

An antenna installer familiar with the local area will be able to advise which type of antenna is best for a particular application. Antennas should meet requirements outlined in the Interim *Australian Standard, AS 1417:2011 Receiving antennas for radio and television in the VHF and UHF broadcast bands*.

[4] A single frequency network or SFN is a broadcast network where several transmitters at different sites simultaneously send the same signal over the same frequency channel.

3.7.1.4 Signal polarisation

The polarisation of the broadcasters' transmitted signal is determined by the ACMA and can be found under Technical Information on *mySwitch*. It is important that the receive antenna is polarised in the same way as the transmitted signal. Polarisation of receive antennas can be established by noting whether the antenna's elements are horizontal or vertical.

3.7.2 Cabling

It is recommended that RG6 and RG11 quad-shielded coaxial cable, and 'flooded' cable for all underground sections of the installation, be used.

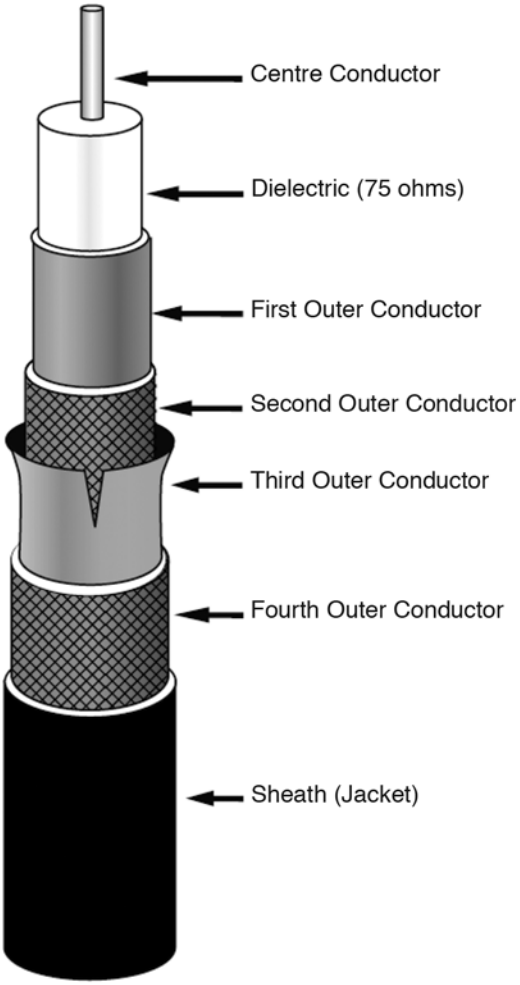

Figure 3: Quad Shielded Coaxial Cable

3.7.3 Connectors

Compression F-type connectors should be used for the interface between coaxial cables and passive or active devices. In systems used exclusively for terrestrial FTA TV services, PAL connectors may be used only at the front of the wallplate or on the flylead to connect to the consumer's equipment.

Although PAL-type connectors are still in widespread use for FTA TV equipment, the move to F-type connectors using compression connection is recommended because of its greater consistency of performance.

3.7.4 Amplifiers

Amplifiers are used in distribution systems to overcome losses in cables, connectors and splitters. Correctly locating amplifiers within the system and ensuring they have the correct gain settings is crucial for avoiding signal overload and degenerative noise effects.

There are two main types of amplifiers commonly used in TV reception systems - masthead amplifiers and distribution amplifiers. New amplifiers on the market are able to switch out channels 52 and above. This will reduce the amount of interference amplified by the system when channels 52 and above are used by mobile and other technologies.

3.7.4.1 Masthead Amplifiers

Masthead amplifiers are used to compensate for the losses of a signal from the antenna and cabling. These are usually used in domestic installations to ensure adequate signal strength reaches the wallplate(s).

Importantly, amplifiers simply provide more power and cannot improve the quality of the signal. They cannot be used to compensate for inadequate antennas as they are only able to boost whatever the antenna can pick up. A higher gain antenna will be able to pick up a better quality signal in areas of low signal strength. However, where an antenna is mounted on a mast, or at some distance from a distribution system, a masthead amplifier may well be part of a good system design.

It should be noted that in strong signal areas masthead amplifiers may be subject to signal overload and should be positioned so that they can be accessed easily if required.

3.7.4.2 Distribution Amplifiers

If the system needs to service a small number of outlets (usually up to about four) a simple distribution amplifier is likely to be sufficient. However, for a larger MDU, a complete headend system should be considered.

Amplifiers should meet the performance requirements described in the Australian/New Zealand *Standard AS/NZS 1367:2007*.

3.7.5 Headends

The term 'headend' is normally used to describe the equipment in an MDU that feeds the cables providing each residence with digital TV signals. There are five types of headends which vary in complexity. They are:

- Wideband amplifiers
- Channelised amplifiers
- Trans modulation headends
- Channel processing headends, and
- PAL remodulators.

3.7.5.1 Wideband Amplifiers

These are used in smaller MDU installations where signal conditions are good. They are the simplest form of headend.

3.7.5.2 Channelised Amplifiers

These are used when the MDU is larger and signal conditions are not ideal. Channelised amplifiers have an inbuilt filter so that it will only pass one or two channels into the cable network. By reducing the bandwidth of the amplifier, better noise performance is obtained and the distribution of the signal is improved. Several channelised amplifiers are used to cover all available channels.

A potential problem for this type of amplifier is the loss of reception on one or more channels if the frequency used for distribution of any of the channels changes. Since most of these types of amplifiers have their bandpass filters programmed during production, it is likely they will have to be replaced to recover any missing channels.

3.7.5.3 Trans Modulation Headends

This type of headend is designed to receive a signal under one type of modulation, such as from a satellite-delivered (DVB- S2) signal, and convert it to another type of modulation, such as standard terrestrial DVB-T signal. As it is remodulating the signal the output signal level can be accurately controlled to ensure good signal levels are maintained throughout the installation.

With these headends, the trans modulated quality will always be lower than the received quality.

Often trans modulation headends can be controlled and programmed via an internet connection which allows the channels being received to be changed remotely. They are often described as agile since the loss of any channel if a frequency is changed is only temporary, as it can be recovered remotely.

3.7.5.4 Channel Processing Headends

This type of headend receives the digital TV signal and retransmits it on the same or different frequencies through the cabling system. It also allows for a high level of control over the output levels and does not convert the transmission between differing modulation schemes.

As with the trans modulation type, the retransmitted signal from this headend will be lower quality than the received signal.

Channel processing headends may be programmed remotely to allow for the received channels to be reprogrammed if the transmitted frequencies change.

3.7.5.5 PAL Remodulated Headends

This type of headend consists of several receivers, often in the form of set-top boxes, which have their video outputs remodulated as an analog PAL signal and distributed to PAL receivers through a cabling system.

Both terrestrial and satellite digital TV signals can be distributed using this type of installation. It is important to note that many of the advantages of digital TV will not be available under this model, including improved picture quality, electronic program guides and surround sound.

Drawbacks of this type of headend include:

- They do not carry the complete broadcaster's signal and therefore do not allow for the following features to be used - electronic program guides (EPGs), the Parental Rating Guide for programs, closed captions, multi-channel sound or high definition and wide-screen pictures
- They cannot respond to changes such as the addition of new program channels or channel changes
- The set-top box receivers they use tend to hang up and need to be reset on a regular basis, and
- PAL tuners may be not be available in TV receivers once all analog transmissions have ceased, which may make it difficult to replace TVs being used in such an environment.

3.8 Other considerations

3.8.1 Building design

When designing a building or new antenna system, attention should be given to the amount of space available in risers for the routing of cabling and the installation of outlets.

3.8.2 Complying with Specifications and Standards

The National Construction Code and its referenced documents (which includes Australian Standards) may have additional provisions that impact on the installation of MATV systems. This Handbook does not describe or list all of these requirements.

State and Territory and/or local council planning regulations and policies should be taken into account when mounting antennas, masts and satellite dishes on buildings and structures, as development approvals may be required in some areas.

3.8.3 Watching analog or digital TV after a system is converted

Once an MATV system has been installed which meets the specifications outlined previously, residents in individual dwellings will need to purchase a set-top box, digital Personal Video Recorder or a TV with built-in digital tuner in order to receive digital FTA TV signals.

Viewers may need a VAST set-top box if free-to-air digital satellite signals are being distributed through the MATV system.

It is possible to design a system that allows a simulcast period by distributing both the analog and digital FTA signals while they are both available.

3.8.4 Documenting installations

A copy of installation documentation should be left on site to assist with future upgrades or repairs of the MATV system.

3.8.5 Health and Safety

Any contractor working on an antenna system should comply with all relevant Commonwealth and State or Territory workplace and occupational health and safety guidelines.

3.9 Measuring digital TV signal

3.9.1 Terrestrial signal

Due to the digital cliff effect, an accurate assessment of the quality of digital reception cannot be provided by simply measuring the signal level and looking at the quality of the TV picture. To properly assess the level/quality of reception at the dwelling, antenna installers need to use an accurate digital signal meter capable of measuring:

- Signal level in dBµV (some meters also indicate in dBm)
- Modulation Error Ratio (MER) in dB, and
- Pre-Viterbi Bit Error Ratio (BER).

The signal level measurement will determine the level of the received digital signal and the MER and BER measurements will provide an objective assessment of the quality, and the quality margin, of the signal.

Based on these measurements, the installer can determine how close the signal is to the digital cliff. These measurements may also help determine potential causes of reception problems and assist with finding solutions.

3.9.1.1 Signal Level

A good digital TV installation should provide an adequate signal level at the wallplate outlet. The recommended signal levels at the wallplate for terrestrial services are specified in Table 1.1. Ensuring the installation provides signal levels below the maximum avoids problems associated with overloading the receiver.

Digital FTA TV (DVB-T)	**Minimum**	**Preferred**	**Maximum**
Outlet signal level	45 dBµV	60 ~70 dBµV	80 dBµV

Table 1.2: Minimum and maximum signal levels required at the outlet

3.9.1.2 Modulation Error Ratio (MER)

The MER is the most appropriate measurement for determining reception quality. It measures all of the disturbances present in the signal and not just the BER. It is easily interpreted, as a value of MER of 25 dB or higher indicates a good signal condition.

The Signal to Noise Ratio (S/N or SNR) or Carrier to Noise Ratio (C/N or CNR) may appear to be the same as or convertible to MER. This is true in a Gaussian noise environment such as a digital cable transmission environment, but not in a terrestrial environment where it cannot be assumed that signal impairment is solely due to Gaussian noise. The SNR and CNR give some measure of how high the wanted level is above the noise floor, but do not give an overall quality measure as is provided by the MER.

3.9.1.3 Bit Error Ratio (BER)

The BER is a measurement of the ratio of bit errors to the number of bits transmitted. Receivers have in-built error correction decoders that use the forward error correction (FEC) data in the transmitted signal. These error correction processes are referred to as Viterbi and Reed-Solomon (RS) and most test meter units designed for DVB-T digital TV signals will be able to measure both pre-Viterbi and post-Viterbi BERs. That is, the error rate before and after the error correction process. If working above threshold and within the design range of input signal, the error rate after correction should be near zero.

The *Australian/New Zealand Standard AS/NZS 1367:2007* states the following:

> The BER should always be measured before Viterbi FEC rather than after Viterbi FEC (or pre RS) as the after Viterbi BER will very quickly, within typically 3 dB of the C/N threshold, decrease to zero errors (<1E-8) whereas the pre-Viterbi BER will typically still remain measurable.

As such, it is important that both the MER and pre-Viterbi BER are measured as combined they will provide a clearer indication of how far the signal is above threshold. This should be great enough to account for daily, seasonal and weather variations that may affect the signal propagation to the antenna.

3.9.1.4 Recommended MER and BER values

Table 1.2 contains values for MER and BER at the digital cliff and the recommended values that adequate to good installations should achieve.

	@ Cliff edge	**Minimum**	**Preferred**
Pre-Viterbi BER	Approx. 4E-2	8E-4	< 2E-7
MER	20 dB	25 dB	25 dB

Table 1.3: Pre-Viterbi BER and MER measurements

Note: these values correspond to the current transmission parameters used by most networks, but some broadcasters may use different parameters.

3.9.2 Satellite signal

The majority of satellite dishes used for domestic installations in the Ku Band Optus C and D series satellites are between 65cm and 100cm in diameter.

The C/N at the wallplate for DVB-S2 signal should be within 1 dB of that measured at the low-noise block downconverter (LNB) and should meet the minimum C/N and MER figures specified in Table 1.3.

All satellite dish installations must comply with the relevant wind loading codes (AS/NZS 1170.2) and be installed using the appropriately rated mounts. It is important to refer to the manufacturer's specifications for the type of mount to suit each premises and location.

Broadcast System Type	**C/N**	**MER**	**Signal Level**
	Minimum dB	Maximum dB	Preferred
DVB-S2	13	12	60 ~70 dBµV

Table 1.4: Digital signal quality at the system wallplate outlet

4 Subscription TV services

Some buildings may have a cable or satellite–delivered subscription TV service available to residents.

Modifications to subscription TV services should only be carried out in accordance with service level agreements in place between the facility owners and the subscription TV providers. Where these systems are intended to be used or modified, consultation with the relevant subscription TV providers should be sought to ensure minimal interruption to services.

If digital subscription TV services are being considered at the time of upgrading or installing a new system to cater for digital FTA TV, cabling provisions for both could be taken into account to ensure efficiency in costs and ease of access, to undertake all required works. Advice, standards and specifications for systems capable of receiving and distributing digital subscription TV services can be obtained by contacting your local subscription TV service provider.

5 Restack and the Digital Dividend

As the final step in the move to digital only television, all digital television services on channels 52 to 69 will need to move to a new channel below channel 52 to clear the Digital Dividend. The Government expects that this will occur by the end of 2014. Some other digital services, currently transmitted below channel 52, will also need to move channels to accommodate the relocated services and ensure broadcasting spectrum is organised more efficiently.

After restack, all digital television services in an area will generally be transmitted on channels located in one of five blocks of six channels: Block A (Channels 6-8 and 10-12[5]); Block B (Channels 28-33), Block C (Channels 34-39), Block D (Channels 40-45) and Block E (Channels 46-51). This is expected to make antennas, filters and amplifiers more efficient in an MDU and assist in blocking out noise and interference by only allowing these channels through the system.

Below is a table showing examples of current and restack channels for the six metropolitan areas. Note that these are from the Television Licence Area Plans (TLAPs) released by the ACMA, which can be found at the ACMA's website: http://www.acma.gov.au/WEB/STANDARD/pc=PC_410167

Licence area	Area Served	Current digital TV channels	Restack channels
Adelaide	Adelaide	33,12,6,8,11,30	7,12,6,8,11,30[1],10[2]
	Adelaide Foothills	61,64,57,66,54	34,39,35,36,37,38[2]
	Angaston RT	55,58,61,64,67	34,39,35,36,37,38[2]
	Cape Jervis RT	41,42,43,44,45	41,42,43,44,45,40[2]
	Carrickalinga RT	50,49,46,47,48	50,49,46,47,48,51[2]
	Craigmore/Hillbank	34,39,35,36,37	34,39,35,36,37,38[2]
	Elizabeth South RT	61,64	29,32

[5] Channels 9 and 9A are being reserved nationwide for digital radio.

Licence area	Area Served	Current digital TV channels	Restack channels
	Eudunda RT	69,66,57,60,63	34,39,35,36,37,38[2]
	Gumeracha RT	50,49,46,47,48	50,49,46,47,48,51[2]
	Lyndoch RT	53,56,59,62,65	34,39,35,36,37,38[2]
	Maitland RT	50,51,58,67,47	50,51,46,47,48,49[2]
	Mannum RT	41,42,43,44,45	41,42,43,44,45,40[2]
	Myponga RT	41,42,43,44,45	41,42,43,44,45,40[2]
	Normanville RT	39,38,35,36,37	39,38,35,36,37,34[2]
	Strathalbyn RT	41,42,43,44,45	41,42,43,44,45,40[2]
	Swan Reach RT	69,66,57,60,63	34,39,35,36,37,38[2]
	Victor Harbor	53,56,59,62,65	34,39,35,36,37,38[2]
	Yankalilla RT	41,42,43,44,45	41,42,43,44,45,40[2]
Brisbane	Boonah	39,42,51,45,48	40,42,41,45,44,43[2]
	Brisbane	36,12,6,8,11,38	7,12,6,8,11,38[1],10[2]
	Brisbane North West RT	69,41,66,43,44	45,41,42,43,44,40[2]
	Brisbane South East RT	44,29,35,41,32	33,29,30,31,32,28[2]
	Canungra RT	33,29,30,31,32	33,29,30,31,32,28[2]

Licence area	Area Served	Current digital TV channels	Restack channels
	Currumbin	36,62,53,59,56,65, 68,43	49,50,34,35,36,37, 38,39,51[2]
	Esk	51,39,45,42,48	34,39,35,37,38,36[2]
	Gold Coast	36,62,53,59,56,65, 68,43	40,41,42,45,44,46, 47,48,43[2]
	Gold Coast Southern Hinterland	36,62,53,59,56,65, 68,43	49,50,34,35,36,37, 38,39,51[2]
	Kooralbyn RT	33,29,30,31,32	33,29,30,31,32,28[2]
	Maroon RT	46,47,48,49,50	46,47,48,49,50,51[2]
	Mt Alford RT	67,55,58,61,64	50,49,46,47,48,51[2]
	Rathdowney RT	33,29,30,31,32	33,29,30,31,32,28[2]
	Sunshine Coast South	35,39,53,59,56	35,39,34,37,38,36[2]
Melbourne	Anglesea/Aireys Inlet RT	39,56,42,31,33	28,29,30,31,33,32[2]
	Ferntree Gully	50,47,41,44,54	40,43,41,44,45,42[2]
	Geelong RT	53,64,66,67,69	50,49,46,47,48,51[2]
	Healesville RT	34,35,36,37,38	34,35,36,37,38,39[2]
	Marysville	57,60,63,51,54	34,35,36,37,38,39[2]
	Melbourne	29,12,6,8,11,32	7,12,6,8,11,32[1],10[2]

Licence area	Area Served	Current digital TV channels	Restack channels
	Melbourne Inner Suburbs RT	57,60,63,51,54	40,43,41,44,45,42[2]
	Monbulk RT	53,49,46,52,48	50,49,46,47,48,51[2]
	Ocean Grove RT	57,60,63,51,54	40,43,41,44,45,42[2]
	Rosebud	57,60,63,51,54	40,43,41,44,45,42[2]
	Safety Beach	57,60,63,51,54	40,43,41,44,45,42[2]
	Selby	50,47,41,44,54	34,35,36,37,38,39[2]
	South Yarra	57,60,63,51,54,66	40,43,41,44,45,42[1,2]
	Upwey	50,47,41,44,54	34,35,36,37,38,39[2]
	Warburton (VIC)	57,60,63,51,54	34,35,36,37,38,39[2]
	Wye River RT	34,35,55,37,38	34,35,36,37,38,39[2]
Perth	Lancelin RT	40,41,42,43,44	40,41,42,43,44,45[2]
	Mandurah/ Singleton RT	30,31,45	30,31,33
	Perth	29,12,6,8,11,32	7,12,6,8,11,32[1],10[2]
	Perth Coastal RT	50,49,46,47,48	50,49,46,47,48,51[2]
	Perth City RT	50,49,46,47,48	50,49,46,47,48,51[2]

Licence area	Area Served	Current digital TV channels	Restack channels
	Roleystone	53,56,59,62,65	40,41,42,43,44,45[2]
	Toodyay	53,56,59,62,65	46,47,48,49,50,51[2]
	Two Rocks RT	28,38,30,31,33	28,29,30,31,33,32[2]
Sydney	Bouddi	34,37,61,62,65,59,68	40,41,42,43,44,46, 47,48,45[2]
	Gosford	34,37,61,62,65,59,68	40,41,42,43,44,46, 47,48,45[2]
	Kings Cross	34,30,48,33,45	32,30,28,33,31,29[2]
	Manly/Mosman	34,30,48,33,45	32,30,28,33,31,29[2]
	Picton RT	64,41,47,50,44	40,41,42,43,44,45[2]
	Sydney	34,12,6,8,11,29	7,12,6,8,11,29[1],10[2]
	Sydney North West RT	32,30,48,33,45	32,30,28,33,31,29[2]
	Sydney South West RT	64,41,47,50,44	40,41,42,43,44,45[2]
	Woronora RT	40,41,42,43,44	40,41,42,43,44,45[2]
	Wyong	38,37,61,62,65,59,68, 56	40,41,42,43,44,46, 47,48,45[2]
Hobart	Acton Road	35,36,38,37,51	35,36,38,37,34,39[2]

Licence area	Area Served	Current digital TV channels	Restack channels
	Cygnet	41,44,50,47,52	41,44,45,43,42,40[2]
	Dover	55,58,64,61,65	46,47,48,49,50,51[2]
	Geeveston	55,58,64,61,65	34,35,36,37,39,38[2]
	Hobart	9A,8,10,7,11	6,8,10,7,11,12[2]
	New Norfolk	54,57,63,60,51	34,35,36,37,39,38[2]
	North Eastern Suburbs	64,56,62,65,66	46,47,48,49,51,50[2]
	Orford	37,36,47,43,39	40,41,42,43,44,45[2]
	Taroona	42,45,48,39,41	42,45,40,43,41,44[2]

Table 1.5: Current and restack channels for the six metropolitan areas

Notes:

1. Community television services are transmitted on this channel. The Government is currently considering the long-term future of the community television but has indicated such services can be transmitted on this channel until at least 31 December 2014.

2. Channel has been reserved in each area (the 'unassigned channel') across Australia for the possible future rollout of additional digital television services.

MATV systems being upgraded for the switch to digital-only television may also need to be reconfigured for the new frequencies at restack. This should be taken into account when choosing the best type of headend for the upgrade, as it may be more cost effective to prepare the system for restack at the same time as upgrading it for the switch to digital-only television. You should discuss the following upgrade options, as well as any other options available, with your antenna installer:

- Including additional modules for the new channels – this will be especially relevant for systems receiving services from some of the main metropolitan sites where services may be moving into the VHF band;
- The advantages of frequency agile systems, especially ones that can be retuned remotely (saving the cost and time of a technician visit at restack);
- The possibility of adding filters to reduce interference after restack – this will be especially relevant for systems receiving post restack block E frequencies.

Residents in areas affected by restack will need to retune their digital TV or set-top box to continue to receive any services that have changed channels. Most will find this a regular part of owning a digital receiver as retuning is required to receive any new services as they become available.

Further information on restack channel planning is available from the Australian Communications and Media Authority website at www.acma.gov.au/WEB/STANDARD/pc=PC_312417**.** Further information on the restack schedule is available from the Department of Broadband, Communications and the Digital Economy website at www.dbcde.gov.au/restack.

6 Digital Switchover Programs and Initiatives

6.1 Viewer Access Satellite Television

Viewer Access Satellite Television (VAST) is a satellite TV service which covers all of mainland Australia and Tasmania. It is a direct-to-home digital television service which provides the same number of channels that are available in capital cities, in both standard and high definition. It also includes channels rebroadcasting the local news bulletins of regional commercial television broadcasters in Eastern and Central Australia.

The Australian Government is funding VAST to service areas of remote Australia currently serviced by the Aurora satellite service (which only transmits four TV channels); areas previously covered by self-help facilities; and to provide services to people living in any area where a good, reliable digital television signal cannot be provided terrestrially.

One of the Australian Government's objectives in the switch to digital TV is to address long-standing issues in regional and remote areas of Australia where residents have poor, or in some cases, no access to terrestrially broadcast TV services.

For information about applying for VAST visit the Digital Ready website at www.digitalready.gov.au.

6.2 Satellite Subsidy Scheme

The Satellite Subsidy Scheme (SSS) will help households that rely on analog-only self-help towers make the transition to the VAST service if their self-help tower is not being upgraded to digital.

For households eligible for assistance under the SSS, the subsidy substantially reduces the cost of purchasing and installing the VAST service, to less than half the total cost, resulting in a one-off household contribution of around $200-$350. There are no ongoing fees to receive VAST. The SSS is being rolled out progressively across Australia.

6.3 Household Assistance Scheme

The Household Assistance Scheme (HAS) provides assistance to older Australians, veterans and people with disabilities, or their carers.

The following package is available free-of-charge to eligible people:

- a high definition set-top box
- a demonstration of the new equipment and instructions on how to use it, and
- 12 months warranty, service and technical support.

HAS provides equipment to receive FTA TV via satellite (i.e. the VAST service) for those living in an area that cannot receive terrestrial TV.

Assistance is available to people who own a working TV, have not yet converted to digital TV and receive the full rate of the Age Pension, Disability Support Pension or Carer Payment, or the Department of Veterans' Affairs Service Pension or Income Support Supplement.

If a person already has digital equipment, they might still be eligible for help if they cannot get good reception.

If a person owns their home, they may be eligible for necessary upgrades to cabling and antenna systems. The upgrading of external antennas or cabling can only be undertaken if the eligible person owns the place of residence and the household is not located in a property with an MATV system. However, if an eligible single dwelling household needs to use the VAST service to get reliable digital signals, the cost of the installation of a satellite dish and cabling is covered by HAS.

HAS does not provide external antennas or cabling assistance, or a satellite dish or cabling for the VAST service, if a household is located in an MDU. In these cases any upgrades, including the provision of an MATV system, are the responsibility of the owners' corporation or property owner.

6.4 Antenna Installer Endorsement Scheme and nationally recognised training

6.4.1 Antenna Installer Endorsement Scheme

The Antenna Installer Endorsement Scheme (AIES) was developed in consultation with industry to ensure consumers have access to knowledgeable and experienced antenna installers. The Scheme is voluntary and free to join. It is not a licence or qualification, but a way for consumers to know that endorsed antenna installers have met industry agreed standards.

Antenna installers can be endorsed at three levels: Domestic, Commercial and/or Satellite. Those working on MATV systems should be endorsed at the Commercial level. If the VAST service is being used, the installer should also be endorsed at the Satellite level.

6.4.2 Nationally recognised training

The Australian Government developed the Digital Reception Technology – Antenna Installer Training Resources to streamline the delivery of accredited training for antenna installers. The resources are based on specified units from Certificates II and III (ICT20410 and ICT30410) in Telecommunications Digital Reception Technology (ICT10) or the equivalent units from the ICT02 training package. Antenna installers who have completed the stipulated units are not required to undergo a separate online assessment to be eligible for endorsement under the AIES.

7 Installation Options

The various ways of distributing (reticulating) TV signals throughout a building are outlined below. The best outcome will depend on the location of the building, its particular circumstances and the availability of FTA TV services.

It is important to know whether the digital signals being received are FTA via a roof-top antenna or whether they come via a subscription TV service, as this may affect the quality of the transmission and limit the FTA services available.

Type of system	**Distribution system delivers**	**Issues**
Analog only	Analog channels only	This only allows for reception of analog channels. Residents with analog receivers will lose all TV reception when analog transmissions are stopped. Residents with digital TV receivers (i.e. a set-top box or a TV with an in-built digital tuner) will have difficulty receiving digital TV channels without a system upgrade.
Analog and digital	Analog and digital channels	Residents with a set-top box or a TV with an in-built digital tuner can access FTA digital TV. Most digital TVs with in-built digital tuners also receive analog services. Analog FTA signals are available until switch-off. In some systems problems can occur if the headend equipment shifts analog channels to prevent ghosting as these channels may appear on a digital channel and interfere with the digital signal
Digital only	Digital channels only	Residents with a set-top box or a TV with an in-built digital tuner can receive FTA digital TV. This allows every unit owner / tenant full access to all FTA digital services.

Type of system	Distribution system delivers	Issues
Digital and digital to analog	Digital channels and digital channels remodulated to analog (e.g. output of a set-top box)	Digital TV is available to residents with a set-top box or with a TV with an in-built digital tuner. Similar services are available to residents with analog receivers but the advantages of FTA digital TV are missing. This allows for the continued use of analog TV sets in hotels, hospitals etc. Conversion of digital channels to analog for distribution is mainly for commercial premises. The headend equipment may need to be reconfigured when digital transmissions change, such as when new services are added.
Analog and digital to analog	Analog channels and digital channels remodulated to analog	Residents can access analog versions of digital channels. Many of the advantages of digital TV, such as widescreen and surround sound, are not available. Residents with a TV with a digital tuner or set-top box do not have access to digital TV.
Digital to analog only	Digital channels remodulated to analog	Residents can access analog versions of digital channels. Many of the features and advantages of digital TV, such as widescreen and surround sound, are not available. Residents with a TV with a digital tuner or set-top box do not have access to digital TV.
Subscription TV and analog	Analog channels rebroadcast by subscription TV broadcasters	Some analog FTA signals will be available until switch off. FTA channels are only available to residents who pay for a service. The only way to ensure access to all the FTA digital services for all residents is via distribution of the signals received from a roof-top antenna or from the VAST satellite service.
Subscription TV, analog and digital	Analog and digital channels and channels rebroadcast by subscription TV broadcasters	Analog FTA signals will be available until switch-off. FTA digital TV is available to residents with a set-top box or TV with an in-built digital tuner. Subscription channels are available to residents who subscribe to the service.

Digital reception may be achieved when broadband amplifiers are used in distribution systems, but old antennas may not adequately receive new digital transmission channels – e.g. in most capital cities digital transmissions on channels 6, 11, 12, and 28 to 36 may not be well received on older antennas designed for channels 2, 7, 9 and 10.

A Master Antenna TV System Installation Assessment Form has been included at Appendix A. The installer should complete this form and include it with their quote for works on the system.

In some cases, owner/managers may wish to continue distributing analog signals because they have a large number of analog receivers (e.g. in hotels). To do this, the headend may be equipped with digital receivers tuned to particular services that feed analog TV 'modulators'. FTA broadcasters may need to change their digital transmissions from time-to-time. Therefore any digital receiver used in an MATV installation should be fully compliant with the Australian Standard AS 4933.1-2005: *Digital television-Requirements for receivers Part 1: VHF/UHF DVB-T television broadcasts* or easy access should be provided to allow for the receiver to be manually reset.

It should be noted that direct distribution of FTA reception signals from a roof-top antenna or the VAST service ensures all FTA services can be accessed.

7.1 Want to know more?

For general information about the Digital Switchover visit www.digitalready.gov.au

Click on the *mySwitch* link for information on:

- Digital TV reception in a particular area
- Switchover dates
- Endorsed antenna installers
- Antennas suitable for an area

Click on the *Antenna System e-Toolkit (ASeT)* link for detailed information about conversion options for residential MDUs and facilities such as hospitals and nursing homes, hotels and motels and correctional centres.

For information about digital TV products, go to the Australian Industry Group website at www.aigroup.asn.au

For enquiries related to the Australian/New Zealand Standard AS/NZS 1367, contact Standards Australia www.standards.org.au

For information about subscription TV services, visit the Australian Subscription Television and Radio Association (ASTRA) website at www.astra.org.au

For information on the free digital television services in Australia visit www.freeview.com.au

8 Appendix A

MASTER ANTENNA TV SYSTEM

INSTALLATION

ASSESSMENT FORM

DATE OF INSPECTION:	
BUILDING ADDRESS:	
BUILDING MANAGEMENT CONTACT DETAILS:	
DESCRIPTION OF BUILDING	
Number of dwelling units, apartments, townhouses	
Number of floors	
Approximate date of construction	
Does the building have any heritage restrictions?	
Public (housing development), private, investment, owner/occupiers	
TYPE OF DISTRIBUTION SYSTEM	
Does the existing MATV system, if installed since 2000, appear to generally comply with AS/NZS 1367:2000?	
If yes, is Section 2 Safety adhered to for safety earthing and AC isolation of outlets?	
Does the building have a lightning protection system installed?	

Are any FTA analog channels translated and, if so, to which channels?	
Does the building have a subscription TV service? If so, how is the service received (cable, satellite) and who is the provider?	
If via satellite, does the SMATV system combine terrestrial FTA services?	

TYPE OF ANTENNA - Provide the details for each existing antenna			
Antenna	1	2 (if applicable)	3 (if applicable)
Description of type (UHF, VHF, Wideband, single band)			
Polarity			
Channel coverage			
Likely age of antenna			

TYPE OF HEADEND	
Master Head amplifier (if used) or Preamplifier (if used)	
Passive equalisers (if used)	
Fixed channelised amplifiers with equalizers	
Frequency agile channelised amplifier	
Fixed channel converters	
Frequency agile channelised converters	
Launch amplifier (multiband or wideband)	

Final active device specified maximum output level, if available	
FREE-TO-AIR DISTRIBUTION SYSTEM COMPONENTS	
Type of cable used for trunk, branch, spur (RG59, RG6, RG11, air spaced)	
Shielding employed in cable above (single, dual, tri, quad) if determinable	
Style of splitters and taps (screw and saddle, F)	
Type of cable used to outlet (RG59, RG6, RG11, air spaced)	
Shielding employed in cable above (single, dual, tri, quad) if determinable	
Type of connection on rear of outlets (screw and saddle, PAL, F, etc)	
Type of outlet (PAL, F, etc)	
Type of equalisers (if any)	
Type of inter-stage amplifiers without equalisers (if any)	
Type of inter-stage amplifiers with equalisers (if any)	
Specified maximum output level of inter-stage amplifiers, if available	

DISTRIBUTION TOPOGRAPHY	
Type – loop through, tree and branch or star system; mixture; unknown, etc	
Location and accessibility of distribution components (in riser, external housing, ceiling, false ceiling cavity, unknown, etc.)	
Distribution cabling – internal or external to building	
Distribution cabling: if internal (in conduit/duct/ cable tray), if external (conduit / duct, etc.)	
Cable to outlet – internal or external to building (completely or partly)	
Cable to outlet totally in conduit / duct, in conduit and ceiling cavities, wall cavity and ceiling cavities, rendered into walls and / or slab, unknown, etc.	

SIGNAL LEVELS OF RECEIVED ANALOG CHANNELS	
Input to headend or preamplifier (if used)	
Output from headend	
At outlet/s (at most distant extents of system, if possible). Required absolute minimum 60dBµV, preferred 63dBµV or greater; maximum 80dBµV	
Other areas as may be applicable for the system installed (i/p and o/p of inter-stage amplifiers, etc.)	
SIGNAL LEVELS OF RECEIVED DIGITAL CHANNELS	
Input to headend or preamplifier (if used)	
Output from headend	
At outlet/s (at most distant extents of system, if possible). Required absolute minimum 45dBµV, preferred 60 ~70 dBµV; maximum 80dBµV	
Other areas as may be applicable for the system installed (i/p and o/p of inter-stage amplifiers, etc.)	

AT OUTLETS, PICTURE QUALITY FOR ANALOG CHANNELS	
What level of picture quality across all terrestrial analog channels is present at outlets checked (Kyoto scale 1-5, with 5 excellent)	

AT OUTLETS MODULATION ERROR RATIO (MER) AND MARGIN FOR DIGITAL CHANNELS	
If any terrestrial digital channels are available at outlets, what is their margin above Quasi Error Free point (minimum required greater than 9dB, typically equal or greater than 15dB)? Depending on the digital meter available, provide at least one of the following measurements: • Across all terrestrial digital channels, what value of MER is achieved? Required MER ≥ 25 dB • Across all terrestrial digital channels, what value of margin of failure is achieved? Margin to	

failure measured at outlets on all digital channels shall be greater than 9dB (typically ≥ 15dB with preferred ≥20dB) relative to Quasi Error Free. **NOTE:** **To determine margin to failure -** add attenuation in 3dB or larger steps until Quasi Error Free is reached or almost exceeded. If exceeded by next 3dB attenuation added, previous total is margin.	
LEVEL OF UPGRADE OR REPLACEMENT REQUIRED FOR THE RETICULATION OF FTA DIGITAL TV RF CHANNELS TO OUTLETS AT THE REQUIRED LEVELS OF SIGNAL QUALITY	
Minor upgrade (replace antenna / minor headend adjustments)	
Major upgrade (extend or replace most or all of headend)	
Total upgrade of the headend and distribution system (complete replacement)	

In your opinion, would it be appropriate for people in this building to use an indoor antenna to receive DTT services?	

OTHER COMMENTS, INCLUDING FIRST STEPS TO IMPROVE RECEPTION DIFFICULTIES

SIGNATURE OF TECHNICIAN UNDERTAKING SURVEY .....

NAME .....

DATE .....

9 Appendix B

9.1 Digital TV Timetable by Region

Switchover area	**Switchover date**
Mildura/Sunraysia Victoria	Switched - 3 June 2010
Regional South Australia	Switched – 15 December 2010
Regional Victoria	Switched – 5 May 2011
Regional Queensland	Switched – 6 December 2011
Southern New South Wales, ACT and MIA	Switched – 5 June 2012
Northern New South Wales	Switched – 27 November 2013
Adelaide	Switched – 2 April 2013
Tasmania	Switched – 9 April 2013
Perth	Switched – 16 April 2013
Brisbane (includes Gold Coast and Sunshine Coast)	Switched – 28 May 2013
Regional and Remote Western Australia	25 June 2013
Darwin	30 July 2013
Sydney (includes Gosford)	3 December 2013
Melbourne	10 December 2013
Remote Central and Eastern Australia	10 December 2013

9.2 Early switch to digital TV

The roll out of digital-only TV will require some towns in Australia to switch earlier than the scheduled date for their switchover area.

Analog TV services in some towns have to be switched off early to make way for digital TV services. This is happening because television broadcasters need to replace the equipment at the local TV transmission site so that they can provide the new digital TV services.

To check the switchover date for a particular area, use *mySwitch* on the Digital Ready website at www.digitalready.gov.au.