

AS 1367:2023



STANDARDS
Australia



Coaxial cable and optical fibre systems for the RF distribution of digital television, radio and in-house analogue television signals in single and multiple dwelling installations



AS 1367:2023

This Australian Standard ® was prepared by CT-002, Broadcasting and Related Services. It was approved on behalf of the Council of Standards Australia on 28 August 2023.

This Standard was published on 29 September 2023.

The following are represented on Committee CT-002:

- Australian Broadcasting Corporation
- Australian Digital and Telecommunications Industry Association
- Australian Industry Group
- Australian Information Industry Association
- Australian Subscription Television and Radio Association
- CHOICE
- Community Broadcasting Association of Australia
- Consumer Electronics Suppliers Association
- Engineers Australia
- Free TV Australia
- Special Broadcasting Service

This Standard was issued in draft form for comment as DR AS 1367:2022.

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ISBN 978 1 76139 324 2

Coaxial cable and optical fibre systems for the RF distribution of digital television, radio and in-house analogue television signals in single and multiple dwelling installations

Originated as AS 1367—1976.
Previous edition AS/NZS 1367:2016.
Revised and redesignated as AS 1367:2023.

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Preface

This Standard was prepared by Standards Australia Committee CT-002, Broadcasting and Related Services, to supersede AS/NZS 1367:2016.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this document as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this document is to provide specifications and requirements for the cabling of a range of premises and buildings (generally referred to in this document as dwellings) for distribution of services such as free-to-air TV and radio, subscription or pay TV, or in-house video systems via radio frequency (RF) distribution. Such distributed services may include an interactive path.

A further objective of this document is to provide building owners, managers, architects, consultants, designers, manufacturers, installers, maintainers, service providers and users with requirements to meet user and service provider expectations, including performance criteria, for existing and foreseeable future services.

This document specifies the required equipment and system performance to meet safety, electromagnetic compatibility (EMC) and quality of service requirements of the end user or consumer.

The major changes in this edition are as follows:

- (a) Removal of references to New Zealand.
- (b) Removal of grade 1 and 2 references.
- (c) Removal of references to analogue and cable systems.
- (d) Addition of DAB+ notes.
- (e) Inclusion of an appendix for updated current and legacy system designs.
- (f) Addition of fibre system drawing.
- (g) Update of system design symbols.
- (h) Revised earthing requirements.
- (i) Updated coaxial cables attenuation levels and frequencies.

The terms “normative” and “informative” have been used in this document to define the application of the appendix to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

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NOTES

Australian Standard®

Coaxial cable and optical fibre systems for the RF distribution of digital television, radio and in-house analogue television signals in single and multiple dwelling installations

Section 1 Scope and general

1.1 Scope

This document specifies requirements and gives guidelines for the design, installation, electrical safety aspects, working performance, final commissioning and ongoing maintenance of a range of radio frequency (RF) distribution systems using passive and active components that enable the high quality distribution of off-air, in-house television and radio signals in single and multiple unit dwellings (and where required, in other commercial premises such as electrical goods retail stores, offices, etc.).

The intended result of the application of the requirements in this document is a distribution system that delivers a desired range of RF-based signals to the end-users' tuners/receivers at a sufficient but not excessive level to ensure that noise, intermodulation, cross-modulation or other interference will not impair reception quality. A conforming specified design and construction of the distribution system is also intended to minimize other effects such as reflections and signal ingress or egress from the system that could be caused by component and coaxial cable mismatch or shielding deficiency.

The level and quality parameters applicable to the final system are provided for design, installation and system commissioning guidance as indicated by the recommended signal levels and signal quality at the system outlets (e.g. wallplates) shown in [Tables 9.2](#) (levels), [9.3](#) (level ratios) and [9.4](#) (C/N, MER and BER).

This document is relevant to systems capable of accommodating the distribution of RF signals depending on service requirements over a frequency range from 5 MHz to 2 400 MHz, including any required d.c. or low frequency power or signalling paths.

NOTE 1 The PAL analogue television system was used in Australia prior to the change to digital and therefore many "in house" distribution systems used in hotels, motels, etc. used analogue equipment, such as modulators and frequency translators. It should be noted that some such systems may still exist; however, analogue television is recorded in this document for legacy purposes only and not covered in this latest version.

This document applies to distribution systems that typically carry, as a minimum, the local digital television free-to-air (FTA) terrestrially broadcast services (see Note 2 below) through to extensive systems that combine terrestrial and satellite IF signals.

This document provides specifications for a range of passive and active devices including coaxial cable and connectors. The individual component's specifications conformance and the interaction between components is an essential primary requirement to allow for a system design and installation that has predictable signal levels and quality outcomes.

It is recognized that "connected" television receivers and other electronic media devices may require access to Internet connections. However, this document does not include specifications for the reticulation of IP streaming services to television receivers or other media devices. This document also does not cover the interfacing and distribution of telephony, IP or other data services, such as asymmetric digital subscribers line (ADSL) over twisted pair, Broadband over NBN, Broadband over Powerlines (BPL), Local Area Networks (LANs), in-home digital multimedia networks and baseband systems. Communications Alliance document AS/CA S009 covers communications and data cabling installation requirements, including distribution of ethernet over coax (EoC) services.

This document does not cover distribution of AM radio.

NOTE 2 The scope is illustrated in [Figure 1.1](#).

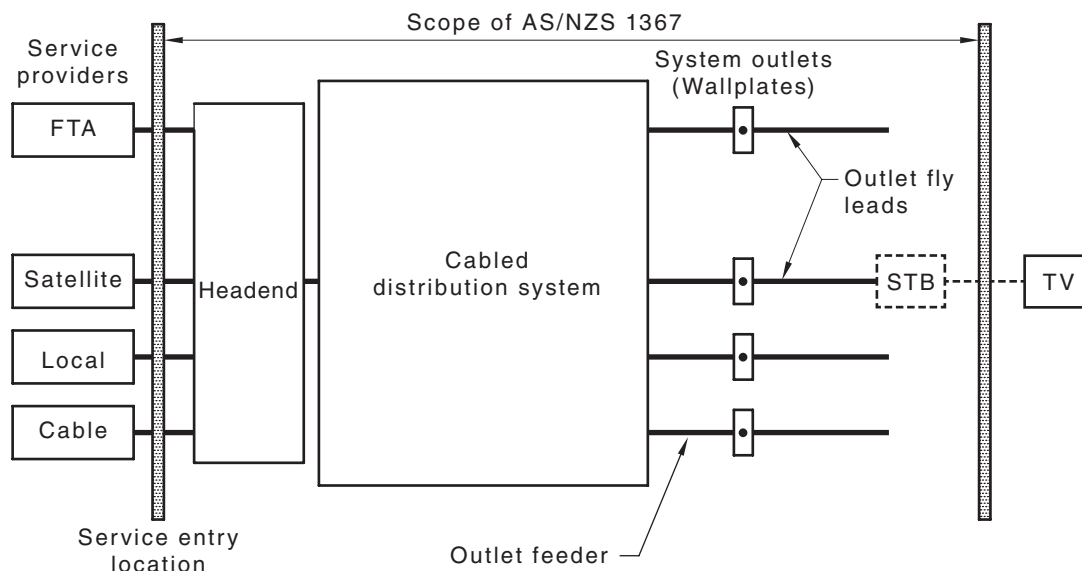


Figure 1.1 — Illustration of the scope of this document

1.2 Application

This document is equally applicable to new installations or upgrades to existing installations and is intended to be applied to the design, installation and commissioning of all multi-channel coaxial cable distribution systems, including fibre optic distribution systems in single and multiple residential and commercial buildings designed to carry multi-channel television and radio signals originating from a choice of terrestrial/satellite/cable FTA digital television, FTA DAB and FM radio, VAST satellite television, subscription satellite television (pay TV), or in-house video systems.

The digital platforms supported in this document include DVB-T, DVB-T2, DVB-S, DVB-S2, DAB+ and FM radio.

Situations are covered where, in addition to the reticulation of FTA terrestrial services, a separate distribution system may be required to reticulate signals of other services. Because of spectrum overlaps and other factors, systems carrying services from multiple providers may require systems each with their own outlets to feed specific receivers.

1.3 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 1417, *Receiving antennas for radio and television in the VHF and UHF broadcast bands—Design, manufacture and performance of outdoor terrestrial television antennas*

AS 5362, *Requirements for receivers for VHF/UHF DVB-T2 television broadcasts including ancillary services*

AS 60529, *Degrees of protection provided by enclosures (IP Code)*

AS/NZS 1768, *Lightning protection*

AS/NZS 3000, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

AS/NZS 62368.1, *Audio/video, information and communication technology equipment, Part 1: Safety requirements (IEC 62368-1:2018 (ED. 3.0), MOD)*

AS/CA S009, *Installation requirements for customer cabling (Wiring rules)*

IEC 61169-1, *Radio-frequency connectors – Part 1: Generic specification – General requirements and measuring methods*

IEC 61169-2, *Radio-frequency connectors – Part 2: Sectional specification – Radio frequency coaxial connectors of type 9,52*

IEC 61169-24, *Radio-frequency connectors – Part 24: Sectional specification – Radio-frequency coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F)*

IEC 60728-1, *Cable networks for television signals, sound signals and interactive services – Part 1: System performance of forward paths*

IEC 60728-2, *Cable networks for television signals, sound signals and interactive services – Part 2: Electromagnetic compatibility for equipment*

IEC 60728-3, *Cable networks for television signals, sound signals and interactive services – Part 3: Active wideband equipment for coaxial cable networks*

IEC 60728-5, *Cable networks for television signals, sound signals and interactive services – Part 5: Headend equipment*

IEC 60728-6, *Cable networks for television signals, sound signals and interactive services – Part 6: Optical equipment*

IEC 60966-1, *Radio frequency and coaxial cable assemblies, Part 1: Generic specification—General requirements and test methods*

EN 50083, *Cable networks for television signals, sound signals and interactive services*

ITU-T Recommendation G.983.3 (03/2001), *Digital sections and digital line system – Optical line systems for local and access networks – A broadband optical access system with increased service capability by wavelength allocation*

ITU-T Recommendation G.983.3 Amendment 1 (06/2002), *Digital sections and digital line system – Optical line systems for local and access networks – A broadband optical access system with increased service capability by wavelength allocation*

ITU-T Recommendation G.983.3 Amendment 2 (07/2005), *Digital sections and digital line system – Optical line systems for local and access networks – A broadband optical access system with increased service capability by wavelength allocation*

ITU-T Recommendation G.984.5 (02/2022), *Digital sections and Digital line system – Optical line systems for local and access networks – Gigabit-capable passive optical networks (G-PON): Enhancement band*

1.4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

1.4.1

A.C

alternating current

periodic current whose direction reverses at regular time intervals

Note 1 to entry: A.C. has alternating positive and negative values.

1.4.2

A.C. mains isolation

electrical 230 V r.m.s. a.c. mains isolation provided between dwellings or between a dwelling and a network operator's coaxial cable system

Note 1 to entry: This may be achieved by using isolating components (special double insulated high voltage capacitors or double wound transformers) in series with both inner and outer conductors of a coaxial connection [see *galvanic isolator* ([1.4.71](#))].

1.4.3

active device

in a cabled distribution system, any device that requires a source of electric power to operate

Note 1 to entry: An active device may increase the strength of a signal (i.e. amplify a signal) or change its frequency or modulation.

1.4.4

audio

baseband signal that carries information regarding the sound of the program being broadcast

1.4.5

automatic gain control

AGC

automatic control of a device to maintain the level of the signal at its output constant, using the signal to be controlled as the control stimulus

1.4.6

automatic level-controlled amplifier

ALC

amplifier that includes means to control, automatically, the level of the signal(s) at its output

Note 1 to entry: This may be achieved by controlling the variation of gain or slope or both, by means of —

- (a) one or more pilot carriers;
- (b) a temperature sensing device; and
- (c) remote control.

1.4.7

amplifier

<television> active device used to increase the power and amplitude of radio-frequency electrical signals mainly to compensate attenuation in cable or losses in multi-output signal splitters

Note 1 to entry: Limited bandwidth amplifiers are intended for operation with less than 10 TV channels.

Note 2 to entry: Broadband amplifiers operate over a continuous bandwidth greater than 10 TV channels.

Note 3 to entry: Cascaded amplifiers are used in cascade or in series with other amplifiers.

Note 4 to entry: Non-cascaded amplifiers are used in single or stand-alone configurations.

Note 5 to entry: Two-way or interactive cable systems use a forward and a reverse amplifier inside the one enclosure to boost signals travelling in both directions.

1.4.8

analogue

system in which a signal is continuous (linear) and varies in magnitude and frequency in sympathy with the source signal

Note 1 to entry: Analogue is commonly used in conjunction with the type of transmission [see *digital* ([1.4.41](#))].

1.4.9**analogue TV**

television system that uses analogue TV modulation

EXAMPLE PAL system B for Australia, or System I for New Zealand.

1.4.10**antenna**

RF reception device for terrestrial reception, or a dish for satellite reception

Note 1 to entry: Also known as an aerial.

1.4.11**antenna amplifier**

amplifier (often a low noise type) associated with an antenna

Note 1 to entry: A masthead amplifier is usually mounted with the antenna and used to compensate the signal loss in a long down link cable.

1.4.12**attenuation**

<of a system or equipment> weakening or reduction of input power to the output power as a ratio expressed in negative decibels (dB)

EXAMPLE Power loss of half is -3 dB.

1.4.13**attenuator**

passive device that reduces the signal power level

Note 1 to entry: Typically, an attenuator or pad is in the form of an in-line device with male and female F-type connectors.

1.4.14**backbone**

cable or fibre path between the headend and lateral, side or drop paths

Note 1 to entry: Includes trunk cables or fibres, amplifiers, taps, splitters and multiswitches that are normally parts of multiple dwelling systems.

1.4.15**bandwidth****BW**

difference, expressed in Hertz (Hz), between the highest and lowest frequencies of a transmission channel, i.e. a contiguous group of frequencies

1.4.16**baseband**

<signal> pure audio and video signal without a carrier wave

1.4.17**bit error ratio****BER**

the number of erroneous bits at the output of a system divided by the total number of received bits

Note 1 to entry: This term is used in evaluation of digital transmission systems. Also referred to as "bit error rate".

1.4.18**Bose-Chaudhuri-Hocquenghem****BCH**

multiple error correction binary block code used as an outer code in combination with LPDC (inner code) in DVB-S2 and DVB-T2 for FEC error correction system

1.4.19**broadband**

general term used to describe a wide bandwidth in equipment, or a system that can carry a relatively large section of the electromagnetic spectrum

EXAMPLE

An amplifier that amplifies from 5 MHz to 862 MHz, 950 MHz to 2 400 MHz or 5 MHz to 2 400 MHz.

1.4.20**cabled distribution system**

general term used to define MATV systems and individually cabled receiving systems that are used primarily to deliver television and radio signal via coaxial and or optical fibre for both the terrestrial and satellite IF bands, unless otherwise defined

1.4.21**carrier to noise ratio**

the difference (in decibels) between the vision or sound carrier level or channel power, at a given point in equipment or systems, and the noise level (or power) at that point (measured within a bandwidth appropriate to the television or radio system in use)

Note 1 to entry: The noise component may be a combination of Gaussian thermal noise and intermodulation products generated in the system plus other noise types and interference.

1.4.22**carrier wave**

single unmodulated carrier

Note 1 to entry: Also an abbreviation for continuous wave.

1.4.23**channel**

frequency division of the bandwidth of the terrestrial broadcast spectrum or a similar division in a cabled distribution system

Note 1 to entry: The Australian terrestrial broadcast channel width for both analogue PAL and DVB-T digital is 7 MHz for both VHF and UHF channels. Cable may use 7 MHz for analogue TV and 8 MHz for DVB-C digital.

1.4.24**channel power**

<digital services> measurement of power within the relevant bandwidth of the service (7 MHz for DVB-T, transponder B/W for DVB-S, 8 MHz for DVB-C, 1.5 MHz for DAB+) but with the power/level expressed as a voltage in dB μ V (across 75 Ω)

1.4.25**chrominance**

colour portion of a video signal that includes hue and saturation information

Note 1 to entry: Chrominance requires the black and white luminance to make a complete picture.

Note 2 to entry: Low chrominance results in the colour picture looking pale or washed out; high chrominance makes the colour too intense [see also *luminance* (1.4.92)].

1.4.26**Closed Captions**

words and symbols carried by a data channel in the DVB-S and DVB-T broadcast signals intended to help hearing impaired viewers

Note 1 to entry: Closed Captions differ from open captions and subtitles by being “closed” which means the viewer can choose to superimpose them or not on the picture.

1.4.27**coaxial cable**

dual conductor cable wherein a centre conductor is surrounded by but does not contact a concentric cylindrical outer conductor

Note 1 to entry: The outer conductor may be a solid tube (“hardline” or semi-rigid cable), or a braid of many wires or a thin aluminium foil (flexible cable).

1.4.28**combiner**

device in which the signals arriving at two or more input ports are fed to a single output port

Note 1 to entry: Some forms of this device may be used in the reverse direction as splitters.

1.4.29**commissioning**

procedure aiming at providing documentary evidence that the implementation was carried out in accordance with relevant specifications and design and includes tests and drawings

1.4.30**composite cross modulation**

undesired modulation of the carrier of a desired signal by the modulation of another signal as a result of equipment or system nonlinearities

Note 1 to entry: This appears as undesirable “beats” in another carrier. It is measured at the specified maximum channel loading.

1.4.31**composite second order**

amplitude distortion of a desired signal caused by the second order curvature of the nonlinear transfer characteristic occurring in the distribution system equipment

Note 1 to entry: Composite second order is the combination of all possible second order beat frequencies. It is the ratio, expressed in dB, of the peak level of the desired signal to the peak of distortion component falling within the channel.

1.4.32**core ovality**

<coaxial cables> difference between the minimum and maximum dimensions over the first laminated shield tape bonded to the core dielectric of the coaxial cable

1.4.33**cross-modulation**

undesired modulation of the carrier of a desired signal by the modulation of another signal as a result of equipment or system nonlinearities

1.4.34**DAB+**

digital radio system based upon the Eureka 147 DAB with COFDM modulation that was extended (+) using high efficiency advanced audio coding (HE AAC) and an extra level of error correction (RS), and is as used in Australia on VHF Band III with 1.5 MHz “ensembles”

1.4.35**dB**

the ratio in decibels of two quantities of power P1 and P2 and defined by the following: $10 \times \text{Log}(P1/P2)$

1.4.36**dBm**

measure of signal power expressed in dB and referred to a power input of 1 mW

1.4.37**dB μ V**

measure of signal level expressed in dB and referred to a signal level of 1 μ V when terminated in 75 Ω

Note 1 to entry: To convert dB μ V to dBmV, deduct 60 from the value expressed in dB μ V.

1.4.38**dielectric**

non-conductive insulator material between the centre conductor and outer conductor (shield) of the coaxial cable

1.4.39**differential gain**

in analogue colour TV, the change in chrominance gain (colour saturation), expressed in dB, or in the 4.43 MHz colour sub-carrier as a result of the level of the luminance (brightness) signal varying from blanking to white

1.4.40**differential phase**

change in the television signal's chrominance phase (hue) or variation in phase of its colour subcarrier as a result of the level of the luminance signal varying from blanking to white

1.4.41**digital**

sampling and coding of analogue signals into discrete "bits" of information, viz. ones and zeros

Note 1 to entry: Digital may also refer to digital modulated transmission based upon, for example, DVB-C, DVB-S/S2 or DVB-T/T2.

1.4.42**digital compression**

way of reducing the number of bits (ones and zeros) in a digital signal by using mathematical algorithms to eliminate redundant information, thereby reducing the space it occupies when being transmitted or recorded

1.4.43**digital service rating**

indication or measure of a device's maximum output level capability determined under specific conditions with a defined number of channel or transponder loadings

Note 1 to entry: Digital service rating has a similar purpose to a maximum output level (MOL) rating but with deratings based on loading by the number of digital services carried (see [Clause 4.13](#)).

1.4.44**digital TV****DTV**

FTA terrestrial television equivalent to DTTB

Note 1 to entry: A digital television transmission system uses digital techniques such as MPEG compression of the digitized vision and audio components into a data stream, and then encodes the data onto multicarriers in a DVB-T/T2 system or a single carrier in a DVB-S/S2 or DVB-C system.

1.4.45**diplexer**

passive filter that combines or separates bands or groups of signals

Note 1 to entry: The signals are typically VHF and UHF, satellite IF and terrestrial signals, or forward and reverse paths.

Note 2 to entry: Some forms of this device may be used in the reverse direction for combining or as a multiplexer.

1.4.46**directivity**

directivity of any device is defined as the difference in losses measured between (A to B) and (C to B) or (B to A) and (B to C) with the unused port terminated

Note 1 to entry: This definition does not apply to antenna directivity.

1.4.47**distribution amplifier**

amplifier designed to feed one or more branch or spur drops

Note 1 to entry: It is a general term embracing both branch and spur amplifiers.

1.4.48**distribution point**

point where signals are taken from the trunk to distribute to a lateral, side path, or spur drops

Note 1 to entry: The distribution point may be also refer to the direct connection from the headend via an amplifier or splitter.

1.4.49**distribution tap**

device for connecting from the main distribution system to the lateral or outlet drops (also referred to as Tap path or side path) with the required attenuation

Note 1 to entry: Also known just as a tap, or as a multiport tap or multiway tap (e.g. 2, 4, 8 outputs).

1.4.50**drop (path)**

transmission path forming part of a cabled distribution system that refers to the path from the trunk path distribution device, such as a tap or multiswitch, to the outlet

Note 1 to entry: Such a path may consist of a coaxial cable, optical fibre, or any combination.

1.4.51**earth electrode**

conductive part or a group of conductive parts in intimate contact with and providing an electrical connection with earth

Note 1 to entry: Required characteristics are specified in AS/NZS 3000.

1.4.52**earthing conductor**

protective conductor connecting the main earthing terminal to the earth electrode

1.4.53**earthing terminal**

connection point by means of which the earthing or grounding of a conducting part of an item of equipment is accomplished

1.4.54**echo**

time-delayed reflected signal caused by one or more distant impedance mismatches or in terrestrial reception from longer reception paths or from system generated echoes in a SFN system arrangement

1.4.55**EEP3A**

common error protection method used for sound in DAB+ that applies an error protection procedure that allows the bit error characteristics to be matched with the bit error sensitivity of the different parts of the bit stream

Note 1 to entry: EEP3 refers to protection level 3 that is the most common level used in operating DAB+ systems in Australia.

Note 2 to entry: Refer to ETSI TR 101 496–3 for further information.

1.4.56**egress**

leakages of RF signal energy (as electromagnetic radiation) out of the cabled distribution system

1.4.57**electromagnetic compatibility****EMC**

relates to the limits of ingress and egress to ensure compatibility between electronic systems

1.4.58**emissions**

electromagnetic radiation (sometimes unwanted)

1.4.59**equalizer**

device designed to compensate, over a certain frequency range, for the amplitude/frequency distortion or phase/frequency distortion introduced by system cable or equipment

Note 1 to entry: This device is for the compensation of linear distortion only and causes greater attenuation to the low frequency signals than to high frequency signals.

1.4.60**equipotential bonding**

electrical connection that puts various “exposed conductive parts” and “extraneous conductive parts” at an effectively equal potential

1.4.61**external immunity**

ability of a device, equipment or system to resist electromagnetic disturbances appearing outside the operating band and other than at its normal input terminals or antenna

1.4.62**filter**

device or circuit that passes one frequency band while blocking other frequencies

1.4.63**flylead**

shielded coaxial cable that carries RF signals from the system outlet or wallplate, to a TV receiver or set top unit, or PVR/VCR etc

Note 1 to entry: A flylead is also known as an outlet flylead.

1.4.64
forward error correction
FEC

system of error control for data transmission

Note 1 to entry: FEC differs from Standard error detection and correction in that the technique is specifically designed to allow the receiver to correct some errors without having to request a retransmission of data. The maximum fraction of errors that can be corrected is determined in advance by the design of the code, so different forward error correcting codes are suitable for different conditions.

1.4.65
forward path

in a two-way cabled distribution system, the frequency spectrum used to send information signals to the unit (dwelling) from the network operator's system, commonly in the frequency range 45 MHz to 2 400 MHz

Note 1 to entry: "Downstream" is a synonymous term.

1.4.66
free-to-air services

term used to refer to terrestrial TV and radio services that are available to the public without payment of a fee

Note 1 to entry: FTA signals in use in this document are normally terrestrially transmitted (broadcast) over the air and received via an antenna. Australian terrestrial broadcasts are in 7 MHz VHF and UHF channels using DVB-T digital. In some areas, there are deliveries of FTA services via DVB-S2 satellite, although access permission via smart card is required.

1.4.67
frequency converter

device for changing the carrier frequency of one or more signals at the headend

1.4.68
frequency modulation
FM

method of embedding an information signal (audio, video, or other) into a carrier signal where the information is expressed as fluctuations in the frequency of the carrier

1.4.69
F-type connector

standard 75 Ω flexible coaxial cable connector that conforms to IEC 61169-24

1.4.70
gain

decibel ratio of the output power to the input power in any equipment or system

1.4.71
galvanic isolator

device providing electrical isolation below a certain frequency range including direct current (d.c.) isolation, intended primarily for 230 V a.c. mains isolation

Note 1 to entry: Both the outer shield and the inner conductor of the coax are isolated by a specified voltage in a galvanic isolator. DC blocking devices only offer isolation of the inner of the coax.

1.4.72
group delay

distortion resulting from non-uniform speed of transmission of the various frequency components of a signal, i.e. the various frequency components of the signal have different times of travel (delay) between the input and the output of a circuit [see *chrominance* (1.4.25)]

1.4.73**guard interval**

characteristic of a DVB-T (and DAB+) COFDM transmission that helps with the reception of a signal with echoes whether occurring naturally or artificially from SFN transmission systems

1.4.74**headend**

equipment that is connected between receiving antennas or other signal sources and the remainder of the cabled distribution system, to process the signals to be distributed

Note 1 to entry: For example, the headend may comprise amplifiers, frequency converters, combiners, diplexers, PAL modulators and transmodulators.

Note 2 to entry: An *MATV headend* is used in blocks of flats and in built-up sites to feed TV channels and FM radio channels into the house network or the spur network.

1.4.75**High-Definition Multimedia Interface****HDMI**

internationally standardised nearly rectangular shaped connector with multi pins for transferring picture and sound signals in digital format between receivers, displays, headend processors computers, etc

Note 1 to entry: HDMI connectors, cables and sockets come in several varieties but in the context of this standard the HDMI type A connector applies.

1.4.76**hum modulation**

low frequency electromagnetic component, typically below 1 kHz, exhibited on a broadband medium and specifically attributed to the undesired coupling of 50 Hz (and harmonics) a.c. mains power supply

1.4.77**immunity**

ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

1.4.78**impulse response**

<measuring instruments> allows the display of echoes in both level and time and typically derived from an equalizer in the receiver that automatically adjusts to improve reception

Note 1 to entry: The impulse response is used to ascertain whether the echoes are safely within the guard interval time window so that robust reception can be supported.

1.4.79**ingress**

unwanted external signals entering into the cabled distribution system at various weak points (opposite of egress)

Note 1 to entry: The most common weak points are faulty cables and connectors where shield discontinuities or breaks reduce the ground shield effectiveness. Most common sources include local TV and sound broadcasts, amateur radio, local and international short-wave.

1.4.80**insertion loss**

additional loss in a system when a device such as a directional coupler is inserted; equal to the difference in signal level between input and output of such a device

1.4.81 interference

effect of unwanted energy due to emissions, radiations, or induction upon reception in a radio communication system, or any combination thereof

Note 1 to entry: Interference is manifested by any performance degradation, misinterpretation, or loss of information that would be extracted in the absence of such unwanted energy.

1.4.82 intermediate frequency IF

used in receivers or equipment which translates (shifts) a signal in the receiver's tuning range to a different but fixed intermediate frequency

Note 1 to entry: A shift to an intermediate frequency allows signal amplification and filtering in a more uniform way. In some cases there may be a second shift to give improved out-of-band rejection performance.

Note 2 to entry: Analogue PAL TV receivers used an IF of 36.875 MHz or 38.9 MHz for the video carrier. DVB-T receivers may use 36 MHz or 4.5 MHz. For satellite systems, the 11 MHz to 12 GHz received signal band is shifted down to 950 MHz to 2 400 MHz intermediate range and then tuned in the receiver to a 40 MHz IF.

1.4.83 intermediate frequency range IF range

<satellite> well-defined output frequency range of the LNB and comprises the frequency band known as "L-Band", between 950 MHz and 2 400 MHz or parts thereof

1.4.84 intermodulation IM

process whereby the nonlinearity of equipment in a system produces spurious output signals (called intermodulation products) at frequencies that are combinations of those of the input signals

1.4.85 isolation

attenuation between outputs, taps, trunks, interface ports, or polarization selection in any equipment or system

Note 1 to entry: The isolation type is described, for example, as output, trunk or switch, as a prefix to isolation.

1.4.86 lateral (path)

path from the backbone or trunk path (usually via a tap) to the outlets (usually directly or via a multiswitch)

Note 1 to entry: Also referred to as a side path or tap path. A drop is usually understood to be a coax (or fibre) from the tap or multiswitch to the outlet.

1.4.87 L-Band

frequency range of 950 MHz to 2 400 MHz

1.4.88 level

<power> decibel ratio of any power (dBm) to the Standard reference power P_r (1 mW), i.e. level (dBm) = $10 \times \log(P/P_r)$

<voltage> decibel ratio of any voltage to the Standard reference voltage (V_r)

Note 1 to entry: Voltage level may be expressed in decibels (relative to 1V), dBmV (relative to 1 mV) or dBµV (relative to 1 µV), i.e. level (dBµV) = $20 \times \log(V/V_r)$.

Note 2 to entry: For 75 Ω systems, add 109 to the dBm level to convert to dB μ V.

1.4.89

long term evolution

LTE

types of transmission technology used for mobile telecommunications, and that may have the potential to cause interference to terrestrial TV in the UHF band

1.4.90

low density parity check

LDPC

error correction method (inner code) used in DVB-S2 and DVB-T2 and is concatenated with a BCH code (outer code) in a FEC error correction system

1.4.91

low noise block down converter

LNB

device mounted on a satellite or MDS antenna to amplify and lower the entire block of frequencies in one step to usually an L-Band intermediate frequency range to be processed by a receiver, STB or IRD

Note 1 to entry: Being mounted externally, LNBs are normally powered by a d.c. voltage fed by the L-Band output cable. Sometimes called an LNBF because with most dual polarity devices the antenna "Feedhorn" is integrated into the LNB structure.

1.4.92

luminance

term used for the black and white or monochrome component of a video signal. Called luma and represented by the letter "Y"

1.4.93

may

indicates the existence of an option

1.4.94

maximum output level

MOL

rating for an active device normally given in dB μ V for a 75 Ω device

Note 1 to entry: The rating needs to be devalued dependent on the number and type of services carried (see [Clause 4.13](#)).

1.4.95

modulation error ratio

MER

measure of noise within digital modulation

Note 1 to entry: Refer to ETSI TR 101 290.

1.4.96

Moving Pictures Experts Group

MPEG

group within the Joint Video Team (JVT) of ISO/IEC MPEG and ITU-T VCEG, which has and continues to work on Standards of digital compression techniques for storage and transmission formats of multimedia including video and audio, for example, MPEG-1 audio formats such as Layer II (MP2) and Layer-III, popularly known as MP3

Note 1 to entry: The MPEG-2 Standard for video delivers, in DVB-T transmissions, Standard definition pictures up to 720 pixels per line by 576 active picture lines or high definition pictures that include 720p or 1080i formats.

Note 2 to entry: Higher efficiency compression formats are MPEG-4 (known also as ITU-T H.264) and AAC (Advanced Audio Coding).

1.4.97
multiple dwelling unit
MDU

residential or commercial dwelling where there is more than one unit (usually attached) or resident within a building sharing a common lead-in (e.g. block of flats)

Note 1 to entry: Typically, an MDU with less than 13 units and less than 4 storeys may be referred to as a SMDU (small MDU) (see also *SDU* and *MRE*).

1.4.98
multi-residential estate
MRE

residential dwelling where there is more than one residence that is not attached and/or shares a common entrance

1.4.99
mutual isolation
RF

attenuation between two output ports of a device within a specified frequency range

Note 1 to entry: The device's design may require other ports to be terminated to conform to the specification.

1.4.100
optical amplifier

device for amplifying optical signals directly; it consists of an active medium, and its associated components, which amplifies the optical signal without demodulation or regeneration

1.4.101
optical receiver

device for converting optical signals into electrical signals; it consists of a detector (e.g. PIN-diode) and its associated components as well as all the components between the optical input and coaxial output connectors

1.4.102
optical transmitter

device for converting electrical signals into optical signals; it consists of a light source (e.g. laser) and its associated components as well as all components between the coaxial input and optical output connectors

1.4.103
outlet drop

drop connecting a unit's (dwelling's) distribution tap to a system outlet. It is sometimes also known as a "drop" cable

1.4.104
packet error rate
PER

measurement of errors used in DVB-S2 and DVB-T2

1.4.105
passive device

circuit or network not requiring power for its operation

1.4.106
pay TV

TV service requiring payment by the user or the subscriber

1.4.107**personal video recorder****PVR**

similar to a set top box but provided with internal record/replay capability of program media

Note 1 to entry: A PVR is often provided with two or more separate tuners so that the user may watch one program while recording another. In the case of satellite PVRs, the two tuners usually require separate antenna feed inputs so as to give access to programs on different receive polarizations or positions.

1.4.108**power inserter/injectors**

passive device used to insert power into a distribution line to power another device

Note 1 to entry: Such devices are also called "Bias Tee".

1.4.109**quadrature amplitude modulation****QAM**

digital modulation technique used on cable (e.g. 64QAM and 128QAM) and within the DVB-T COFDM systems for digital FTA TV (see *DVB-C* and *DVB-T*)

1.4.110**quasi error free****QEF**

one uncorrected error event per hour

Note 1 to entry: In a DVB-T transmission system using Reed-Solomon error correction it corresponds to an after RS BER of $1\text{E-}11$ at the input of the MPEG-2 demultiplexer and aligns with $2\text{E-}4$ BER before RS.

1.4.111**radiation (emission)**

phenomenon by which energy in the form of electromagnetic waves emanates from a source into space, including induction phenomena

1.4.112**radio frequency****RF**

any frequency between 5 MHz and 2 400 MHz

1.4.113**return loss RL**

ratio of reflected signal power to transmitted signal, expressed in dB

1.4.114**satellite master antenna television****SMATV**

system where a headend only has IF signals supplied by the satellite antenna outdoor unit that are inserted into a distribution network either as individual signals or together with terrestrially received signals

Note 1 to entry: If the TV signals received from the satellite are remodulated into an AM-TV format, the term "SMATV headend" should not be used. It is recommended that the term MATV encompass both terrestrial and satellite systems, as used in this Standard.

1.4.115**second order distortion**

Spurious signals of one of two types, those caused by harmonics and those caused by intermodulation

Note 1 to entry: The second-order harmonic of a signal of frequency f_1 has a frequency of $2f_1$, and such a harmonic may interfere with any signal whose fundamental frequency is around twice the frequency of f_1 .

Note 2 to entry: The second-order intermodulation products of any two signal frequencies f_a and f_b will be $(f_a + f_b)$ and $(f_a - f_b)$. These intermodulation products may interfere with any signal that is close in frequency.

1.4.116

service information

SI

MPEG and DVB information data tables that are required to be in DVB-T, C or S/S2 transmissions so that a receiver is able to identify and separate the programs

Note 1 to entry: The PAT and PMT are MPEG essential, while the NIT, EIT, SDT, TDT and TOT are specified by DVB in ETSI EN 300 468.

Note 2 to entry: Australian use is detailed in Free TV Australia's OPs.

1.4.117

set top box

STB

receiver-decoder unit, usually located in a user's dwellings, that primarily tunes or selects and then decodes the required media/program

Note 1 to entry: The STB output is fed to the user's presentation and display system. The unit may also include functionality for program access authorization (e.g. with a "Smartcard" slot) to activate descrambling capability.

Note 2 to entry: The term STB is most generally associated with terrestrial DTV services and IRD (Integrated receiver decoder) with subscription/pay media service reception via satellite and cable.

1.4.118

shall

indicates that a statement is mandatory

1.4.119

should

indicates a recommendation

1.4.120

single channel amplifier

amplifier that accepts and amplifies the signals of one TV channel and rejects the signals of frequencies of other channels

1.4.121

single frequency network

SFN

terrestrial transmissions of DVB-T and DAB+ services in a transmission structure that allows a number of transmitters/translators to operate on the same frequency

Note 1 to entry: A single frequency networks provides greater efficiency in the use of the frequency spectrum [see also *impulse response*(1.4.78)].

1.4.122

slope

difference in gain or attenuation at two specified frequencies between any two points in an item of equipment or in a system

Note 1 to entry: A positive slope of level with increasing frequency may be deliberately established to compensate for frequency dependant losses in coaxial cables and other components in systems.

Note 2 to entry: Slope is also sometimes referred to as *linearity* in MATV industry.

1.4.123**splitter**

device in which the signal power at the input port is divided equally or unequally between two or more output ports

Note 1 to entry: A splitter specified in this document has a minimum specified amount of isolation between output ports.

Note 2 to entry: Some forms of this device may be used in the reverse direction for combining signals.

1.4.124**structural return loss****SRL**

return loss characteristic of a coaxial cable due to periodic structural variations along its length

1.7.125**subtitles**

form part of the transmitted video signal and consist of words superimposed onto the picture that are translated from a foreign language being used in the program

Note 1 to entry: The word subtitle is also sometimes used for closed captions, on the remote control of the receiver.

1.4.126**system outlet**

device for interconnecting an outlet drop and an outlet flylead at the wall of a dwelling

Note 1 to entry: Also commonly referred to as a “wallplate”.

1.4.127**terminal device**

device connected to a system outlet. It may be a STB, recording device or television or radio receiver

1.4.128**termination (terminating resistors)**

75 Ω resistive load that minimizes RF signal reflections on coaxial cabled distribution systems and on unused ports of equipment

1.4.129**terrestrial**

categorizes radio-frequency transmissions typically at VHF or UHF, broadcast through the atmosphere over the earth that carry television and radio signals in contrast to satellite or closed cable distribution techniques

1.4.130**thermal noise**

noise generated in a resistive component due to the thermal agitation of electrons that increases with temperature

Note 1 to entry: The amplitudes contained within pure thermal noise have a Gaussian distribution, therefore this is also referred to as Gaussian noise.

1.4.131**transparent digital transmodulator****TDT****transmodulator**

data packet in a DVB digital broadcast that gives the current date and (UTC) time to the receiver

Note 1 to entry: Refer to ETSI EN 300 468 and Free TV Australia OP 45.

1.4.132**ultra high frequency****UHF**

frequency band range from 300 MHz to 3 GHz

Note 1 to entry: For terrestrial TV broadcasting, mainly for antenna design, the band is broken into two with frequency ranges dependent upon the country of operation.

1.4.133**unwanted signal**

signal that causes or has the potential to interfere with a wanted signal

Note 1 to entry: An unwanted signal can be inside or outside the operating frequency range.

1.4.134**very high frequency****VHF**

frequency band range from 30 MHz to 300 MHz

Note 1 to entry: For broadcasting, the VHF band is broken into the following ranges:

- (a) Band I: 45~70 MHz was used for analogue TV.
- (b) Band II: 85~92; 94~101; 101~108 MHz was used for analogue TV.
- (c) Band II radio: 87.5~108 MHz.
- (d) Band III: 174~230 MHz (DTV Channels 6 to 12).
- (e) Band III DAB+: 174~230 MHz (Block labels 5A to 12C).

1.4.135**video**

baseband signal that carries information regarding the picture of the program being broadcast

1.4.136**video recorder**

home video recording device using such media as magnetic tape cassettes, sometimes referred to as a "video", a "VCR" (video cassette recorder) or a "VTR" (video tape recorder), DVD (digital video disc), or for hard disc types as a PVR (personal video recorder)

1.4.137**Viewer Access Satellite Television****VAST**

provides television and radio services to viewers in remote areas of Australia, as well as those unable to receive "off-air" television for various reasons including local terrain and/or distance from transmitters

Note 1 to entry: The VAST service is "free-to-air" and has channels for the ABC, SBS and some of the commercial TV networks. Refer to www.mysattv.com.au. Refer also to Viewer Access Satellite Television (www.myvast.com.au).

1.4.138**viterbi**

forward error correction (FEC) system based on convolutional code that is also called "Inner coding" and that is normally applied to the digital data stream during modulation

Note 1 to entry: Viterbi is used in DVB-T and DVB-S systems where typically values of 2/3 and 3/4 are used, which refer to the number data packets over the number of total data packets that include the error protection packets. This error correction type is suited to noise corrupted signals.

1.4.139 well matched

<test set-up> when the port or ports “facing” the equipment under test have a return loss ratio of at least 20 dB relative to the system impedance

1.5 Documentation provided with the system

The system design and commissioning data log results information shall be included in the documentation provided with the system and a copy shall remain with the installed system after completion. While such information may also be necessary at the planning, design, installation and commissioning stages, there is much value for later maintenance or system upgrade if these details are available, even if the products used are discontinued and/or the original manufacturer no longer exists.

NOTE 1 [Appendix B](#) provides requirements on documentation as recommended to be provided by the installer and/or system contractor.

NOTE 2 [Appendix B](#) also details minimum equipment labelling and specifications.

NOTE 3 [Appendix C](#) provides recommended symbols to be used in diagrams and plans.

1.6 Services

1.6.1 General

This document covers the distribution of television and radio signals, which comprise the services defined below.

1.6.2 DVB-T and DVB-T2

DVB-T services utilizing multi-carrier COFDM modulation as referenced by ETSI EN 300 744 and in Australia using 7 MHz channels, as detailed in the *Digital Terrestrial Television Broadcasting Planning Handbook* available from the ACMA, and in AS 4599.1 (transmission) and AS 4933 (receivers). Should spectrum be reduced in the future for broadcast television in Australia, it is likely that it will convert to the second-generation DVB-T2 modulation as referenced by ETSI EN 302 755 (to be re-issued as ETSI TS 302 755) and AS 5362 for receivers.

NOTE AS 4599.1 is currently under development and is expected to be redesignated AS 4599.

1.6.3 DVB-S and DVB-S2 TV

Satellite digital television services utilizing single-carrier QPSK or 8PSK modulation as detailed for DVB-S in ETSI EN 300 421 and for DVB-S2 in ETSI EN 302 307. DVB-C TV.

Cable digital television service utilizing single-carrier QAM modulation is as detailed in the ETSI EN 300 429. Consideration in this document includes 64QAM to 256QAM.

1.6.4 FM radio

Frequency modulated (FM) radio services are located in the frequency range 87.5 MHz to 108 MHz that is commonly referred to as Band II. The characteristics of terrestrial transmissions in Australia are defined in *Broadcasting Services (Technical Planning) Guidelines 2017*, available from the ACMA.

1.6.5 DAB+ radio

Digital radio services for Australian terrestrial transmissions utilize multi-carrier COFDM modulation with AAC+ audio as detailed in ETSI EN 300 401 and TS 102 563 and operate in VHF Band III between 174 MHz to 230 MHz. Four nominally 1.5 MHz wide carriers (Mode 1) fit into a 7 MHz TV channel and

in Australia are mainly planned to operate in a sub-band in TV RF Channels 9 and 9A catering for commercial, national (public) and community broadcast services.

1.7 Locations

1.7.1 Dwelling categories

Single and multiple dwellings are defined in terms of accommodation, plus whether there is exclusive or shared use of an antenna.

For the purpose of this document a single commercial premise such as a retail showroom is considered as a single dwelling.

A single dwelling has —

- (a) only one mains power feed that may be isolated; and
- (b) accommodation that may be isolated by the locking of doors without interfering with other dwellings.

Examples of a single dwelling are an individual house, a townhouse or flat/unit/apartment within a complex.

Multiple Dwelling Units (MDUs) have —

- (i) multiple lockable individual accommodation; and
- (ii) shared use of an antenna between dwellings on a property.

Examples of multiple dwellings are a block of flats, apartments, home units, a motel, a hotel, a retirement village, a resort and Multiple Residential Estates (MRE's), etc.

Recommended cabling installation practices are summarized in [Appendix E](#).

1.7.2 Service entry locations

The nominal location for the service entry (SE) location [previously referred to as the premises cabling interface (PCI)] for each type of network operator is shown in [Table 1.1](#).

Table 1.1 — Nominal service entry locations

Service carriage medium	SE — Single dwellings	SE — Multiple dwellings
Terrestrial free-to-air TV (FTA) (DVB-T and DVB-T2) Terrestrial FM radio Digital radio (DAB +)	At output of FTA antennas	At output of FTA antennas
Satellite TV (DVB-S/S2)	Output of LNB or down converter	Output of LNB or down converter

1.7.3 Variations in equipment specifications

In order to meet system performance objectives at commissioning, the specifications of equipment used should be superior to or equal to those specified in this document.

Any connection subsequent to an existing cabled distribution system that has previously met the requirements of this specification shall not degrade the existing system and/or the service provider's system. Typically, additional connections may include another network operator's system, an external

signal source sub-system, such as a VHF/UHF MATV system, an in-house video system or any locally originated signal source.

1.7.4 Provision of free-to-air digital services

1.7.4.1 Provision for FTA Digital TV services

The typical requirement is to deliver the off-air received FTA digital TV signals to all the system outlets. The FTA signals shall be delivered intact with all the services and other features included in the signal by the broadcaster, such as programs in high definition, widescreen, multichannel with interactive services, service information (SI) and other information such as Closed Captions. Such a requirement does not preclude, for example, processing for level control (AGC) or channel frequency translation, although this may be less necessary with the channels now broadcast in contiguous blocks.

NOTE SI carries mandatory parental guidance rating information in the program guide (EIT) (see AS 4599.1).

1.7.4.2 Provision for DAB+ Radio services

The DAB+ Radio services are conveyed in DAB Ensembles that are 1.54 MHz bandwidth with the number of Ensembles required depending on the particular broadcast market. For example, the Brisbane, Sydney and Melbourne markets have three Ensembles with 9A and 9B for Commercial and Community services and 9C for the National services. The Adelaide and Perth markets have two Ensembles with 9B for Commercial and Community services and 9C for the National services. These Ensembles are located in TV Channel 9A.

The relevant example Ensemble centre frequencies (block frequencies) are the following:

- (a) DAB 9A: 202.928 MHz.
- (b) DAB 9B: 204.640 MHz.
- (c) DAB 9C: 206.352 MHz.

Four DAB Ensembles fit into a 7 MHz TV channel with the following block frequencies used in other cities and regional broadcast markets:

- (i) DAB 9D: 208.064 MHz.
- (ii) DAB 8C: 199.360 MHz.
- (iii) DAB 8D: 201.072 MHz.

The following is a guide to the required DAB Ensemble level and method for provision of DAB+ into the distribution system that has been designed to provide optimum performance when DAB coexists with DTV:

- (A) *DAB Ensemble launch level* — System arrangements with separate DTV and DAB antennas the DAB Ensemble levels referenced to DTV channel levels at output of headend should be as shown in [Figure 1.2](#).

NOTE this figure represents a typical field analyser display (idealised). Channel 10 is allocated to the sixth digital television channel and is not currently on air.

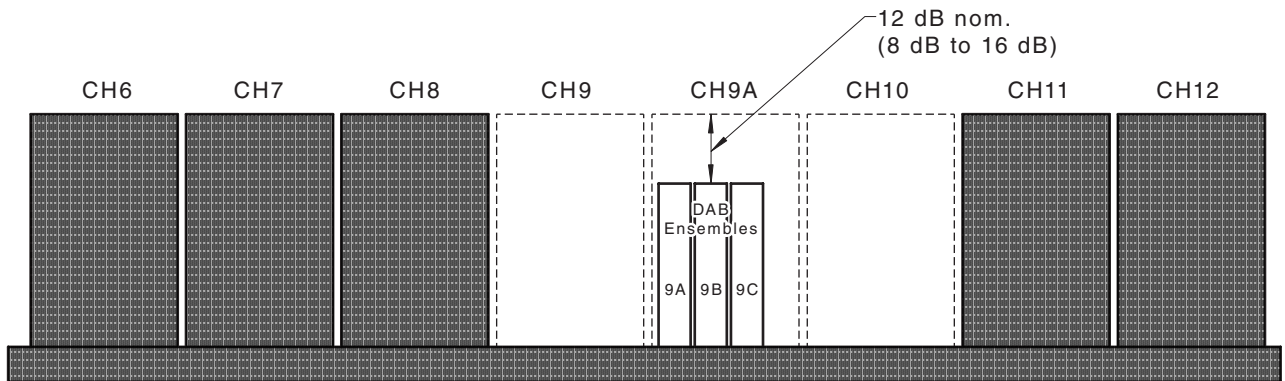


Figure 1.2 — – DAB Ensemble levels referenced DTV channel levels guide

- (B) *Launch method scenarios* — To provide DAB+ Radio services, the method will depend upon the structure of the headend system and reception location scenarios. Examples and recommended methods are as follows:
- (1) Amplifier only headend for locations with the following:
 - (a) Reception in areas covered by TV and DAB Main transmissions on same tower, as the DAB Ensemble level will be typically around 6 dB lower than VHF TV levels due the cross-polarization rejection of the TV antenna, an extra DAB antenna is not required, as such DAB Ensemble levels will be adequate.
 - (b) Reception in areas covered only by UHF TV Translators and DAB Infill or DAB Main transmissions, the vertically polarized DAB antenna can be combined with the horizontally polarized TV antenna via a splitter as an input to headend system distribution amplifier. The DAB Ensemble levels at output of amplifier should be adjusted to be a nominal 12 dB lower referenced to the UHF TV channel levels as seen on a field analyser spectrum display. The UHF TV antenna and VHF DAB antenna should have UHF Band and VHF Band filters installed respectively.
 - (2) Channel programmable headend — For a channel filtered headend system, the DAB antenna is connected to a VHF input and programmed to the required DAB occupied channel (example TV Channel 9A). The DAB Ensemble levels at output of headend should be adjusted to a nominal 12 dB lower the VHF TV channel levels as seen on a field analyser spectrum display as indicated in [Figure 1.2](#).
 - (3) DTV Modulator processed headend — With a DTV Modulator processed headend, the DAB antenna (possibly via an amplifier) can only be combined via splitter with the output of the processor headend. The DAB Ensemble level should be adjusted to a nominal 12 dB lower the VHF TV channel levels as seen on a field analyser spectrum display as indicated in [Figure 1.2](#).

1.7.4.3 Provision for FM Radio services

The following is a guide for the method for provision FM Radio services in the frequency Band 87.5 MHz to 108 MHz to all system outlets. The methods of insertion of the FM Band into the distribution system headend have been designed to coexist without interference with other services. The guide is as follows:

- (a) *Antenna type and filtering* — Adequate levels would typically be provided by a separate 3 or 4 element BII antenna oriented either horizontally or vertically. The antenna's output prior to input to the headend, shall have a FM Band Pass filter installed to prevent pickup by the FM

Antenna of DTV and DAB services potentially corrupting the purposed built DTV and DAB reception systems.

- (b) *FM Radio launch level* — Referring to levels at system outlets in [Table 9.2](#), it is to be noted that the FM levels per service in dB μ V are in the same order as the FTA DTV services. Hence the dominant FM levels per service launched into the distribution system at the headend are to be a similar level to that of the DTV services as indicated on the spectrum display of a field analyser.
- (c) *Launch method scenarios* — To provide FM Radio services, the launch method will depend upon the structure of the headend system. Examples and recommended methods are as follows:
 - (i) *Amplifier only headend* — The output of the antenna after the filter, can be combined with the other antennas at the input of the amplifier with the FM levels adjusted to that as indicated above.
 - (ii) *DTV Channel programmable and Modulator processed headend* — An amplified output of the FM antenna and filter can be combined into the DTV processed headend with the FM levels adjusted to that as indicated above.

1.7.4.4 FTA antennas selection, location and impulsive noise consideration

See [Clause 6.5.4](#) in this document for detailed information on antenna selection and installation. [Clause 2.2](#) gives some details of safety aspects. The following is a basic starting guide for FTA reception:

- (a) Information on the broadcast transmissions available in the area may be obtained from the ACMA and the broadcasters. This will include details of the distance and direction or bearing to the optimum transmit site, be it a main or locally retransmitted (referred to for TV as Translators and for DAB as Infills). Also required are the RF channels (in Australia usually a 6 or 9 channel block for FTA DTV), and antenna polarization.
- (b) In Australia, since the introduction of digital TV and the switch off of all analogue PAL broadcasts, the TV coverage of many Australian cities and towns has been enhanced by the addition of extra “gap-filler” retransmit sites. Reception from one of these sites may be a better alternative. Several of these sites on Australia’s east coast currently have a total of 9 UHF channels to include both metropolitan and regional broadcaster transmissions.
- (c) Antenna type selection criteria and guidance is provided by AS 1417.
- (d) Antenna location and height should be selected so that there is a clear line of sight and no obstructions such as buildings, trees, etc.
- (e) Avoiding antenna locations near power lines, particularly high voltage lines and other things such as lift motor rooms that have a potential to generate impulsive noise from arcing.
- (f) Antennas with baluns should preferably be of the transformer type (offered by ferrite type baluns) to achieve good rejection of impulsive noise.
- (g) Conformity with this document ensures the shielding performance that is provided by the use of quad shielded coaxial cable and F-type compression connectors from the antenna input to the system output reduces the possible ingress of impulsive noise and other interference.
- (h) A separate antenna for FM is required and for DAB+ may be required depending on the type of system (see [Clause 1.6](#)).

NOTE 1 Replacement of legacy antennas with an antenna designed for the specific VHF Block A and UHF blocks (B, C, D and E) being broadcast is important to ensure equal reception level across the band and no loss of performance at the band edge (e.g. RF channels 6 and 12 in VHF Block A). A VHF Block A antenna that has minimal pickup below RF channel 6 may minimize pickup of impulsive noise. UHF antennas that have suitable response up to RF channel 51 (694 MHz), but little response above, may minimize other interference from mobile broadband devices.

NOTE 2 Care is needed in combining multiple antennas for services such as VHF/ UHF DTV, FM and DAB+, for example, the use of a diplexer may be required and level adjustments need to be taken into consideration to minimize interference between the received services.

1.7.4.5 System outlet signal characteristics

The recommended signal levels, level difference between services and signal quality at a dwelling's wallplate outlet are given in [Tables 9.2](#), [9.3](#) and [9.4](#) respectively.

Note that the DVB-T level requirements shall apply to all COFDM signals operating at 64QAM and 3/4 error correction Code Rate (FEC).

1.7.4.6 Legacy system structures

In some distribution systems, one or more of the channels now used by FTA digital TV and DAB+ radio transmissions have been used for various other purposes, resulting in blocked access to these digital TV and radio signals. FTA digital TV services should not be interfered with by the in-house services. The digital radio channels shall not be translated from their transmitted RF channel.

NOTE 1 Digital TV RF channels contain several programs and features that will not be accessible if the broadcaster's complete digital signal is not available to the receiver.

NOTE 2 Some legacy systems intercept digital TV signals in the headend where "fixed-tuned" digital receivers are used to select one or more services as provided in Standard definition (SD) to an analogue PAL modulator to be distributed to drive in-house analogue TV receivers. These systems compromise the display of digital widescreen 16:9 pictures on PAL analogue 4:3 picture aspect ratio receivers. However, it is to be emphasized, such systems may have a limited life and may create problems for end user viewers as the format of FTA digital broadcasts can change from time to time.

NOTE 3 DAB+ frequencies must remain unchanged without any conversion.

1.7.4.7 Subscription Pay TV and FTA TV services

The provision of a distribution system for subscription TV services does not preclude the need to provide a separate or integrated distribution system for access to off-air FTA TV services. These FTA TV services are normally available via reception from terrestrial transmissions although in remote or poor reception areas FTA TV services may be obtained from the Viewer Access Satellite Television (VAST) service. Information about eligibility for satellite access may be obtained from the MySatTV website (mysattv.com.au). The VAST satellite service is encrypted; however, ABC and SBS VAST services are available to all viewers with a VAST decoder. Access to commercial VAST services is restricted to premises where terrestrial TV is unavailable, or to travellers. Information on VAST decoder registration and activation is available from the MySatTV website (mysattv.com.au). Information about TV coverage and the VAST application form can be accessed via the Australian Government's mySwitch website (<https://myswitch.digitalready.gov.au/>).

Where FTA and satellite IF systems share the same cabled distribution system, [Clause 8.6](#) describes the requirements to protect FTA signals from noise or interference from the satellite IF system.

1.7.4.8 Selecting free channel space

System designs that require other services as well as FTA TV and radio distribution, such as in-house channels and or a Multistacker for conversion of DVB-S or DVB-S2, should have the following selection

priorities for the RF channel allocations to ensure current and future integrity of FTA TV and radio services:

(a) *For in-house services:*

- (i) Use of channels above 694 MHz (however, there is potential of local interference from mobile broadband transmissions).
- (ii) Use of unused channels in terrestrial transmissions; refer to the ACMA for local area channel frequency allocations.

NOTE See Australian Communications and Media Authority at <http://www.acma.gov.au/>.

(b) *For Multistacker derived services* — Use of S-band up to 2 400 MHz distribution.

Cabled distribution system performance and installation quality shall conform to relevant conditions and specifications for FTA, satellite delivery specified in this document.

Since the specific requirements of satellite providers vary, the required service provider should be identified, and their interface parameters made known, prior to system design.

1.7.5 Component quality and aging

Consideration should be given to the quality of the chosen components, cables and electronic systems in regard to aging. As components and systems age, their characteristics may vary, which may cause degradation of signal levels and/or quality. In poorly selected components and systems, the aging may be accelerated leading to more frequent maintenance. Typical aging problems may be frequency drifting and increased phase noise in active equipment, loss of system gain, increase in noise and/or hum in amplifiers. In passive equipment for example, loss of shielding due to lost or degraded connectors and increased attenuation plus poor return loss in cables due to damage or exposure to the environment. Consideration should also be given to shelter from the weather, humidity, extreme temperatures and dust in order to prevent premature degradation of the system components and connectors.

1.7.6 Documentation and labelling

Refer to [Appendix B](#) for details on the documentation, system and equipment labelling that shall be provided with and in a system.

Section 2 Safety requirements

2.1 Application and general requirements

2.1.1 Application

This section specifies requirements and gives guidelines for the safety of the system, the authorized service personnel working on it, the occupant, and the occupant's equipment. It deals with safety aspects only. It is not intended to protect the equipment used in the system and does not constitute a lightning protection system (LPS).

2.1.2 General requirements

The cabled distribution system within single or multiple dwellings shall be so designed, constructed and installed as to prevent hazards, either in normal use or under any single fault condition, to the occupants connected to the system, or to any other person who may come in contact with normally accessible components of the system.

In particular, a system shall provide —

- (a) personal protection against electric shock;
- (b) personal protection against physical injury including eye damage in the case of optical systems; and
- (c) protection against fire.

WARNING — AUTHORIZED SERVICE PERSONNEL, WHEN WORKING ON THE EQUIPMENT IN AN APPROVED MANNER, MAY BE EXPOSED TO LIVE PARTS OF THE EQUIPMENT BY THE REMOVAL OF EQUIPMENT PROTECTIVE COVERS.

2.2 Antennas

2.2.1 General

This [clause \(2.2\)](#) is intended to give guidance for personal safety and to minimize effects of static atmospheric overvoltages and lightning discharges that may be encountered with antenna systems, including satellite antennas.

If the building is equipped with an LPS, any connection between the LPS and the antenna system shall be referred to the LPS designers.

NOTE The LPS should conform to AS/NZS 1768.

2.2.2 Antenna earthing

In systems feeding multiple dwellings, a safety earth cable of 2.5 mm² should run from the antenna metal support. This earth wire should be run with the signal feed cable back to the earthing point at the headend or initial distribution point, known as a communications earthing terminal (CET). To reduce the possibility of discharges coming down the cable feed, an inductive loop (typically three turns of approximately 200 mm diameter) in each cable feed(s) from the antenna(s) may reduce the possibility of equipment damage.

In a single house installation, earthing an antenna mast should be approached with caution as there is the possibility of minor electric shock (touch current effect) when plugging in or removing the antenna lead from a receiver. This may be caused by mains current leakage that in many cases may be made greater by the receiver's interconnection with other "double-insulated" non-earthed consumer equipment such as amplifiers, DVD players, etc.

An exclusion is made for antenna systems including satellite dishes external to the building that are located more than 2 m below the apex of the roof and less than 1.5 m from the building.

2.3 Powering of cabled distribution system

2.3.1 Line powered

In systems where line powering is used on the coaxial cable between the service entry (SE) and the distribution tap, the following conditions shall be met:

- (a) Line powering shall be confined to feeder only. Line powering shall not extend to the outlet cable.
- (b) Line powering voltage shall be completely inaccessible to unauthorized personnel.
- (c) Line powering voltage shall be accessible to authorized personnel only after removal of equipment protective covers by means of a tool.

2.3.2 Remote powering and control signals via the outlet

Where “back powering and control signals” to a network or to outdoor equipment are employed, such as amplifiers, low noise block converters, polarizers in antenna installations and multiswitches, the system shall conform to the following:

- (a) The voltage applied between the inner and outer conductor of the outlet shall not exceed the ES1 limits of AS/NZS 62368.1, i.e. 42.4 V a.c. r.m.s. or 60 V d.c (equivalent to the SELV limits of older standards).
- (b) The equipment shall be so designed and constructed such that no hazardous voltages can be touched under normal operating or single fault conditions.

NOTE Equipment may need to comply with appropriate Australian regulatory requirements. Refer to Electrical Regulatory Authorities Council (ERAC) information available on the ACMA website.

2.3.3 Mains connected devices

The devices used in a cabled distribution system shall meet the requirements of AS/NZS 60065 for electrical safety.

2.4 Environmental protection

Devices installed outdoors and either operated from the mains supply or line powered shall provide, as a minimum, a degree of protection afforded by an IPX4 rating, in accordance with AS 60529. Alternatively, they shall be installed in an appropriate splash-proof or watertight enclosure so as to provide the appropriate degree of protection for both atmospheric conditions and safety, preventing access by fingers.

2.5 Transient and fault protection

2.5.1 General

When a coaxial cable distribution system is installed in a building, there are a number of aspects to be considered including the following:

- (a) The power-related currents that may flow in the coaxial cable.
- (b) The potential the coaxial cable can assume with respect to other earth zones, e.g. the power earth.

- (c) The ability to bleed induced voltages and currents resulting from static discharge and the accumulation of leakage currents.

The system shall employ equipotential bonding and/or a.c. mains isolation as summarized in [Table 2.1](#).

2.5.2 Protection method choice

In cases where control signals and back powering are used, e.g. satellite multiswitches and LNBs, a.c. mains isolation at outlets shall not be used. Equipotential bonding should be employed in this system structure.

2.5.3 Equipotential bonding

2.5.3.1 General

Equipotential bonding to earth can be used to ensure that no hazardous voltages are present on the outer conductors of any cable or accessible metalwork of any equipment, including passive items.

Bonding can bleed induced voltages and currents resulting from static discharge pickup on outer conductors of cabling thus possibly reducing the chance of damage to system components and connected equipment.

2.5.3.2 Equipotential bonding technique

Equipotential bonding shall be achieved by connecting each active and passive device together and terminating to the CET location.

The CET is connected to the earth point for the area where the cabled distribution system is located.

If the cabled distribution system covers a number of earth zones, then the use of isolators may be required (see [Clause 2.5.4](#)).

2.5.3.3 Installation of communications earth terminal (CET)

The installation of the equipotential bonding and earthing for the coaxial cable distribution system shall be in accordance with AS/CA S009 and meet all the prescribed requirements of the Communications Earth System (CES) and the Communications Earth Terminal (CET).

The CET is a terminal block that allows the bonding conductors to be individually disconnected.

The CET shall be installed in a convenient and readily accessible location near but external to the electrical switch or distribution board.

The CET shall be marked "Communications Earth Terminal".

The CET shall be connected to protective earth using a bonding conductor. The bonding conductor shall be labelled "Communications Earth System" at the protective earth end.

The connection to protective earth may be made either within the switchboard (Option 1) or external to the switchboard (Option 2) and shall conform to AS/NZS 3000 with respect to earthing arrangements and earthing conductors (see [Figures 2.1](#) and [2.2](#)).

NOTE Only a licensed electrical worker may make connections within the switchboard (see AS/NZS 3000).

The protective earth connection can be made to the earthing conductor external to the switchboard if the earthing conductor(s) is not cut or rearranged or has the electrical integrity impaired during the installation of the bonding conductor terminations. Finally, any insulation removed shall be reinstated.

For the case of an external connection in multistorey dwellings, the bonding conductor can only be connected to the earthing conductor on its vertical rise between the floor and the tee-off for the switchboard or distribution board.

The bonding conductor from a distribution component shall be connected via the CET and not direct to the earth electrode except in an individual house.

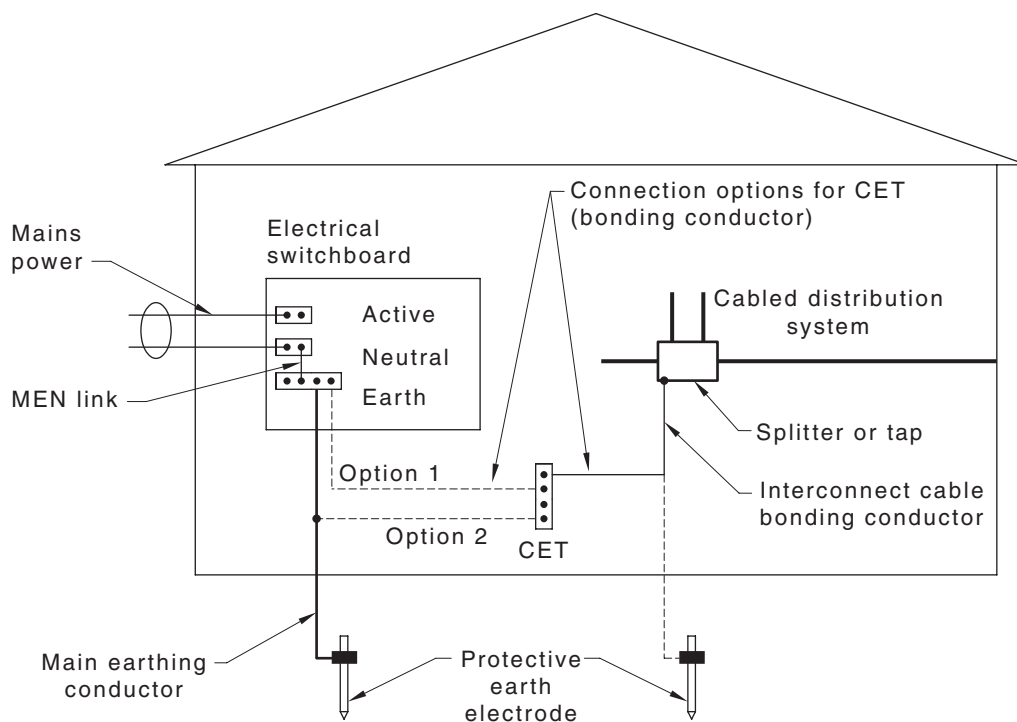


Figure 2.1 — Options for earthed equipotential bonding in a single dwelling installation

2.5.3.4 Bonding conductors

The conductors used for equipotential bonding to the CET to the electrical earthing system shall be green/yellow PVC insulated multi-stranded copper conductors having a cross-section of at least 6 mm² and shall be as short as practicable. Every connection of an earthing or bonding lead shall be soundly made by the use of clamps, connectors, crimp connectors, or soldering and shall be accessible for inspection.

The resistance of the communications bonding conductor shall not exceed 0.5 Ω .

2.5.3.5 Component earthing cable

The bonding conductor connection to the electrical earthing system shall be made by means prescribed in AS/NZS 3000 and be suitably protected against corrosion.

Cables for earthing of components shall be a minimum of 2.5 mm².

2.5.3.6 Fault current capacity

When equipotential bonding is employed, all coaxial cable sheaths, sheath series fittings, and series components with an impedance of less than 0.5 Ω shall be capable of carrying a current of 30 A r.m.s. for a period of 5 s. Such components shall be accessible for inspection, even if only with the aid of a tool. The outer system between any connecting device, such as a socket forming part of a system outlet

point and the next bonding point shall be capable of carrying a current of 30 A r.m.s. for a period of 5 s. Provision shall be made to maintain bonding while units are changed or removed.

NOTE This requirement prevents equipment reaching dangerous voltages under fault conditions.

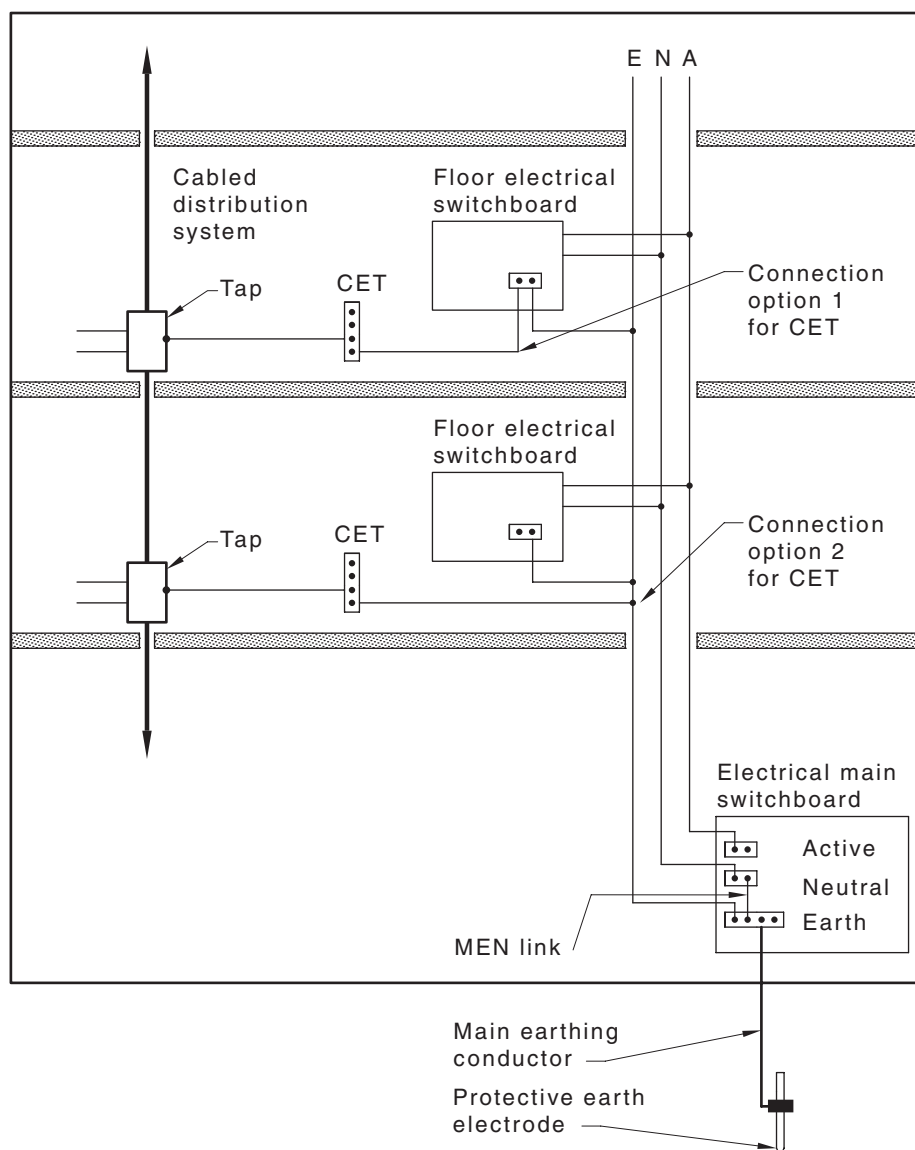


Figure 2.2 — Options for equipotential bonding in a multiple dwelling installation

2.5.3.7 Earth loops

Employing equipotential bonding may produce “earth loops” from multiple earths. This is due to different parts of a system being connected to separate earthing electrodes, allowing earth currents to flow. This can result in hum and other disturbances in the system. An isolator inserted in the main distribution path between different “earthed” sections of a system will prevent such currents from arising.

2.5.4 Mains isolation

2.5.4.1 General

Where isolation is to be used, e.g. between premises or different earth zones, it shall be provided by a galvanic isolator where at mains frequency both the centre and outer conductors of the coaxial cable are isolated across the device. This prevents mains currents from flowing in the coaxial cable. The complete device shall be capable of withstanding 3.5 kV peak without breakdown.

NOTE 1 As a device providing a.c. mains isolation may cause the radiation or pick-up of RF energy usually at lower frequencies, special attention should be given to ensuring the device's screening effectiveness is adequate, especially if a return path is utilized.

NOTE 2 For mains isolator/galvanic isolator RF performance specifications, see [Clause 5.10](#).

2.5.4.2 Outlets

The following outlet types apply:

- (a) *Non-isolated system outlet* — This type of outlet doesn't have any isolation components and is widely used in Australia. These non-isolated outlets allow remote powering and/or controlling of devices such as mast-head amplifiers and LNBs or selecting source in a multiswitch. Provision shall be made in the distribution system to prevent the power reaching other outlets. When a non-isolated outlet is used, an equipotential bonding system shall be used for safety reasons.

NOTE For systems with integrated satellite and FTA on the same cable, a diplexer provides the required d.c. isolation.

- (b) *Fully isolated system outlet* — This type of outlet incorporates d.c. isolating components in series with both the inner and the outer conductors of the coaxial connections as in [Clause 2.5.4.1](#). The isolating components may be either high-voltage capacitors or double-wound transformers. This type of outlet inhibits remote powering and/or control of remote devices and is generally not used in Australia.

2.5.4.3 Single dwellings

In an RF installation within a single dwelling, an a.c. mains isolating device (RF pass) shall be provided if —

- (a) there is a feed from an external RF network, in which case the device shall be installed externally, prior to any splitting at the dwelling cabling interface (see [Figure 2.3](#)); or
- (b) the number of outlets exceeds six and does not have equipotential bonding.

This is to prevent the cumulative leakage currents from double insulated equipment from becoming excessive and tripping the core-balance residual current device (RCD) safety switch protecting the dwelling. Such leakage currents give rise to touch currents that can become excessive and result in unpleasant sensations when any part of the installation is contacted. One or more isolating devices can be used to divide the outlets into groups of approximately equal numbers such that the total in each group does not exceed six.

A consumer mains power board (power strip) with a loop-through RF port with the outer connected to the protective earth (preferably via a 0.02 μf high voltage capacitor) may be used to offer equipotential bonding.

NOTE For descriptions of single and multiple dwelling categories, see [Clause 1.7](#).