Cabling of premises for telecommunications

Essential information for home cabling

IT'S HOW WE CONNECT

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Summary

This document provides summary guidance to developers, builders, electricians, telecommunications cabling providers and consumers about the installation of telecommunications cabling when building or renovating a home. For detailed information, refer to Telstra Document No. 017153a00, *Cabling of premises for telecommunications — A complete guide to home cabling*.

This document is optimised for reading on a tablet or portable computer to take advantage of hyperlinks, document search functions and on-screen magnification of photographs and drawings.

Essential information for home cabling

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1 PURPOSE

The purpose of this document is to provide essential guidance for the installation of home cabling systems that are suitable for connection of telecommunications services independent of the type of telecommunications network technology used to supply the services.

Currently, telephone and broadband services may be supplied using any of the following technologies:

- copper twisted pair cable — for telephone and ADSL (Asymmetric Digital Subscriber Line) services
- HFC (Hybrid Fibre-Coax) — otherwise known as "Cable" (for Cable internet and Cable pay TV)
- FTTP (Fibre To The Premises) — for telephone, broadband and, in some cases, TV services
- Satellite — for broadband and, in some cases, telephone services
- 3G (3rd Generation) or 4G (4th Generation) wireless — for broadband and, in some cases, telephone services.

The guidance provided by this document is intended to ensure that the cabling is compatible with the **National Broadband Network (NBN)** to which all homes are expected to be connected eventually.

The Telstra documents may be downloaded from the "Builders" menu of the Telstra Smart Community® website (http://www.telstra.com.au/smart-community/builders/).

2 SCOPE

This document applies to any building constructed for use as a home. It applies to detached buildings (single dwellings) as well as semi-detached buildings (town houses, villas, etc.). Certain aspects of this document may also be applied to the internal cabling of residential apartments.

While the document generally describes cabling for new buildings, it may also be applied to rewiring of established buildings.

3 INTRODUCTION

3.1 What are broadband services?

"Broadband" is the general term used to describe services that operate at higher frequencies or digital bit rates ("data speeds") than are necessary to transmit the human voice (e.g. for high-speed access to the internet). Voice grade transmission is often referred to as "baseband" or "narrowband".

3.2 What is the National Broadband Network?

The National Broadband Network (NBN) is a telecommunications network that is being constructed by NBN Co Limited, a company established by the Commonwealth Government in 2009 to provide access to high-speed broadband services by all Australian residents by the year 2021.

Ultimately, NBN Co intends to provide up to 93% of homes, schools and workplaces with access to optical fibre cabling capable of supplying broadband services with speeds of 100 Mbps (100 million bits per second), with the balance being connected via fixed wireless or satellite technologies capable of supplying broadband speeds of 12 Mbps (12 million bits per second).

The NBN requires the installation of electronic equipment in the customer's home and a dedicated power point — even if the customer only wants a basic telephone service. The telecommunications services are also wired from within the home (i.e. from the NBN equipment) instead of from outside the home.

Typical NBN equipment is illustrated in Figure 1.

For more information, go to the NBN Co website at www.nbnco.com.au.

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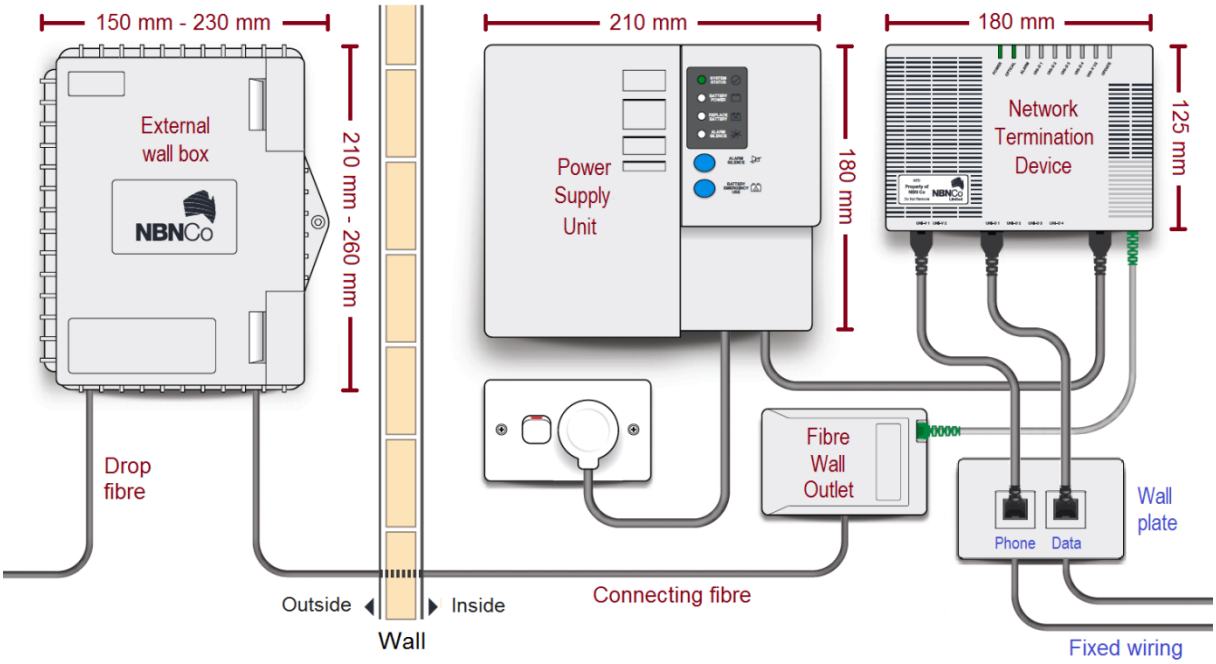
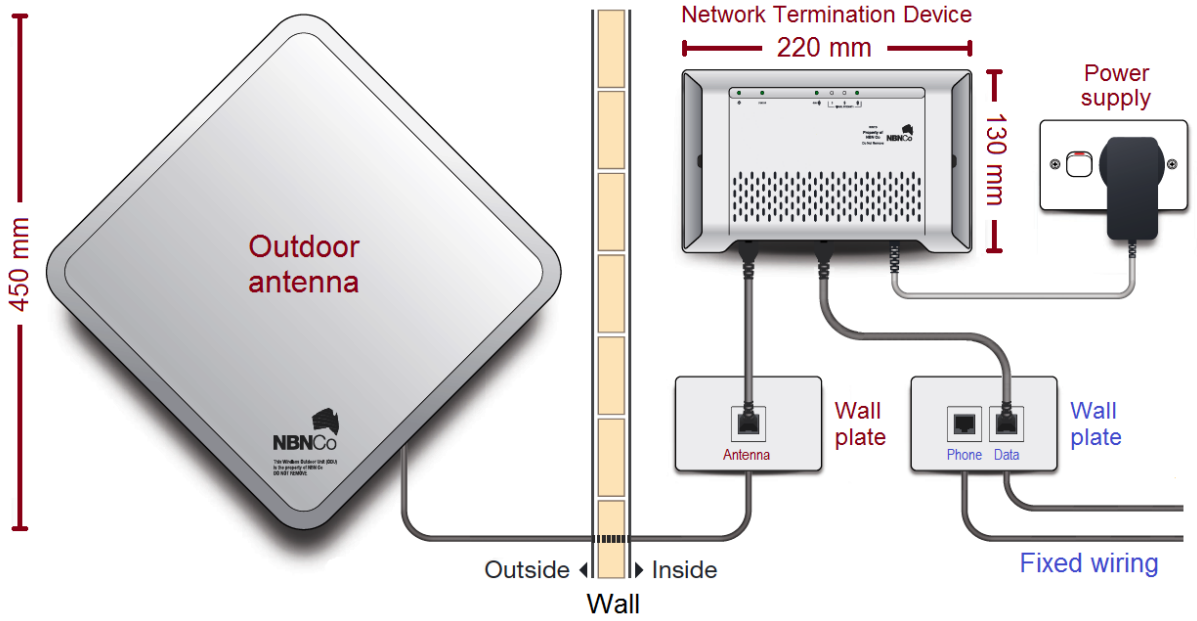
Figure 1 Basic components of typical NBN installations

(a) Fibre To The Premises (FTTP)



(b) 4G fixed wireless



3.3 Home cabling requirements have changed!

Traditional cabling methods used for telephone and ADSL services are not compatible with the NBN.

3.3.1 Previous requirements ("legacy cabling")

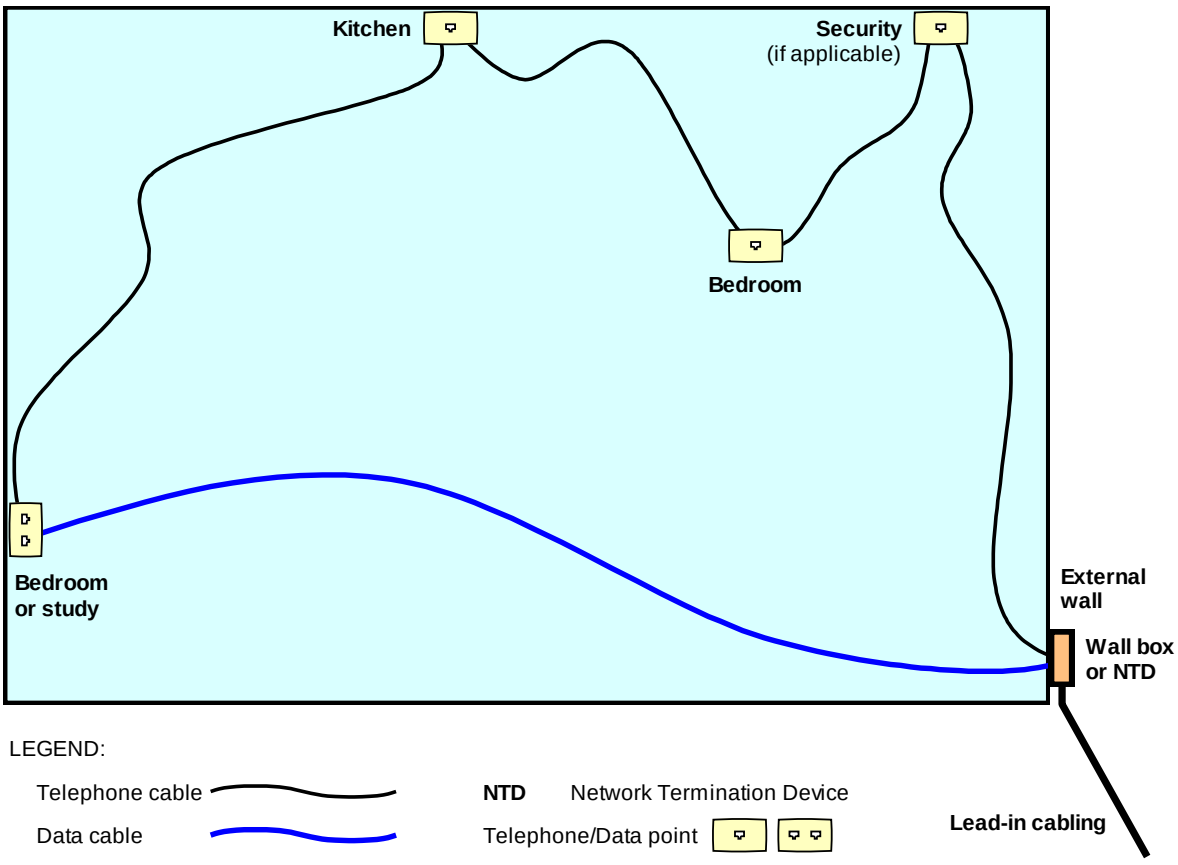
Traditionally, telephone and ADSL access points (outlets) have been wired sequentially from an external connection point (e.g. a wall box), as shown in Figure 2. In some cases, a separate cable may be installed between an external ("outdoor") Network Termination Device (NTD) or a central ADSL splitter and an access point for connection of an ADSL modem (also shown in Figure 2).

Either telephone cable (two to three pairs) or data cable (four pairs) could be used with this cabling method.

This type of cabling is often referred to as "legacy cabling" because it is a legacy from a bygone era when telephones were the primary means of communicating with other persons outside the home.

This method of cabling is unsuitable for new homes as it will not support modern telecommunications services, especially data services supplied via the NBN.

Figure 2 An example of conventional telephone/ADSL home cabling



Note: This type of cabling is often referred to as "legacy cabling" and is an unsuitable cabling method for modern telecommunications services, especially NBN data services.

3.3.2 New requirements ("generic cabling")

Modern telecommunications services – especially NBN services – require the installation of **locally powered electronic devices** that are **located inside** the customer's building, unit or apartment.

With modern telecommunications services, access points (outlets) should be cabled radially ("star wired") from an internal **central connection point** (CCP) located next to the powered electronic devices, as shown in Figure 3 (some cabling providers may prefer to call the CCP a "cross-connection point").

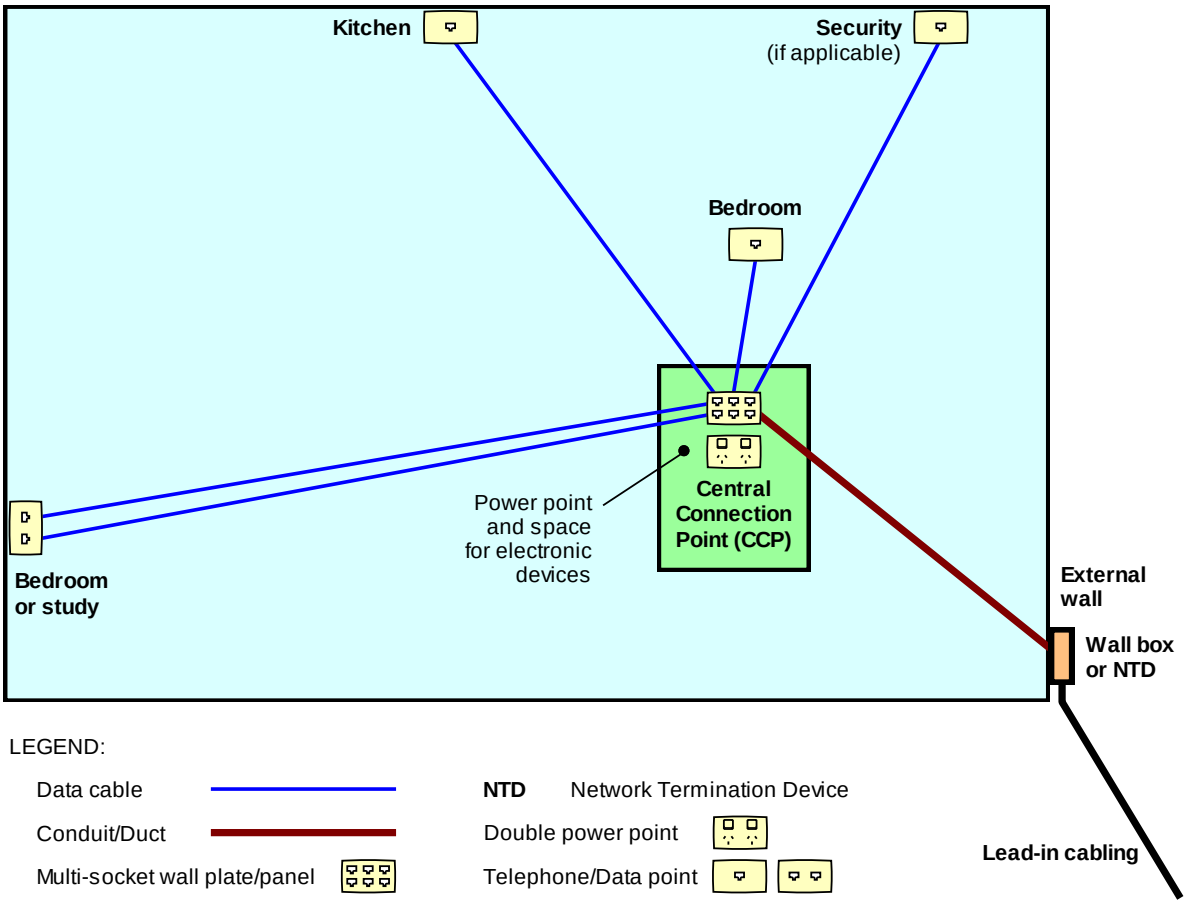
Data cable (four pairs) rated at Category 5 or better (see Note) **must be used** with this cabling method to support both telephone and Ethernet (data) connections.

Note: Category 5 is the minimum required to support 100 Mbps Ethernet; however, Telstra recommends the installation of Category 6 cable as a minimum (see 5.4.2). For an explanation of cable "category" and "Ethernet", refer to Document No. 017153a00.

In this document, this cabling methodology is referred to as "**generic cabling**".

Note: In some standards and handbooks, the CCP may be described as a "Home Distributor" (HD). However, if only a few outlets are installed (as shown in Figure 3), the CCP is not a distributor and the cabling may be installed by a cabling provider with either "Restricted" or "Open" registration.

Figure 3 Home cabling method for modern telecommunications services (e.g. NBN)



Notes:

1. The Central Connection Point (CCP) provides a common point for connection of the incoming service cables, telephone/data point cables and electronic devices such as a modem/gateway or NBN equipment. The CCP may consist of a single, multi-socket wall plate or a "Home Distributor" (e.g. a patch panel), depending on the number of outlets.
2. In this document, this cabling methodology is referred to as "generic cabling".

3.4 Other changes

While power for operating a telephone service has traditionally been supplied via the copper telephone line from the telephone exchange, new technologies, such as Fibre To The Premises (FTTP), satellite and fixed wireless used for the NBN, use transmission media that do not conduct electricity (namely optical fibre and radio waves). Therefore, a power supply must be installed inside the home to operate the electronic equipment. This requires the provision of a **dedicated power point** and the supply of **continuous power** for the equipment — even if the customer only wants a basic telephone service.

The customer may also be required to maintain a **backup battery** if the operation of a "lifeline" telephone service is essential during power failure (e.g. a blackout). This is a new requirement.

When it comes to cabling a new home, there are other differences between NBN services and traditional copper-based services supplied by Telstra, described below. While, for the time being at least, Telstra continues to provide copper-based services in small property developments and established areas, ultimately, Telstra will cease installing copper networks and will supply Telstra services via the NBN.

To summarise **what has changed** for **cabling a new home**:

- Where services will be supplied to the premises via NBN FTTP (urban areas):
  - The builder or customer is required to **supply and install the lead-in conduit**, to NBN Co specifications, between the property boundary and the building.
  - The builder or customer must **provide an internal conduit or accessible cabling pathway**, to NBN Co specifications, between the external wall of the building where the lead-in conduit terminates and the location of the internal electronic equipment.

    Note: In the case of apartments, a contiguous conduit or an accessible pathway is typically required between the floor riser cupboard and the electronic device location inside the apartment.
- The builder or customer must **provide a suitable internal enclosure or space** to accommodate the electronic equipment, power point, a central connection point and associated connecting cords.
- The builder or customer must **provide at least one dedicated, double-socket power point** for the electronic equipment even if the customer only requires a basic telephone service.
- The builder or customer must **provide the internal cabling** between the central connection point and the outlets to be used to access the telecommunications services in the selected rooms.

3.5 What happens if I don't cable my home properly?

Carriers and service providers are not required to pre-wire premises and the responsibility to ensure that the home is pre-wired for telecommunications services rests with the builder, owner or customer. If the home is not suitably pre-wired, the carrier or service provider is not obliged to conceal any necessary cabling in the building cavities and may elect to install the cabling on the surface of walls or ceilings.

If the home is not cabled in accordance with this guideline, while the consumer may still be able to gain access to services that are available in the area, failure to cable the home properly may result in:

- installation delays
- cabling on the surface of external and internal walls that the occupant may regard as unsightly
- additional installation costs, especially if concealed cabling is preferred
- inconvenient location of equipment and service access points
- limited access to the telecommunications services from multiple access points
- the inability to use some high-speed data applications such as IPTV and media networking
- low flexibility or additional cost for adjusting to any changes in technology or future personal needs.

3.6 What about wireless?

While wireless ("Wi-Fi") technology used in homes is improving all the time, it does not work well through masonry or metallic walls and its application is ultimately limited by the available frequency bands and the number of concurrent users. Wi-Fi will always have its place in a wired home and may meet the current needs of some consumers. However, it cannot be relied on to provide access to high-speed digital applications (such as high definition IPTV, media streaming and video calling) in all situations.

3.7 Pre-wiring the home

3.7.1 There is no such thing as "future-proof" cabling!

Telecommunications technology is advancing at a rapid rate and there is no such thing as "future-proof" cabling. At best, current home cabling technology will meet consumer expectations for **10-15 years**, which is a fraction of the life expectancy of both the home and the occupants.

Therefore, when building a new home it is important to **make provision for easily and economically augmenting or replacing the cabling** at some future time by providing suitable accessible cabling pathways and spaces. This is the only real way to "future-proof" a home to ensure continued access to modern telecommunications services.

Ultimately, as described in 3.2, it is expected that up to 93% of homes, schools and workplaces will be connected to FTTP. Accordingly, any homes and small businesses that will initially be connected to the existing ADSL (telephone) or HFC ("cable") network will need to provide an upgrade path for FTTP. Even with FTTP, the home should be provisioned for the possibility of either an outdoor or an indoor FTTP NTD in case the carrier or the FTTP cabling methodology changes.

3.7.2 Home cabling elements

Figure 4 illustrates a "generic" cabling model that may be applied to all "landline" or "wireline" telecommunications network technologies. It provides for easy upgrade from copper-based network technologies (telephone/ADSL and HFC) to FTTP, 4G wireless or satellite technology.

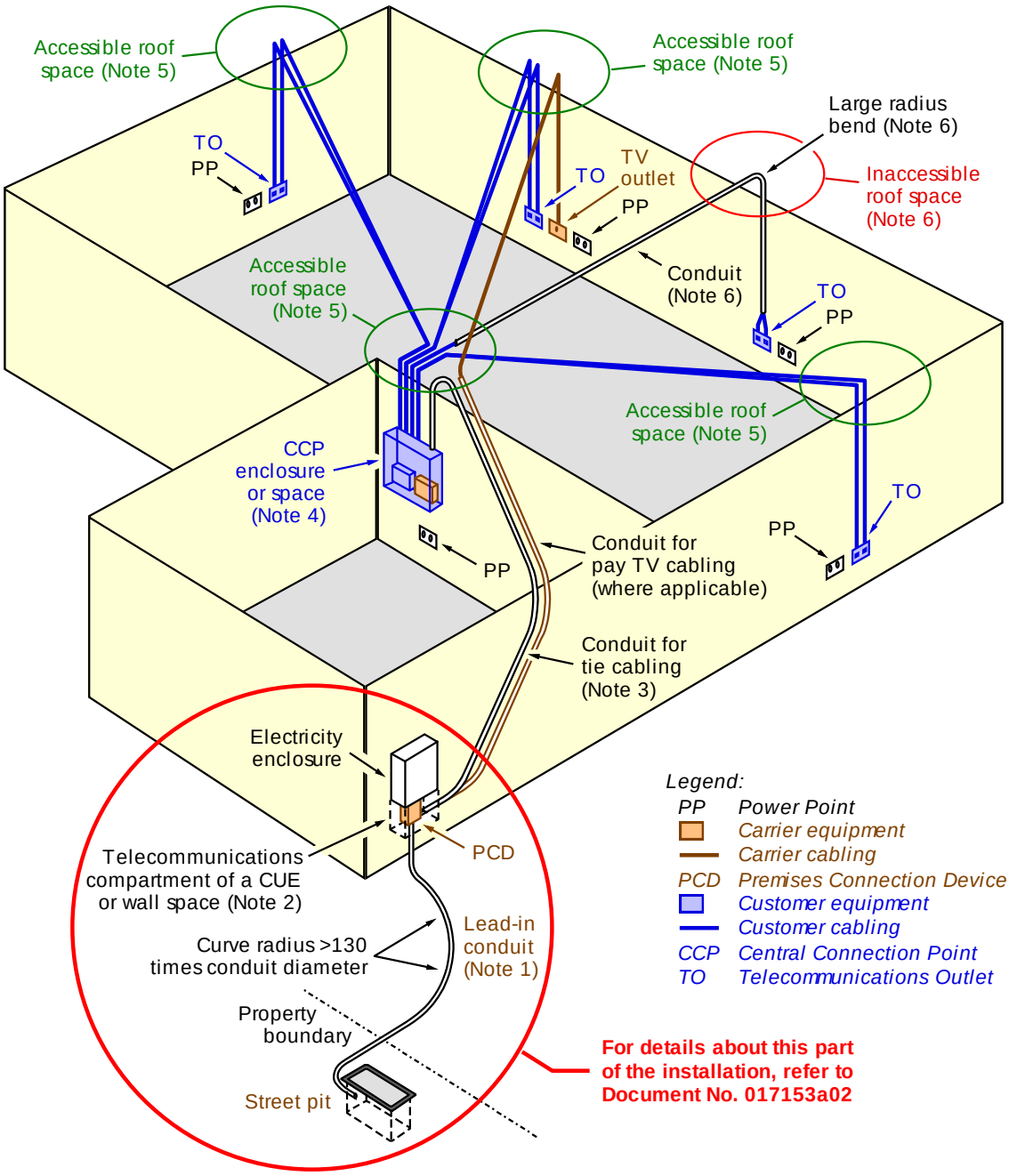
With this model, the same elements are used for telephone/ADSL, HFC and FTTP technologies, comprising:

- **lead-in conduit** (for twisted pair, coaxial or optical fibre cable provided by the carrier)
- a **Premises Connection Device (PCD)** to connect the external lead-in cabling to the internal cabling
- **tie cabling** between the PCD and the internal electronic equipment
- a **Central Connection Point (CCP)** from which the internal cabling radiates to selected rooms
- **customer cabling** between the CCP and the rooms where access to the services will be required
- **Telecommunications Outlets (TOs)** to connect the customer's equipment to the customer cabling.

Whether wireline or wireless/satellite network technology is used, the customer cabling between the CCP and the TOs will be the same regardless of the level of cabling sophistication that the customer requires.

No matter what level of customer cabling is installed initially, allowance should be made for future upgrading of this cabling by providing suitable accessible pathways and spaces for the installation of additional or replacement cables long after the building has been completed.

Figure 4 Generic home cabling elements



Notes:

1. The lead-in conduit is used for pulling in twisted pair, coaxial, or optical fibre lead-in cabling, as required.
2. The use of a Combined Utilities Enclosure (CUE) is recommended. A CUE will house any style of PCD and avoids the need to work out conduit positioning for the PCD. Refer to Document No. 017153a02 for details.
3. An accessible cabling pathway is required between the PCD and the CCP for installation of the tie cable(s) **after** completion of the building. The conduit for the tie cabling is used for pulling in twisted pair, coaxial, power supply or optical fibre cabling, as required. A second conduit may be required for coaxial cabling for cable TV (where available). The length of cable from the PCD to the CCP **must not exceed 25 m in some cases** (see 5.4.3).
4. The CCP enclosure may be sized to house some or all of the powered electronic devices or the devices may be located outside the CCP enclosure or in a separate enclosure.
5. If possible, ensure that permanent access will be available for future installation of additional or replacement cables between the CCP and the TOs.
6. Where suitable access will not be available for future installation of additional or replacement cables, consider installing rigid conduit with large radius bends between access points. Bend radius should be 100 mm or more.

4 EXTERNAL CABLING

For cabling requirements external to the building, refer to Document No. 017153a02, *Cabling of premises for telecommunications — Lead-in cabling and building entry facilities for homes*, which covers:

- underground and aerial lead-in cabling;
- cable entry ("building entry") facilities; and
- PCD description and location.

5 INTERNAL CABLING

5.1 Key components

The key components of the internal ("indoor") cabling system, as shown in Figure 4, are:

- **tie cabling** between the PCD and the CCP
- a **CCP** (i.e. a multi-socket wall plate or a patch panel) for connection of services and equipment
- **customer cabling** between the CCP and access points (wall plates) in selected rooms
- **Telecommunications Outlets (TOs)** that consist of one or more sockets on a wall plate.

5.2 Tie cabling

5.2.1 Description

Tie cabling is the cabling between the PCD and the CCP. It may consist of customer cabling, multi-core DC power cabling, extension of the carrier's lead-in cabling, or a combination of these.

The tie cabling for various "wireline" telecommunications network technologies will be as follows:

- telephone and ADSL
  - 2 x Category 6 data cables between the PCD and the CCP
- HFC
  - 1 x RG6 coaxial cable between the PCD and the CCP (for the data service)
  - 1 x RG6 coaxial cable between the PCD and each coaxial wall plate (for FOXTEL)
    - ⇒ A second conduit may be required for the cable(s) running to the FOXTEL wall plate(s).
    - ⇒ Where more than one coaxial cable is required, a radio frequency (RF) splitter is installed in the PCD by the service provider (i.e. either Telstra BigPond or FOXTEL).
    - ⇒ More than three cables in total may require the installation of an RF amplifier in the PCD.
- FTTP where the PCD consists of an **external** ("outdoor") Network Termination Device (NTD)
  - 1 x special multi-core DC power cable between the NTD and the internal ("indoor") power supply unit
  - 2 x Category 6 data cables between the NTD and the CCP (for telephone and data services)
  - 1 x RG6 coaxial cable between the NTD and an internal radio frequency (RF) splitter or amplifier (for free-to-air TV and pay TV services, where supplied from the NTD).
- FTTP where an **internal** ("indoor") Network Termination Device (NTD) is used (e.g. NBN)
  - 1 x optical fibre cable between the PCD and the CCP — provided by the carrier.

For more information, refer to Document No. 017153a00.

5.2.2 Access for the installation of tie cabling

For occupational health and safety reasons, employees and contractors of some companies (including Telstra) may not be permitted to enter some roof spaces or underfloor spaces to install cables. In such cases, the installer of the tie cabling may be inclined to install it on the surface of walls or ceilings where access is safe and easy.

Therefore, it is strongly recommended that suitable conduit be installed through building cavities for pulling in the tie cabling **after** building completion to avoid the need for any unattractive surface cabling. Where necessary, access spaces should be provided for installing the tie cabling through the conduit.

5.2.3 Conduit through building cavities for tie cabling

At least one contiguous conduit should be provided for the tie cabling through building cavities in accordance with Figure 6 or Figure 7, as applicable. A second conduit may be required where an HFC PCD ("cabled" areas) or an external ("outdoor") FTTP NTD that supplies TV services may be installed (refer to 5.2.1). The conduit must comply with 5.2.5.

For timber-framed or metal-framed cavity walls, a mounting bracket ("stud bracket") should be installed where the cable will exit the internal wall, with the conduit terminated in the wall cavity about 100 mm above the bracket, as shown in Figure 6. Alternatively, the conduit may directly enter the top of a CCP enclosure that is recessed into the wall between studs.

5.2.4 Solid masonry or double-brick walls

With solid masonry or double-brick walls:

- unless surface-mounted conduit or trunking is acceptable to the customer, the conduit for the tie cabling will need to be chased into the wall and terminated into a **vertically orientated outlet box** (called a "wall box" in the electrical trade — see Figure 8); or
- accessible trunking (rectangular section duct with a removable cover along its entire length — see Figure 9) may be used on **internal** walls and interconnected by conduit that complies with 5.2.3 through the roof space or other inaccessible portion of the cabling path, as illustrated in Figure 7.

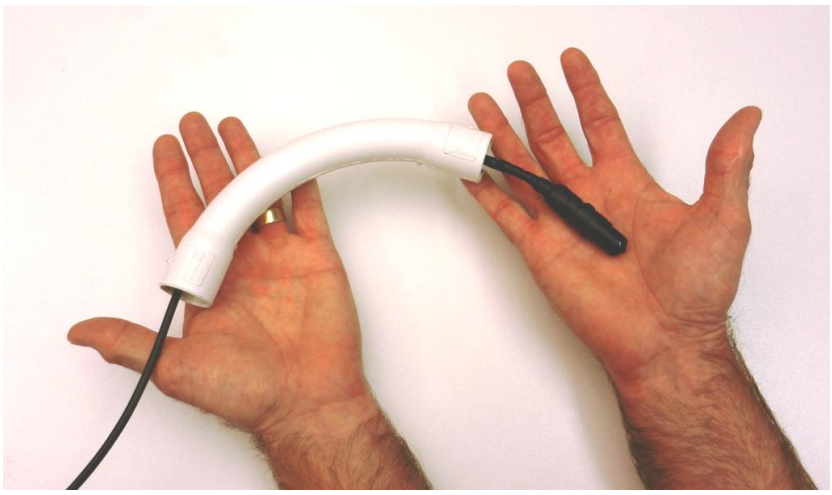
5.2.5 Conduit specification

The conduit for the tie cabling is to comply with the following:

- **White, rigid (UPVC) plastic conduit** with a minimum **inside diameter (ID)** of **23 mm** must be used (e.g. Telstra or NBN "20 mm" conduit or 32 mm UPVC "Communications" conduit to AS/NZS 2053).

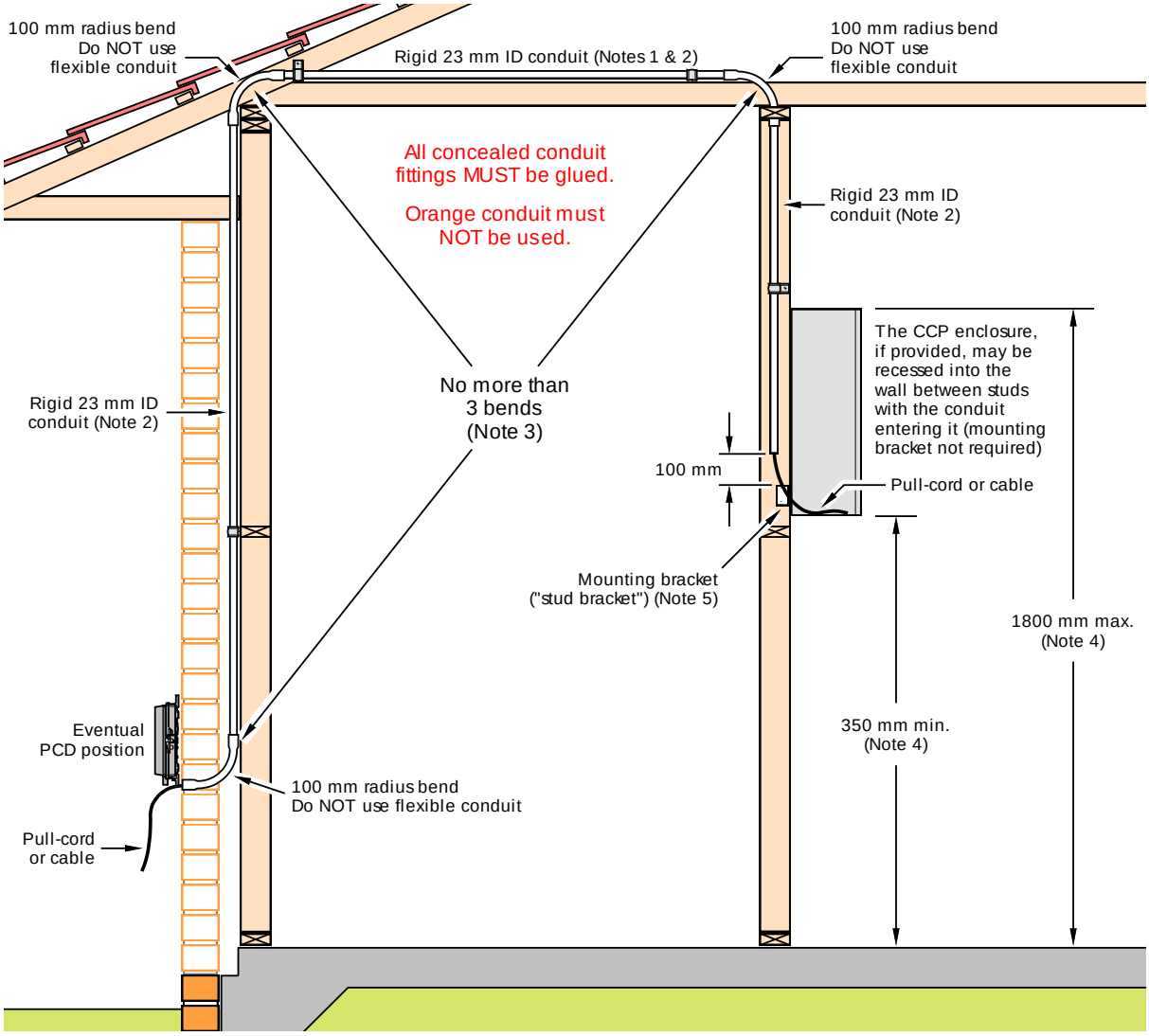
  Note: 32 mm (outside diameter) conduit won't fit in some external wall cavities (e.g. within double-brick walls or between bracing ply and brick veneer). Check with the builder or bricklayer before using 32 mm conduit.
- There must be **no more than 3 x 90° bends** between cable pulling points.
- Each bend must have an **inner bend radius of 100 mm or greater** (see Figure 5).
- All conduit and fittings **must be glued**.
- The conduit must be **restrained along its length** to prevent movement while pulling cable in.
- Orange conduit, flexible conduit or any conduit marked "ELECTRICAL" **must not be used**.

Figure 5 100 mm radius conduit bend



Note: A factory-fitted connector and protective boot on an internal optical fibre cable (e.g. that may be used for connection of an indoor FTTP NTD) may be up to 16 mm in diameter. A large-radius conduit bend is required for pulling the cable and connector through it.

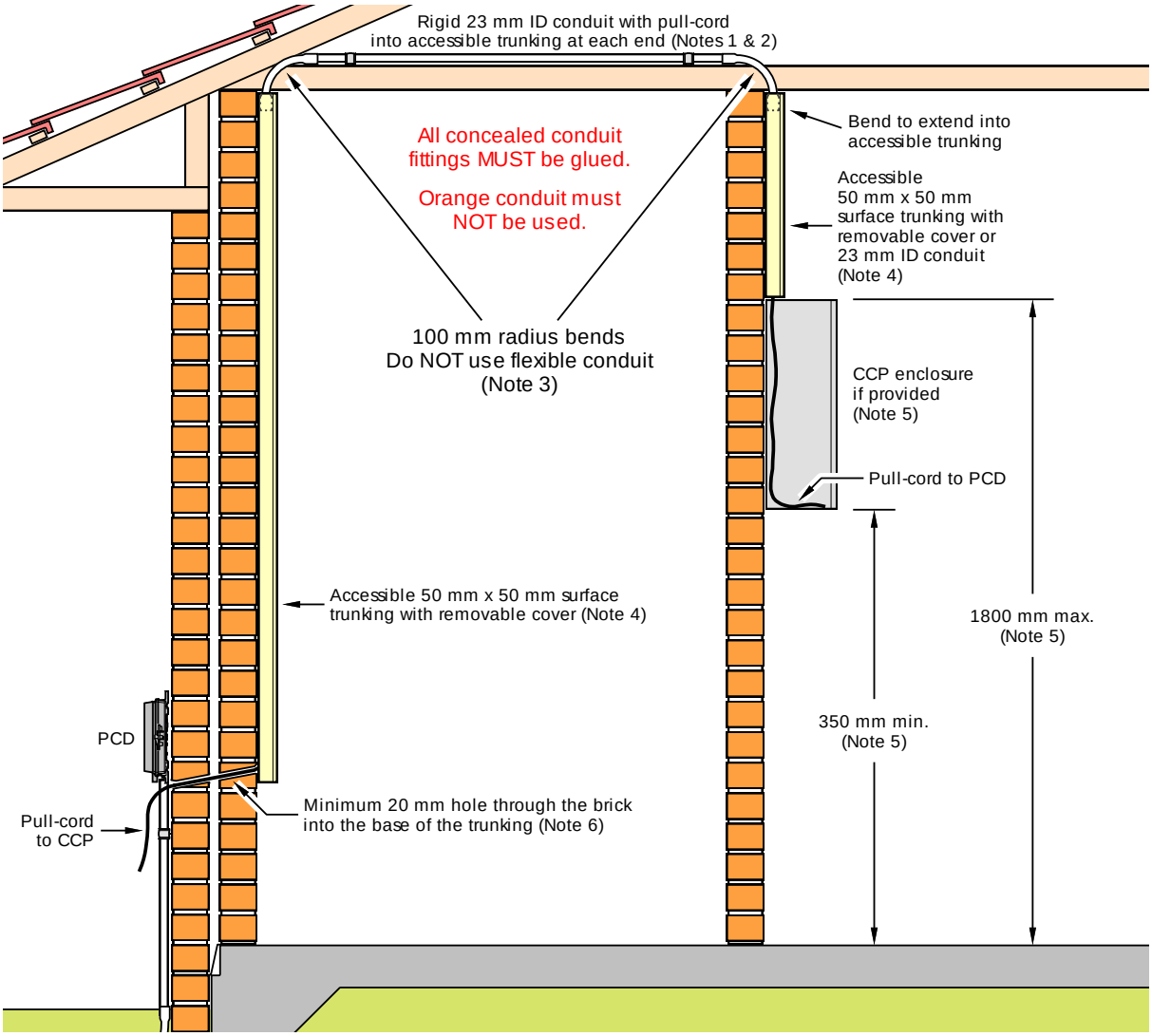
Figure 6 Typical conduit installation for tie cabling in cavity walls



Notes:

1. For a two-storey home, the conduit may pass between or through the bearers of the upper floor (subject to compliance with building codes) or through the roof space of the upper storey as long as the total length of cabling between the PCD and the CCP **will not exceed 25 m where this limit applies** (see 5.4.3). The CCP may be located in the lower or upper floor, whichever is convenient. Where solid masonry or double-brick building construction is used, it may be necessary to chase the conduit into the walls unless surface-mounted conduit or trunking is acceptable to the customer (see Figure 7).
2. Use rigid conduit with a minimum inside diameter (ID) of 23 mm (e.g. Telstra or NBN “20 mm” UPVC conduit). Do **not** use orange conduit, flexible conduit or any conduit marked “ELECTRICAL”. Extra conduit(s) may be required for any coaxial cables (see 5.2.1).
3. Use no more than 3 x 90° bends between cable pulling points. The inner bend radius of each bend must be 100 mm or greater. The conduit must be restrained along its length to prevent movement while pulling cable in.
4. Normally the CCP enclosure would be installed between wall studs above the nogging (about 1200 mm above the floor). If the CCP enclosure will be lower or higher, the bottom of the enclosure should be no less than 350 mm from the floor and the top of the enclosure should be no more than 1800 mm above the floor. Whether the powered electronic devices are to be located inside or outside the enclosure, they should be installed within the range of 350 mm to 1800 mm from the floor (i.e. no part of any device should be outside that range).
5. Where a CCP enclosure is not installed between the wall studs, install a mounting bracket 100 mm below the end of the conduit as a place marker for the tie cable.

Figure 7 Typical conduit/trunking installation for tie cabling on solid masonry or double-brick walls



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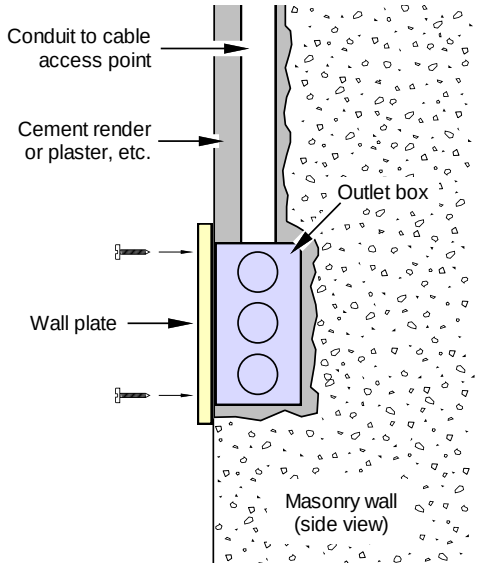
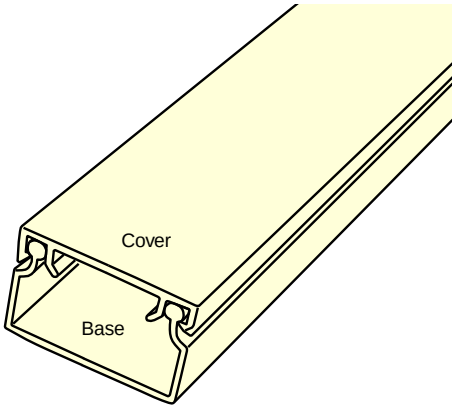
1. For a two-storey home, the conduit may pass between or through the bearers of the upper floor (subject to compliance with building codes) or through the roof space of the upper storey as long as the total length of cabling between the PCD and the CCP **will not exceed 25 m where this limit applies** (see 5.4.3). The CCP may be located in the lower or upper floor, whichever is convenient.
2. Use rigid conduit with a minimum inside diameter (ID) of 23 mm (e.g. Telstra or NBN “20 mm” UPVC conduit). Do **not** use orange conduit, flexible conduit or any conduit marked “ELECTRICAL”. Extra conduit(s) may be required for any coaxial cables (see 5.2.1).
3. Use no more than 3 x 90° bends between cable pulling points. The inner bend radius of each bend must be 100 mm or greater. The conduit must be restrained along its length to prevent movement while pulling cable in.
4. The trunking must be accessible for removal of the cover and insertion of the cable(s). The conduit and pull-cord must extend into an accessible part of the trunking. Conduit may be chased into the wall or run on the surface of the wall in preference to using surface-mounted trunking, as long as the conduit complies with 5.2.3.
5. The bottom of the CCP enclosure should be no less than 350 mm from the floor and the top of the CCP enclosure should be no more than 1800 mm above the floor. Whether the powered electronic devices are to be located inside or outside the enclosure, they should be installed within the range of 350 mm to 1800 mm from the floor (i.e. no part of any device should be outside that range).
6. A hole must be drilled through the external wall from the bottom of the PCD into the trunking at a slight upward angle. The hole must be at least 20 mm diameter to pass an optical fibre cable fitted with a connector. Extra hole(s) may be required for any coaxial cable(s) (see 5.2.1).

Figure 8 Vertically orientated outlet box ("wall box")



Note: Where conduit is run vertically to an outlet box, the outlet box should be vertically orientated to maximise the bend radius of the cable coming out of the conduit.

Figure 9 Typical cable trunking (also called "ducting")



Note: Trunking is available in various colours including white, grey and brown. 50 mm x 50 mm trunking will usually be required to accommodate the end of a 23 mm ID conduit or bend (see Figure 7).

5.3 Central Connection Point (CCP)

5.3.1 Description

The cables from the external PCD are to be run to a Central Connection Point (CCP) which facilitates connection of the telecommunications network services to the Telecommunications Outlets (TOs) located in selected rooms. The CCP may consist of:

- a single, **multi-socket wall plate** (for a basic cabling system); or
- a **patch panel** (for a more advanced cabling system).

The CCP:

- provides an indoor cable distribution point and a connection point for any powered electronic devices; and
- enables service providers or end-users to make service connections according to the technology used.

The CCP will allow the end-user to:

- connect a telephone or VOIP service to any TO
- connect a broadband internet service to any TO
- share a broadband internet service among several personal computers (PCs) using a gateway device
- interconnect Ethernet devices such as PCs, printer and media player using a gateway/router/switch.

Whatever form the CCP takes, sufficient space should be provided for the powered electronic devices (e.g. FTTP NTD, modem/gateway, associated power supplies and connecting cords).

The CCP may be contained in a proprietary home networking box, as shown in Figure 11 (a), or may be constructed by the cabling provider using generic components, as shown in Figure 11 (b).

For guidance about wiring of CCP sockets, refer to Document No. 017153a00.

5.3.2 Multi-socket wall plate

A **multi-socket wall plate** like the one shown in Figure 10 provides basic connectivity and minimal functionality. It provides the means to connect the incoming telecommunications network services, e.g. data (internet) and voice (telephone), to the relevant Telecommunications Outlets (TOs). This may be sufficient to meet the needs of some home owners or occupants.

For more information, refer to Document No. 017153a00.

Figure 10 A typical multi-socket wall plate

5.3.3 Patch panel

A **patch panel** is a socket array that is used for flexible connection of the incoming telecommunications network services to multiple Telecommunications Outlets (TOs), enabling the home occupants to tailor the connections to meet their own needs. It also allows the occupants to change the configuration as their needs change without the need to engage a cabling provider to alter the cabling or rewire the home.

For guidance about wiring patch panel sockets and using the patch panel for connection of services and equipment, refer to Document No. 017153a00.

Figure 11 Typical patch panels

(a) A proprietary home networking box

PHOTO COURTESY OF MADISON TECHNOLOGIES

(b) A patch panel made using wall plates and sockets

WALL PLATES & SOCKETS COURTESY OF CLIPSAL BY SCHNEIDER ELECTRIC

5.3.4 CCP location

The CCP should be installed **inside the building** in a readily accessible location, preferably **within a 25 m cabling distance of the PCD**, i.e. the total length of any cable between the PCD and the CCP, including bends and curves, should not exceed 25 m if possible (refer to 5.4.3 for details).

The CCP must be readily accessible by the end-user, service provider and, if applicable, the carrier. Therefore it should be installed within the range of **350 mm** to **1800 mm** from the floor, i.e. no part of the CCP or any equipment located at the CCP should be outside that range (see Figure 6 and Figure 7).

The CCP does not need to be located in the centre of the home unless the home is so large that any cable between the CCP and any TO is likely to exceed a length of **50 m** (see 5.4.3) or it is to house a central wireless (Wi-Fi) access point.

The CCP should **not** be located within the **roof space** or any **underfloor space**.

The CCP should not be located within **1 m** of a possible source of **electromagnetic interference**, such as:

- an electrical switchboard or electricity supply meters
- any fluorescent light
- an electrical transformer of any description
- an electric motor or generator (e.g. ducted vacuum system motor, fixed electric drill, grinder or saw)
- any area where an arc welder may be used
- an air-conditioning unit
- a refrigerator or freezer
- a microwave oven
- an induction cooktop
- a television set
- loudspeakers.

Recommended locations for the CCP are a garage, utility room, study, walk-in robe or hall closet.

The CCP enclosure **should not be recessed into the cavity of an external wall**, as the cavity may be damp, which means the inside of the enclosure may be damp, and this may lead to corrosion of the CCP components. The enclosure may also be exposed to the entry of dust and debris from the roof space.

Note: Dust and debris may enter the CCP enclosure via cable entry holes and any other holes or gaps in the recessed portion of the enclosure. While it may be possible to seal these against the entry of dust and debris, this is virtually impossible to do for moist air. The enclosure may be installed on the surface of the internal wall but the cable entry holes to the wall cavity should be stopped to minimise the entry of humid air and debris from the cavity to the enclosure.

5.3.5 Space requirements

Sufficient space is required at the CCP location to provide:

- air circulation for the powered electronic devices;
- the required clearances to access the devices and connections;
- the required separation distances between telecommunications and power cabling and sockets; and
- room to manipulate and accommodate the connecting cords (including spare cords).

5.3.6 CCP enclosure

The CCP should be installed in an enclosure that incorporates the following features:

- sufficient **space** to accommodate an indoor FTTP NTD and power supply unit, a fibre wall outlet, a gateway device and power supply, at least one double power point, a CCP and all connecting cords
- a **cover** to protect against the ingress of dust and accidental disturbance of cord connections (a lockable cover is recommended so that the CCP may be secured against unauthorised alterations)
- **non-metallic construction** (e.g. made of plastic or timber) if it is intended to house a wireless device
- **provision for cords to enter the enclosure with the cover closed** to provide for connection of any equipment located outside the enclosure, e.g. a Network-Attached Storage (NAS) device.

The enclosure may be an "off-the-shelf" product or constructed from timber fibreboard (e.g. as part of the home cabinetwork). A metallic enclosure is not recommended if it is intended to house a wireless gateway unless a separate wireless access point will be provided in accordance with 5.6.

An enclosure with the following minimum **internal** dimensions is recommended to allow the enclosure (whether made from plastic, metal or fibreboard) to fit between timber studs spaced at 450 mm centres:

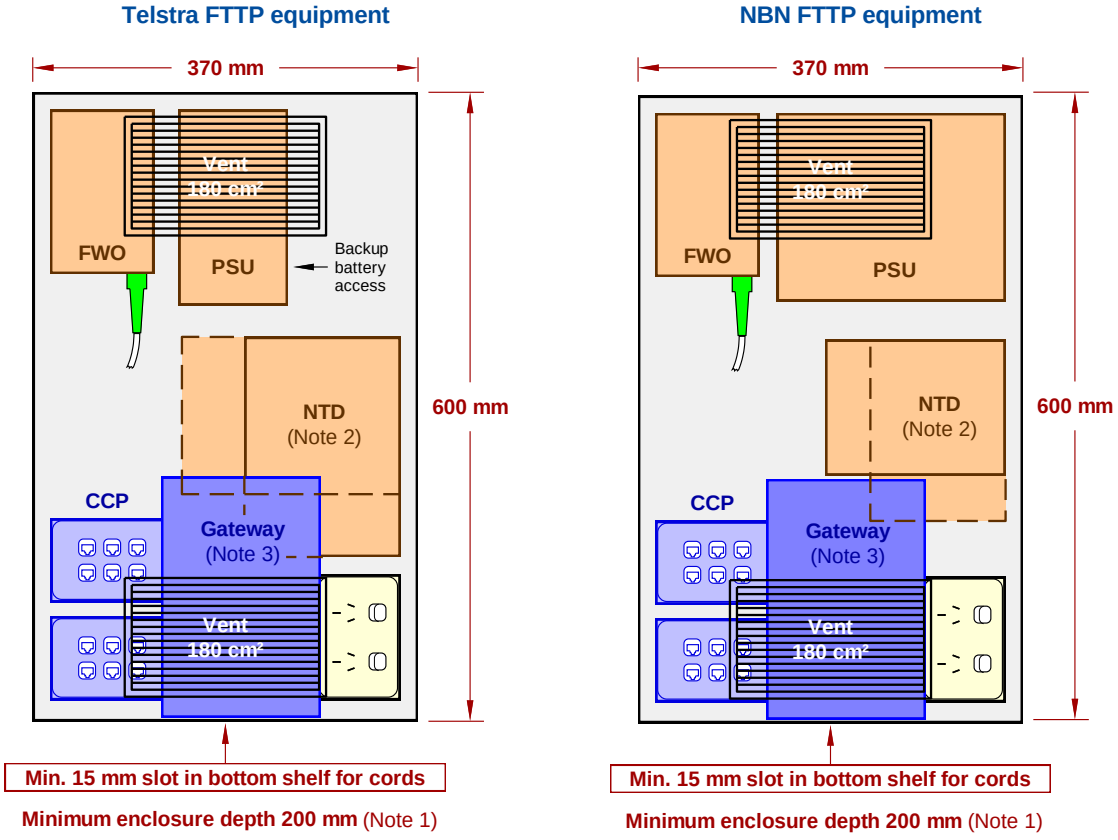
- 370 mm wide
- 600 mm high
- 200 mm deep.

Any enclosure intended to house any **powered electronic devices** must be **vented**.

Refer to Figure 12.

Examples of CCP enclosures are pictured in Figure 13.

Figure 12 Minimum CCP enclosure dimensions and typical equipment arrangements (worst-case scenario — FTTP)



FWO = Fibre Wall Outlet NTD = Network Termination Device PSU = Power Supply Unit

Notes:

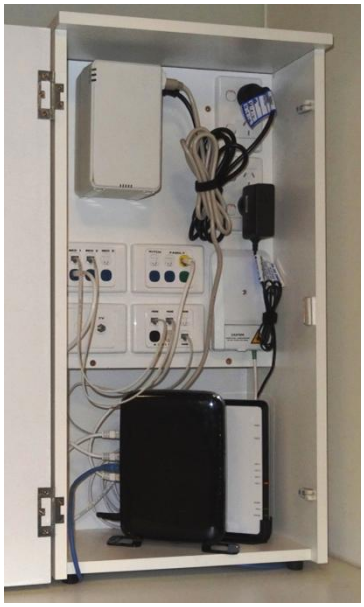
1. The internal depth of the enclosure should be at least 200 mm.
2. The Telstra NTD may be mounted in either horizontal or vertical orientation. The NBN Co NTD is normally mounted horizontally.
3. Vents providing at least 180 cm² of ventilation (e.g. 180 mm x 100 mm) are required at the top and bottom of the enclosure door. A cord access slot should be provided in the bottom of the enclosure for connection of external devices (e.g. a NAS) or for power cord entry where the power point is outside the enclosure.
4. The service provider's gateway may stand vertically on the bottom shelf in front of the other equipment.

Figure 13 Examples of CCP enclosures

A prefabricated plastic enclosure

PHOTO COURTESY OF CLIPSAL BY SCHNEIDER ELECTRIC

A custom-built enclosure made from laminated fibreboard



THIS ENCLOSURE MAY BE INCLUDED IN THE CABINETWORK INCLUSIONS FOR A NEW HOME.

5.4 Cabling options

5.4.1 General

Described below are cabling systems of varying sophistication and cost. In all cases, some form of CCP is required to provide connectivity for all telecommunications network technologies.

5.4.2 Cable and connector type

All twisted pair cables should be 4-pair **Category 6** (or better) unscreened twisted pair (UTP) data cable, which may be used for either digital ("data") or analogue ("voice") applications. Connecting hardware (e.g. sockets) should match or exceed the cable rating (i.e. Category 6 or better). For an explanation of cable/hardware "Category" and why Category 6 is recommended, refer to Telstra Document No. 017153a00, *Cabling of premises for telecommunications — A complete guide to home cabling*.

5.4.3 Maximum cabling length

Irrespective of what cabling system is installed:

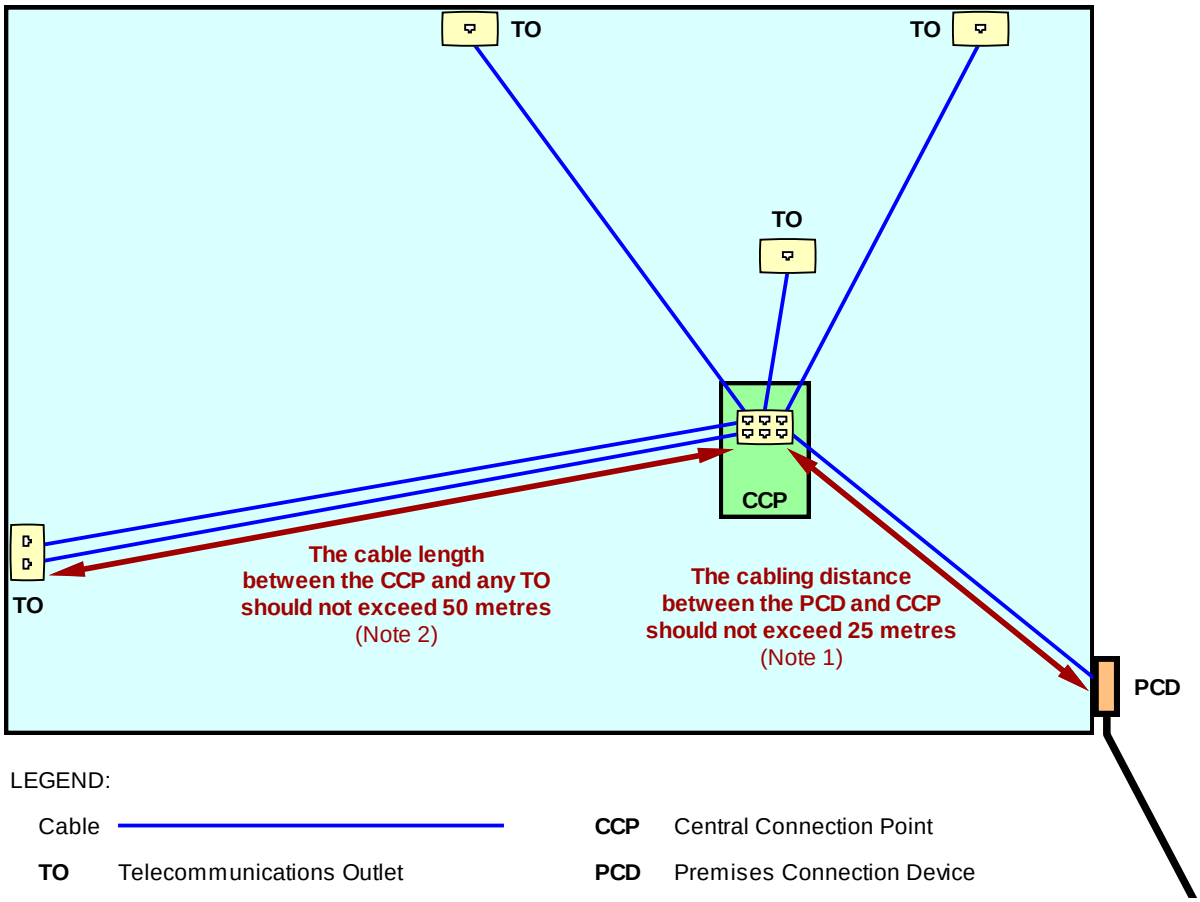
- the total cabling distance between the PCD and the CCP, including bends and curves in the cabling path, **should not exceed 25 m** unless it is certain that FTTP with an **indoor** NTD will be installed, in which case the cabling distance should not exceed **40 m**; and
- the total cabling distance between the CCP and any TO, including bends and curves in the cabling path, **should not exceed 50 m**.

Notes:

1. The 25 m limit is to ensure that any coaxial cabling for HFC ("Cable") internet or DC power supply cabling for an outdoor FTTP NTD will be within specified limits. The 40 m limit is an arbitrary limit that may be discussed with the relevant carrier if it is unachievable for a particular home.
2. A maximum length of 50 m for TO cabling is recommended to support future 10GBase-T Ethernet using Category 6 components and to ensure compatibility with some equipment that may use the data cabling for distribution of audio/video (A/V) signals from a TV appliance. Refer to Document No. 017153a00 for details.

Refer to Figure 14. For more information, refer to Document No. 017153a00.

Figure 14 Cabling limits for homes



Notes:

1. The **25 m** cabling limit between the PCD and the CCP is to ensure that any coaxial cabling for HFC ("Cable") internet or DC cabling required between an indoor power supply and an outdoor FTTP NTD will be within the specified distance limits. If it is certain that FTTP with an **indoor** NTD will be installed, the cabling limit is **40 m** unless a greater distance is specifically approved by the relevant carrier.
2. The **50 m** limit between the CCP and each TO is to ensure that the TO cabling may support certain types of audio/video networking devices and future 10G Ethernet using Category 6 cables and connecting hardware.

5.4.4 Basic home cabling system

A basic home cabling system is shown in Figure 15. This system in its simplest form provides the **bare essentials** required to facilitate connection of services and equipment for **all telecommunications network technologies**. A basic cabling system may be adequate for some homes, e.g. retirement homes/units, low-cost housing, rental homes/units, boarding rooms.

With this cabling system, the CCP may comprise:

- one or two multi-socket wall plate(s) for connection of services;
- a Fibre Wall Outlet (FWO) — or space for an FWO — for future connection of an indoor FTTP NTD (e.g. NBN).

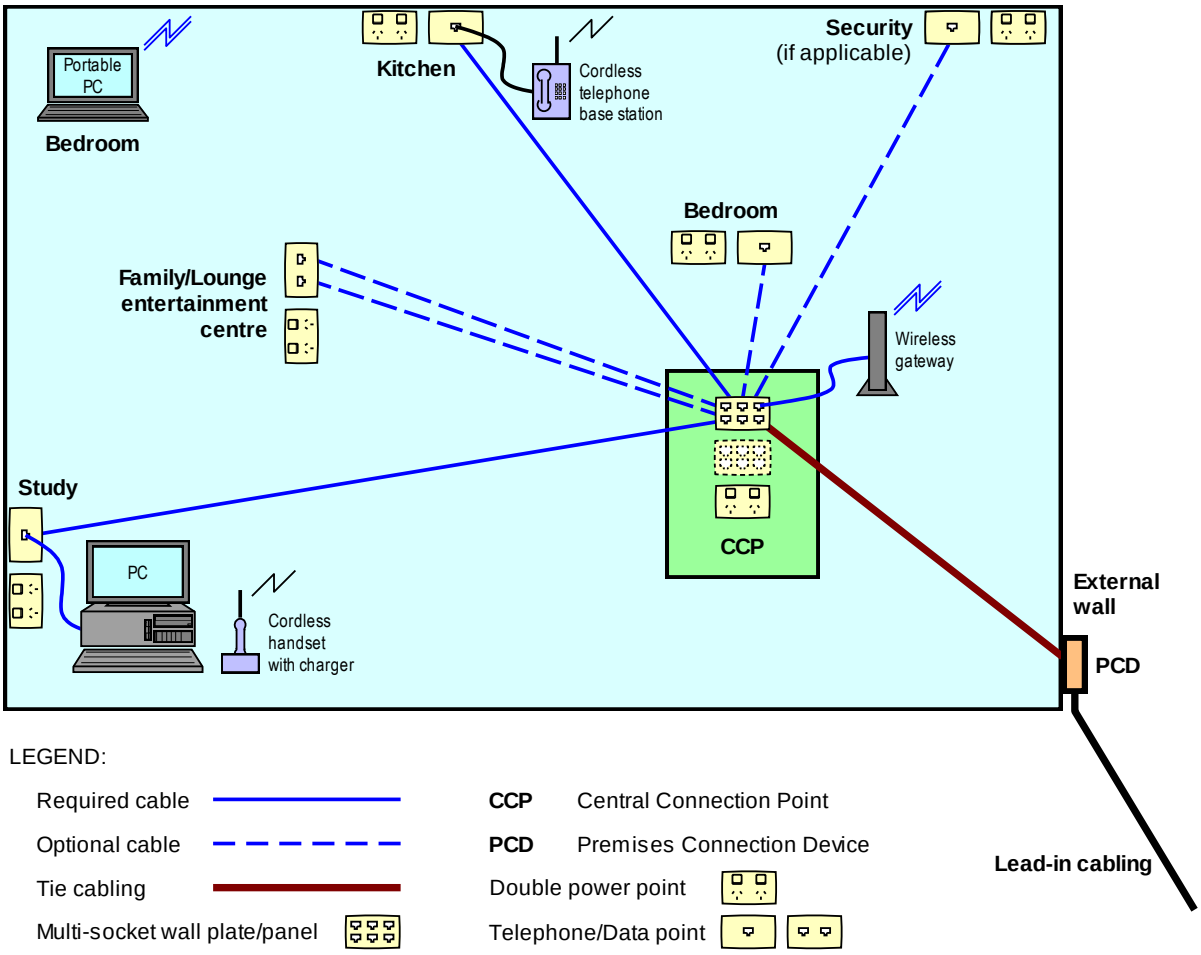
At least **two TOs** should be provided — one for **telephone** and one for **data**. An **additional TO** may be required for the connection of **"Mode 3" equipment** such as a security alarm panel or a personal response (emergency call) system (refer to 5.7.1 for information about "Mode 3" connections).

A **double-socket power point** should be provided **within 1 m of the CCP** for powering of an FTTP NTD and/or a gateway device. A **power point** should also be provided **within 1 m of each TO** for powering of customer equipment (e.g. cordless telephone, gateway device or personal computer).

The addition of one or two extra telephone/data points, as indicated in Figure 15 (e.g. family/lounge, bedroom), will provide some capacity for wired networking of the broadband internet service to personal computers (PCs) and entertainment/games equipment. Wired networking may be supplemented by the wireless (Wi-Fi) networking provided by the wireless gateway.

Typical line/equipment connections are shown in Figure 16 to Figure 19 for various telecommunications network technologies using this basic cabling system.

Figure 15 Plan of a basic home cabling system

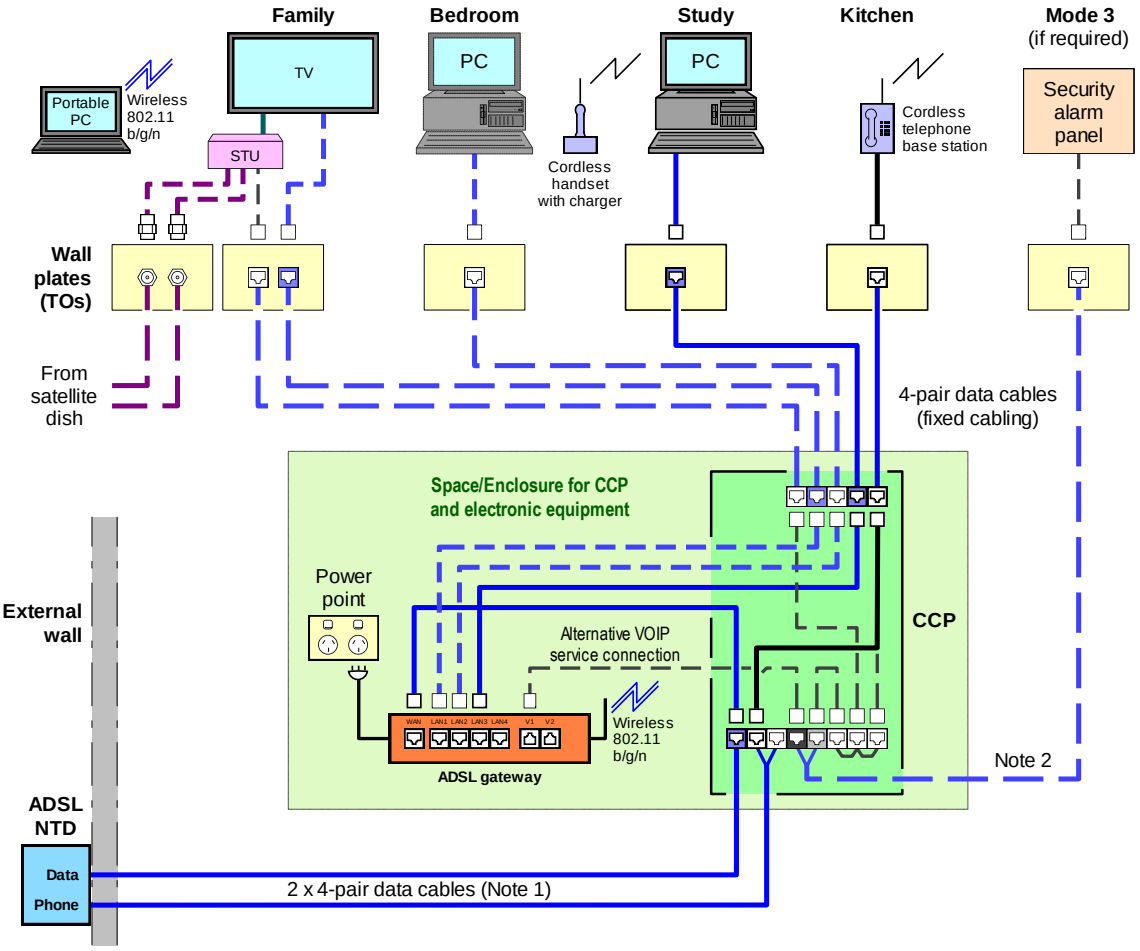


Notes:

1. The basic home cabling system in its simplest form (i.e. two telephone/data points cabled from the CCP) provides virtually no capacity for wired networking of the broadband internet service to personal computers (PCs) and entertainment/games equipment. PC networking may be achieved using wireless (Wi-Fi) technology with its inherent limitations (see 3.6). Cordless telephone handsets may be used for multiple telephone access.
2. The addition of one or two extra telephone/data points (e.g. family/lounge, bedroom) will provide limited capacity for wired networking of the broadband internet service to personal computers (PCs) and entertainment/games equipment. Wired networking may be supplemented using wireless (Wi-Fi) technology.
3. This cabling system is adaptable to all telecommunications network technologies. Refer to Figure 16 to Figure 19 for examples on how different telecommunications network technologies are connected to the cabling system.

Figure 16 Basic home cabling system
Typical cabling arrangement and connections for telephone and ADSL services

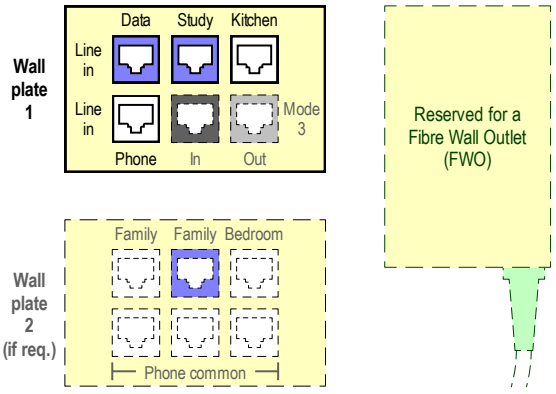
(a) Typical telephone and ADSL service connections



LEGEND:

	Modular socket	ADSL	Asymmetric Digital Subscriber Line	STU	Set Top Unit (pay TV)
	Modular plug	CCP	Central Connection Point	TOs	Telecommunications Outlets
	Coaxial socket	NTD	Network Termination Device	TV	Television
	Coaxial plug	PC	Personal Computer	VOIP	Voice Over Internet Protocol

(b) Typical CCP layout (using multi-socket wall plates)

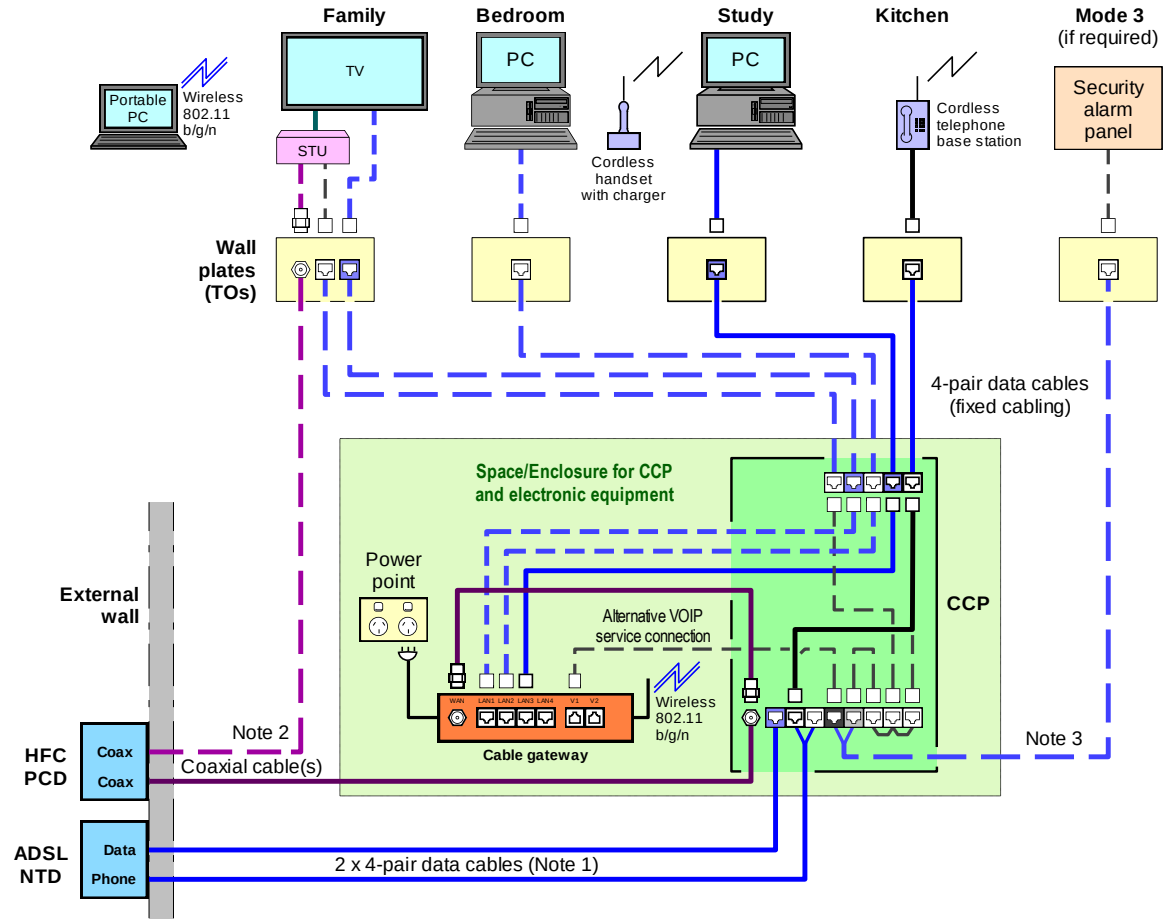


Notes:

1. An ADSL splitter (central filter) should be installed at either the NTD or the CCP (refer to Document No. 017153a00 for details). However, even if the splitter will be located at the CCP, two data cables should be installed between the outdoor NTD and the CCP for a possible, future outdoor FTTP NTD (e.g. NBN).
2. For an explanation of “Mode 3”, see 5.7.1. For Mode 3 wiring options, refer to Document No. 017153a00.

Figure 17 Basic home cabling system
Typical cabling arrangement and connections for telephone, HFC and optional ADSL services

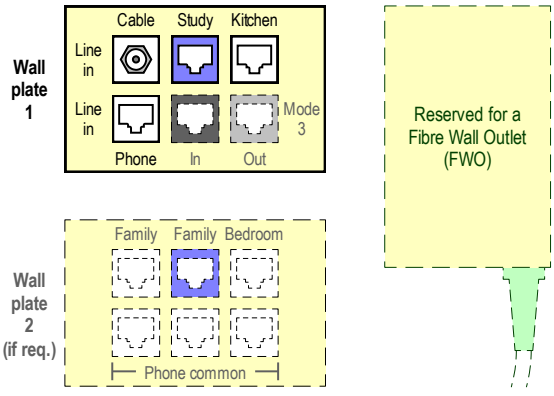
(a) Typical telephone and HFC service connections (plus optional ADSL)



LEGEND:

	Modular socket	ADSL	Asymmetric Digital Subscriber Line	PCD	Premises Connection Device
	Modular plug	CCP	Central Connection Point	STU	Set Top Unit (pay TV)
	Coaxial socket	HFC	Hybrid Fibre-Coax (“Cable”)	TOs	Telecommunications Outlets
	Coaxial plug	NTD	Network Termination Device	TV	Television
		PC	Personal Computer	VOIP	Voice Over Internet Protocol

(b) Typical CCP layout (using multi-socket wall plates)

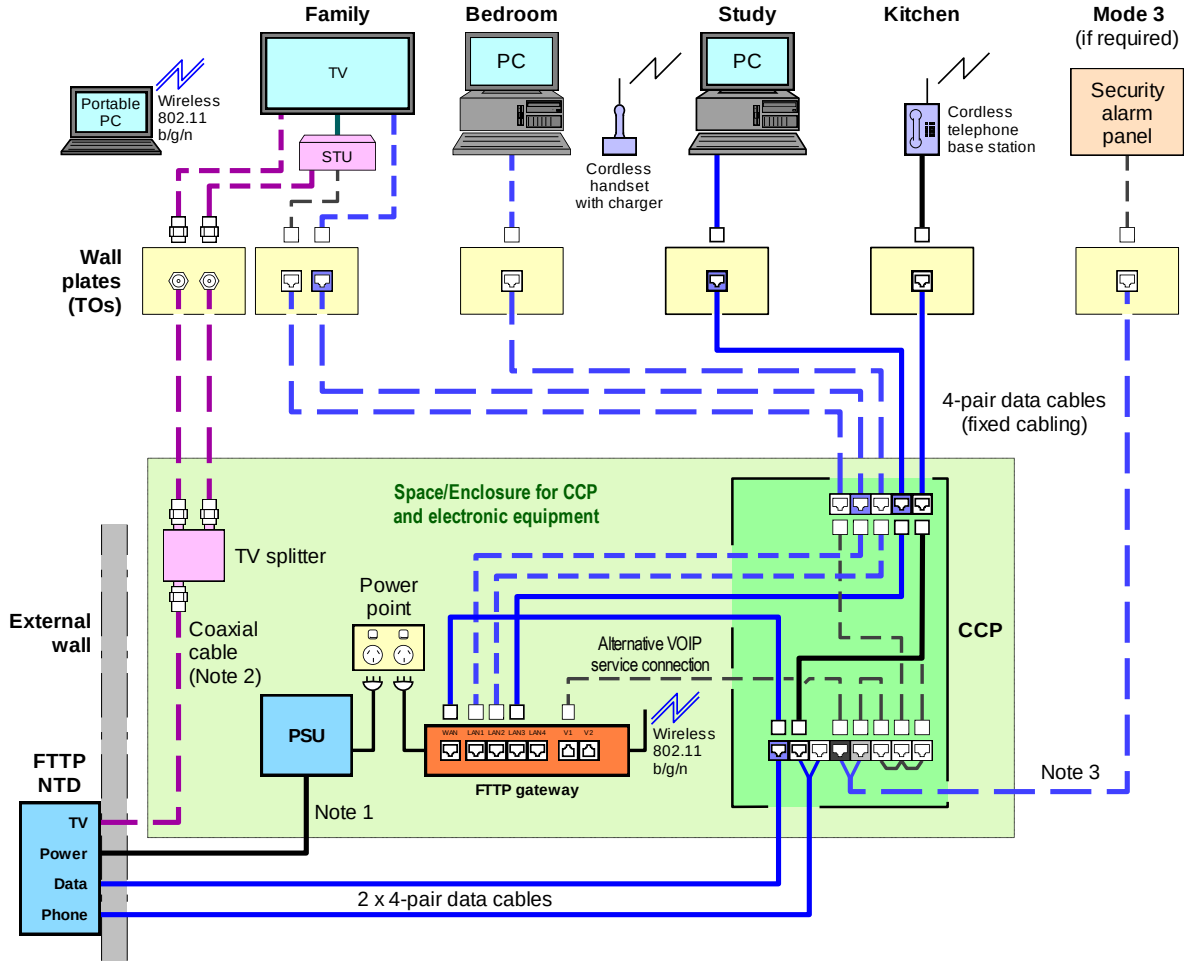


Notes:

1. Two data cables should be installed between the outdoor NTD and the CCP wall plate to support:
   - the supply of telephone and optional ADSL services (unlike HFC, ADSL can usually be supplied by multiple service providers); and
   - a possible, future, outdoor FTTP NTD (e.g. NBN).
2. The coaxial cable for the data service should run to the CCP for connection of the cable gateway. The coaxial cable for the pay TV service should run directly to the wall plate for the STU and **not** to the CCP.
3. For an explanation of “Mode 3”, see 5.7.1. For Mode 3 wiring options, refer to Document No. 017153a00.

Figure 18 Basic home cabling system
Typical cabling arrangement and connections for FTTP (outdoor NTD)

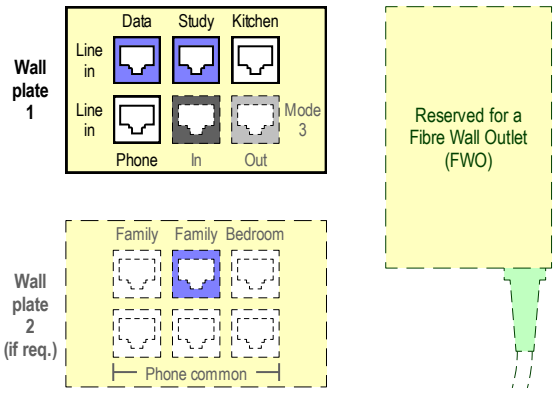
(a) Typical telephone and data service connections (and optional TV and/or pay TV, if applicable)



LEGEND:

Modular socket	CCP	Central Connection Point	PSU	Power Supply Unit
Modular plug	FTTP	Fibre To The Premises	STU	Set Top Unit (pay TV)
Coaxial socket	NTD	Network Termination Device	TOs	Telecommunications Outlets
Coaxial plug	PC	Personal Computer	TV	Television
			VOIP	Voice Over Internet Protocol

(b) Typical CCP layout (using multi-socket wall plates)

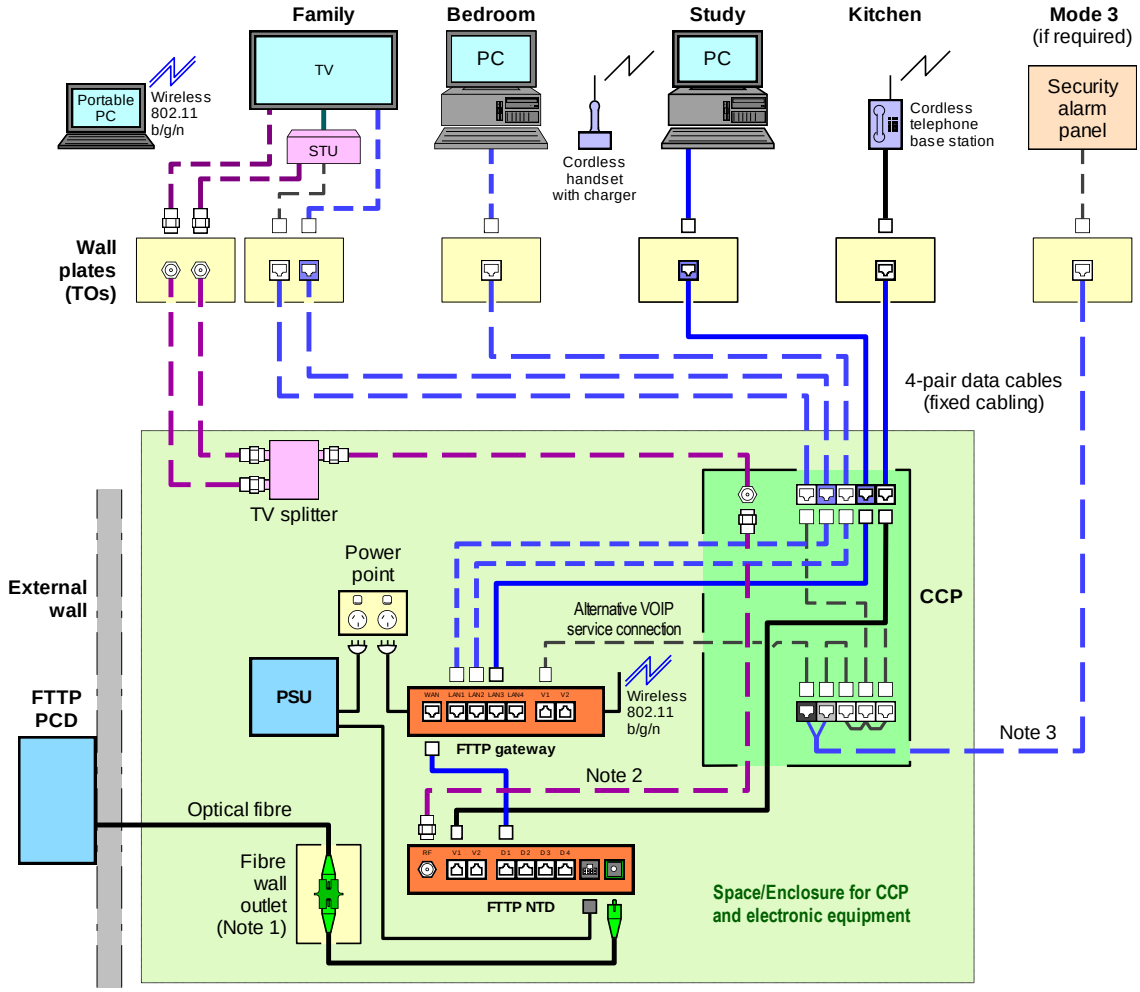


Notes:

1. A special multi-core DC power cable is required between the outdoor FTTP NTD and the indoor PSU.
2. Some FTTP NTDs have a radio frequency (RF) port for the supply of free-to-air TV and/or pay TV services. Where TV services are supplied from the NTD, refer to Document No. 017153a00 for coaxial cabling requirements.
3. For an explanation of “Mode 3”, see 5.7.1. For Mode 3 wiring options, refer to Document No. 017153a00.

Figure 19 Basic home cabling system
Typical cabling arrangement and connections for FTTP (indoor NTD)

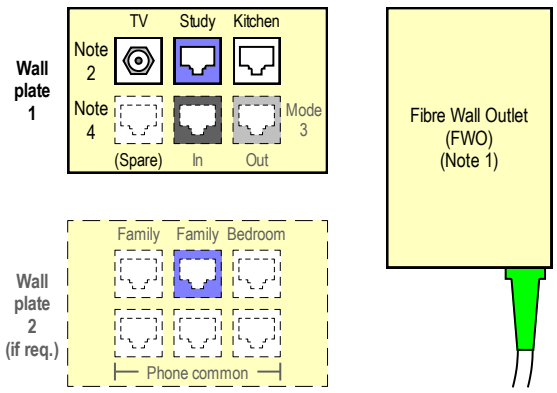
(a) Typical telephone and data service connections (and optional TV and/or pay TV, if applicable)



LEGEND:

	Modular socket	CCP	Central Connection Point	PSU	Power Supply Unit
	Modular plug	FTTP	Fibre To The Premises	STU	Set Top Unit (pay TV)
	Coaxial socket	NTD	Network Termination Device	TOs	Telecommunications Outlets
	Coaxial plug	PC	Personal Computer	TV	Television
	Optical fibre connector	PCD	Premises Connection Device	VOIP	Voice Over Internet Protocol

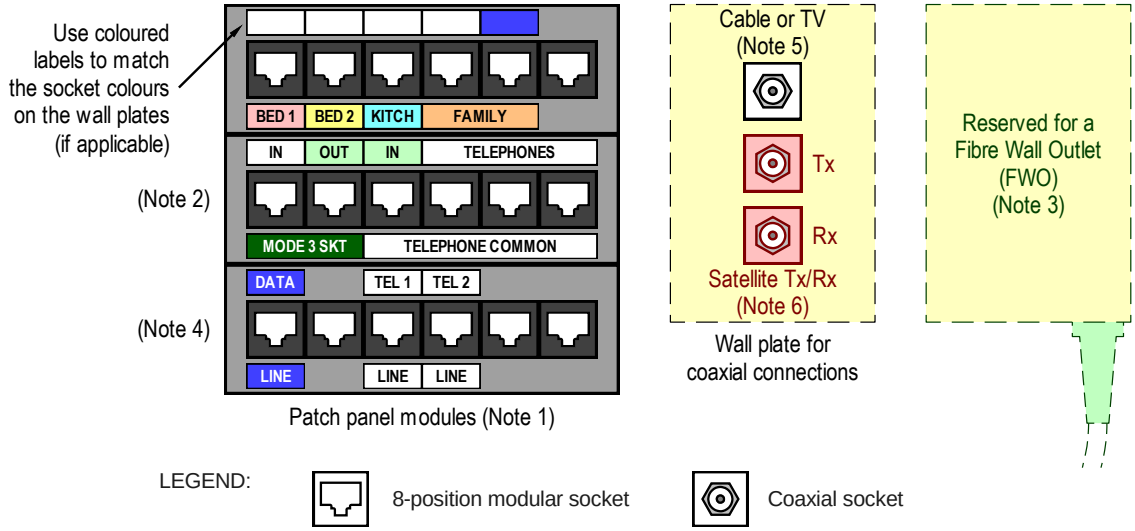
(b) Typical CCP layout (using multi-socket wall plates)



Notes:

1. The carrier may not use a fibre wall outlet but allowance should be made for one to be installed at the CCP.
2. Some FTTP NTDs have a radio frequency (RF) port for the supply of free-to-air TV or pay TV services. If TV services are supplied from the NTD, refer to Document No. 017153a00 for coaxial cabling requirements.
3. For an explanation of “Mode 3”, see 5.7.1. For Mode 3 wiring options, refer to Document No. 017153a00.
4. Where an indoor FTTP NTD is used, the **Line in** sockets are not required because the FTTP services will be connected directly from the rear of the NTD or gateway to the relevant sockets on the CCP.

Figure 20 Typical CCP layout for a basic home cabling system using socket modules



Notes:

1. Some home networking boxes use modules that contain a bank of six sockets (as shown above) while others may use modules containing eight or more sockets. See Figure 11 (a) for a typical proprietary home networking box. Some home networking boxes also provide a coaxial connector for connection of a cable modem/gateway.
2. If Mode 3 equipment (such as a security alarm panel or a personal response system) is to be installed, additional sockets may need to be allocated on the patch panel. Refer to Document No. 017153a00 for details.
3. The Fibre Wall Outlet (FWO) is used for connection of the fixed optical fibre cable (from the outdoor PCD) to the indoor FTTP NTD fly lead. The carrier may not install an FWO but allowance should be made for one. The space required for the FWO and the NTD fly lead is slightly larger than the size of a standard wall plate.
4. Where an indoor FTTP NTD is used, the **LINE** sockets are not required because the FTTP services will be connected directly from the rear of the NTD or gateway to the relevant sockets on the patch panel.
5. A separate coaxial connector may be required for connection of a cable modem/gateway (where HFC is available) or to connect the coaxial port of an indoor FTTP NTD to the fixed coaxial cabling (some FTTP NTDs have a radio frequency (RF) port for the supply of free-to-air TV and/or pay TV services). Refer to Document No. 017153a00 for coaxial cabling requirements.
6. Most homes will not require access to satellite broadband. However, if satellite broadband will be used, the coaxial cables from the satellite dish may terminate on a separate wall plate adjacent to the patch panel for connection of the satellite gateway. Alternatively, this wall plate may be used for the NBN fixed wireless antenna connection, noting that this connection is a Category 5 modular connection, not coaxial (refer to Figure 1).

5.4.5 Advanced home cabling system

An advanced cabling system is shown in Figure 21. This system supports additional telephone service connections plus full wired networking including IPTV and on-line games at all telephone/data points.

With this cabling system, the CCP consists of a patch panel for connection of services and equipment. Provision should be made for telecommunications network technology changes and future expansion.

At least **four double-socket TOs** should be provided in **four separate rooms** for wired connection of data and voice (telephone) services. An **additional TO** may be required for the connection of **Mode 3 equipment** such as a security alarm panel or a personal response (emergency call) system (refer to 5.7.1 for information about “Mode 3” connections). **Extra TOs** should also be provided in the **main bedroom** and any room designated as a **study** or **home office** (see 5.5.5).

It is also recommended that a TO with **at least four sockets** be provided at the **main entertainment point** (e.g. next to the TV outlet in the lounge or family room) to provide for:

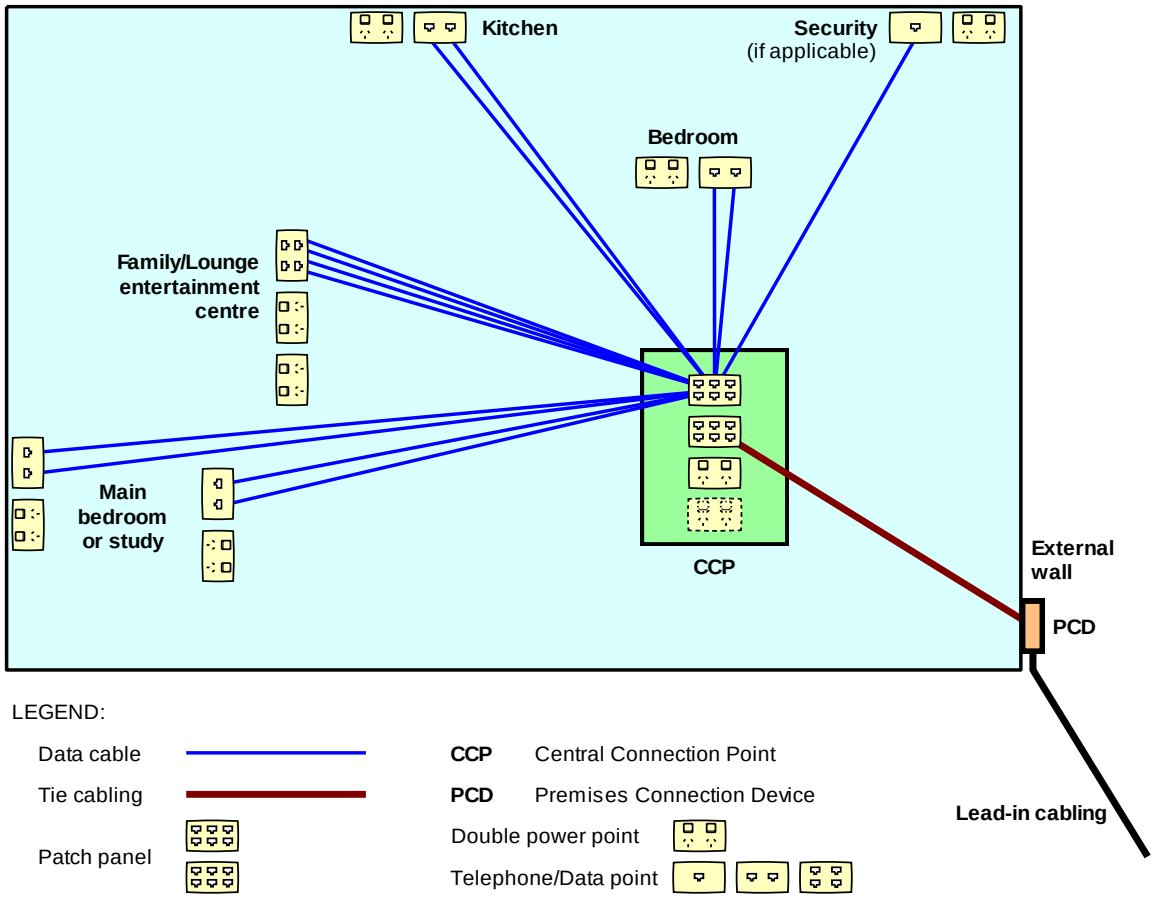
- a telephone or Ethernet connection for a pay TV set top unit
- a separate Ethernet connection for one or more of the following:
  - television set
  - Blu-ray player
  - network media player
  - games console
- high-definition audio/video streaming via the data cabling (see Document No. 017153a00 for details).

Note: The pay TV set top unit requires connection to either the telephone service or an Ethernet connection to support interactive TV. Most modern digital TV sets and Blu-ray players have an Ethernet port for access to IPTV and online firmware updates. Network media players require an Ethernet connection for IPTV, media distribution across the home network and online firmware updates. Most games consoles have an Ethernet port for access to online games and IPTV.

At least one **double-socket power point** should be provided **within 1 m of the CCP** for powering of an FTTP NTD and/or a gateway device. A **power point** should also be provided **within 1 m of each TO** for powering of customer equipment (e.g. cordless telephone or personal computer).

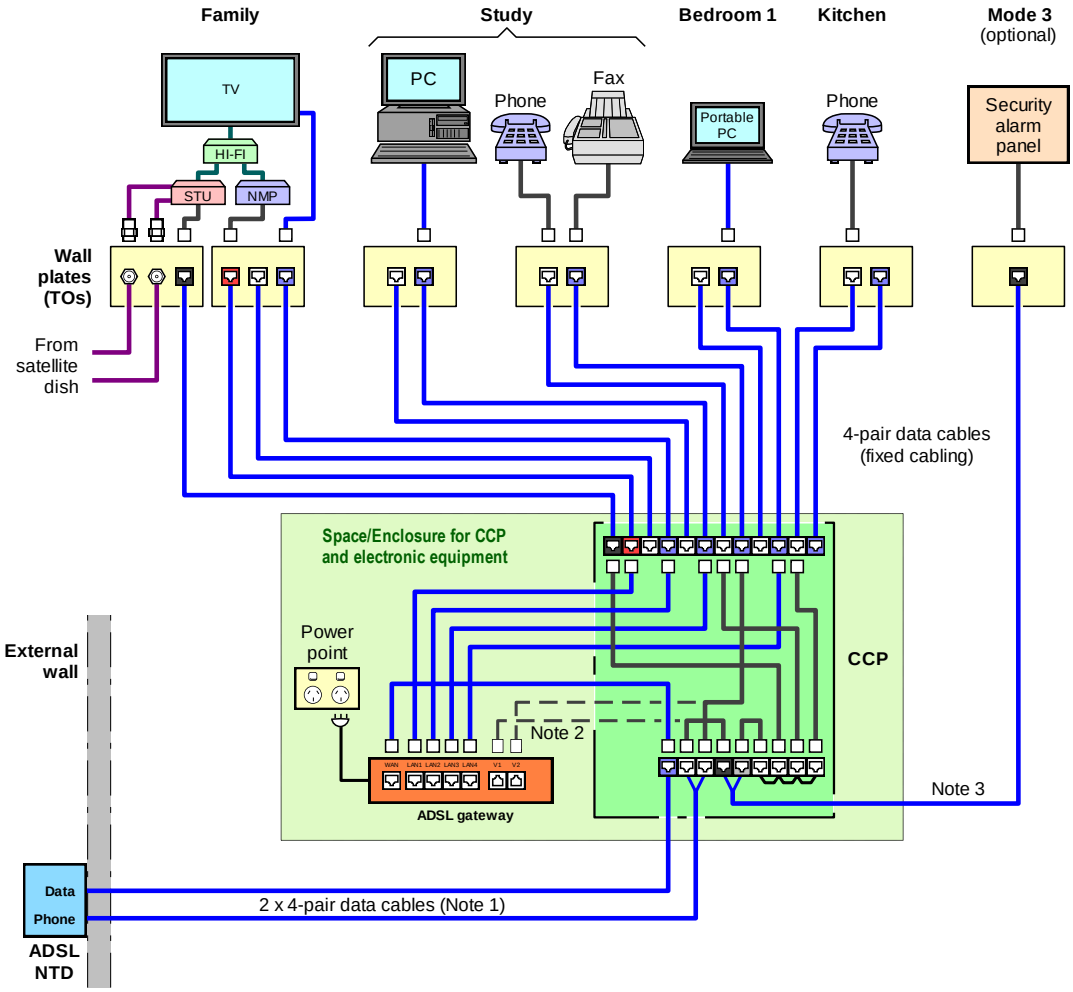
Typical line and equipment connections for this cabling system are shown in Figure 22 to Figure 25, while Figure 26 and Figure 27 illustrate the corresponding patch panel configurations at the CCP.

Figure 21 Plan of an advanced home cabling system



Note: This cabling system supports distribution of two or more telephone services (including VOIP services) plus wired networking of personal computers (PCs) and entertainment/games equipment, including IPTV, on-line games and high definition media (audio/video) streaming. Telephone service access and PC networking may be supplemented using cordless or wireless (Wi-Fi) technologies.

Figure 22 Advanced home cabling system
Typical cabling arrangement and connections for telephone and ADSL services



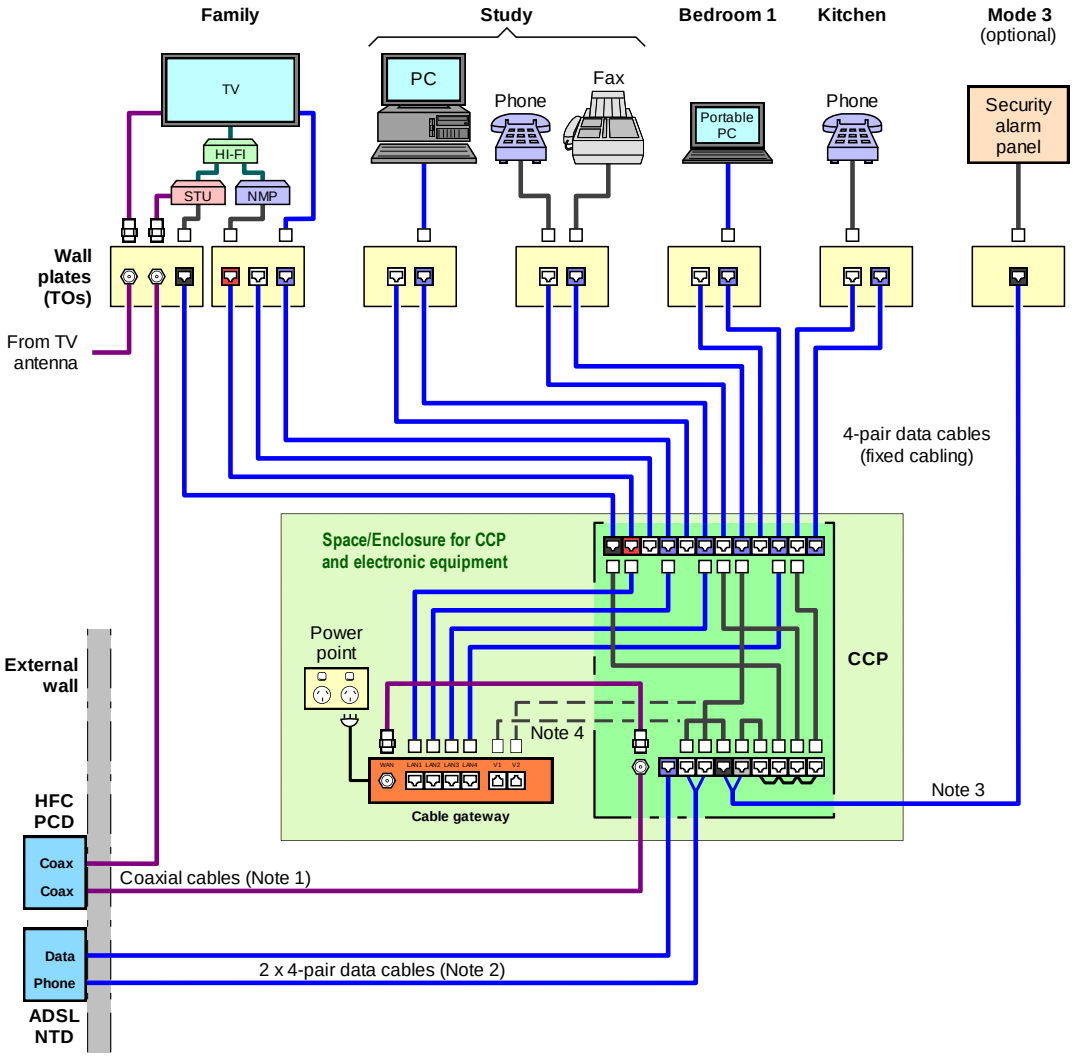
LEGEND:

▣	Modular socket	ADSL	Asymmetric Digital Subscriber Line	PC	Personal Computer
□	Modular plug	CCP	Central Connection Point	STU	Set Top Unit (pay TV)
◎	Coaxial socket	HI-FI	High-Fidelity amplifier/receiver	TOs	Telecommunications Outlets
◎	Coaxial plug	NMP	Network Media Player	TV	Television
		NTD	Network Termination Device		

Notes:

1. An ADSL splitter (central filter) should be installed at either the NTD or the CCP (refer to Document No. 017153a00 for details). Nevertheless, even if the splitter will be located at the CCP, two data cables should be installed between the outdoor NTD and the CCP for a possible, future outdoor FTTP NTD (e.g. NBN).
2. Alternative telephone services may be provided from VOIP (Voice Over Internet Protocol) ports on the gateway.
3. For an explanation of “Mode 3”, see 5.7.1. For Mode 3 wiring options, refer to Document No. 017153a00.
4. For typical CCP patch panel layouts, refer to Figure 26 and Figure 27.

Figure 23 Advanced home cabling system
Typical cabling arrangement and connections for telephone, HFC and optional ADSL services



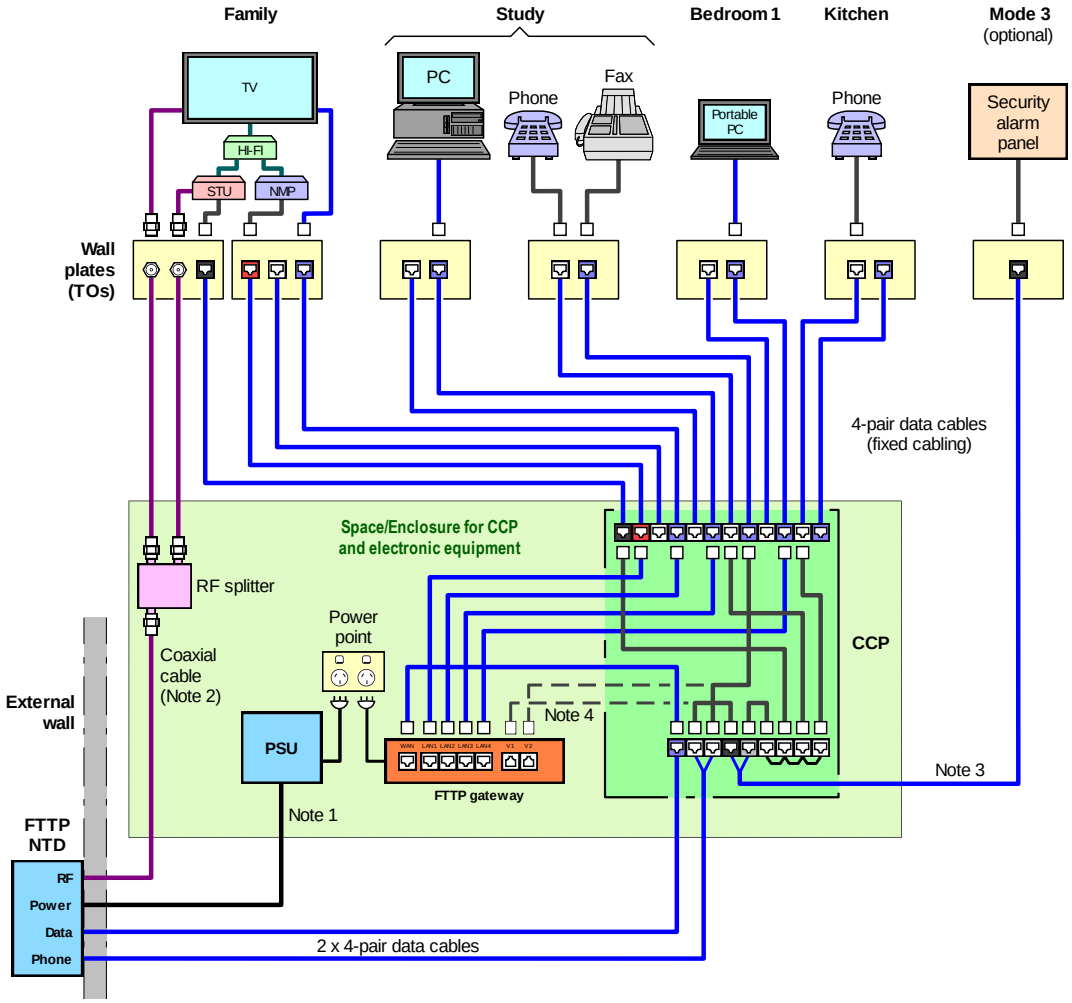
LEGEND:

Modular socket	ADSL	Asymmetric Digital Subscriber Line	PC	Personal Computer
Modular plug	CCP	Central Connection Point	PCD	Premises Connection Device
Coaxial socket	HFC	Hybrid Fibre-Coax (“Cable”)	STU	Set Top Unit (pay TV)
Coaxial plug	HI-FI	High-Fidelity amplifier/receiver	TOs	Telecommunications Outlets
	NMP	Network Media Player	TV	Television
	NTD	Network Termination Device		

Notes:

1. The coaxial cable for the internet service should run to the CCP for connection of the cable gateway. The coaxial cable for the pay TV service should run directly to the wall plate to be used for connection of the STU and **not** to the CCP.
2. Two data cables should be installed between the outdoor NTD and the CCP patch panel to support:
   - the supply of telephone and optional ADSL services (unlike HFC, ADSL can usually be supplied by multiple service providers); and
   - a possible, future, outdoor FTTP NTD (e.g. NBN).
3. For an explanation of “Mode 3”, see 5.7.1. For Mode 3 wiring options, refer to Document No. 017153a00.
4. Alternative telephone services may be provided from VOIP (Voice Over Internet Protocol) ports on the gateway.
5. For typical CCP patch panel layouts, refer to Figure 26 and Figure 27.

Figure 24 Advanced home cabling system
Typical cabling arrangement and connections for FTTP (outdoor NTD)



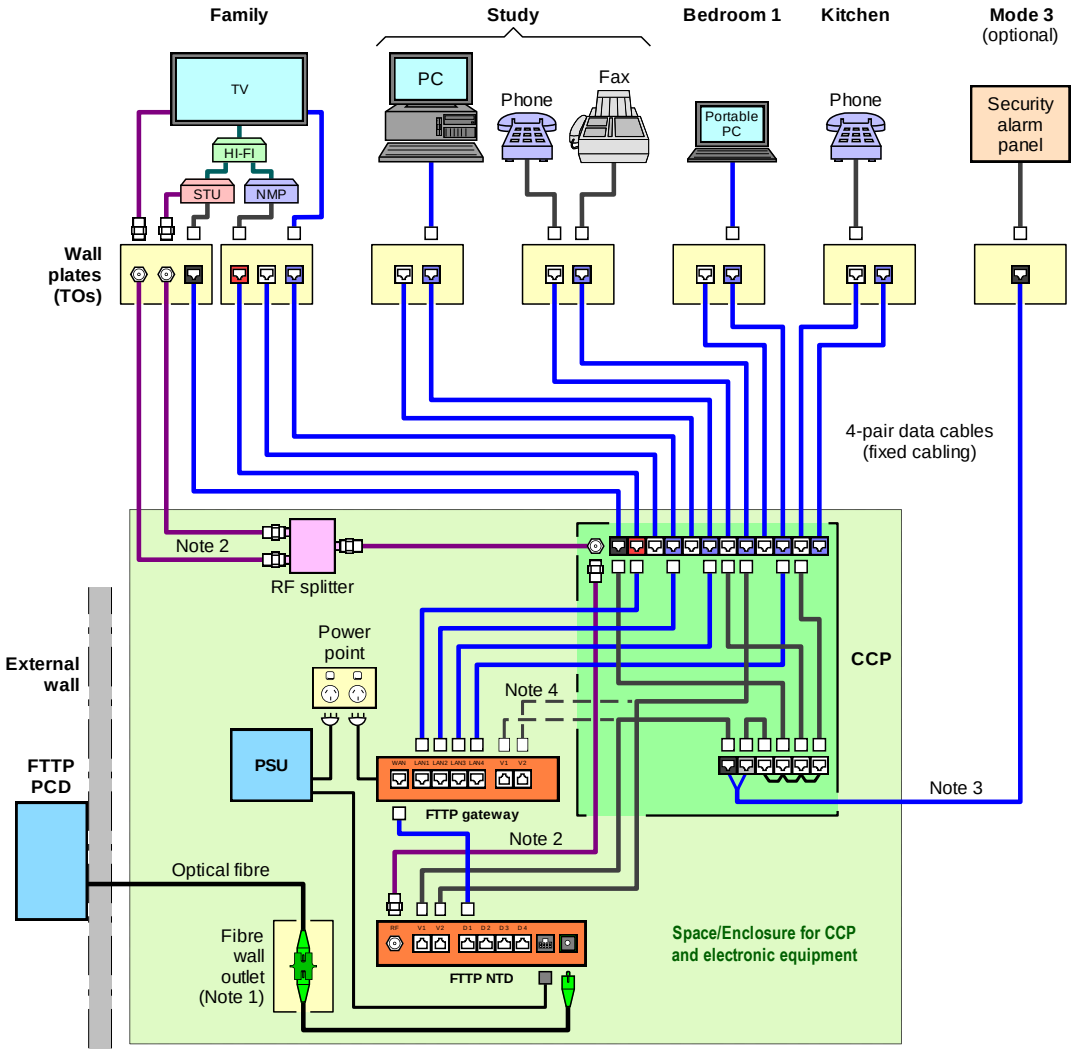
LEGEND:

▽	Modular socket	CCP	Central Connection Point	PC	Personal Computer
□	Modular plug	FTTP	Fibre To The Premises	PSU	Power Supply Unit
◎	Coaxial socket	HI-FI	High-Fidelity amplifier/receiver	STU	Set Top Unit (pay TV)
▭	Coaxial plug	NMP	Network Media Player	TOs	Telecommunications Outlets
		NTD	Network Termination Device	TV	Television

Notes:

1. A special multi-core DC power cable is required between the outdoor FTTP NTD and the indoor PSU.
2. Some FTTP NTDs have a radio frequency (RF) port for the supply of free-to-air TV and/or pay TV services. Where TV services are supplied from the NTD, refer to Document No. 017153a00 for coaxial cabling requirements.
3. For an explanation of “Mode 3”, see 5.7.1. For Mode 3 wiring options, refer to Document No. 017153a00.
4. Alternative telephone services may be provided from VOIP (Voice Over Internet Protocol) ports on the gateway.
5. For typical CCP patch panel layouts, refer to Figure 26 and Figure 27.

Figure 25 Advanced home cabling system
Typical cabling arrangement and connections for FTTP (indoor NTD)



LEGEND:

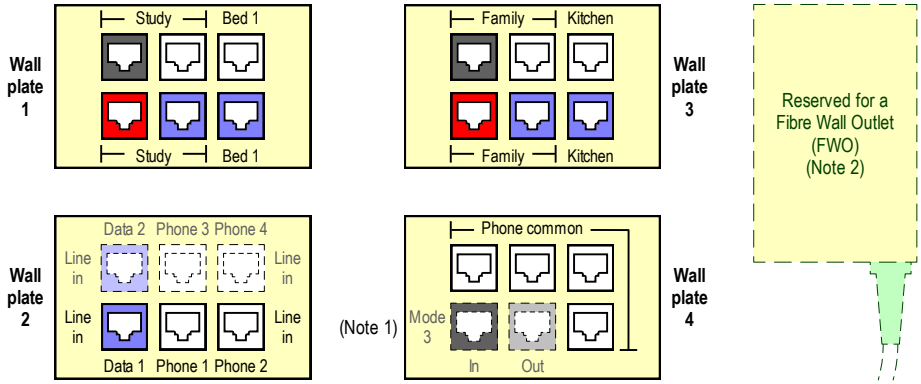
	Modular socket	CCP	Central Connection Point	PCD	Premises Connection Device
	Modular plug	FTTP	Fibre To The Premises	PSU	Power Supply Unit
	Coaxial socket	HI-FI	High-Fidelity amplifier/receiver	STU	Set Top Unit (pay TV)
	Coaxial plug	NMP	Network Media Player	TOs	Telecommunications Outlets
	Optical fibre connector	NTD	Network Termination Device	TV	Television
	Optical fibre adaptor	PC	Personal Computer		

Notes:

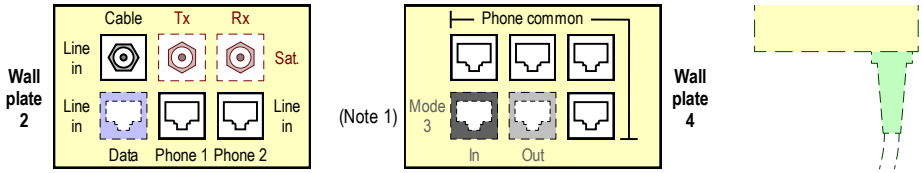
1. The carrier may not use a fibre wall outlet but allowance should be made for one to be installed at the CCP.
2. Some FTTP NTDs have a radio frequency (RF) port for the supply of free-to-air TV and/or pay TV services. Where TV services are supplied from the NTD, refer to Document No. 017153a00 for coaxial cabling requirements.
3. For an explanation of “Mode 3”, see 5.7.1. For Mode 3 wiring options, refer to Document No. 017153a00.
4. Alternative telephone services may be provided from VOIP (Voice Over Internet Protocol) ports on the gateway.
5. For typical CCP patch panel layouts, refer to Figure 26 and Figure 27.

Figure 26 Typical CCP layouts for an advanced home cabling system using wall plates

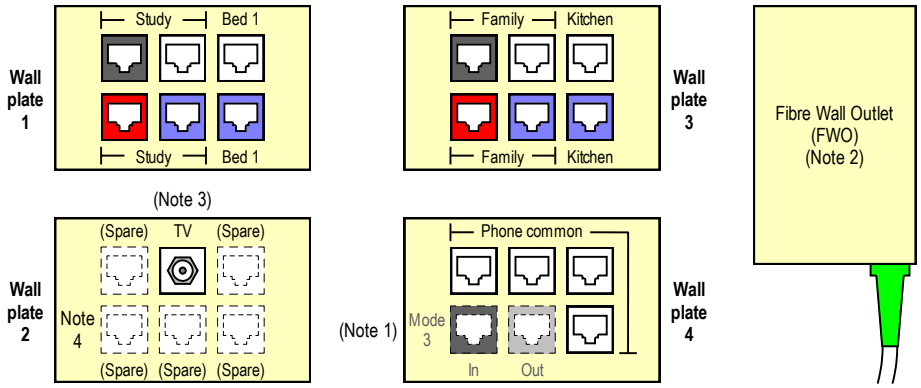
(a) Where services are supplied from an outdoor ADSL NTD or FTTP NTD



(b) Variation to (a) above for HFC ("Cable") or satellite broadband



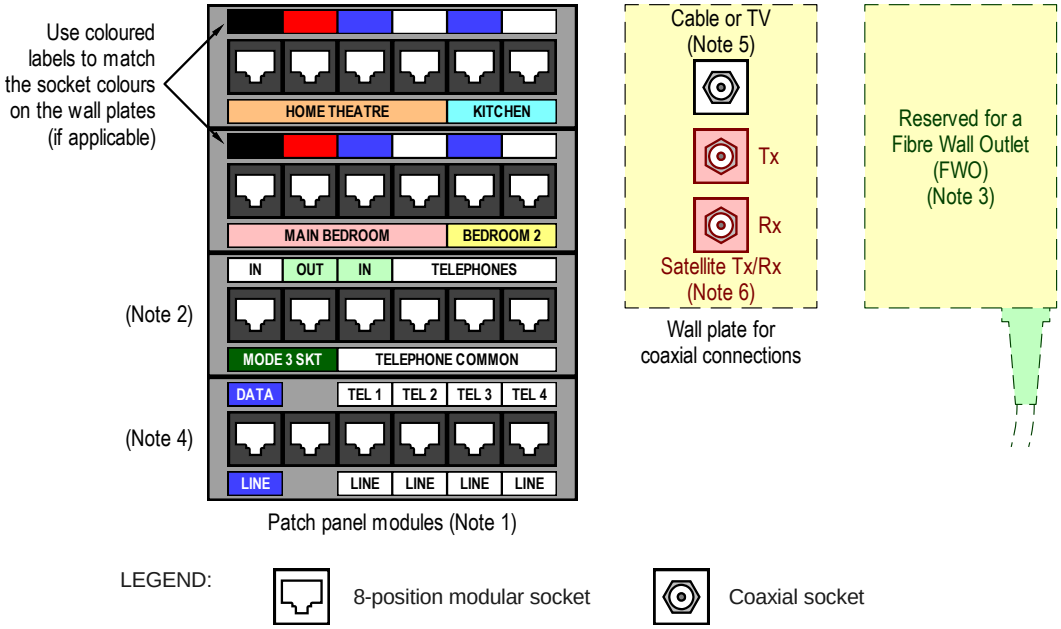
(c) Where services are supplied from an indoor FTTP NTD



Notes:

1. If a Mode 3 device (such as a security alarm panel or a personal response system) is to be installed, extra sockets may be required on the wall plate. Refer to Document No. 017153a00 for details.
2. The Fibre Wall Outlet (FWO) is used for connection of the fixed optical fibre cable (from the outdoor PCD) to the indoor FTTP NTD fly lead. The carrier may not install an FWO but allowance should be made for one. The space required for the FWO and the NTD fly lead is slightly larger than the size of a standard wall plate.
3. Some FTTP NTDs have a radio frequency (RF) port for the supply of free-to-air TV and/or pay TV. If a coaxial socket and a modular socket are to be fitted one above the other on the same wall plate, position the coaxial socket **above** the modular socket so that the end-user will have suitable finger access to the retaining clip at the bottom of any modular plug connected to the modular socket.
4. Where an indoor FTTP NTD is used, the **Line in** sockets are not required because the FTTP services will be connected directly from the rear of the NTD or gateway to the relevant sockets on the patch panel.

Figure 27 Typical CCP layout for an advanced home cabling system using socket modules



Notes:

1. Some home networking boxes use modules that contain a bank of six sockets (as shown above) while others may use modules containing eight or more sockets. See Figure 11 (a) for a typical proprietary home networking box. Some home networking boxes also provide a coaxial connector for connection of a cable modem/gateway.
2. If Mode 3 equipment (such as a security alarm panel or a personal response system) is to be installed, additional sockets may need to be allocated on the patch panel. Refer to Document No. 017153a00 for details.
3. The Fibre Wall Outlet (FWO) is used for connection of the fixed optical fibre cable (from the outdoor PCD) to the indoor FTTP NTD fly lead. The carrier may not install an FWO but allowance should be made for one. The space required for the FWO and the NTD fly lead is slightly larger than the size of a standard wall plate.
4. Where an indoor FTTP NTD is used, the **LINE** sockets are not required because the FTTP services will be connected directly from the rear of the NTD or gateway to the relevant sockets on the patch panel.
5. A separate coaxial connector may be required for connection of a cable modem/gateway (where HFC is available) or to connect the coaxial port of an indoor FTTP NTD to the fixed coaxial cabling (some FTTP NTDs have a radio frequency (RF) port for the supply of free-to-air TV and/or pay TV services). Refer to Document No. 017153a00 for coaxial cabling requirements.
6. Most homes will not require access to satellite broadband. However, if satellite broadband will be used, the coaxial cables from the satellite dish may terminate on a separate wall plate adjacent to the patch panel for connection of the satellite gateway. Alternatively, this wall plate may be used for the NBN fixed wireless antenna connection, noting that this connection is a Category 5 modular connection, not coaxial (refer to Figure 1).

5.5 Telecommunications Outlets (TOs)

5.5.1 What is a TO?

A Telecommunications Outlet (TO) is a wall plate or a small plastic box ("surface-mount box") containing one or more sockets for connection of customer equipment such as telephones, modems or personal computers and other Ethernet devices.

5.5.2 Socket type

8-position 8-contact (8P8C) modular sockets (commonly called "RJ45") should be used for all voice/data TOs to ensure compatibility with consumer Ethernet equipment (other types of socket are available but may not be compatible with RJ45 plugs).

6-position (6P) modular sockets (commonly called "RJ11" and used for telephone connections) should **not** be used as these will negate the generic nature (flexibility) of the cabling system.

The TO sockets should be rated to match or exceed the cable rating (e.g. if Category 6 cable is installed, the sockets should be rated at Category 6 or Category 6_A).

If a TO has more than one socket, each socket should be colour-coded as shown in Figure 28 (subject to compatibility with the decor) or marked in a way that its corresponding socket at the CCP can be readily identified.

Figure 28 A typical TO with two colour-coded sockets

Sockets should be mounted on their wall plates with the **contacts at the top** and should be fitted with a shutter to minimise the exposure of contact surfaces to dust and other airborne particles.

Any 8P8C ("RJ45") socket that is **within the reach of small children** should be **fitted with a shutter** to prevent access or discourage them from probing the socket with their fingers.

Note: The socket aperture is large enough to enable a child to touch the contacts with a finger. It is possible to get a small electric shock from these contacts under certain conditions. Fitting of mechanical protection to prevent finger access to the socket contacts is recommended in homes.

5.5.3 TO cabling method

TOs should be "star wired" (cabled individually) from the CCP with a socket terminated at each end of the cable — one at the TO and one at the CCP as shown in Figure 16 to Figure 19 and Figure 22 to Figure 25.

No more than one socket should be terminated on any cable at either the CCP or the TO, i.e. if a TO has two sockets, then two cables are required between the CCP and the TO.

5.5.4 Power outlets

At least one double-socket power outlet should be provided within 1 m of each TO for powering of customer equipment such as cordless telephones and computer equipment.

5.5.5 TOs in a bedroom or study/home office

If only one TO is to be provided in a bedroom, locate it **next to the TV outlet** as shown in Figure 29.

Additional TOs are recommended for some rooms to provide additional connectivity, for example:

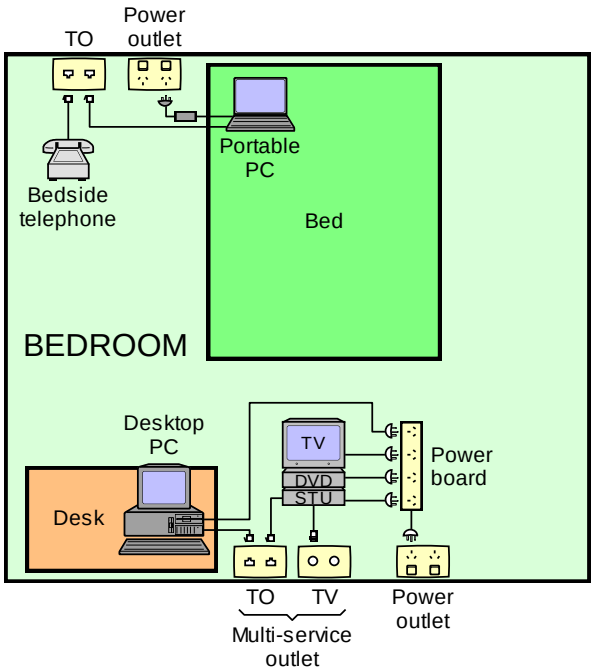
- Install one or two additional TOs in any room that may be used as a study or home office, for connection of additional lines or equipment such as a second telephone service, a fax machine or a network printer.
- Install an additional TO beside the bed in the master bedroom for connection of a telephone, internet radio or a portable (laptop/notebook) computer (see Figure 29).

Additional TOs (or cables for future TOs) may also be considered for the following locations:

- at the electrical switchboard for energy management (ensure that appropriate separation is maintained between the telecommunications and power cabling in accordance with the wiring rules)
- beside or behind the kitchen refrigerator for connection of an “internet fridge”
- in the laundry for connection of a “web-enabled” washing machine.

Figure 29 Two TOs installed on separate walls (recommended for at least the main bedroom and any study or home office)

Typical arrangement



Typical multi-service outlet

Tip: If an F-connector and a modular socket are to be fitted one above the other on the same wall plate, position the F-connector **above** the modular socket so that the end-user will have suitable finger access to the retaining clip at the bottom of any modular plug connected to the modular socket.

Notes:

1. If the cabling budget is limited and this precludes the installation of two TOs in the room, the TO should be installed **next to the TV outlet** to support:
   - wired Ethernet connection of a desktop PC
   - wired Ethernet connection of a TV (for IPTV), network media device or games console
   - connection of a pay TV set top unit (STU) to the internet or the telephone service for interactive pay TV.

   For homes with timber-framed cavity walls, cordless or wireless (Wi-Fi) technology may provide suitable bedside access to the telephone or internet service.
2. Each TO should have at least two sockets. Consideration should be given to providing at least three data sockets near the TV to support high-definition audio/video streaming over the data cabling — refer to Document No. 017153a00.
3. For coaxial cabling guidelines, refer to Document No. 017153a00.

5.6 Wireless Access Point (WAP)

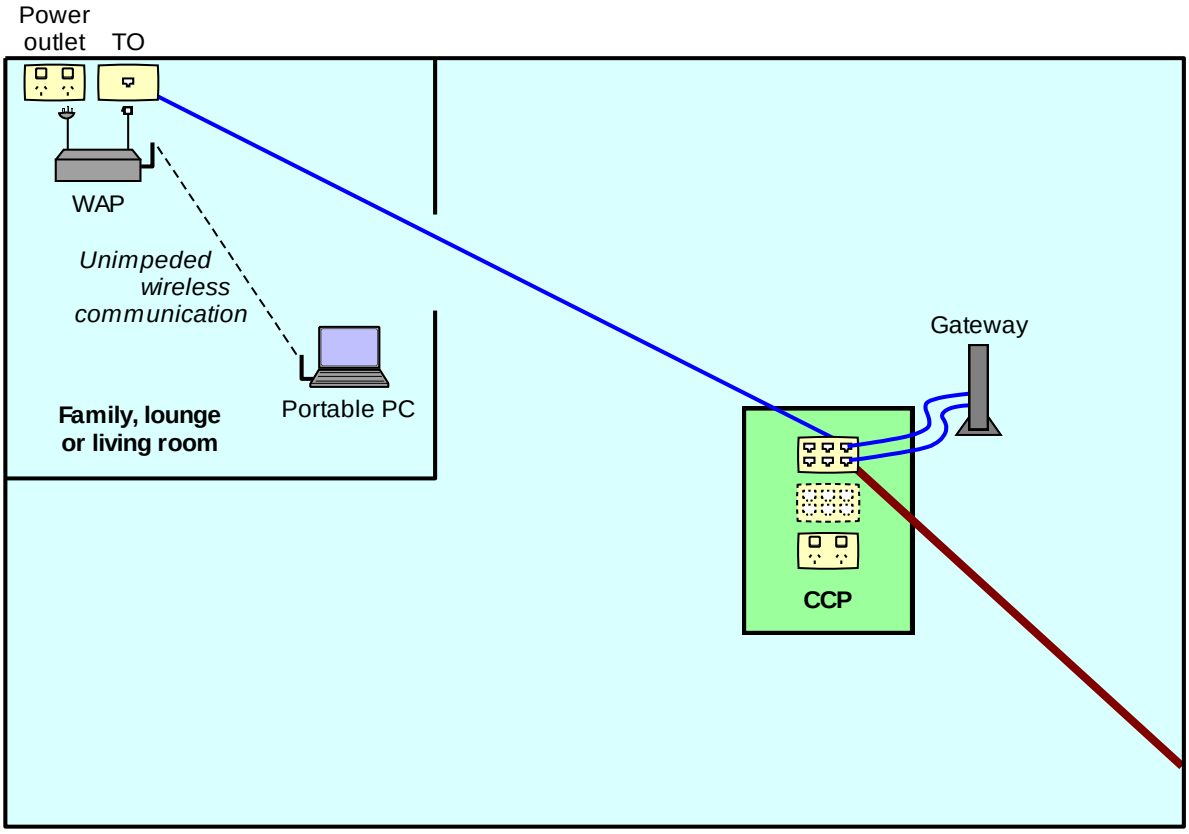
With some homes, it may be necessary to install a TO in an open area of the home, such as the family, lounge or living room, to provide for connection of a Wireless Access Point (WAP). While a wireless gateway may be located at the CCP to provide wireless (Wi-Fi) access, the internal walls of the home may attenuate the radio signals (especially masonry walls), reducing the data speed or Wi-Fi availability throughout the home.

The WAP should ideally be positioned in the same horizontal plane as the devices that will be used to access it, e.g. between one and two metres from the floor for a person sitting or standing while using the wireless device. However, for a two-storey home, if only one WAP is installed, it should be positioned as high as possible in the lower floor or as low as possible in the upper floor to maximise coverage to the other floor. Installation of a WAP in the roof space is not recommended.

Unless PoE (Power over Ethernet) will be used for the WAP (PoE is uncommon in homes as yet), a power point will also be required near the TO that is installed for connection of the WAP.

Refer to Figure 30.

Figure 30 Providing a Wi-Fi access point in the family/lounge/living room



Note: A Wireless Access Point (WAP) located in an open area where portable devices are likely to be used and connected to a LAN port of the gateway located at the CCP will provide optimal Wi-Fi access.

5.7 Connection of other cabling subsystems

5.7.1 Security alarm

Most security alarm systems are cabled using special cable with stranded conductors between the alarm panel, keypad(s), activators and motion sensors. The alarm panel is the cabling hub for the system and is usually secreted away in a cupboard or robe in a room that is monitored by one of the motion sensors. If the alarm panel is to be located at the CCP, the CCP should be monitored by a motion sensor.

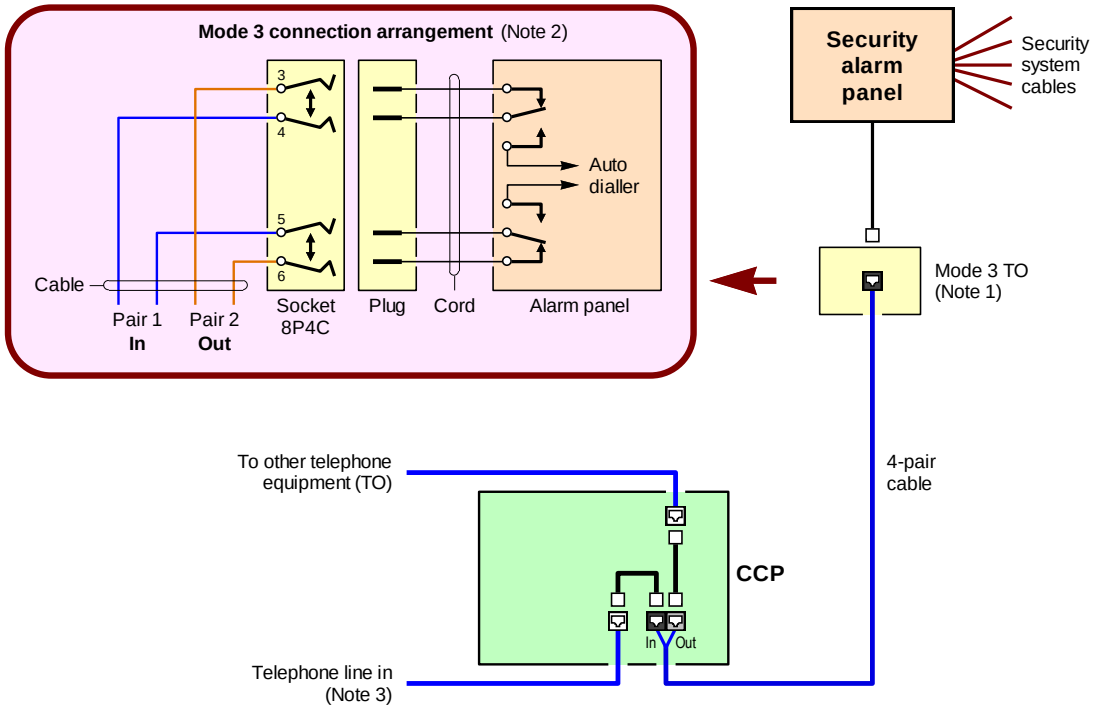
Where a "back-to-base" alarm system is to be installed using a "Mode 3" connection, the telephone line should be connected to the alarm panel before it is connected to any other telephone equipment. This may be achieved by one of the methods described in Document No. 017153a00.

A monitored security alarm should always be connected to the first telephone line of any FTTP NTD (whether outdoor or indoor) because any backup battery installed in the NTD power supply may only maintain operation of the first telephone line during a power failure.

The security alarm panel will have battery backup so that it will still operate during power failure or if the power is switched off at the power mains. Therefore, any FTTP power supply should also be fitted with a backup battery so that the telephone line will function under the same conditions. However, the FTTP backup battery may not maintain operation of any VOIP-based telephone service (e.g. supplied from a gateway connected to the FTTP NTD) and a separate UPS (Uninterruptible Power Supply) may be required to power the VOIP gateway. Refer to Document No. 017153a00 for more information.

Figure 31 illustrates a typical connection arrangement for a "back-to-base" security alarm system.

Figure 31 Interconnection of a monitored ("back-to-base") security alarm system



Notes:

1. The TO may be installed on the wall next to the alarm panel, inside the alarm panel or the alarm panel may be hard wired without a TO. The connection principle is the same in all cases.
2. With a Mode 3 connection, the alarm panel takes priority over the line and disconnects all other telephone equipment when the alarm is activated. It is important that the alarm panel is the first connection point on the telephone line to which it is connected. If a "switching" type socket is used as shown in the above diagram, the line will be automatically connected through to the other telephone equipment if the alarm panel is unplugged.
3. If an ADSL service is supplied via the same line that is used to supply the telephone service, an ADSL splitter (central filter) must be installed at the NTD or the CCP. Refer to Document No. 017153a00 for details.

5.7.2 Personal response system

A personal response system (also referred to as a "medical alert" system or an "emergency call" system) is a communications system that facilitates the connection of an end-user requiring assistance to a central monitoring facility (usually via the public switched telephone network) from an automatic dialling device called a "local unit". The call may be initiated from a trigger device (e.g. located in a bedroom, bathroom or toilet or worn around the neck) or directly from the local unit, which must be readily accessible.

Where a personal response system is to be installed, the local unit must be connected in a "Mode 3" arrangement as shown in Figure 31 for a security alarm panel. If both a security alarm panel and a personal response system are to be installed, the Mode 3 sockets must be wired in tandem. The personal response system should take precedence over the security alarm, i.e. be the first connection in the connection chain. Refer to Document No. 017153a00 for more information.

5.7.3 Home automation

Home automation, such as "intelligent" lighting and push-button or remote control of electrical appliances, is usually installed as part of the electrical wiring system by the electrician. The control cables for such systems may be bus-wired or star-wired from a central control unit, which may be located near the CCP.

While the home automation wiring is usually totally separate from the cabling described in this document, the home automation control unit may be connected to the CCP to provide remote control of appliances via the public telephone network or the internet. This can be achieved by wiring the control unit to a socket in the CCP for connection to a telephone service or an Ethernet port of the gateway.

5.7.4 Home theatre

Home theatre cabling is generally installed as separate cabling. The loudspeaker wiring is normally point-to-point, heavy gauge, stranded conductor cable, while the audio/video links between the home theatre component equipment may comprise point-to-point HDMI, A/V, S/PDIF, TOSLINK or coaxial cables. Such cabling is outside the scope of this document. However, at least one TO should be provided near each TV outlet to provide for such things as:

(a) an internet (Ethernet) connection for on-line games, internet radio, IPTV or Video on Demand (VoD)

(b) a digital (Ethernet) connection for a network media device (e.g. for music or video "streaming")

(c) a telephone service or Ethernet connection for interactive pay TV

(d) analogue audio distribution to amplifiers or low-power speakers in each room (e.g. for music)

(e) high-definition audio/video (A/V) distribution of in-house TV channels using data cabling.

Given the likelihood that two or more of the above connections may be required simultaneously in an entertainment area, the installation of **at least four** independently cabled TO **sockets** at the home theatre point is recommended. While an Ethernet switch may be installed at the home theatre point to aggregate the equipment Ethernet ports for connection to a single LAN port of the gateway at the CCP via a single data cable, this will not support applications that use the physical cabling rather than IP-based signalling, such as the applications described in (c), (d) and (e) above.

Note: Modern TVs, Blu-ray players, digital video recorders, games consoles, media centres and pay TV set top units — all of which are likely to be located at the home theatre point — have an Ethernet port requiring connection to the internet or a home network for full functionality.

5.8 Coaxial cabling

Coaxial cabling may form part of the generic cabling system in accordance with Australian Standard AS/NZS ISO/IEC 15018, *Information technology — Generic cabling for homes*. Some consumer equipment requires connection to both the data cabling and the coaxial cabling.

For more information, refer to Document No. 017153a00.

6 ABBREVIATIONS

For a full list of abbreviations and definitions, refer to Document No. 017153a00.

Acronym	Full expression
3G	Third Generation
4G	Fourth Generation
6P	Six Position
8P8C	Eight Position, Eight Contact
10G	Ten Gigabits
ADSL	Asymmetric Digital Subscriber Line
AS/NZS	Australian Standard/New Zealand Standard
A/V	Audio-Visual
CCP	Central Connection Point (or Cross-Connection Point)
CUE	Combined Utilities Enclosure
DC	Direct Current
FTTP	Fibre To The Premises
FWO	Fibre Wall Outlet
HDMI	High-Definition Multimedia Interface
HFC	Hybrid Fibre-Coax (“Cable”)
HI-FI	High Fidelity
ID	Inside Diameter
IP	Internet Protocol
IPTV	Internet Protocol Television
LAN	Local Area Network
LV	Low Voltage
m	metre(s)
Mbps	Megabits per second
NAS	Network-Attached Storage

Acronym	Full expression
NBN	National Broadband Network
NMP	Network Media Player
NTD	Network Termination Device
PC	Personal Computer
PCD	Premises Connection Device
PoE	Power over Ethernet
PP	Power Point
PSU	Power Supply Unit
RF	Radio Frequency
RJ45	Registered Jack no. 45
Rx	Receive
S/PDIF	Sony/Philips Digital Interconnect Format
STU	Set Top Unit
TO	Telecommunications Outlet
TOSLINK	Toshiba link
TV	Television
Tx	Transmit
UPS	Uninterruptible Power Supply
UPVC	Unplasticised Polyvinyl Chloride
VoD	Video on Demand
VOIP	Voice Over Internet Protocol
WAN	Wide Area Network
WAP	Wireless Access Point

7 ASSOCIATED DOCUMENTS

Document number	Title
017153a00	Cabling of premises for telecommunications — A complete guide to home cabling
017153a02	Cabling of premises for telecommunications — Lead-in cabling and building entry facilities for homes

8 DOCUMENT CONTROL SHEET

Issue number	Issue date	Details on the change
1	26/08/2013	Approved version for publication