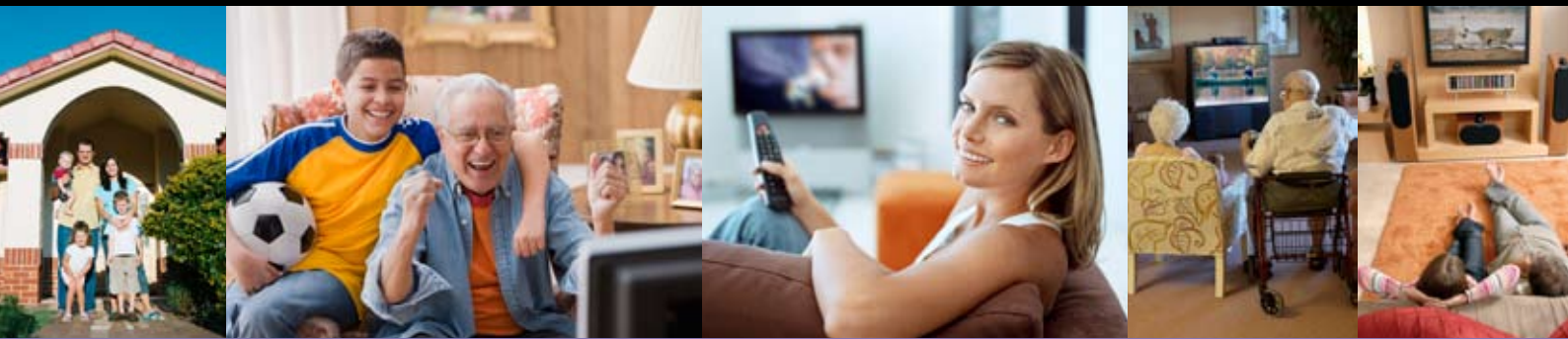




Australian Government  
Department of Broadband,  
Communications and the Digital Economy  
Digital Switchover Taskforce



# Digital TV Antenna Systems for Homes



2009

# Handbook

Non-Mandatory Document



Australian Government

Department of Broadband,  
Communications and the Digital Economy

Digital Switchover Taskforce



# Digital TV - Antenna Systems for Homes

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Free-to-air digital TV in buildings with single antennas



1st Edition  
March 2009



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# Introduction

## General

### Reminder

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

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 switchover, which will see it begin in 2010 and finish 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.

Every Australian needs to prepare so they can access the benefits of the worldwide digital revolution. It is vital to start any necessary upgrade of receiver equipment and antenna systems now to avoid the anticipated rush in the lead up to the switch off of analog TV signals.

While most homes may not require any significant modification, others may need relatively modest upgrades to their antenna systems. This Handbook was developed by industry to assist those who live in single dwellings with their own antenna or aerial, which includes houses.

## Scope

This Handbook is written in generic terms. It has been developed to provide guidance to its users on the issues relating to antenna systems for digital TV. It has been written principally for a general audience.

Consideration of the installation or modification of antenna systems should always be made in conjunction with appropriate consideration of other relevant requirements and issues, including those relating to structure, fire safety, town planning, services and other matters.

## Limitations

It should be noted that this Handbook is not intended to:

- override or replace any legal rights, responsibilities or requirements;
- provide comprehensive or detailed guidance on issues relating to the installation or modification of antenna systems; and
- provide specific design solutions for a particular building or site; or replace available published information.

# Switching to free-to-air digital TV

## About this Handbook

To assist the transition to FTA digital TV, the Digital Switchover Taskforce is working in conjunction with industry and has assisted in the development of two Handbooks that address the issues surrounding transition of dwellings to digital. The first Handbook 'Digital TV - Antenna Systems - Non-Mandatory Handbook' is available from the Australian Building Codes Board (ABCB) website at [www.abcb.gov.au](http://www.abcb.gov.au) and addresses the issues surrounding the conversion of master or communal (shared) TV antenna systems in multi-dwelling units (MDUs).

This Handbook has been developed to provide guidance on the conversion of FTA analog TV systems in single dwellings so that they can receive FTA digital TV transmissions. Single dwellings include houses and other properties with stand alone antenna systems.

## Who should use this Handbook?

The Handbook is intended to provide antenna installers with a best practice guide to installing digital TV systems in single dwellings.

It will also be a helpful checklist for the following people to use when contracting the services of domestic antenna installers:

- property owners
- owner builders
- tenants
- real estate agents and property managers.

The Handbook is also aimed at those involved in the design, construction and maintenance of buildings and their TV systems, including:

- architects
- designers
- developers
- builders
- electrical consultants
- electrical contractors
- electrical wholesalers.

## About the change to digital TV

Broadcasters are currently transmitting analog, standard and high definition digital FTA TV. The timetable for the digital switchover shows when the switchover will occur region by region across the country<sup>1</sup>.

The FTA digital TV transmissions are currently broadcast in the same frequency bands as analog TV, but on different channels. Digital transmissions do not occur below Channel 6 and there is no plan to utilise these channels for digital TV.

## Advantages of digital TV

Metropolitan broadcasting services began transmitting in the digital mode from 1 January 2001 while regional broadcasting services were required to commence broadcasting in the digital mode between 1 January 2001 and 31 December 2003. These services consist of analog services, a simulcast in standard definition digital of the analog services and high definition digital services. Commercial remote area licensed broadcasters have yet to commence transmission in the digital mode and are in discussions with the Department and the Australian Communications and Media Authority on an appropriate start date.

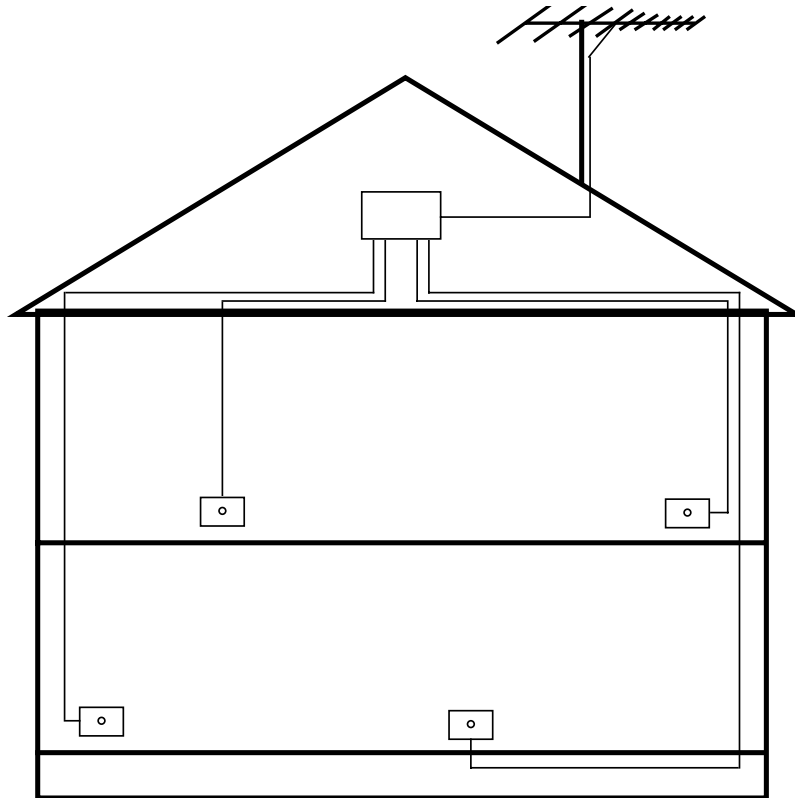
Digital TV will provide the benefits of improved picture and sound quality and greater program choice. Each broadcaster's digital TV signal allows viewers access to a range of other features which may include:

- additional channels
- high definition channels
- widescreen pictures not available via analog
- ghost free reception
- surround sound
- electronic program guides (EPG)
- datacasting services
- closed captioning
- interactive services, and
- over the air upgrades for receiver operating software.

These services will be expanded over time.



## What is involved in the conversion process?



**Figure 1: Typical household set up**

A typical household TV system, illustrated in Figure 1, will normally consist of an antenna, cabling, wallplates and flyleads leading to the digital reception equipment (e.g. TV, set-top box). Problems with receiving digital services may occur in one or more parts of the system. For example, reception of some or all of the new digital channels via the existing antenna might be marginal and/or the cabling may not carry the digital signal effectively. In such cases replacement needs to be considered.

An initial assessment should be made of each part of the existing system to find out whether an upgrade is required. The level of upgrading necessary will vary depending on what equipment is used in the existing installation. There is no need to upgrade antenna systems or cabling to receive High Definition (HD) digital signals if the dwelling receives Standard Definition (SD) digital signals clearly.

To get the benefits of the extra program channels and clearer pictures from the digital broadcasts, there may be costs associated with upgrading the receiving system for digital FTA TV. These may include:

- upgrading the rooftop antenna/aerial;
- installation of new shielded cabling; and
- labour costs associated with the design and/or installation of the above.

Note that if the dwelling is located in a weak signal area and/or multiple outlets are required around the house, a high gain antenna may not be sufficient and new amplifiers may be required. Professional installers should take signal measurements during the assessment to determine if amplifiers are required.

It is important to determine if the current TV antenna/aerial is designed for the same band of operation that the digital TV broadcasts in the area will be transmitted on. In most cases the antenna is likely to be suitable for digital services. In some cases there will be a need to upgrade the antenna either because the new digital channels are in a new frequency band or because the antenna is older or in disrepair and is unlikely to receive adequate signal levels due to that disrepair. Refer to Appendix D for further information about antennas.

Once it is established that the antenna is of a suitable type and is in good repair, it is important to determine whether the digital TV signals are distributed to each TV wallplate outlet at a sufficient level and without interference. Some detailed information on these measurements is contained in the section titled 'Measuring Signal Strength'.

Some installations, especially in larger single dwellings, may use equipment such as channel converters, amplifiers and splitters that were only designed to cater for the reception of analog services and may not meet the requirements necessary for digital FTA TV reception. For example, for a small distribution system installed for analog TV, the installer may have shifted some analog TV channels to different channels to avoid nearby interference issues or reduce ghosting. Those channels selected could now be a channel used for digital TV transmissions.

Poor performance can be due to a number of factors including low received signal level at the receiver or the ingress of interference into the installed system. In some circumstances it is appropriate to replace the existing cabling with more modern, better shielded coaxial cable suitable for digital TV reception. Cabling will need to be replaced if there is a loss of signal quality or level that occurs as the signal travels from the antenna to the wallplate.

Once the dwelling's system has been assessed and possibly upgraded to access digital TV, residents will need reception equipment, such as a set-top box or a TV with an integrated digital tuner, to receive digital FTA transmissions.

A Single Dwelling Antenna TV System Assessment Checklist can be found at Appendix B. This Checklist should be used when performing an initial assessment on a single dwelling's TV antenna system.

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## When is a system ready for digital TV?

In most circumstances some level of digital reception will be available from existing systems and certain systems may not require an upgrade. Where a system is upgraded, or installed new, that system will be fully capable of receiving and distributing FTA SD and HD digital transmissions from a rooftop antenna if:

- It complies with the design specifications and meets the requirements of the Australian 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; and
- Every TV outlet has been tested to ensure all digital FTA signals are free from interference and within the level ranges specified in the Standard.

## Getting better digital TV reception

### The 'digital cliff'

One of the benefits of digital TV is that it is able to correct any disturbance in the signal to keep the picture perfect, but as the disturbances become greater due to a weak signal or other interference there comes a point where the digital correction cannot cope. Consequently, 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 and describes the sudden loss of digital signal reception with a relatively small variation of the signal strength/quality. As the digital signal gets closer to the digital cliff, the TV picture may break up into small blocks (pixellation). As the signal gets worse the picture may freeze, go blank and/or show indicators such as 'low signal' or 'weak signal'.

### What does this mean?

In 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 digital TV signal is sitting close to the 'cliff edge'.

Furthermore, a location that previously received a poor, but watchable analog picture from a distant analog transmitter site, may not be able to receive a digital picture from the same

transmitter site. Masthead amplifiers or antenna with greater gain may assist in correcting this problem.

## Measuring digital TV Signal

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, bit error ratio (BER) and modulation error ratio (MER).

More information on the digital TV signal levels required and how to measure them can be found at Appendix C.

## Understanding antenna and TV reception quality

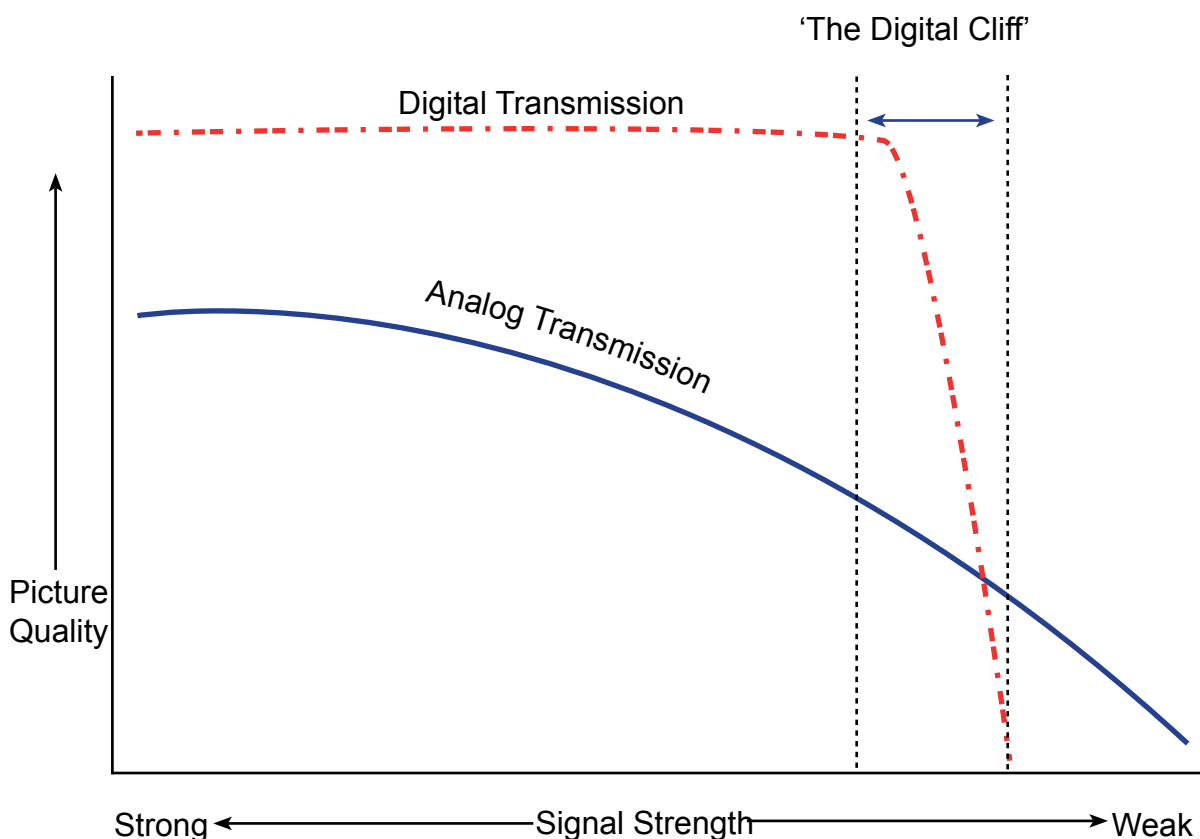


Figure 2: Comparing analog and digital transmissions

## Current antenna installations

Particular antenna types will provide various levels of performance, affecting the robustness of the digital services.

In the capital cities and some other locations the antennas currently used by the consumer to receive the Band III services have been predominantly installed to receive CH7 to CH10. Digital reception requires that all the Band III channels from CH6 to CH12 should be received. Some existing antennas, especially the older installations, are not as sensitive at Channels 6, 11 and 12 and may not provide the required signal quality. While there is no such thing as a 'digital antenna', some antennas have been manufactured specifically to receive both digital and analog channels (particularly those made after 2000). To ensure adequate reception of digital services, antenna performance must be assessed to investigate whether antenna replacement is required.

UHF antenna installations, particularly in some regional areas, may need to be changed to successfully receive the new digital services further up the band. In some areas digital services may be spread over Bands IV and V. Where that occurs a broadband or multi-band UHF antenna installation may be required.

For channel numbers and digital transmissions in all areas, go to the Australian Communications and Media Authority (ACMA) website: [www.acma.gov.au](http://www.acma.gov.au)  
Home > For licensees & industry: Service & technical requirements > Broadcasting : Digital TV > Digital TV Channels

## Fixed roof top antennas

An antenna for a digital installation must be selected for the situation demanded by the locality. The presence of nearby impulse noise can be a threat to the robustness of the digital reception. The effects of noise can be reduced or removed by selecting an antenna with adequate gain and directivity, good impedance matching, choice of good quality quad shielded coaxial cable and effective termination practices.

Antennas should be positioned to receive the best available digital signal. In most cases, this will be on the roof with the antenna pointing towards the nearest transmitter. The signal levels and quality should be the determining factor in antenna position. Lowering or 'hiding' the antenna for purposes of building aesthetics may reduce the quality of the signal, or may restrict it altogether.

## Indoor antennas

Australian Communications and Media Authority (ACMA) planning of digital television services assumes that the receiving systems will use an outdoor antenna. Generally, it is unlikely that reliable, ongoing digital reception will be received via an indoor antenna. Even the movement of people can cause problems, but 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 occasions (i.e. in areas of high signal strength) where indoor antennas may be sufficient.

## Receiving and distributing digital FTA signals

Even in single dwellings there are occasions where the signal must be redistributed using channelised headends, amplifiers and splitters to many sites within the dwelling. To be effective an installation in a single dwelling for digital FTA should meet the following requirements:

Supply each digital FTA signal received at the antenna to each wallplate or socket so that all services offered by each FTA broadcaster may be accessed by a digital TV receiver.

The signal for each digital TV service should be at a suitable level such that the signal is not adversely affected by interference.

## Cabling

The use of RG6 quad shielded coaxial cable is recommended.

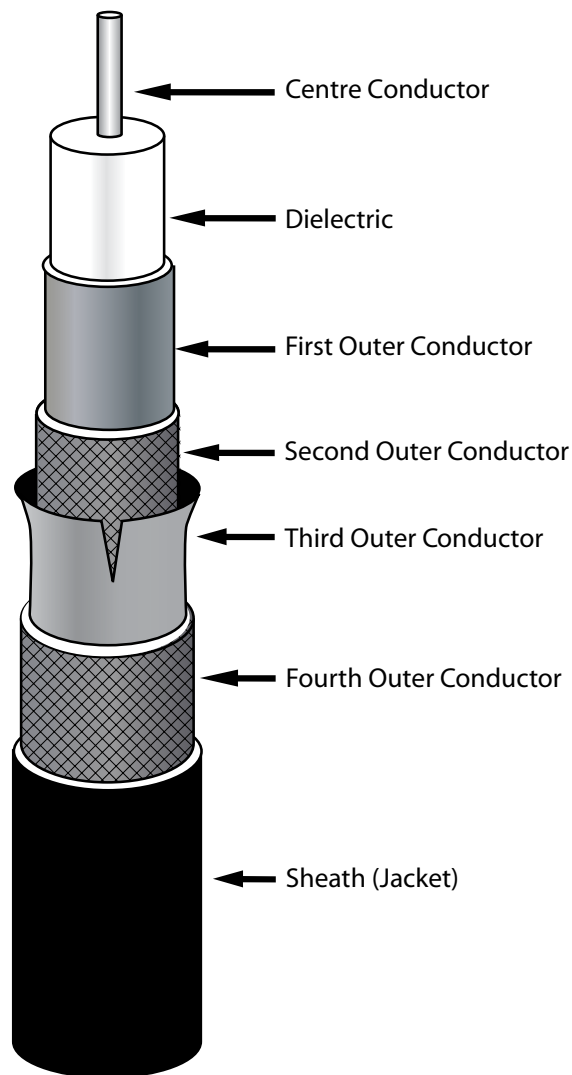


Figure 3: Quad shielded coaxial cable

## Connectors

It is recommended that good quality F-type connectors be used for the interface between coaxial cables and system devices and equipment. In systems used for terrestrial FTA services, PAL connectors should only be used at the front of the wallplate or on the flylead to connect to the consumer equipment.

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

## Amplifiers

When broadband or channelised headend and/or distribution amplifiers are used within the system each device should meet the performance requirements described in the standard AS/NZS 1367:2007.

## Other considerations

Other requirements such as the Building Code of Australia and its referenced documents (which includes Australian Standards) may have additional provisions that impact on the installation of TV antenna systems. This Handbook does not describe or list all requirements relevant to the installation of TV systems. To access a full range of interactive services a broadband connection may be required.

A Single Dwelling Antenna TV System Assessment Checklist has been attached at Appendix B. The antenna installer should complete this form and include it in their quote for work on the system.



## Improving reception

Problems in receiving digital services may be improved by one or more of the following:

- **Antenna Repositioning**  
Raising the height or position of the antenna may improve signal level and picture quality.
- **Antenna Gains and Types**  
Changing to a different type of antenna when accessing a digital service may provide for:
  - higher gain on the available channels where there is insufficient signal levels or signal quality; or
  - greater rejection of echoes and interference such as local impulse noise sources or reflections produced from aircraft (or 'aircraft flutter').
- **Alternate Transmissions**  
Changing antennas from VHF to UHF to take advantage of alternate digital services from local area translators or gap fillers may be required, or at least a re-pointing of a UHF antenna.
- **Cabling and Connections**  
Using quality quad shielded coaxial cable and high quality flyleads can reduce interference (especially from household appliances). Using good quality F connectors for the system wiring will help minimise interference in domestic installations.
- **Digital Receiver Scanning**  
Digital receivers acquire channels by scanning through the broadcast bands and collecting available services. Changes to the available channels, with the introduction of new services, or changes in the frequency of channels already being watched by the consumer will occasionally require re-scanning which may, depending upon receiver design, take some time.

Figure 4 below shows two scenarios for connecting digital receiver equipment to the antenna. The first uses a TV with integrated digital tuner and the second, an analog TV with digital set-top box.

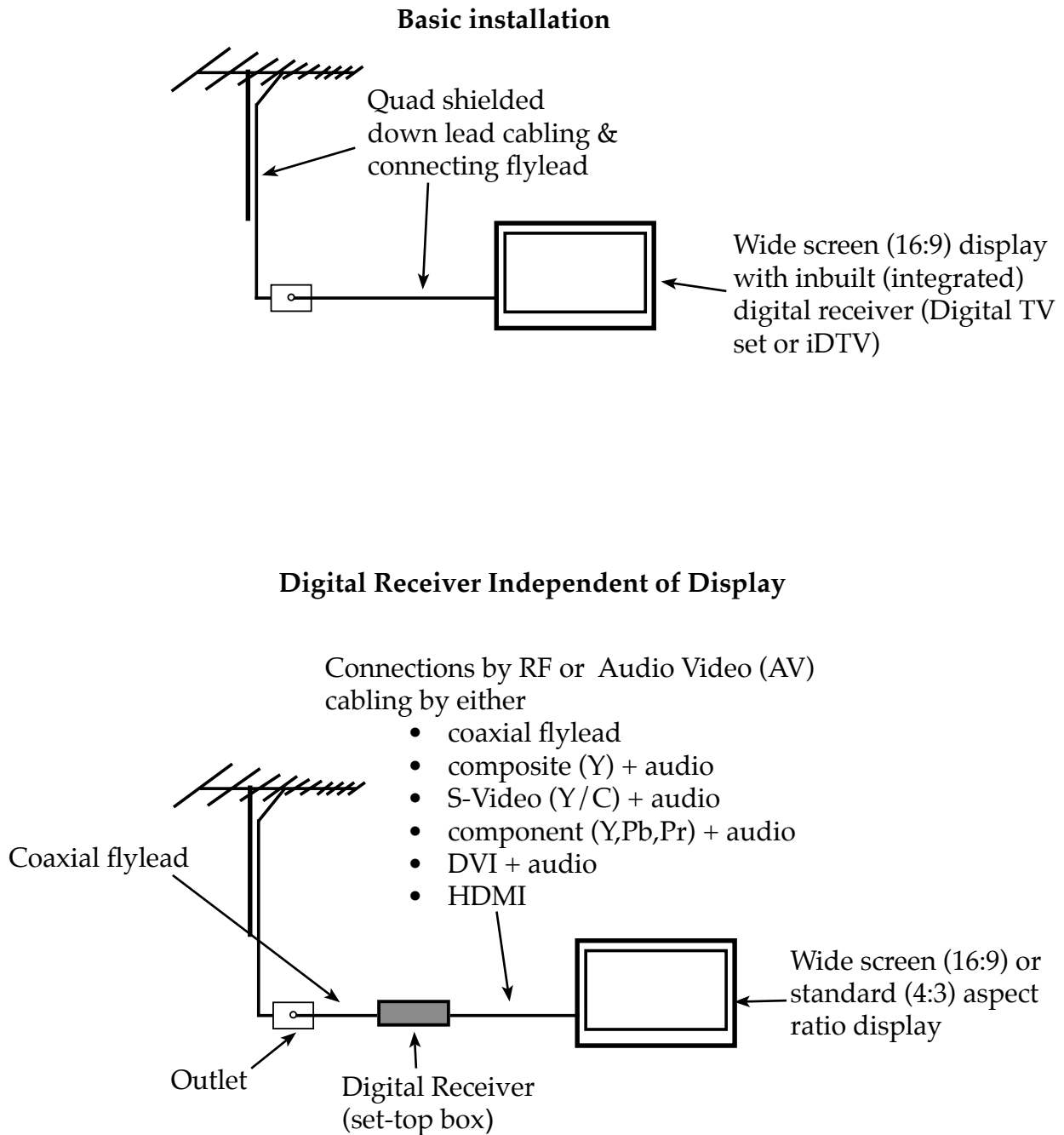


Figure 4: 'Beyond the Wallplate'

## Alternative delivery of FTA TV

If there are no viable options for improving reception of local terrestrial TV services, residents may be able to access either the Remote and Regional Western Australia or the Remote Central and Eastern Australia TV services using satellite direct-to-home (DTH) reception equipment.

The Remote and Regional Western Australia TV market is served by FTA WIN and GWN, as well as ABC and SBS services. The Remote Central and Eastern Australia TV market is served by FTA Imparja TV (broadcasting Nine Network programming and Indigenous programs), Southern Cross Central (Seven Network programming), plus ABC and SBS services.

### Approval to access out-of-area services

To be considered for an out-of-area service, applications to the Australian Communications and Media Authority (ACMA) need to include a technical assessment stating that the reception of broadcasting services in the commercial TV broadcasting licence area is inadequate.

Householders will therefore need to arrange for a qualified TV antenna installer to visit their home and measure the 'off air' TV signals to establish the signal level of the local commercial TV networks to satisfy this requirement. Before doing this it may be useful to check with neighbours as they may already have approval to access commercial TV via Remote Area Broadcast Services (RABS). If this is the case, householders may wish to contact the ACMA to inquire whether a technical assessment is necessary.

If householders want to pursue the DTH option, they must contact the relevant commercial satellite broadcaster in their state. Only these broadcasters can apply to the ACMA for permission to provide their services to a household with poor or no reception that is within a commercial terrestrial licence area. The ACMA's approval is not needed to access the ABC and SBS services available direct to home.

Satellite reception-dependent viewers in Tasmania, the Australian Capital Territory, New South Wales and Victoria presently receive the ABC South East Australian satellite TV service from the Optus Aurora platform.

## Householder equipment

The necessary equipment for alternative FTA TV reception (a satellite receiver dish, an integrated receiver decoder and smart card) would vary in cost depending on the size of the dish required and the logistics associated with installing this equipment at a particular location. A local TV antenna installer, qualified in the installation of DTH equipment, would be able to provide advice about the equipment configuration appropriate to the area and more precise information about the cost of purchasing and installing such equipment.

The ACMA recommends that applicants hold off purchasing the necessary receiving equipment until approval has been given for the commercial satellite services, unless the applicant only wants to receive ABC and SBS services.

## Subscription TV services

Cable or satellite delivered subscription TV services may be available to residents in some properties.

Any systems currently providing subscription TV services should only be modified in accordance with service level agreements in place between the home owner and 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 is incurred.

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 the local subscription TV service provider.

## Want to know more?

For general information visit [www.digitalready.gov.au](http://www.digitalready.gov.au) or FTA broadcasters' web sites:

- [www.abc.net.au](http://www.abc.net.au)
- [www.sbs.com.au](http://www.sbs.com.au)
- [www.freetv.com.au](http://www.freetv.com.au)
- [www.freeview.com.au](http://www.freeview.com.au)

For information about digital TV products, go to the Australian Industry Group website [www.aigroup.asn.au](http://www.aigroup.asn.au)

To find TV system installers in the area, search for 'TV antenna services' in the local phone directory.

For reference to issues dealing with Australian Standard NZS 1367: 2007 or 2000, enquiries should be directed to Standards Australia sub committee CT-002-06 Cabled Distribution Systems [www.standards.org.au](http://www.standards.org.au)

For information about subscription TV services, visit the Australian Subscription TV and Radio Association (ASTRA) website – [www.astra.org.au](http://www.astra.org.au)

For information about receiving FTA TV via satellite, contact the Australian Communications and Media Authority (ACMA) [www.acma.gov.au](http://www.acma.gov.au)

## Frequently asked questions

### Analog TV

*What is analog TV?* The TV system we are all familiar with that 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 ABC, SBS and the affiliated TV networks are Prime, Southern Cross, WIN, GWN, NBN and Imparja.

Analog TV is subject to interference such as ghosting and impulse noise. Australian analog broadcasters use the 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.

### Amplifier

*What is an amplifier?* A device 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 master antenna TV systems to compensate for loss in the cabled distribution system and ensure the strength of the signal being received by each dwelling is correct.

### Connectors

*What is a connector?* Connectors are used as a method of connecting coaxial cable. Hex Crimp or compression connections are recommended, because of the greater consistency of performance of the finished connection. A Hex Crimp connection has a six-sided indentation from the crimping tool. The Compression Connector uses a conical compression that encircles the entire circumference of the RG cable maintaining the integrity of the cable structure. This method provides excellent pullout strength and reduces signal ingress/egress providing superior connection and impedance matching.

### Datacasting Services

*What are datacasting services?* 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.

## Digital TV

*What is digital TV and how is it different from analog?* 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 – i.e. extra channels, widescreen pictures, some in high definition, surround sound etc. In the future digital FTA services may include interactive services, significantly increasing the user experience. It is important however to have a good quality signal for a digital receiver as unlike analog TV, the picture and sound will suddenly break up if the quality falls below a threshold ('digital cliff' effect). Also picture break-up can be experienced from interference generated by electrical equipment especially with arcing contacts e.g. motors in hair driers. This is known as electrical impulse noise.

## Digital Program Channel Numbers

*What are Digital Program Channel Numbers?* As FTA broadcasters can send extra program channels in their digital TV transmissions, they can assign a program number that a digital TV receiver uses so a viewer can press that number in on their remote control to access that program. 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 (Macquarie Southern Cross – Ten affiliate), 6 (Prime – Seven affiliate) and 8 (WIN or NBN – Nine affiliate). The program numbers are sometimes called Logical Channel Number or LCN.

## Electronic Program Guide (EPG)

*What is an electronic program guide?* An application available on some digital receivers that provides an on-screen listing of programming and content that digital TV viewers have available to them.

## Free-to-air (FTA) TV

*What is FTA TV?* Broadcasts delivered 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 and appropriate indoor or outdoor antenna.

## High Definition – HDTV

*What is high definition TV?* This 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 standard definition channels can be received, there is no need to upgrade an antenna system to receive high definition but a receiver that is capable of also decoding HD is required.

## **Interactive Services**

*What are interactive services?* Interactive services describe a number of techniques which allow viewers to interact with their digital television through a set-top box or a television with an integrated 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.

## **Quad Shielded Cable**

*Why use quad shielded cable?* This antenna cabling that has four layers of shielding to prevent leakage or interference of TV signals.

## **Subscription TV Services**

*What are subscription TV services?* These digital TV services are provided by cable and satellite. A regular monthly fee is usually paid to maintain access to subscription TV services. In Australia these services are provided mainly by FOXTEL, AUSTAR, TransACT, Neighbourhood Cable, SelectTV and a range of other providers.

## 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:

This Handbook could not have been developed without the assistance and technical expertise of TV antenna consultants, installers and system integrators; and antenna installers, manufacturers, suppliers, retailers wholesalers and subscription TV providers; and the following national, commercial (metropolitan, regional and remote) and community broadcasters who will be affected by digital switchover:



## Appendix A – Digital TV Timetable by Region

Type	Switchover Area	Examples of Major Centres	Window
VIC	Mildura / Sunraysia	Mildura	1 January – 30 June 2010
SA	Broken Hill	Broken Hill	1 July – 31 December 2010
SA	Riverland	Renmark and Loxton	1 July – 31 December 2010
SA	Mt Gambier / South East South Australia	Mt Gambier, Naracoorte and Bordertown	1 July – 31 December 2010
SA	Spencer Gulf	Port Lincoln, Whyalla, Port Augusta	1 July – 31 December 2010
VIC	Gippsland	Traralgon, Bairnsdale and Mallacoota	1 January – 30 June 2011
VIC	North Central Victoria	Bendigo and Swan Hill	1 January – 30 June 2011
VIC	South West Victoria	Ballarat, Warrnambool and Horsham	1 January – 30 June 2011
VIC	Goulburn Valley / Upper Murray	Albury/Wodonga, Wangaratta and Shepparton	1 January – 30 June 2011
QLD	Wide Bay	Hervey Bay, Bundaberg and Maryborough	1 July – 31 December 2011
QLD	Capricornia	Rockhampton, Emerald and Yeppoon	1 July – 31 December 2011
QLD	Queensland Central Coast & Whitsundays	Mackay, Proserpine and Bowen	1 July – 31 December 2011
QLD	Darling Downs	Toowoomba, Warwick and Dalby	1 July – 31 December 2011
QLD	North Queensland	Townsville, Ayr and Charters Towers	1 July – 31 December 2011
QLD	Far North Queensland	Cairns, Port Douglas and Innisfail	1 July – 31 December 2011
NSW	Griffith / Murrumbidgee Irrigation Area	Griffith and Hay	1 January – 30 June 2012
NSW	South West Slopes & Eastern Riverina	Wagga Wagga and Gundagai	1 January – 30 June 2012
NSW	Illawarra and the South Coast	Wollongong, Ulladulla and Eden	1 January – 30 June 2012
NSW	Central Tablelands & Central Western Slopes	Dubbo, Orange and Mudgee	1 January – 30 June 2012
NSW	ACT & Southern Tablelands	Canberra, Thredbo and Cooma	1 January – 30 June 2012
NSW	North West Slopes & Plains	Tamworth, Armidale and Inverell	1 July – 31 December 2012
NSW	Richmond / Tweed	Byron Bay, Tenterfield and Lismore	1 July – 31 December 2012
NSW	Northern Rivers	Coffs Harbour, Forster and Grafton	1 July – 31 December 2012
NSW	Hunter	Newcastle, Port Stephens	1 July – 31 December 2012

Metro	Tasmania	Hobart, Launceston and King Island	1 January – 30 June 2013
Metro	Perth	Perth	1 January – 30 June 2013
Metro	Brisbane	Brisbane, Gold Coast and Noosa	1 January – 30 June 2013
Metro	Melbourne	Melbourne	1 July – 31 December 2013
Metro	Adelaide	Adelaide	1 July – 31 December 2013
Metro	Sydney	Sydney and Gosford	1 July – 31 December 2013
Metro	Darwin	Darwin	1 July – 31 December 2013
Re- mote	Remote Central & Eastern Australia	Alice Springs and Mt Isa	1 July – 31 December 2013
Re- mote	Regional & Remote Western Australia	Kalgoorlie, Broome and Bunbury	1 July – 31 December 2013

## Appendix B – Single Dwelling Antenna TV System Assessment Checklist

DATE OF INSPECTION:	
RESIDENTIAL ADDRESS:	
Number of Wallplates in dwelling:	
<b>ANTENNA</b>	
Description of Antenna (e.g. type of antenna):	
Receiving signal from:	
Make and Model:	
Condition of Antenna:	<input type="checkbox"/> Excellent <input type="checkbox"/> Very Good <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor
Polarisation:	<input type="checkbox"/> Horizontal <input type="checkbox"/> Vertical
Channel Coverage:	<input type="checkbox"/> VHF Only <input type="checkbox"/> UHF Only – Band IV <input type="checkbox"/> UHF Only – Band V <input type="checkbox"/> VHF/UHF



Age of Antenna (approx.)	<input type="checkbox"/> < 1 year <input type="checkbox"/> 1-5 years <input type="checkbox"/> 5-10 years <input type="checkbox"/> 10-15 years <input type="checkbox"/> >15 years <input type="checkbox"/> Unknown
<b>CABLING</b>	
Type of cable used:	<input type="checkbox"/> RG59 <input type="checkbox"/> RG6 <input type="checkbox"/> RG11 <input type="checkbox"/> Air spaced <input type="checkbox"/> Other.....  Comments:
Shielding:	<input type="checkbox"/> Single <input type="checkbox"/> Dual <input type="checkbox"/> Tri <input type="checkbox"/> Quad <input type="checkbox"/> Unknown  Comments:
Cable Condition:	<input type="checkbox"/> Excellent <input type="checkbox"/> Very Good <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor
<b>CONNECTORS</b>	
Type of connectors on rear of outlets (where determinable):	<input type="checkbox"/> PAL <input type="checkbox"/> F Connector
<b>AMPLIFIERS</b>	
(Empty space for notes)	



SIGNAL LEVELS OF RECEIVED DIGITAL CHANNELS									
Channel									
Input at Antenna									
Output at Wallplate 1									
Output at Wallplate 2									
Output at Wallplate 3									
OTHER CONSIDERATIONS									
Common issues:	<input type="checkbox"/> Impulse noise <input type="checkbox"/> Pixellation <input type="checkbox"/> Audio break up <input type="checkbox"/> No signal <input type="checkbox"/> Other Comments on above issues:								
UPGRADE INFORMATION									
Upgrade required:	<input type="checkbox"/> No upgrade required <input type="checkbox"/> Minor upgrade required Comments: <input type="checkbox"/> Major upgrade required: Comments: <input type="checkbox"/> Other (please specify):								
COST									
Estimated cost:									

# Appendix C – Getting better digital TV reception

## Measuring digital TV signal

Due to the digital cliff effect, signal level measurement, in combination with subjective assessment of the quality of the TV picture, cannot provide an accurate guide to the quality of digital reception.

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,
- bit error ratio (BER) and
- modulation error ratio (MER).

While signal level measurements will determine the level and the level margin of the received digital signal, BER and MER 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 lies to the 'digital edge' or the digital reception threshold. These measurements may also help in determining potential causes of reception problems.

Meters that only measure analog signals are not suitable for measuring digital signal. At a minimum, meters should record BER and the signal level. However, meters which measure MER are beneficial for finding solutions in problem situations.

## Signal Level

A good digital TV installation should provide an adequate signal level as well as a sufficient signal level margin (distance) from the digital cliff at the input of the receiver.

The signal level margin can be determined by attenuating the input signal via an input attenuator, until the signal reaches the digital cliff and starts to break up. The amount of signal attenuation in dB required to induce break-up is considered the level margin of the service.

Signal level at the input of the receiver of around 54 dB $\mu$ V and signal level margin in excess of 20 dB are preferred for digital receivers available to the Australian market. The recommended minimum and maximum signal level and level margins are specified in Table 1.1. Ensuring the installation provides signal levels below the maximum avoids problems associated with overloading the receiver.



Digital TV	Minimum	Maximum
Outlet signal level	45 dB $\mu$ V	80 dB $\mu$ V

**Table 1.1: Minimum and maximum signal levels required at the outlet**

## Bit Error Ratio (BER) and quality margin

Bit Error Ratio is an objective measure of the quality of the digital TV signal after signal demodulation. The coding techniques, which are employed in the digital TV standards, are able to identify and correct a certain amount of errors. Consequently, bit errors can be tolerated up to a particular level without causing quality degradation of pictures or sound.

The digital TV signal decoding, as implemented in the DVB-T standard, has two stages, namely Viterbi decoding, as the first stage and Reed Solomon (RS) decoding as the second stage. Each of these stages is able to perform a degree of error identification/correction. Therefore, BER can be measured before the Viterbi decoding (channel BER), after the Viterbi decoding ('post-Viterbi' BER) and after the RS decoding ('post-RS' BER).

Post-Viterbi BER is the primary parameter which describes the quality of the digital transmission link. As such, post-Viterbi BER should be measured to determine the quality of the received digital TV signal.

A good measurement device should be able to measure at each of the above stages.

A post-Viterbi BER of better than '2E-4' ( $2 \times 10^{-4}$  - i.e. the 'Digital Cliff Edge') corresponds to 'post-RS' BER of better than '2E-11' ( $2 \times 10^{-11}$ ) which is called quasi-error free reception (less than 1 error per hour). A post-Viterbi BER of worse than '2E-4' ( $2 \times 10^{-4}$ ) will exceed the ability of the RS (Reed- Solomon) error correction and may result in picture and sound corruption.

By measuring post-Viterbi BER, the quality margin can be judged. The MER should be a minimum of 25dB. However, this margin can be further assessed by measuring MER (Modulation Error Ratio). MER is a measure of signal-to-noise ratio (S/N) of the digital signal (or a very near equivalent of inband S/N). The theoretical S/N minimum at 'Digital Cliff Edge' is 18.6 dB for the digital TV transmission modes in use in Australia. Therefore, by measuring MER, the quality margin can be determined as a difference between the measured MER and the theoretical minimum.

Post-Viterbi BER	@ Cliff edge	Minimum	Preferred
		2E-4	2E-6
MER	20 dB	25 dB	25 dB

**Table 1.2 Post Viterbi BER**

To provide for a sufficiently robust reception, a minimum post-Viterbi BER of better than '2E-6' with an MER of better than 25 dB is required. However, a post-Viterbi BER of better than '2E-7' with an MER of better than 25 dB is preferred.

## Appendix D Older Antennas

Many older antennas should be able to adequately receive the new digital transmission channels. However, if after the digital receiver goes through its initial installation channel scan, some broadcasters' signals show signs of continual picture break-up or are not found at all, then the antenna (and/or feeder cable) probably needs replacement. For example, in most capital cities, digital transmissions on channels 6, 11, 12 and 33 - 36, may not be adequately received on older antennas designed for 2, 7, 9, 10 and 28. In capital cities for example, an antenna does not need the longer bars at the rear of the antenna required for reception of analog Ch 2 (called VHF Band 1), but does need to be able to receive across the full range of Channels 6 to 12 (called VHF Band III) and across Channels 28 to 35 (called UHF Band IV). Similarly, in many regional areas, the new digital broadcasts may be in a different frequency band to the old analog channels where the older antenna reception capability may be lacking.