

Authority to Alter Facilities in Residential and Small Business Premises

Engineering

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Document control

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1 About this document

Background

nbn supplies **nbn** services to its customers (**RSPs**) under the terms of a Wholesale Broadband Agreement (**WBA**). In order to supply network services, **nbn** must install certain **nbn** owned copper, HFC and fibre network cabling, equipment, material and assets (**Facilities**) in relation to the end user or customer's residential and small business premises (**Premises**) and must maintain these Facilities for continuance of the **nbn** service.

Purpose

This document authorises Registered Cablers accredited by the Australian Communications and Media Authority (ACMA) to move, remove or alter certain **nbn** Facilities.

This document also defines the types of work and the areas of the **nbn** network that can be altered with respect to Health, Safety & Environment (HS&E) regulations.

nbn takes health, safety and environment very seriously and expects the same of our Delivery Partners (**DPs**), network planners, designers and constructors, who have a range of obligations under Workplace Health & Safety (**WHS**) and environmental legislation. Registered Cablers need to consider their specific duty of care; in particular, how they eliminate and minimise risks in the design that have an impact on later stages of the asset lifecycle (including construction, inspection and assurance) and how information about those risks, design rationale, and residual risks and controls are communicated to **nbn**.

nbn has considered the specific risks associated with these design standards for the lifecycle of the assets, and incorporated safety and environmental based design standards within this document where relevant. As a Registered Cabler, there is an obligation to:

- undertake whatever calculations, analysis, testing or examination are necessary to ensure their work as per scope of this document is conducted without safety or environmental risks, so far as is reasonably practicable;
- communicate residual risks associated with the work in the scope of this document and implement further controls/conditions required to manage those risks;
- able to demonstrate to **nbn** they have done the above with appropriate record keeping as stipulated in section 4.1; and
- ensure adequate training and competency of workers involved.

Scope

This document applies to Premises and local areas of the **nbn** network where certain Facilities typically terminate at a Telecommunications Outlet (**TO**), a passive Network Termination Device (**NTD**), Network Connection Device (**NCD**) or a Network Termination Device (**NTD**).

In scope

Facilities on Premises fed by the copper network with copper cables of 10 pair or less, the HFC network and the fibre network as per authorised work activities listed in the document.



Out of scope

The document does not apply to the below and other any other activity not explicitly authorised in this document:

- Facilities and network assets that are not operated by **nbn**
- RSP and other third-party assets
- **nbn** backhaul transit network
- mains cabling that terminates on an MDF
- payphones
- cabling in high voltage substations or power generating stations and fuel dispensing stations
- any equipment or assets associated with the **nbn**TM Satellite network
- any equipment or assets associated with the **nbn**TM Fixed Wireless network
- any other activity that is not explicitly authorised within this document



Note: **nbn** may undertake activities that are deemed out of scope or are otherwise unauthorised, upon request and under a fee-for-service commercial works engagement. This excludes assets and facilities not owned and/or operated by **nbn**.

Further information can be found at:

<https://www.nbnco.com.au/develop-or-plan-with-the-nbn/commercial-works.html>

Audience

Registered Cablers working in Premises.

Assumptions and constraints

The Registered Cabler must be a registered cabling provider in either the 'Restricted' or 'Open' category and include the qualifications below:

- Install, terminate and certify structured cabling installation includes CAT 5 and 6
- Install and terminate coaxial cabling installation
- Install and terminate optical fibre cable on customer premises



Referenced documents

Document number	Document name	Owner
AS/CA S009:2013	Installation requirements for customer cabling (Wiring rules)	Communications Alliance
AS/CA S041.3:2015	Requirements for DSL Customer Equipment for connection to the Public Switched Telephone Network - Part 3: Filters for use in connection Network - Part 3: Filters for use in connection with all xDSL services	Communications Alliance
G649:2017	CABLING EXISTING TELECOMMUNICATIONS SERVICES IN THE CUSTOMER'S PREMISES FOR THE NBN™	Communications Alliance
n/a	Telecommunications Act 1997	Australian Government
n/a	Criminal Code 1995 (Commonwealth)	Australian Government
n/a	Building Code of Australia (BCA)	www.abcb.gov.au



2 Overview

General

Registered Cablers working in Premises may need to alter Facilities to satisfy the end user's requirements. **nbn** authorises Registered Cablers to make limited alterations to Facilities in or on the building when work complies to **nbn**'s requirement as specified by the latest document version of the F0002-31-11678 Authority to alter facilities in residential and small business premises.

Regulatory

Generally, **nbn** owns the Facilities it provides for the purpose of supplying **nbn** services to the network boundary as defined in the WBA, whether or not they become fixtures. **nbn** may alter its Facilities in Premises on request, at appropriate charges. Alternatively, **nbn** may authorise Registered Cablers to perform such alterations on terms and conditions stipulated by **nbn**.

A person who installs or maintains cabling for connection to a telecommunications network ('cabling work') must comply with the Telecommunications Act 1997. The person must be registered to perform cabling work by an Australian Communications and Media Authority (ACMA) accredited body (a 'cabling registrar') and in accordance with the requirements under the *Telecommunications Cabling Provider Rules 2014* (CPRs). It is a condition of the registration for the person to comply with the wiring rules (refer to *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*) and other referenced documents in section 0above where applicable.

Clause 5.13 of *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)* prohibits a cabling provider from moving, removing or altering any lead-in cabling or network boundary facilities without the prior written authorisation of the carrier. However, the note to Clause 5.13 of *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)* clarifies that if a carrier publishes a document authorising cabling providers to alter its Facilities (such as this document), such a document will be taken to be the prior written authorisation of the carrier as long as any terms and conditions set out in the document are adhered to by the cabling provider.

Laws

All telecommunications facilities owned or operated by a licensed carrier (e.g. **nbn**) or a carriage service provider are protected by various laws, whether or not they are located on the carrier's property, public property or private property (e.g. in Premises). A summary of applicable laws follows.

Telecommunications Act 1997

In accordance with Clause 47 of Schedule 3 of the Telecommunications Act 1997 (Cth), **nbn** continues to have ownership of telecommunications facilities that it provides in Premises even if they have become fixtures.



Criminal Code 1995 (Commonwealth)

A person is guilty of an offence under Section 474.6 of the Criminal Code 1995 (Cth) if:

- the person tampers or interferes with a facility owned or operated by a carrier or a carriage service provider
- the person tampers or interferes with a facility owned or operated by a carrier or a carriage service provider and this conduct results in hindering the normal operation of a carriage service supplied by a carriage service provider



The main distinction between a carrier and a carriage service provider is that a carrier owns the network infrastructure over which carriage services are supplied, while a carriage service provider supplies carriage services using the network of one or more carriers.

Each offence carries the risk of a substantial fine and/or imprisonment upon conviction. However, Section 474.3 of the Criminal Code 1995 (Cth) makes provision for a person to do anything for or on behalf of a carrier or a carriage service provider. For the purposes of Section 474.3 of the Criminal Code 1995 (Cth), **nbn** authorises a Registered Cabler to alter certain Facilities, on and subject to the specified terms and conditions set out in this document.

Other

nbn may bring a claim against a Registered Cablers who interferes with or damages **nbn** facilities or services resulting in **nbn** suffering a loss.

Wholesale Broadband Agreement and cabling contracts

nbn supplies **nbn** services to RSPs under the terms of a WBA. Under the terms of the WBA, RSPs must comply with the terms of this document and ensure that its contractors and employees comply with the terms of this document. Registered Cablers should therefore be aware that if they are working under a contract with a RSP, the terms of that contract may expressly require that they comply with this document.

Supplementary Information

Important information for the **nbn**TM Copper Network

Before a Cabling Provider undertakes any work on the **nbn**TM Copper Network, it is important that they understand the context and usage of the copper network for the supply of both **nbn** and other legacy services.

The **nbn**TM Copper Network was originally deployed to provide basic telephony (POTS), and over time evolved to the supply of digital data services, such as Integrated Services Digital Network (ISDN), and Asymmetric Digital Subscriber Line (ADSL) and other technologies.

Within the **current** environment, where **nbn** has acquired the Copper Network from Telstra – there is a requirement for co-existence of legacy services (including POTS, ULLS, ADSL, ISDN and other Special Services).

Technological advances have occurred allowing the delivery of higher speed services, which generally see increased use of higher frequency bands over copper wiring. **Nbn** utilises VDSL2 and G. Fast technologies within their Copper Network, and these are much more susceptible to issues within copper wiring.



To ensure that any work undertaken by a Cabling Provider does not adversely impact a Customer and/or their ability to achieve high speed broadband services over the Copper Network using the **nbn™** FTTB, FTTN or FTTC technologies. Particular care and attention should be paid to the quality of all copper cabling and/or connections made to the copper cabling.

This includes guidance such as:

- Wherever possible, if star-wired configurations exist – they should be removed
- If no longer used, any additional internal sockets should be isolated and removed from connection to the First TO
- If the premises have been migrated to the **nbn™** network and has a voice service being supplied through a RSP modem (instead of an exchange based copper voice service), then additional internal wiring beyond the first TO can be removed – and reconnected into the RSP modem to provide connectivity for legacy telephony devices.

Guidance for migration of existing customer services from the existing Telstra or Optus access network technologies to the **nbn™** network

Communications Alliance has produced materials under Industry Guideline **G649:2017: CABLING EXISTING TELECOMMUNICATIONS SERVICES IN THE CUSTOMER'S PREMISES FOR THE **nbn™**** and were designed to provide a guide to registered cabling providers and assist them in undertaking the migration of existing customer services from Telstra or Optus access network technologies, and onto the **nbn™** access network.

This documentation includes information on:

- Preparation before migrating a customer,
- Identifying services and equipment
- Determining how best to migrate/reconnect services, and
- Verification of cabling work after a migration

It is highly recommended that any cabling provider undertaking work on behalf of a customer to migrate services to the **nbn™** network or undertaking any work under this document, should familiarise themselves with the recommendations made and cabling diagrams under the G649:2017 Industry Guideline.



3 Authorisation

nbn supplies telecommunications network services to RSPs using the **nbn** network, which includes its copper network, HFC network and **nbn** fibre network.

In order for **nbn** to supply network services, **nbn** may be required to install, modify or replace some of the existing Facilities at the Premises, and must maintain these Facilities for the continuance of the **nbn** service or supply of subsequent **nbn** services.

Rationale for limiting authorisation

nbn limits and controls authorisation access to its network for the following reasons:

- in certain circumstances **nbn** has a statutory obligation to supply fixed line broadband services
- in certain circumstances **nbn** may install Over Voltage Protection (OVP) in relation to a Premises
- in some cases, **nbn** may install devices or equipment at the Premises that are essential to the operation and performance of network

nbn has no legal obligation to authorise Registered Cablers to alter **nbn** Facilities within Premises. However, it is not **nbn**'s intention to impede cabling work that may include alterations to the Facilities if, in **nbn**'s opinion, a Registered Cabler is capable of carrying out such alterations without adversely affecting **nbn** or the end user. Accordingly, **nbn** authorises Registered Cablers to make limited alterations to its Facilities in relation to a Premises under the terms and conditions specified in this document.

nbn reserves the right to cancel this document, to revoke or vary any authorisation conveyed in this document, or to vary the terms and conditions prescribed in this document, either generally or selectively, at any time without notice in its absolute discretion.

It is the responsibility of the Registered Cabler to ensure that this document has not been cancelled, the latest version of this document is used, and relevant laws, codes, standards or other regulatory requirements are complied with.

Materials and practices shall be to **nbn** standards

nbn specifies the use of certain materials and practices within the confines of its network (i.e. up to and including the relevant **nbn** network boundary) because **nbn** shall maintain these facilities or requires these facilities to meet **nbn** performance requirements. The Registered Cabler must use the same materials and practices as **nbn** would normally use on its side of the relevant **nbn** network boundary, and this is referred to as the authorised work boundary for the Registered Cabler.

nbn Copper network

nbn owns or operates certain Facilities up to the **nbn** network boundary.

Network Boundary Point (NBP) for FTTN connections not at an MDU site

The NBP for carriage services that **nbn** supplies is determined in accordance with **nbn**'s relevant supply terms with RSPs (e.g. the WBA). Where the **nbn** lead-in cable is not connected to a customer MDF or Passive NTD, the NBP for each line supplied to a Premises will be the first TO ('first socket') after the building entry point. The first TO will be the NBP for most single dwellings throughout Australia. In such cases, **nbn** accepts responsibility for installation and repair of its network up to, and including, the first TO.

Ten Pair termination/Connection boxes are not to be deemed as an MDF or as the NBP.

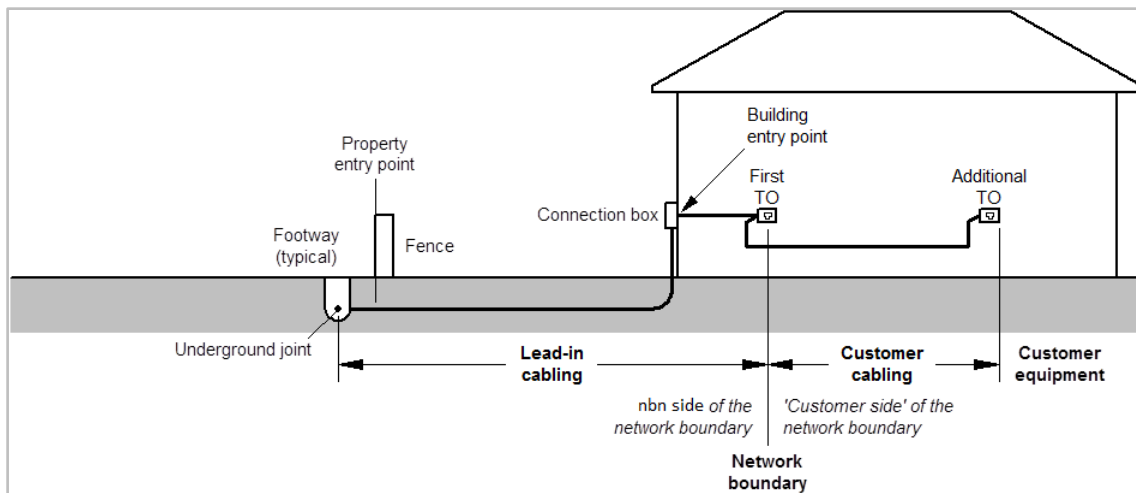


Figure 1 Typical underground residential installation first TO as NBP

Where the **nbn** lead-in cable is connected to an external Passive NTD, this defines the NBP.

Figure 2 details the NBP for underground cabling when a Passive NTD is installed.

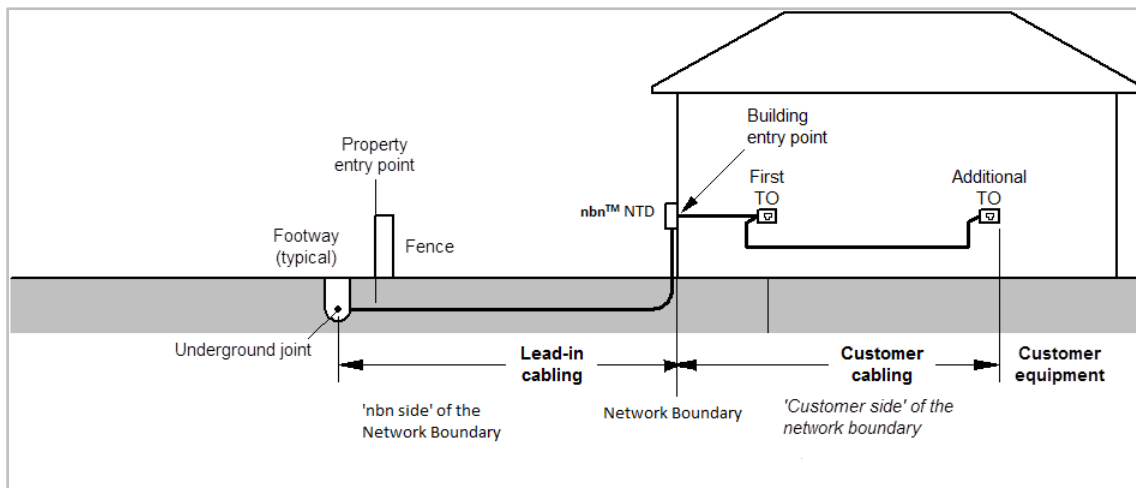


Figure 2 Typical underground residential installation with a Passive NTD as NBP

The same rules apply for aerial fed lead-in cabling. If a NTD is not present, then the first TO is the NBP. Figure 3 details typical aerial fed premises with the first TO as the NBP.

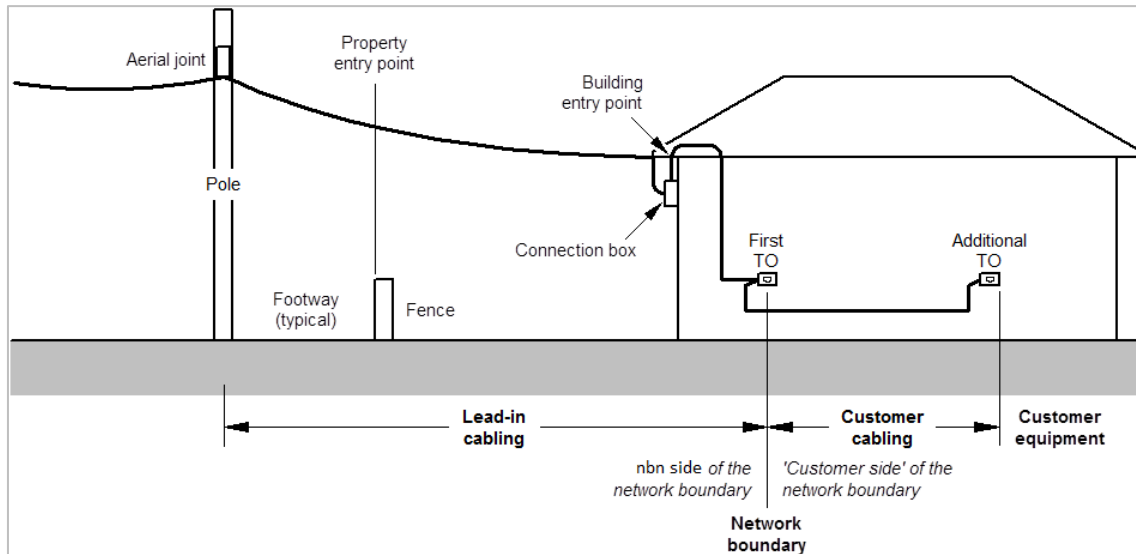


Figure 3 Typical aerial residential installation with first TO as NBP

Figure 4 shows a typical aerial installation with a Passive NTD as the NBP.

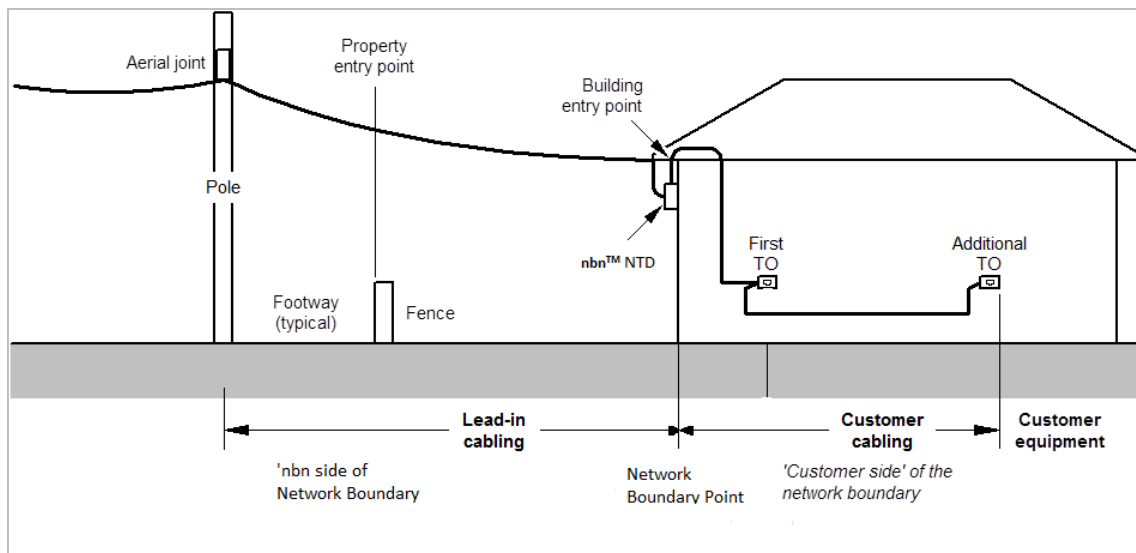


Figure 4 Typical aerial residential installation with a Passive NTD as network boundary

Where a Passive NTD is installed, it is the network boundary for all lines connected to it; otherwise the network boundary defaults to the first TO inside the building (unless the line connects to a distributor, in which case the distributor becomes an MDF, which will be the NBP).

Network Boundary Point (NBP) for FTTN connections at an MDU site

For FTTB and FTTN at an MDU site, the NBP will be the jumper cable termination on the customer side MDF.

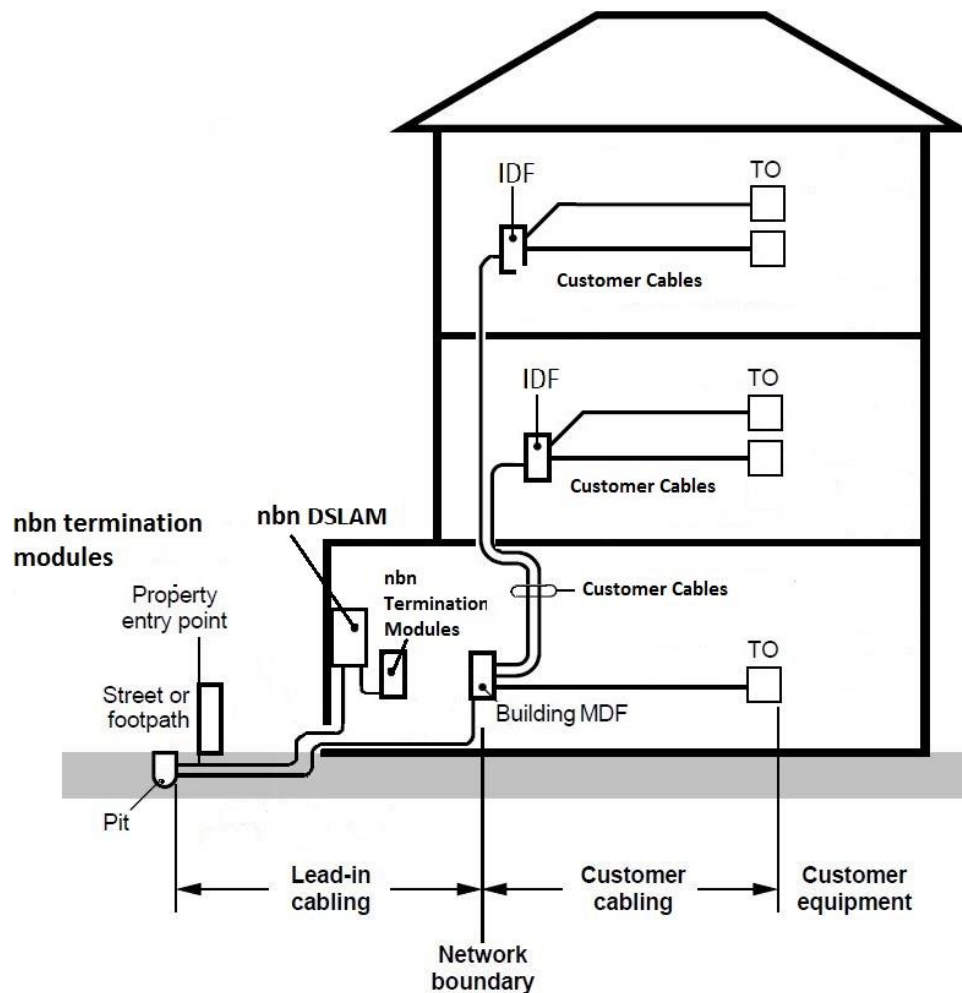


Figure 5 Typical Residential Multi-Dwelling Unit MDU installation with MDF as network boundary (nbn FTTB network)

Within MDUs where the lead in cable copper cable terminates at an MDF the Network Boundary Point is the Customer side of the building MDF as defined in *AS/CA S009:2013*.

nbn may have a Fibre to the Basement FTTB Digital Subscriber Line Access Multiplexer (DSLAM) Installed within the MDU with termination modules jumped to the Building MDF, the installation of a **nbn** DSLAM does not affect the NBP.



For a detailed description of the network boundary, refer to the *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*.

Prior to 'deregulation' of premises cabling in 1989, it was common practice in some areas to star-wire TOs from a connection device or joint in the lead-in cable. In such cases, each star-wired TO is potentially the network boundary for the cable terminated on it. **nbn** is not obliged to reconfigure existing star-wired installations.

This document does not legally change the network boundary from the first TO, NTD or customer side MDF to the building entry point or to any intermediate connection device or joint in the lead-in cabling - the network boundary is determined by legislation and detailed in *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)* and what may otherwise be agreed in the WBA, and as such remains at the first TO, NTD or customer side MDF, as applicable. This document authorises Registered Cablers to make limited changes to certain Facilities, including changing the location of the NBP (e.g. changing the position of the first TO from one part of the building to another, or changing the network boundary from the first TO to a Passive NTD).

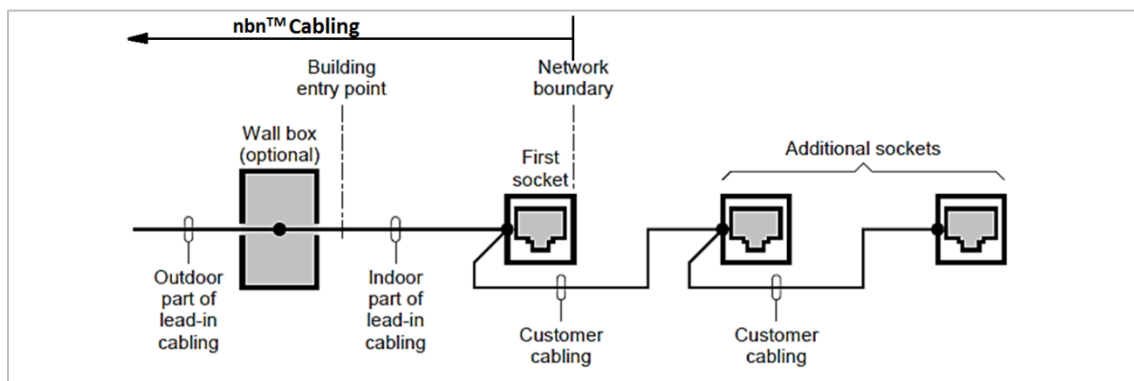


Figure 6 Typical internal residential installation with first TO as NBP

Network Boundary Point (NBP) – FTTC

For FTTC, the NBP is the FTTC-NCD.

nbn Fibre network

nbn owns or operates its Facilities up to the **nbn** network boundary.

Generally, **nbn** owned equipment or cabling on the customer side of the network boundary will be identified as **nbn** property (e.g. labelled or stamped 'nbn').

Fibre Network Boundary Point (NBP)

The NBP for carriage services that **nbn** supplies is determined in accordance with **nbn**'s relevant supply terms with RSPs (e.g. the WBA). The fibre service drop cable can be either aerially or Underground fed and connects to an external premises connection device (PCD), A Premises Internal Cable (PIC) is then installed from the PCD to the Fibre NTD Figure 7 details both aerial and underground **nbn** fibre connections.

The NBP for all fibre installations is the UNI ports on the Fibre NTD. Equipment after the Fibre NTD is defined as Customer or RSP equipment and is not the responsibility of **nbn**.

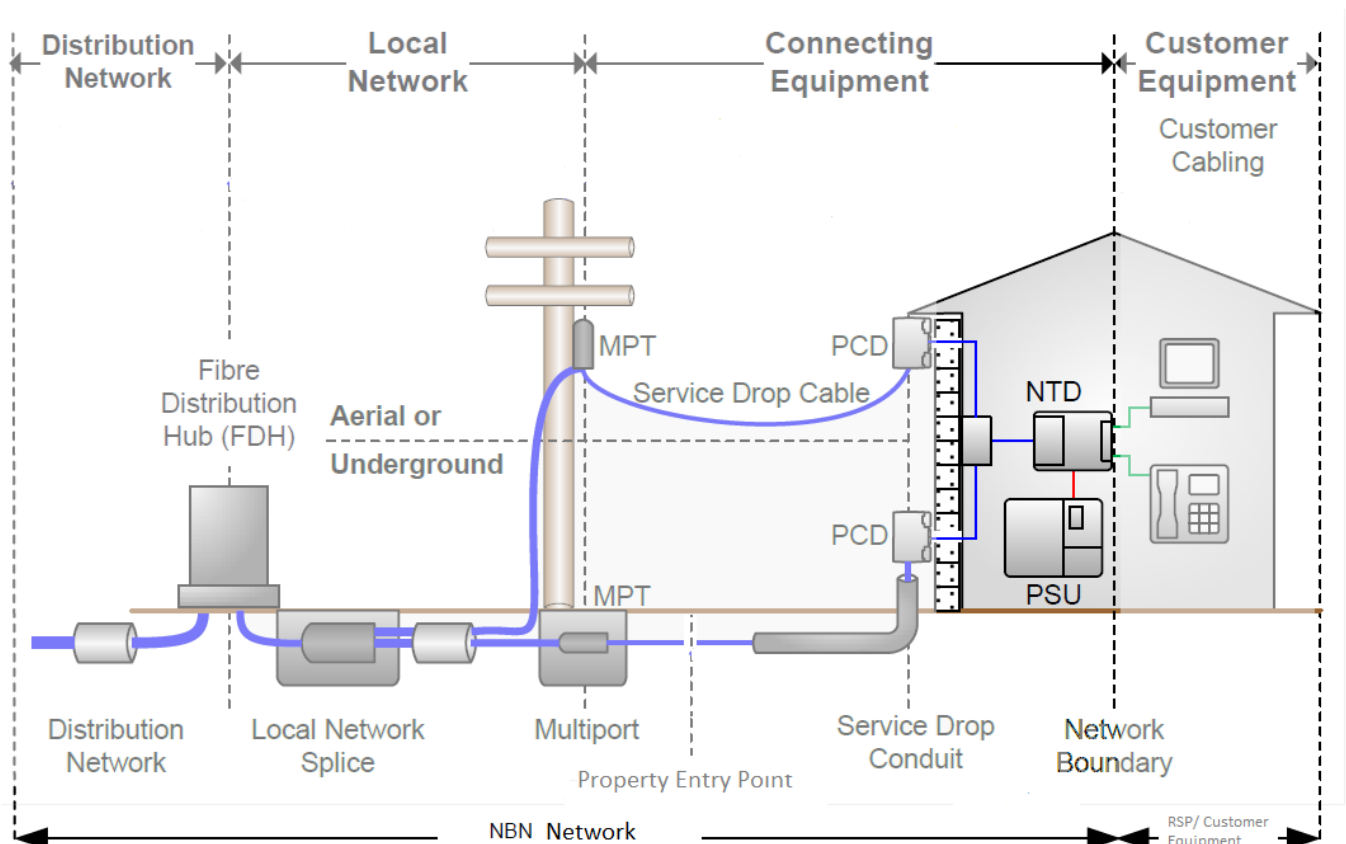


Figure 7 Aerial and Underground Fibre Network Boundary Point

nbn HFC network

nbn owns or operates its Facilities up to the **nbn** network boundary. In some cases, **nbn** also owns equipment beyond the **nbn** network boundary.

Generally, **nbn** equipment or cabling on the customer side of the network boundary will be identified as **nbn** property (e.g. labelled or stamped 'nbn').

Irrespective of whether equipment or cabling is owned by **nbn** or not, such equipment and cabling must:

- conform to **nbn** approved materials lists; and
- be installed and commissioned in accordance with **nbn** approved design rules, construction practices and commissioning/test guides.

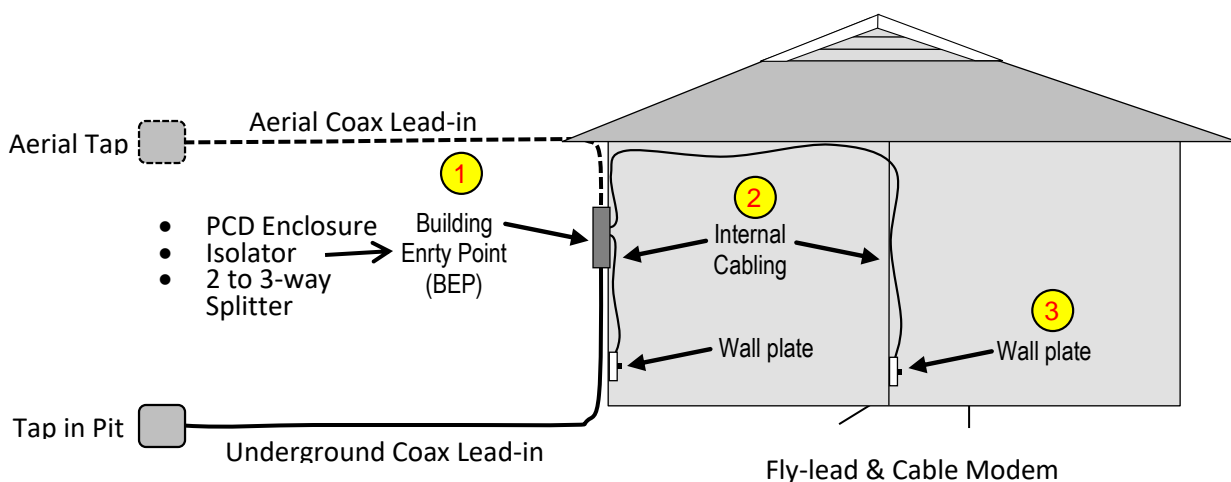


Figure 8 Aerial and Underground HFC Network Building Entry Point & Internal Cabling (SDU)

nbn Installation Responsibility

nbn is and remains responsible for constructing, modifying or removing the lead-in coaxial network from the Tap in the street coaxial network to and including the Premises BEP. As shown in Figure 8, the lead-in may be aerial or underground. At the Building Entry Point (BEP), **nbn** or its Delivery Partner will install a PCD enclosure fitted with a mandatory 7kV Isolator and an optional 2-way or 3-way splitter. The latter is used where multiple wall-plates inside a SDU are to be installed to connect multiple services from one or more Carriage Service Providers or RSPs. The equipment to be connected to the wall plate may include:

- a Telstra Cable Modem during Telstra co-existence;
- a Foxtel Pay-TV Set-Top-Box during Foxtel co-existence; or
- one or more **nbn** compliant HFC NTD.

Network Boundary Point (NBP) – HFC

For HFC, the NBP is the HFC NTD.



4 Authorised work – general terms and conditions

Section 4 to Section 11 (Authorised activities) describes the type of work that is authorised by **nbn** and sets out the general terms and conditions that apply to all activities, including further terms and conditions that apply to each specific activity.

If an activity is not listed in Section 4 to Section 11 (Authorised activities), it is not authorised.

General terms and conditions

nbn authorises a Registered Cabler to do certain work on Facilities, as set out in this document, subject to the general terms and conditions below.

- The Registered Cabler must be a registered cabling provider in either the 'Restricted' or 'Open' category.
- The Registered Cabler must hold additional competencies/endorsements relevant to the category of work being performed, e.g.
 - For work on the **nbn** Fibre Network, hold Optical-fibre cable (OF) endorsement.
 - For work on the **nbn** HFC Network, hold Co-axial cable (OF) endorsement.
 - For work on the **nbn** HFC Network, hold Structured (S) endorsement, if any work performed uses Cat5/5e/6 cabling).
- The Registered Cabler must provide a Telecommunication Cabling Advice 1 form (TCA1 form) for work performed at or beyond on the network boundary, as defined in the CPRs.
- The Registered Cabler should provide a Telecommunication Cabling Advice 2 form (TCA2 form) to alert customers or building managers of any non-compliant cable installations that are outside the contracted scope of work.
- The Registered Cabler must discuss with the End User and make enquiries to determine whether the changes being made may have an impact on a service utilised by a Priority Assistance End User, a Fire or Lift Phone, or a medically vulnerable end user (such as those on monitored and unmonitored medical alarms). In the event that an impact is expected, the End User must be notified and agreeable to the change being undertaken.

All Registered Cablers are required to undertake appropriate training modules to ensure that they are competent to perform the cabling work according to *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*, which ensure safety to end users, Registered Cablers and the **nbn** network.



nbn requires the Registered Cablers to be a registered cabling provider as a condition of this document as a measure of competency to do the work and to ensure that the requirements of *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)* are met in case the work also involves any cabling activity on the customer's side of the network boundary.

The Registered Cabler must be familiar with all applicable legal and regulatory requirements for the performance of this work and comply with all laws, regulations, standards and codes of practice applicable to this work.

The Registered Cabler acknowledges responsibility for the restoration of faulty or substandard work, if they are required to do so by **nbn**, or the RSP and end user:



- **nbn** reserves the right to seek damages from the Registered Cabler, Responsible Third Party or Responsible Third-Party Damager if **nbn** incurs costs due to any work performed by the Registered Cabler on Facilities
- **nbn** retains ownership of any Facilities so worked on, whether re-used or replaced
- the Registered Cabler acknowledges that they are not performing any work under this document in **nbn's** name nor are they a contractor or employee of **nbn**
- the Registered Cabler must not represent or give an impression to end users or third parties that they are performing work as an employee or a contractor of **nbn**
- the Registered Cabler must not seek any remuneration from **nbn** for any work performed
- the Registered Cabler agrees to indemnify **nbn** against any liability, loss, damage, costs or expenses incurred or suffered by **nbn** that is caused by any act or omission of the Registered Cabler whether negligent or not, or which arises from any default under the terms and conditions of this document
- the Registered Cabler must not do anything that may affect the safety, integrity or proper functioning of the **nbn** network or the safety of the end user or any other person (the Registered Cabler must not use substances or material deleterious to health or safety or which could adversely affect the functioning of the **nbn** network)
- the Registered Cabler must ensure that they do not cause unnecessary detriment, inconvenience or damage to **nbn**, RSP the end user or a third party
- the Registered Cabler must not do any act or thing that is prejudicial to the goodwill, commercial reputation or overall public image of **nbn**
- the Registered Cabler must keep proper records of the work performed under this document that is available to **nbn** upon request within a reasonable timeframe
- notwithstanding anything contained in this document, the Registered Cabler must take all reasonable steps to ensure that lightning surge suppressors / isolators or any equipment that may be necessary for the safety and proper functioning of the installation are not bypassed or disconnected
- the Registered Cabler must not create any star-wired connections from an intermediate connection point in the lead-in cabling (i.e. between the property entry point and the first TO), unless the intermediate connection point is:
 - a centralised filter provided in accordance this document
 - NTD provided in accordance with this document
 - a coaxial splitter or premises amplifier fitted to a PCD enclosure in accordance with this document
- the Registered Cabler must not render any **nbn** installation unusable (e.g. by removing the **nbn** cabling or not terminating the **nbn** lead-in cable at a TO that is readily accessible by the end user), unless this is necessary for the purpose of renovation, demolition or relocation of the building
- the Registered Cabler must not connect **nbn** lead-in cable to:
 - a customer MDF or
 - directly to a home networking box or
 - a patch panel of any description



- any new cabling to the first TO must be installed in a manner that enables safe access and/or replacement of such cabling by **nbn** installers subsequent to its installation
- any waste material (e.g. used wire, cable; conduit, etc) must be safely and properly disposed of in accordance with applicable laws
- all works must adhere to *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)* and the Building Code of Australia (BCA)



5 Authorised activities Copper Network

Subject to the terms and conditions set out herein, **nbn** authorises a Registered Cabler to:

- replace **nbn**'s existing first TO with another TO of a type approved by **nbn**
- relocate **nbn**'s existing first TO to another location within the same building
- relocate a fixed wall phone or other hard-wired telephone (other than a payphone) to another location within the same building, or replace it with a TO for the purpose of connecting other customer equipment
- disconnect a fixed wall phone or other hard-wired telephone (other than a payphone) if it is no longer required
- relocate a TO or provide an additional TO where the TOs are cabled from a common ('star-wiring') point in the lead-in cabling
- rearrange a star-wired installation to support a single-ended, bus-wired or 'mode 3' configuration
- replace, relocate or otherwise alter the indoor lead-in cabling for renovation, demolition or relocation of the building,
- disconnect a changeover switch connected to **nbn** lead-in cabling
- install, relocate, replace or, under certain conditions (as detailed in Section 0 (General terms and conditions)), remove a centralised filter connected to **nbn** lead-in cabling
- replace or utilise the existing Passive NTD
- install a new Passive NTD or change a line module in an existing Passive NTD
- replace existing connection box/wall box with a **nbn** connection box
- for **nbn** lead-in cabling not exceeding a total capacity of ten (10) pairs and which does not terminate on a customer MDF, disconnect underground or aerial lead-in cabling at the external surface of the building for renovation, demolition or relocation of the building
- use **nbn** lead-in poles to support customer cabling

The above activities may be performed independently or concurrently.

Scope of authorised work - Copper

This section details the scope of the works that are authorised by **nbn** in relation to the copper network.

Replacement of the first TO

- **nbn** authorises a Registered Cabler to replace the first TO with another TO or an external Passive NTD, and if the TO is replaced, shall be with an Industry approved TO of a modular type (e.g. 6P4C or 8P8C).



Relocation of the first TO

nbn authorises a Registered Cabler to relocate the first TO to another location, subject to the general terms and conditions of Section 0(General terms and conditions) and the following:

- the TO shall only be relocated to another position in the same building (in the case of a building supplied with **nbn**TM FTTB, or a multi-dwelling unit, only relocated within the same premises/sub-address. e.g. relocate to Unit 1 only, and not between Units 1 and 2)
- the TO location shall comply with siting details
- the TO, if replaced, shall be with an Industry approved TO of a modular type (e.g. 6P4C or 8P8C)
- the TO shall be cabled in accordance with *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*

No alterations shall be made to any part of the outdoor cabling except for:

- one-for-one replacement of conductor terminations or connectors at an existing outdoor connection device for the sole purpose of disconnecting the old cable for the first TO and reconnecting the replacement cable
- re-routing of the TO cabling on the outside surface of the building where indoor cabling is not practicable
- the relocation or replacement of an existing outdoor centralised filter
- the replacement of an ADSL centralised filter with a VDSL2 centralised filter
- the installation of a Passive NTD
- disconnection of the cabling for the purpose of renovation, demolition or relocation of the building

Fixed wall phone or other hard-wired telephones

nbn authorises a Registered Cabler to replace an obsolete fixed wall phone or other hard-wired telephone (excluding a payphone) with a TO for the purpose of connecting other customer equipment, subject to the general terms and conditions of Section 0(General terms and conditions) above.

Relocation of the first TO

If the first TO is to be replaced or relocated:

- the installation will meet *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*
- if the existing telephone or replacement TO is to be relocated and is to be reconnected as the first telephone or TO after the building entry point, it shall be installed in accordance with the requirements detailed in Section 0(Relocation of the first TO)

nbn authorises a Registered Cabler to disconnect a fixed wall phone or other hard-wired telephone (excluding a payphone) if it is no longer required and to advise the end user to return to the RSP, subject to Section 0(General terms and conditions) and the following:

- if the aforementioned telephone is the first telephone connected to the line after the building entry point, it shall be replaced with a TO that complies with *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*

- if the replacement TO is the first TO connected to the line after the building entry point and the required location of the TO is different to the location of the aforementioned telephone, it shall be cabled in accordance with the requirements of Section 0(Relocation of the first TO)

Star-wired TOs

nbn authorises a Registered Cabler to relocate a TO that has been star-wired from a connection block/box, lightning protector block or other joint installed in the lead-in cabling, subject to Section 0(General terms and conditions) and the following:

- the TO shall be relocated without disturbing the connection block/box, lightning protector block or joint
- the building cabling shall be reconfigured, with star wiring beyond the first TO removed, in accordance with *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*

Reconfiguration of nbn wiring

nbn authorises a Registered Cabler to rearrange a star-wired installation to support a single-ended, bus-wired or 'mode 3' configuration for connection of a VDSL2 service, monitored security alarm, personal response (emergency call/medical alert) system, etc.

The arrangement shall be altered in accordance with Figure 9 Typical wiring to facilitate 'mode 3':

- the TO connected as the first TO for each service shall be replaced with an approved TO if required
- the first TO shall be cabled in accordance with the requirements of Section 0(Relocation of the first TO)

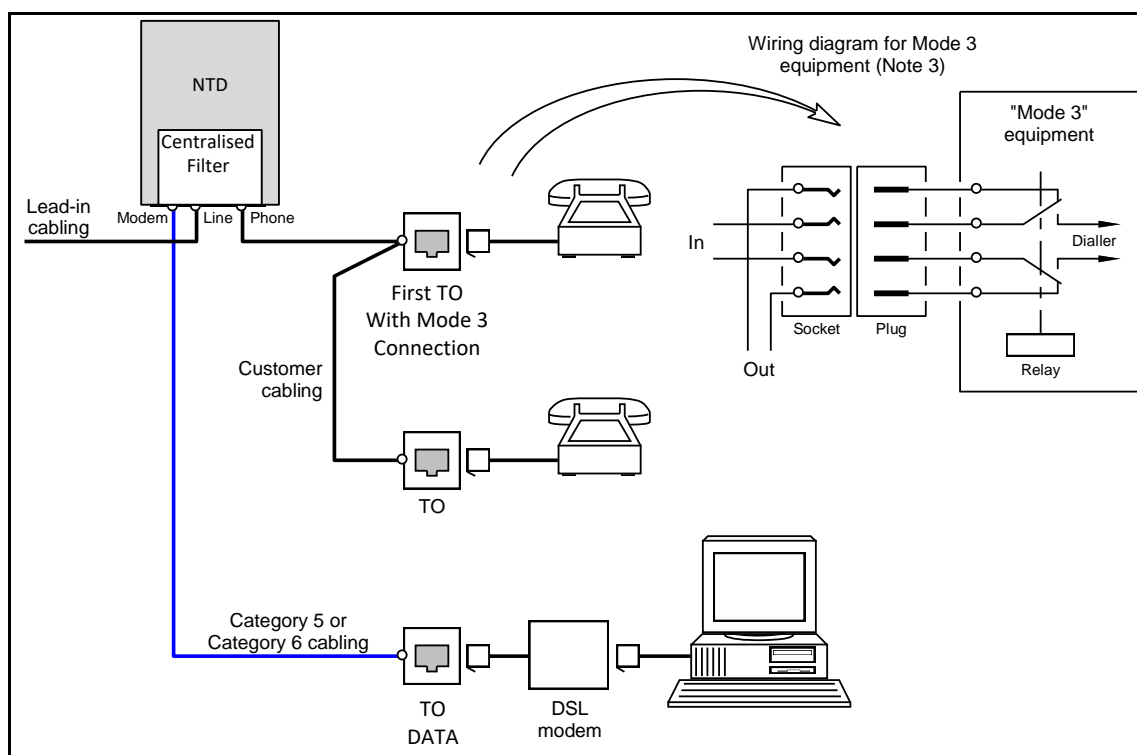


Figure 9 Typical wiring to facilitate 'mode 3'



If a 'mode 3' connection is required (e.g. for connection of a security alarm panel or a personal response (such as an emergency call/medical alert) system), the 'mode 3' TO must be the first connection point on the telephone side of the centralised filter, as shown in Figure 9.

Cabling in the building



Category 5 (or '5e'): cable or connecting hardware that is designed and manufactured to carry signals with a nominal maximum frequency of 100 MHz

Category 6: cable or connecting hardware that is designed and manufactured to carry signals with a nominal maximum frequency of 250 MHz

Where the cabling to the first TO 'first socket' is altered, the existing indoor part of the lead-in cabling (between the building entry point and the first TO) may be re-used or otherwise replaced in whole or in part, with PVC or polyethylene-sheathed cable with at least the same number of pairs as the existing cable.

Category 5 (or '5e') or Category 6 cable is **strongly recommended** for all new indoor cabling due to the number of pairs (four [4] pairs) and its noise and crosstalk immunity for VDSL2 services, and shall be ACMA compliant and have a solid copper conductor with a diameter of 0.4 mm or 0.5 mm.

Any cable that is run as outdoor surface cabling and not enclosed in conduit shall be ACMA rated outdoor type cable.

Any cable that is run internally within the premises shall be ACMA rated indoor cabling for its flame-retardant properties and meeting Australian building codes.

Cable installation

The lead-in cable shall be installed in a manner consistent with the wiring rules (refer to *AS/CA 5009:2013 Installation requirements for customer cabling (Wiring rules)*) in respect of separation from other services, colour of conduit, etc.

Lead-in cabling that is run horizontally along an external wall shall be installed at least 100 mm above finished ground level. Lead-in cable on external walls shall be enclosed in conduit unless the cable is installed higher than 2.4 m or is protected from impact or abrasion by an overhang or similar building feature. Cable may be run as surface cabling without enclosure in conduit along a beam, fascia, soffit moulding, etc. Corrosion-resistant and UV-resistant cable fastenings shall be used on external surfaces.

Surface cabling on internal surfaces may be enclosed in plastic conduit, ducting or trunking, or may be stapled or clipped directly to a suitable timber support (e.g. skirting, architrave).

Outdoor or indoor cable, conduit, ducting or trunking shall be run vertically or horizontally unless it is run in parallel with a sloping building feature (e.g. bargeboard or raked ceiling), and should be run along or adjacent to suitable building features or fittings so as to be unobtrusive.

Lead-in cable installed on any surface without enclosure in conduit shall be fastened at distances no greater than:

- 500 mm for vertical cable runs
- 300 mm for horizontal or diagonal runs.

The cable bend radius for cable sizes of 2 to 5 pairs shall not be less than 25 mm (at least 50 mm bend radius is recommended for 4 pair and 5 pair cable). The cable shall be fastened on each side of the bend as shown in Figure 5 (machine stapling of category 5/5e or category 6 cable is not recommended unless the stapler is a type that limits the staple tension exerted on the cable sheath and is correctly adjusted).

Where conduit is used, rigid conduit should be used for straight or long cabling runs but corrugated (flexible) conduit may be used for short cable runs or difficult bends on the surface of the wall.

Conduit couplings and fittings should be glued or arranged to prevent the entry of water and to allow any water that may get in to drain out. An example of a suitable arrangement that does not require the conduit couplings to be glued is if the socket is above the spigot for vertical or diagonal conduit runs.



Any indoor type cable that is continually immersed in water within the conduit will be prone to failure.

Conduit or ducting/trunking shall be fastened at distances no greater than:

- 900 mm for vertical rigid conduit or ducting/trunking
- 450 mm for vertical corrugated (flexible) conduit
- 600 mm for horizontal or diagonal rigid conduit or ducting/trunking
- 300 mm for horizontal corrugated (flexible) conduit

Outdoor conduits shall be fastened using galvanised saddles or half-saddles. For indoor conduits, nickel-plated or zinc-passivated saddles or half-saddles may be used.

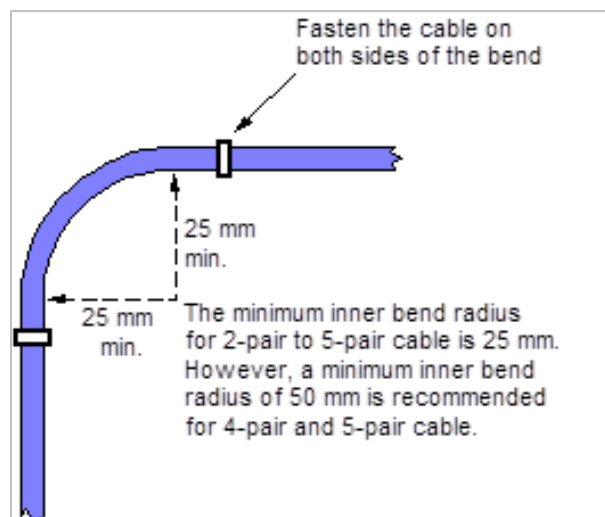


Figure 10 Representation of 2 pair - 5 pair cable minimum bend radius



Fasten the cable immediately before and after the bend, not in the middle of the bend.

Building cable entry

Any copper cable running down the cavity of an external wall should have a 'gooseneck' (half loop) formed in it to provide a 'drip point' so that any condensation or seepage water flowing down the cable does not run into the TO or onto the internal wall lining. Where sarking or panel bracing has been installed between the inner and outer walls, ensure that the drip point is provided on the outside (external wall side) of the sarking membrane or bracing panel. If it is necessary to drill a hole through external wall cladding for cable entry, drill at an upward angle into the wall cavity to ensure that any water running down the outer wall will not flow through the hole into the building. A suitable commercially available sealant should be used to provide a seal at the cable entry.

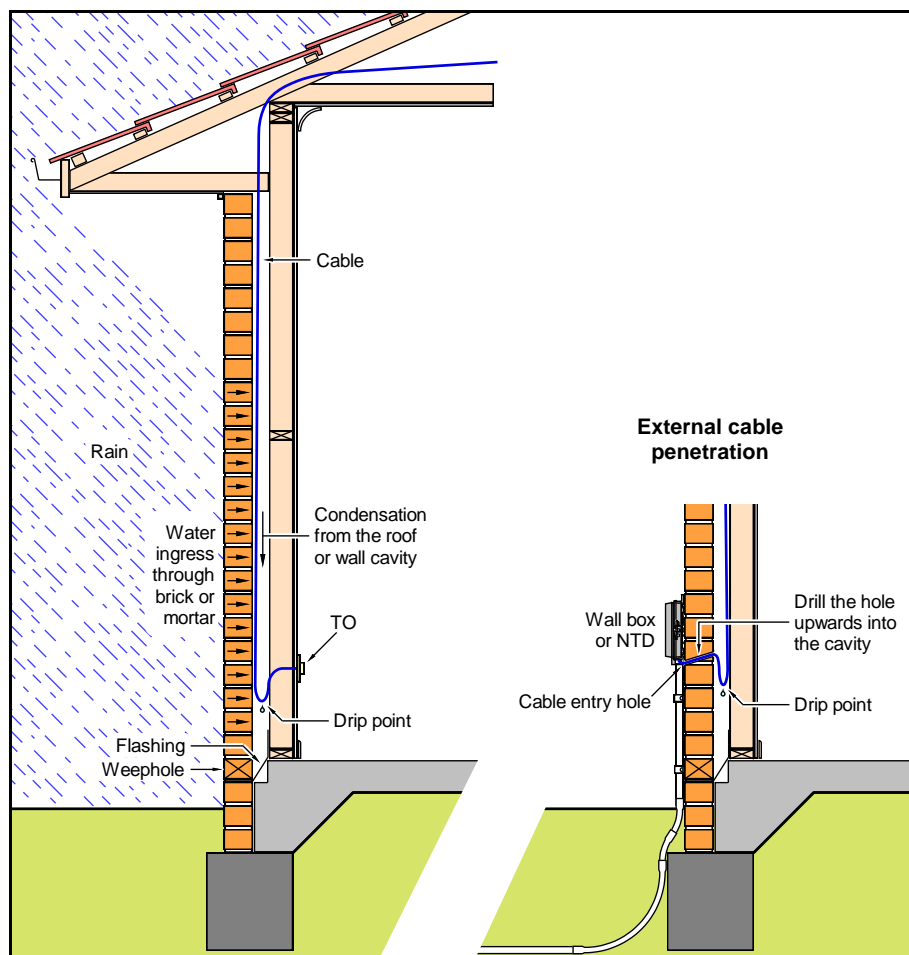


Figure 11 Building cable entry

The drip point consists of slack cable (minimum 200 mm, maximum 500 mm) left in the wall cavity and arranged such that it is looped downwards.

The drip point (slack cable) should be located on the outer side of any wall sarking or panel bracing (i.e. between the external brick or external wall cladding and the sarking/bracing).

For any external cable penetration to the building, drill the hole upwards into the wall cavity so that any water running down the external wall will not run through the hole into the building.

All Installation works shall adhere to *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)* and the BCA.



Cable jointing

No joints shall be made in any part of the outdoor lead-in cabling except for:

- like-for-like replacement of conductor terminations or connectors in an existing outdoor connection device for the purpose of disconnecting the old cable between it and the first TO and reconnecting a replacement cable
- installation of a NTD
- replacement of a connection device/wall box other than a NTD with a PCD or
- installation of a VDSL2 centralised filter

Where it is proposed to join a new cable to the existing lead-in cable:

- the Registered Cabler shall make no more than one joint in the lead-in cable between an existing outdoor connection device or, where there is no outdoor connection device, the building entry point and the first TO
- the new cable shall replace part or all the existing cable and shall not be teed (star-wired) into the existing cable
- the joint shall be installed in an accessible location (e.g. accessible underfloor or roof space or behind a wall plate in a wall cavity) and shall be suitably constructed, enclosed, positioned and supported to prevent physical damage or the ingress of dust, insects, vermin and moisture (any new joint should be made in a suitable joint enclosure or connection box and be accessible)
- the joint shall be made using moisture resistant current industry standard connectors such as Scotchlocks 2 port-UY, using the crimping tool specified by the manufacturer of the connectors (pair twists shall be maintained as close as possible to the connectors)
- all pairs of the existing cable shall be jointed through to the first TO using the corresponding pairs of the new cable (unless the joint is being made in an Outdoor NTD, in which case only working pairs shall be connected)

Change/Over (C/O) switch

nbn authorises a Registered Cabler to disconnect an existing C/O switch connected to **nbn** lead-in cabling if required, subject to Section 0 (General terms and conditions) and the following:

- where the C/O switch is disconnected, **nbn** lead-in cable shall be terminated on a TO
- if the location of the replacement TO is different to the location of the C/O switch, it shall be cabled in accordance with the requirements of Section 0 (Relocation of the first TO)
- if the original need for the C/O switch has lapsed, a Registered Cabler may permanently disconnect the C/O switch, as long as the TO that is connected as the first TO complies with Section 0 (Relocation of the first TO)
- **nbn** does not authorise a Registered Cabler to install a new C/O switch in **nbn** lead-in cabling
- a NTD shall be installed in accordance with this Section 0 (Change/Over (C/O) switch), such that the C/O switch is connected on the customer side of the NTD



VDSL2 centralised filter

nbn authorises a Registered Cabler to install or replace a centralised filter (also referred to as a central splitter or remote splitter) within the **nbn** lead-in, subject to Section 0 (General terms and conditions) and the following:

- the centralised filter shall be certified as compliant to *AS/CA S041.3:2015 Requirements for DSL Customer Equipment for connection to the Public Switched Telephone Network - Part 3: Filters for use in connection with all xDSL services*, or later
- **nbn** approved centralised filters are detailed in Sections 13-15 .1 and shall be housed within either a NTD or TO integrated faceplate.

A Registered Cabler may install or replace a VDSL2 centralised filter in the lead-in cabling so long as all the following conditions are met:

- the centralised filter shall be located in or on the same premises as the modem
- if the centralised filter is to be installed outside the building (i.e. on an external wall), it shall be installed within a NTD
- the TO socket to be used for connection of the VDSL2 modem shall be legibly and durably marked 'DATA' or similar
- the TO socket to be used for connection of the VDSL2 modem must be of a modular type (e.g. 6P4C or 8P8C)
- If any new or replacement cable is provided between a lead-in connection device and the centralised filter shall be category 5 (or '5e') or category 6 cable
- any new or replacement cable provided between the centralised filter and the TO for the DSL service should be category 5 (or '5e') or category 6 cable
- replacement of an existing filter connected to the lead-in cabling
- a Registered Cabler may remove an existing centralised filter if the lead-in is terminated on a single TO (without star or bus wired additional TO) for dedicated connection to a VDSL2 Customer Premises Equipment (CPE)

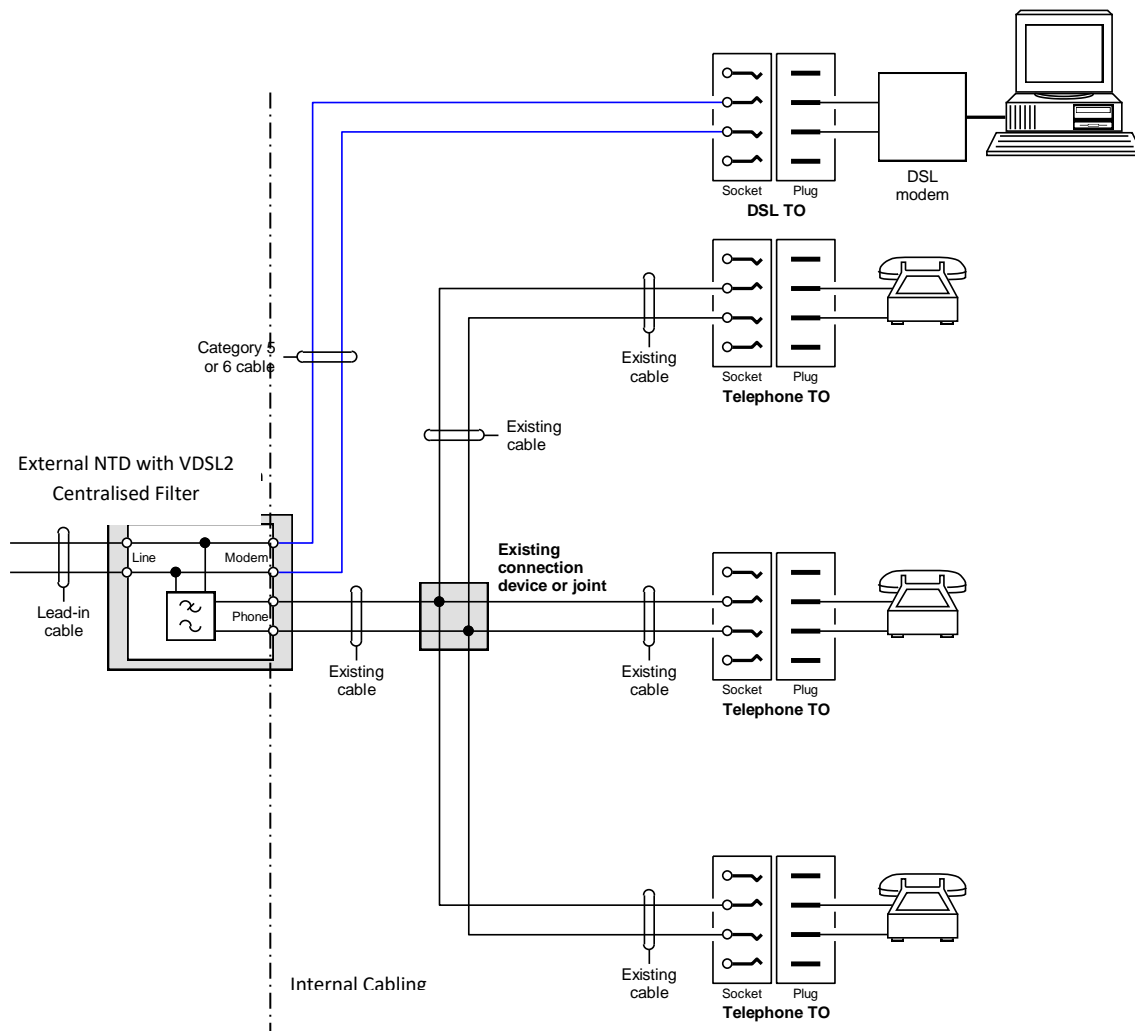


Figure 12 Typical VDSL2 centralised filter installation within an external NTD for existing star legacy wiring

Existing Passive NTD

nbn authorises a Registered Cabler to use the existing NTD if deemed fit for purpose or replace it with a new Passive NTD, subject to Section 0 (General terms and conditions) and the following:

- alterations to the existing Passive NTD can be undertaken if the Passive NTD is fit for purpose i.e. not showing signs of damage, or the seals are damaged or missing
- in cases where the existing Passive NTD requires replacement, then the existing NTD is to be disconnected and a new like for like NTD is to be installed
- the Passive NTD shall not be replaced if the lead-in cabling has more than a total of 5 pairs (e.g. more than one [1] x 5 pair cable or two [2] x 2 pair cables), which should be referred to the RSP/**nbn**
- any new Passive NTD to be installed shall be a Passive NTD described in Sections 13-15
- the NTD shall be installed in accordance with this document and *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*
- an existing DSL line module shall not be replaced with a non-DSL line module; a DSL line module is to be replaced with the **nbn** VDSL2 centralised filter



- if an existing Passive NTD containing OVP or Customer Lightning Protection (CLP) is to be replaced, then the replacement equivalent Passive NTD shall be used (**nbn** part number 10023544) and fitted with **nbn** centralised filter modules and OVP (**nbn** part number 10024460)



Earth connection should always be equipotential bonded to the electrical system where possible to take advantage of the inbuilt lightning protection.

Earth connection shall be made in accordance with Section 20.7 of *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*.

This may need to be undertaken by a licenced electrician depending on the existing earth arrangement at the premises.

nbn Passive NTD

nbn authorises a Registered Cabler to install a Passive NTD where the existing connection device is damaged or otherwise not suitable, or the network boundary location is being changed, subject to Section 0 (General terms and conditions) and the following:

- the existing Passive NTD shall only be replaced with a Passive NTD device that is marked with “NTD”
- the Passive NTD installation is a like for like installation, inclusive of OVP and earthing arrangements (the earthing conductor used for equipotential bonding shall have a minimum cross-sectional area of 6 mm², green/yellow insulation and shall not exceed 10 m from the main earth bar/terminal)
- the **nbn** connection box shall only be used when replacing a connection device (i.e. a ‘Luca box’ or wall box) and not a Passive NTD
- the Passive NTD shall only be installed if the **nbn** lead-in cabling has no more than a total of five (5) pairs (e.g. no more than one [1] x 5 pair cable or two [2] x 2 pair cables)
- the Passive NTD shall only be used to connect a single household (inclusive of a ‘home office’ or ‘granny flat’) or a single office/business
- the Passive NTD shall not be used to connect a cable from another carrier’s network other than a cable connected between the customer side of that carrier’s NTD, first TO, wireless terminal, satellite terminal or a customer MDF and the customer side of the **nbn** NTD
- the Passive NTD shall be located on the external wall of the same building in which the telecommunications service(s) will be used by the end user and shall not be installed at any point away from the building (e.g. at a fence, pole or any other detached structure)
- the new Passive NTD to be used shall be those described in Section 10 Approved Fibre equipment
- the Passive NTD shall be installed on the external wall of the end user’s building as close as practicable to the electrical switchboard for earthing requirements:
 - for a new building under construction, the preferred location is below the electricity enclosure to ensure the Passive NTD will be clear of any downpipes or adjoining fences
- the Passive NTD shall be installed no less than 500 mm and no more than 1300 mm from finished ground level (measured to the bottom of the Passive NTD):



- for a new building under construction, the preferred height is 600 mm above finished ground level (measured to the bottom of the Passive NTD) to ensure that adequate clearance is maintained from an electricity enclosure located above the Passive NTD
- separation from gas shall be at least one (1) m to the left and right of the meter and 500 mm above the regulator or any other fitting
- the Passive NTD shall be installed on a vertical surface with the cable entry ports at the bottom
- the Passive NTD shall not be mounted sideways, obliquely or upside down
- any cables exposed on the surface of the building shall be protected by conduit
- the **nbn** lead-in cable shall enter the cable entry port at the bottom left of the Passive NTD and customer cables shall enter the cable entry port at the bottom right of the NTD (cables shall not enter the rear, side or top of the Passive NTD)
- the grommets/glands shall not be removed
- the end user shall be informed of the existence of the NTD as their new NBP
- adequate clearance shall be provided around and in front of the Passive NTD, in accordance with Appendix D of *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*, to provide safe and convenient access by **nbn**, service providers, Registered Cablers and end users

Disconnection of nbn copper lead-in cabling

nbn authorises a Registered Cabler to disconnect underground or aerial **nbn** lead-in cabling at the external surface of a building for the purpose of renovation, demolition or relocation of the building, subject to Section 0 (General terms and conditions) and the following:

- the lead-in cable shall only be disconnected if the total capacity of the lead-in cabling does not exceed 10 pairs and does not terminate on a customer MDF
- if a span of aerial lead-in cable is detached from the building for the purpose of renovation, demolition or relocation of the building, and the cable is not required to be cut, the cable and conduit shall be unfastened and suitably supported so as to protect from damage and shall be reattached to the building to comply with *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*
- if the underground or aerial lead-in cabling is disconnected for renovation, demolition or relocation of the building and is required to be cut, then it is to be cut at or as close as reasonably practicable to the external termination device, or if none are available, to the building entry point
- the cut cable is to have conductors individually insulated and sealed
- unsupported lead-in cable exceeding a length of 500 mm shall be tied in a loop and marked '**nbn** lead in cable'
- the lead-in cabling shall be reconnected utilizing a Passive NTD or TO

Use of existing telecom lead-in poles for customer cabling

nbn authorises a Registered Cabler to use existing lead-in poles to support aerial customer cabling subject to Section 0 (General terms and conditions) and the following:



- only poles that are located within the boundaries of the Premises shall be used
- the poles shall only be used if sufficient pole height is available to install the customer cabling in accordance with the requirements of *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*, while maintaining the required separation from the **nbn** aerial cable and fittings
- the customer cabling shall be installed and maintained at the end user's cost, including transfer of the cabling to any pole subsequently condemned and replaced by **nbn**
- only poles erected at the end user's cost may be used
- only existing telecommunications poles, located within the property boundary of the Premises, may be used (existing telecom poles located outside the Premises boundary shall not be used for customer cabling)
- the poles shall be of sufficient height and the **nbn** lead-in cable shall be installed on the poles at sufficient height to allow installation of the customer cabling in accordance with the following:
 - the customer cabling shall be installed below the aerial **nbn** lead-in cabling
 - the customer cabling and associated pole fittings shall be separated from the **nbn** lead-in cable and associated pole fittings by at least 300 mm at the pole
 - the customer cabling shall be separated in-span from the **nbn** lead-in cable by at least 300 mm
 - the customer cabling shall be installed in accordance with the relevant requirements of the wiring rules (*AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*) including minimum ground clearances
 - the customer cable shall not be installed within any **nbn** or existing telecom underground pit or conduit, or within any **nbn** or existing telecom conduit installed on the pole



For safety reasons **nbn** will not use end user-owned poles to support **nbn** cabling but will allow **nbn** owned poles erected at the end user's cost to be used to support the end user's aerial LV power mains or customer cabling.

nbn should be advised of this requirement in advance of commencement of pole installation, so **nbn** can ensure that the poles used are of sufficient height to support additional cables.



Physical MDF Tag

nbn may, in its discretion, connect a tag to an **nbn** copper pair to identify that pair to a cabling provider. This will generally only apply to services connected to a Main Distribution Frame (MDF) but may occasionally be used to identify a pair at a connection box or other part of the **nbn**TM network.

An example of the nbn Physical MDF Tag has been provided below in Figures 13 and 14.

Following the connection of a service where a physical tag has been provided, Registered Cablers should remove the physical tag to ensure that it does not interfere with the correct operation of the service in question.

A rectangular form with a blue border. On the left side, there is a small circle. To the right of the circle, there are eight labels with corresponding horizontal lines for input: 'Cable:', 'Pair:', 'Vertical:', 'Order ID:', 'Copper Pair ID:', 'Date:', 'Time:', and 'Cust Ref:'. On the right side of the form, there is the nbn logo.

Figure 13 Physical tag (front)

A rectangular form with a blue border. At the top left, it says 'P/N: 10029145'. On the left side, there is a small circle. To the right of the circle, there is a paragraph of text: 'This tag authorises the Access Seeker (or their authorised agent / cabling provider) to connect a jumper wire to the tagged carrier pair, for the purpose of connecting a service for the customer identified by the tag. Verification of the customer may require a cabling provider or agent to seek validation of information on the tag with the Access Seeker acquiring the service from **nbn**.' Below this paragraph, it says 'The cabling provider should remove this tag after connecting the service.' On the right side of the form, there is the nbn logo.

Figure 14 Physical tag (front)

Activities specific to **nbn**TM Fibre to the Curb (FTTC)

This section details the additional scope of the works that are authorised by **nbn** in relation to the **nbn**TM copper network, specifically where an **nbn**TM Fibre to the Curb (FTTC) service is provided.

Any Network Connection Device (NCD) and related **nbn** equipment shall only be replaced by **nbn** approved products.

Subject to the terms and conditions set out herein, and the requirements throughout Section 5 of this document, **nbn** authorises a Registered Cabler to:

- Replace, relocate or otherwise alter within a premise for renovation, demolition or relocation of the building/premises subject to the boundaries identified in **Figure 15** below, and with reference to Section 3 for details on the Network Boundary Point (NBP)
- Perform the setup of Customer Premises Equipment (CPE) – refer to '**nbn set up guide - Fibre to the Curb (FTTC)**' (available on nbn.com.au/FTTC)
- Where they are working for an RSP, conduct only the NCD self-install activities defined under the WBA. This document sets out rules on how to install NCDs under the WBA NCD self-install provisions. It does not expand or extend your rights to conduct NCD installs, remove or qualify any rules or limits in the WBA, or otherwise vary any WBA obligations or limitations.

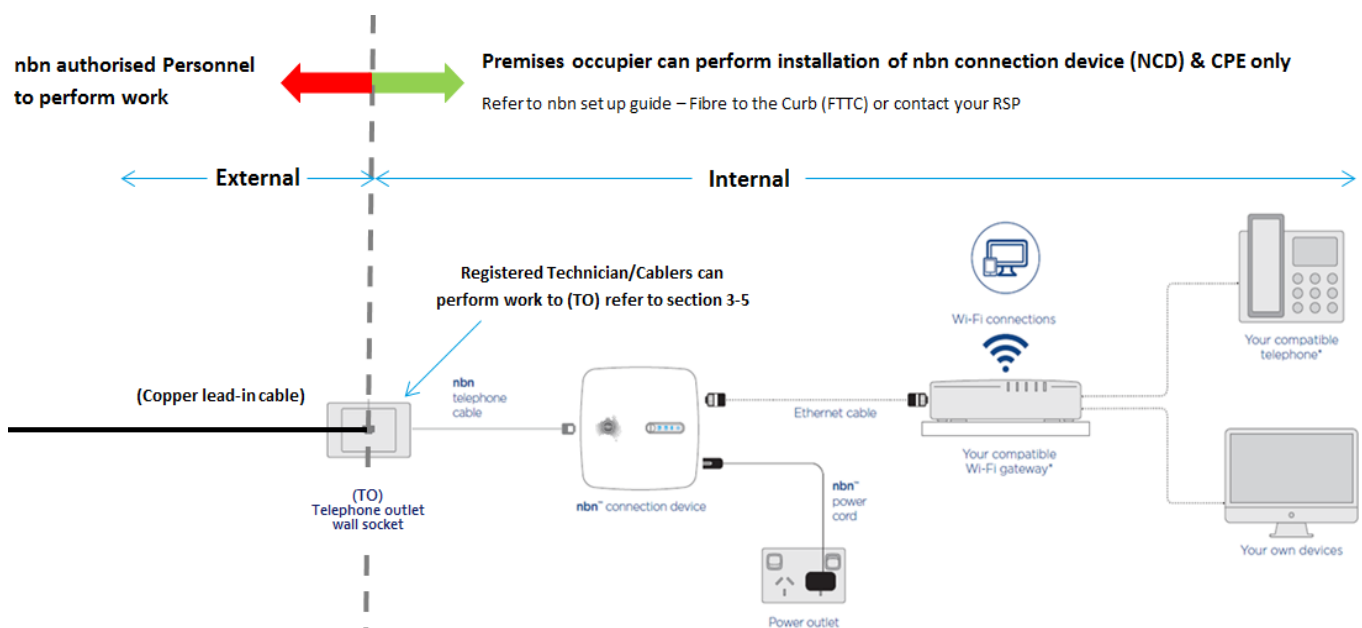


Figure 15 FTTC Network and NBP

Testing and minimum specifications

All tools must be regularly maintained, and test equipment must be calibrated in accordance with the manufacturer's recommendations.

All hand-held power equipment must be electrically tested and tagged in accordance with all applicable legislation and local requirements.

Test Instrument

nbn compatible modems can be utilised for service testing or a test instrument that contains a VDSL2 compatible modem, with the ability to support the following:



1. Vectoring
2. Sync
3. Actual line speed
4. Noise margin
5. Attenuation
6. Attenuation vs Frequency (HLog) – optional (but recommended for visual line impairment indication)

Note: The VDSL2 deployment class profile is ITU-T G.993.2 17a (B8-11 17.664MHz)

A copper test instrument that can perform a minimum of the following:

1. Volt/Ohm
2. Capacitive Balance
3. RFL (Resistive Fault Locator)
4. TDR (Time-Domain Reflectometry)

Service Test (Check)

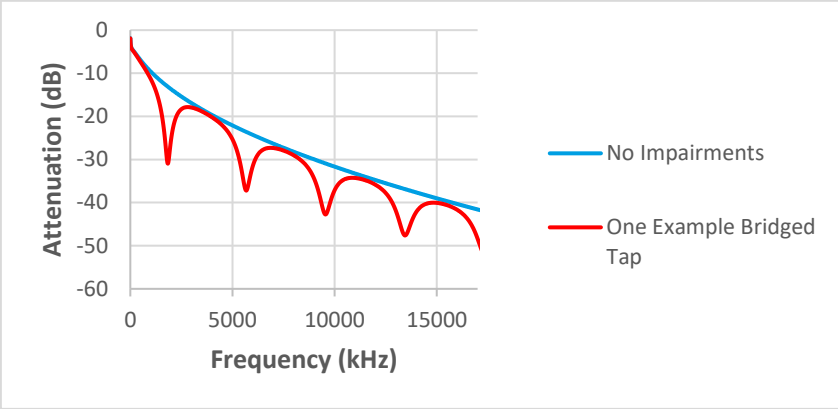
1. Utilising a suitable copper test instrument verify the following (typical values shown in table below):
 - a. No Foreign Voltage
 - b. No Resistive faults
 - c. Balance is within specification
 - d. No Bridged Taps
2. VDSL Synchronisation, Utilising end user modem or one contained within a test instrument:
 - a. Actual Line speed is greater than or equal to the line speed prior to works being performed and not below 25Mb/s Downstream and 5Mb/s Upstream
 - b. Check with the end user that all services are operational (i.e. phone / internet)

If there is a fault indication (No Sync / service / copper test fail) check connections and if fault cannot be cleared, log a fault with the Retail Service Provider whom may choose to engage **nbn**.

Parameter	Value
Foreign Voltage (V)	AC Voltage Fault if: >5V@A-G; or B-G or Hazardous if: >50V@A-G; or B-G Under normal conditions, when the phone is on-hook, there should be no AC voltage on the line. DC Voltage Fault if:



	>5V; or <-5V@A-G; or B-G or Hazardous if: >135V; or <-135V@A-G; or B-G				
Insulation Resistance	Resistive Fault if: <1.8Mohms @A-G or B-G or A-B				
Capacitive Balance	Balance Fault if: Ratio <0.85@[A-G/B-G]				
Attenuation to Support VDSL2	Freq (kHz)		301.875	1000.5	3751.875
	Atten CPFUT 0.4mm (dB/km)		11.05	18.78	37.59686
	Scenario	Max Length (km)	dB Atten @ 300kHz	dB Atten @ 1000kHz	dB Atten @ 3750kHz
	25/5M on Vectored VDSL2	1.14	12.6	21.4	42.9
	25/5M on Vectored VDSL2 (exc. House)	1.1	12.2	20.7	41.4
	50/10M on Vectored VDSL2	0.75	8.3	14.1	28.2
	25/5M on Non-vectored VDSL2	0.65	7.2	12.2	24.4
	43dB @ 3.75MHz is a length of 1.14km				
Longitudinal Balance	< -70dB Good 60 to -70dB Fair > -60dB Bad				
Loop Resistance	worst case figure of > 360 Ohms for 0.4mm to trigger an investigation for a 2.2Km loop (1.1Km each way) Sampled calculations @0.4mm diameter (different copper as below) for 2.2Km are: Pure Copper = 294 ohms Plain annealed Copper = 330 ohms				

<p>No Bridge Taps</p>	<p>The appearance of a straight line (Attenuation vs Frequency) within a HLog graph, indicates good line performance.</p> <p>Dips in a HLog graph indicate attenuation impacted by the presence of bridged taps.</p>  <p>Figure 16 HLOG example with normal line and a bridged tap</p>
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6 Activities not authorised Copper Network

This document does not authorise a Registered Cabler to do any of the following:

- use or alter any part of the underground or aerial **nbn** lead-in cabling between the property entry point and the building, other than disconnect cabling not exceeding a total capacity of 10 pairs for the purpose of renovation, demolition or relocation of the building
- connect or reconnect any underground or aerial lead-in cabling that has been cut at the external surface of the building for renovation, demolition or relocation of the building, unless the lead-in cabling has been cut during building renovation for the eventual purpose of installing a Passive NTD
- disconnect the **nbn** lead-in cable and leave it permanently disconnected in any end user-accessible location, other than where necessary for renovation, demolition or relocation of the building, this includes all safety precautions necessary when cable disconnected
- totally remove **nbn** facilities from the building other than for renovation, demolition or relocation of the building
- alter or disconnect any **nbn** lead-in cabling exceeding a capacity of 10 pairs
- alter or disconnect any payphone installation
- alter or disconnect any **nbn** lead-in cabling in a power generating station or a high voltage distribution substation
- alter or disconnect any **nbn** lead-in cabling in a hazardous area (explosive atmosphere) as defined in *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*
- star-wire an additional TO from an existing connection block/box or joint in **nbn** lead-in cabling (other than a Passive NTD), or install a new termination block/box or joint (other than a Passive NTD) in the lead-in cabling for star-wiring TOs
- disconnect or remove any Passive NTD to change the network boundary from the Passive NTD to the first TO ('first socket') or any other connection point
- disconnect or remove any centralised filter (also referred to as a central splitter or remote splitter) connected to **nbn**'s lead-in cabling or provided within an existing Passive NTD if:
 - its disconnection or removal is essential to the proper functioning of a proprietary high-speed data service or
 - the lead-in is terminated on a single TO (without a star or bus wired additional TO) for dedicated connection to a VDSL2 CPE
- disconnect **nbn** lead-in cabling for migrating services from the **nbn** copper network to a different **nbn** network technology, such as the fibre network, HFC network, fixed wireless network or satellite network.
- bypass an existing Passive NTD containing OVP with a Passive NTD not containing OVP
- remove earth connections from an existing NTD, unless moving the earth to the new Passive NTD that contains OVP



- use screw terminals of any description for connection or jointing of **nbn** lead-in conductors
- Alteration of **nbn** lead-in cabling or authorised work boundary where any the following devices or equipment is connected at the first point (whether hard-wired or plug-connected):
 - any type of line multiplexing, line conditioning or line conversion equipment (e.g. a small pair-gain system)
 - a payphone
 - a functioning Integrated Services Digital Network Type 1 (ISDN NT1) or Analogue Network Termination Type 1 (ANT1)

7 Approved lead-In equipment (Copper)

nbn NTDs and connection box

Connection box 1-2 lines



Figure 17 nbn compact box 10023542

nbn part number 10023542

- 1-2 lines
- Scotchlok termination (Only approved Scotchlok with corresponding Scotchlok tool to be used (no improvised tools such as pliers to be used to for crimping scotch locks)
- IP53
- not marked as **nbn** compact NTD
- NTD enclosure 1-2 lines
- suits up to two (2) x VDSL2 centralised filters
- Scotchlok termination (Only approved Scotchlok with corresponding Scotchlok tool to be used (no improvised tools such as pliers to be used to for crimping scotch locks)
- IP53
- marked with NTD



Figure 18 nbn compact NTD 10023656



Figure 19 nbn compact NTD with unterminated cables (only white conduit and saddles to be used)



Figure 20 nbn NTD with VDSL2 centralised filter installed (only white conduit and saddles to be used)

nbn NTD



Figure 21 nbn NTD 10023544

nbn part number 10023544

- 1-6 lines
- IP54
- six (6) X VDSL2 centralised filters
- earth termination location
- external installation only
- marked with NTD

nbn TO



Figure 22 nbn faceplate

nbn part number 10023548

- faceplate dual outlet
- in built VDSL2 centralised filter - voice and data pre-terminated to RJ4+ sockets
- line in - Scotchlok termination
- flush or surface mounted
- internal installation - only

Centralised filters

nbn VDSL2 centralised filter with OVP/CLP



Figure 23 nbn VDNBN centralised filter

nbn part number 10024460

- built in OVP
- VDSL2 centralised filter
- earth connection
- tool less termination
- only compatible for installation in **NTD nbn part number 10023544**

VDSL2 centralised filter

nbn part number 10023888

- VDSL2 centralised filter
- Scotchlok termination
- face plate installation **nbn part number 10023548** or **nbn compact NTD part number 10023656**

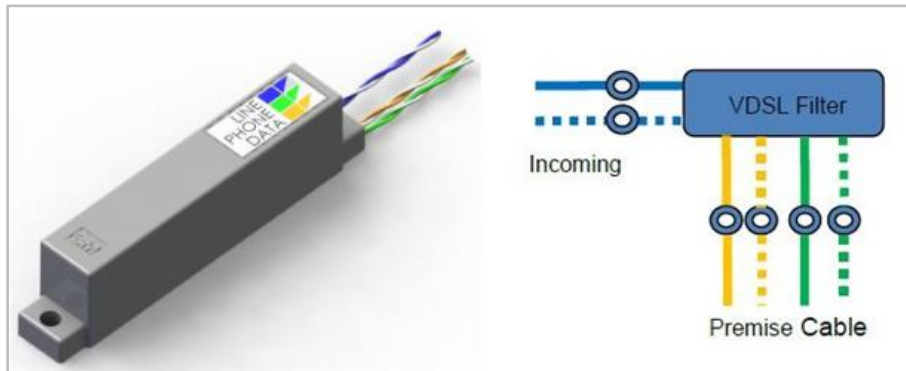


Figure 24 nbn VDSL2 centralised filter

Cable connectors



Figure 25 Connectors and crimping tool

The connectors approved for use are the Scotchlok 2 port-UY:

nbn part number 10023536

- to suit 0.40 mm to 0.90 mm diameter solid copper conductors
- moisture resistant gel filled

The connectors shall be used in accordance with the manufacturer's instructions and shall be crimped using the tool recommended by the manufacturer of **nbn** connectors.



8 Authorised activities Fibre Network

This Section 8 details the scope of the works that are authorised by **nbn** in relation to the nbn fibre network for renovation, demolition or relocation of the building. If it is not specified it is not authorised.

If you are working for an RSP, you and the RSP may only conduct the FTTP NTD relocation activities under the WBA. This document sets out rules on how to install NTDs under the WBA FTTP NTD provisions. It does not expand or extend your rights to conduct NTD installs, remove or qualify any rules or limits in the WBA, or otherwise vary any WBA obligations or limitations.

Any Fibre NTD and related **nbn** equipment such as new longer patch leads; fibre cordage or equipment shall only be replaced by **nbn** approved products.

Scope of authorised work – nbn Fibre Network

Subject to the terms and conditions set out herein, **nbn** authorises a Registered Cabler to:

- replace, relocate or otherwise alter the **nbn** fibre within premises for renovation, demolition or relocation of the building subject to the boundaries identified in Figure 26 and Figure 27
- relocate **nbn**'s existing Fibre NTD to another location within the same Premises
- disconnect the **nbn** fibre patch cord/PIC from the Fibre NTD and at the PCD and/or FWO (if FWO installed)
- disconnect power to the Fibre NTD
- replace the SCA/PC through connector within the PCD, ICD or FWO
- replace the **nbn** fibre patch cord/PIC from the PCD to the FWO (if it has been installed) or to the Fibre NTD
- replace the **nbn** fibre patch cord/PIC between the PCD/ICD and the FWO (if it has been installed) and to the Fibre NTD.
- replace, relocate or otherwise alter the indoor fibre lead-in cabling from the PCD to the Fibre NTD for any purpose, including but not limited to building alterations, or to improve the performance of a service
- replace the existing Fibre NTD under instruction from **nbn**
- install a new Fibre NTD under instruction from **nbn**
- disconnect the battery backup, PS/S or PS/B Power supply from the Fibre NTD and AC Supply and reconnect
- replace and/or remove batteries from the battery back-up (Note: any batteries removed **must** be disposed of through an approved battery recycler)
- access PCD to disconnect the PIC from the **nbn** fibre lead-in cable
- re-terminate the premises cable at the PCD or FWO with approved Field Installable Connector (FIC)
- replace or relocate the FWO if fed from a PCD/ICD

The above activities may be performed independently or concurrently.

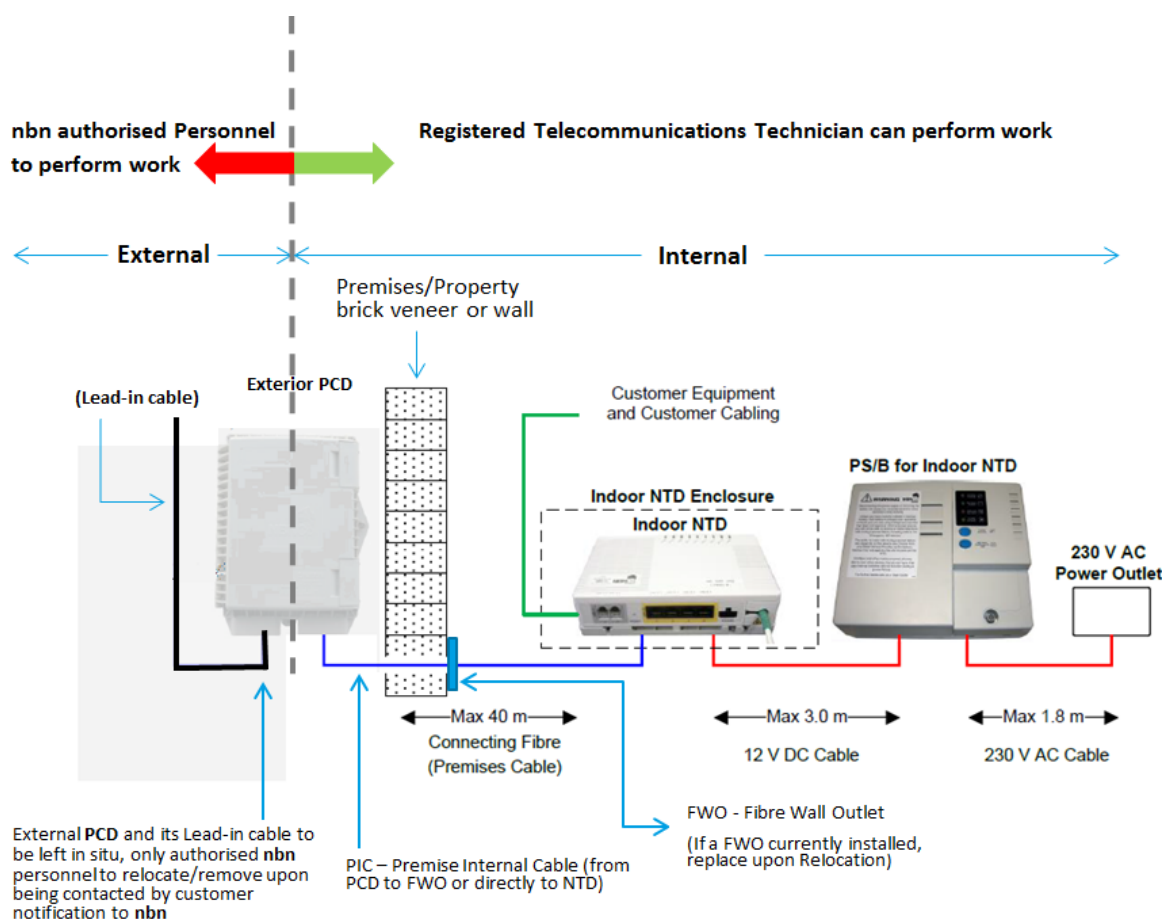


Figure 26 nbn Internal NTD with PS/B Power Unit

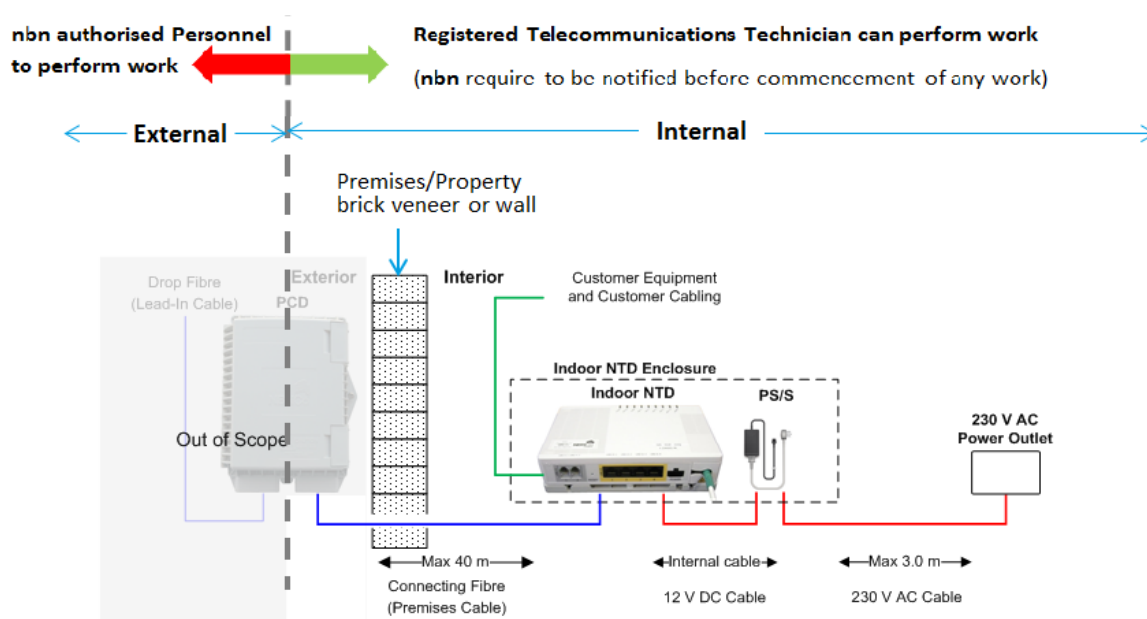


Figure 27 Indoor Fibre NTD and PS/S Power Unit arrangement

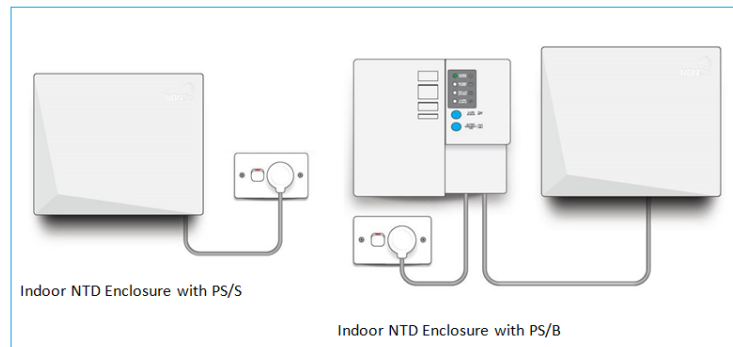


Figure 28 Installation of two combinations of Fibre NTD and Power Supply

nbn Indoor Fibre NTD

nbn authorises Registered Cablers to relocate the Indoor NTD subject to the general terms and conditions of Section 4.1 (General terms and conditions) and the following:

- the indoor fibre NTD shall only be relocated to a different location/ room within the same premises
- replacement of the existing PIC cable from either the Fibre Wall Outlet plate (FWO) or the PCD, with a new PIC Cable with the required length the PIC Cable shall from the approved products detailed in Sections 13 to 16 of this document
- maximum Length of the new premises cable shall not exceed 40 m from the PCD

Subject to the above conditions, nbn authorises Registered Cablers to perform the following activities on an Indoor NTD:

- temporarily disconnect the NTD From the Power supply GPO or PS/B for the relocation

The authorised work boundary is the customer side of the PCD and the premises cable (PIC) that terminates within the PCD

No works shall be undertaken on the Fibre service drop cable (lead-in cable) that enters the PCD from the street or **nbn** local fibre network (LFN)

nbn Outdoor Fibre NTD

The Outdoor NTD is an option that **nbn** deploys in some scenarios. This may include scenarios such as base-building type areas and/or in support of lift and fire phone services.

nbn authorises Registered Cablers to access the Outdoor NTD subject to the general terms and conditions of Section 4.1 (General terms and conditions) and the following:

- the Outdoor NTD can only be worked on with prior approval from the End user or **nbn**

Subject to the above conditions, nbn authorises Registered Cablers to perform the following activities on an Outdoor NTD:

- connect customer/RSP cabling or equipment to the UNI-D and/or UNI-V ports.
- temporarily disconnect the Outdoor NTD From the Power supply GPO or PS/B for the purpose of the relocation of Relocation of the PS/B
- if a PCD Is installed and the Outdoor NTD is connected via a PIC from the PCD i.e. the Outdoor NTD is not directly connected via a **nbn** lead-in cable, then the Outdoor NTD can be relocated

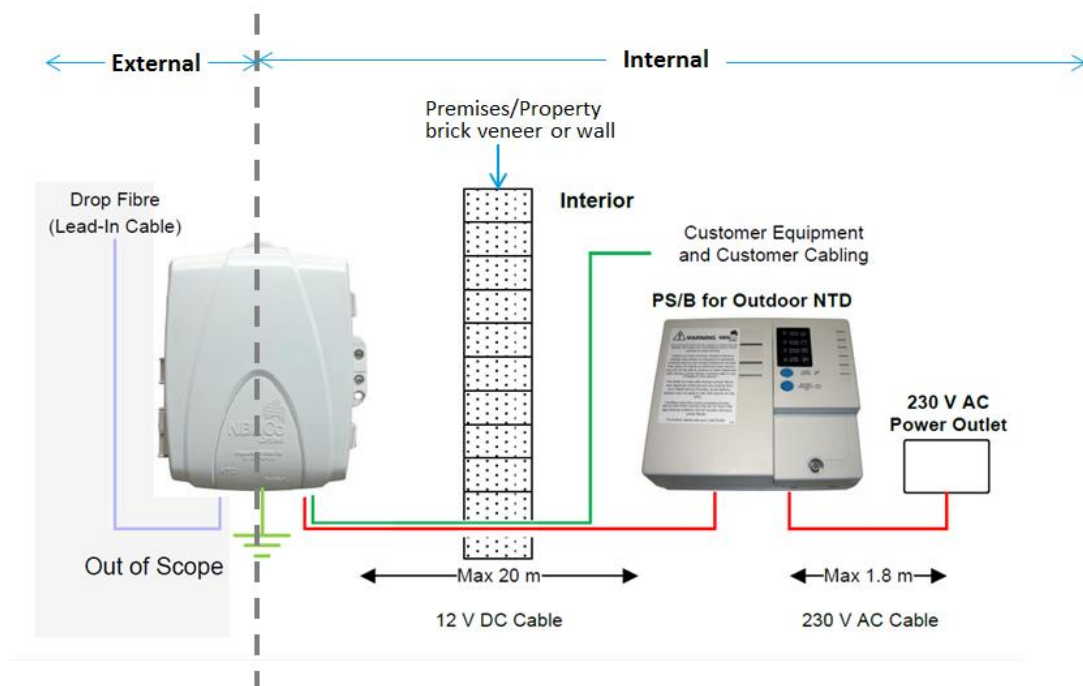


Figure 29 Outdoor Fibre NTD installed internally, without PCD arrangement

Premises internal cable (PIC)

nbn authorises a Registered Cabler to disconnect the PIC connected to the PCD, ICD, FWO or Fibre NTD subject to 0(General terms and conditions) and the following:

- PIC can be disconnected from the ICD, PCD or FWO
- PIC can be replaced with a different length PIC cable up to 40 m in length

- PIC cable must be **nbn** approved
- When the PIC is installed direct to the PCD, the PIC can be disconnected from the lead in cable at the PCD by removing the PIC's SC/APC connector at the Through Connector
- PIC cable can be re-terminated with a Field Installable Connector (FIC) at the PCD or FWO
- If an armoured PIC is used, any replacement of the PIC must be with an armoured cable or equal or higher rating

MDU NTDs and Premises Cabling

nbn authorises a Registered Cabler to perform works within MDU's only at the premises of the end user and subject to 0(General terms and conditions) and all the following:

- Internal NTD can be relocated
- PIC can be disconnected from the ICD, PCD or FWO
- PIC supplied from a FDT cannot be disconnected from the FDT, the PIC can be relocated, redirected and re-terminated within the premises if the existing length is sufficient to do so
- Relocate the FWO to another location with the same premises

nbn authorises work between the Fibre NTD and ICD or FWO Only as detailed in Figure 30 below.

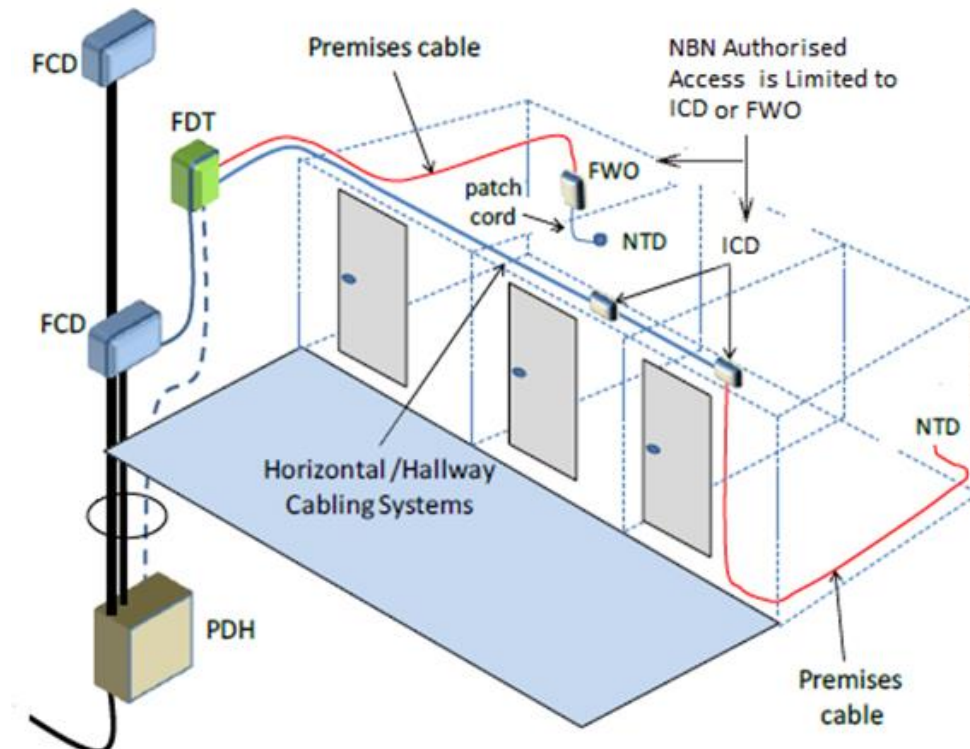


Figure 30 MDU to FWO & ICD arrangement



Testing and minimum specifications

Equipment Required

All tools must be regularly maintained, and test equipment must be calibrated in accordance with the manufacturer's recommendations.

All hand-held power equipment must be electrically tested and tagged in accordance with all applicable legislation and local requirements.

PON Power Meter (minimum specifications)

A PON specific power meter will also include the ability to be inserted into a live PON network. It must have the following minimum specifications:

1. Pass through insertion loss <1.5dB
2. Calibrated Wavelengths as follows:
 - a. 1310nm with spectral passband of 1260 to 1360nm
 - b. 1490nm with spectral passband of 1480 to 1500nm
3. Burst mode measurement @ 1310nm for G.984 GPON up to 1.25 Gb/s (upstream) +/- 0.5dB accuracy.
4. Intrinsic uncertainty for all wavelengths +/- 0.5dB (-7dBm CW signal)
5. Isolation > 35dB all wavelengths
6. Measurement range as follows:
 - a. 1310nm +10 to -40dBm
 - b. 1490nm +10 to -40dBm
7. Optical interface SC/APC

Fibre Inspection Probe (video)

A video inspection probe (not a magnifying optical only scope) with SC/APC adapters for both connector ferrule and bulkhead adaptor.

SC/APC connector cleaning kit

These come in many varieties, but the following should be included:

1. Dry fibre cleaning device (sometimes called one click – e.g. Fujikura / US Conec see examples in figure 21)
2. Wet fibre cleaning equipment designed for optics
3. Cleaning sticks designed for SC bulkhead through connectors

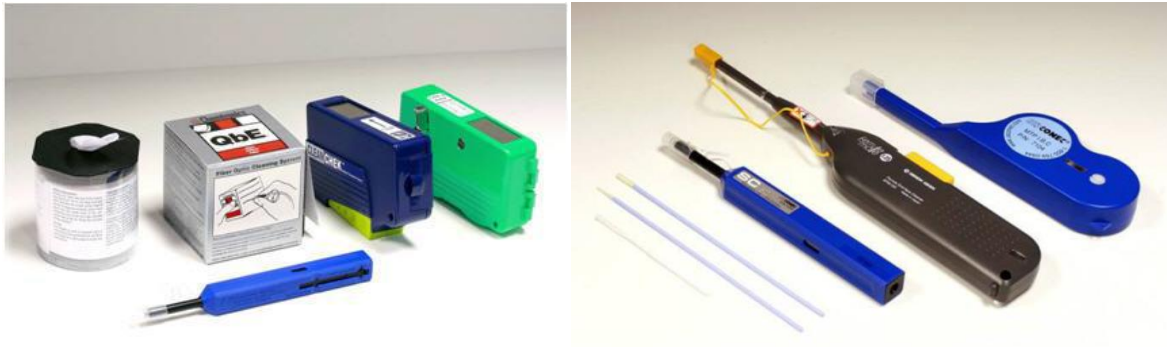


Figure 31 Examples of fibre cleaning wipes and tools for fibre optic connectors

Power Supply Test

After relocation perform the following:

1. PSU Type
 - a. If PS/S go to step 2
 - b. If PS/B go to step 5

PS/S

2. Check that the PS/S is correctly installed, all cables are correctly connected, and there is no physical damage to the PS/S or cable.
3. Check that the PS/S power light is on.
4. Check that the NTD power light is on.

PS/B

5. Check that the PS/B battery is correctly installed (if installed or replaced), all cables are correctly connected, and there is no physical damage to the PS/B, battery, or cable.
6. Verify that the System Status light is green, and no power alarms are active.
7. Test the PS/B Battery Emergency Use function:
 - a. Disconnect AC power from the PS/B.
 - b. Open the battery cover.
 - c. Disconnect the positive (red) battery lead and wait for thirty seconds.
 - d. Reconnect the positive (red) battery lead.
 - e. Press and hold the Battery Emergency Use button. All four lights flash on and a short beep sound.
 - f. Release the Battery Emergency Use button. The top two lights remain on and the battery is connected.
 - g. Reconnect AC power to the PS/B.
 - h. Verify that no power alarms are active.
8. Test the PS/B Alarm Silence function:
 - a. Temporarily silence alarms for 24 hours – press button for 0.5 to 2.5 seconds until the PS/B beeps once, then release. The Alarm Silence light displays flashing amber.
 - b. Reactivate temporarily silenced audible alarms – press the button until you hear two short tones, then release immediately.

- c. Silence alarms indefinitely (more than 24 hours) – press and hold button, after approximately 0.5 seconds you will hear a single tone, wait approximately 15 seconds for a second short tone, then release. The Alarm Silence light displays steady amber.
- d. Reactivate indefinitely silenced audible alarms – press and hold until you hear a single tone, wait another 15 seconds for a second double tone, then release. The Alarm Silence light displays no colour.

NTD Test

To assist when performing tests on the NTD place it in the maintenance position for ease of fibre connector access (refer figure 20)

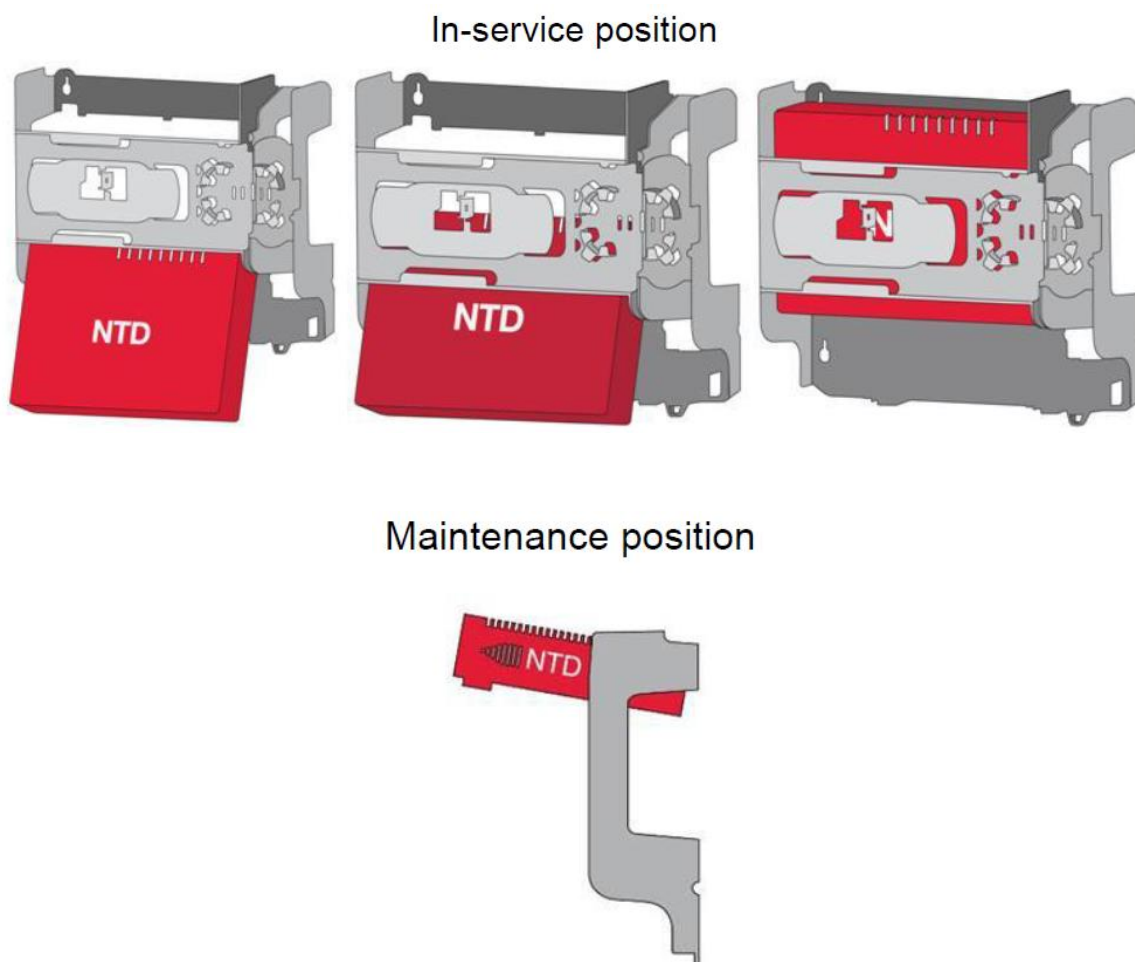


Figure 32 NTD Maintenance position

Inspect and clean Fibre Connections

Dirty connectors are by far the most common cause of fibre network failures. Dirty connectors can permanently damage the fibre mating surface, and cause pitting and damage from dust or debris which results in high signal loss.

It is therefore essential that connectors are checked and cleaned before connection.

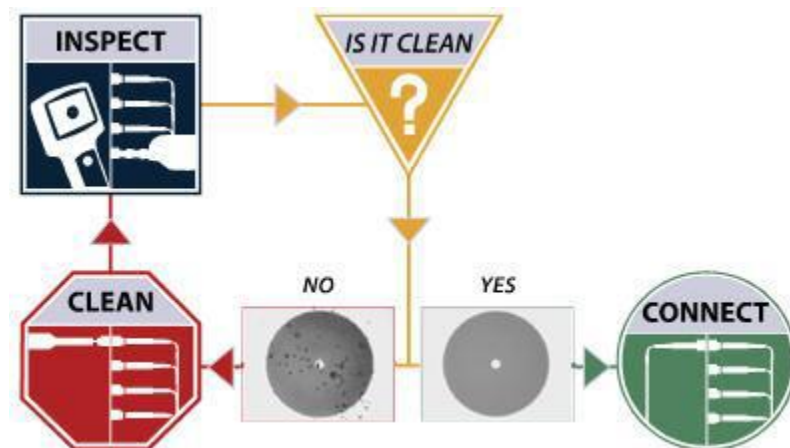


Figure 33 NTD Fibre inspection and connection process flow

1. Inspect all fibre connectors before connection using a fibre video inspection probe
2. Clean dirty connectors using fibre cleaning equipment such as that listed in *Section XX*
3. Replace any Premises Indoor Cable if connectors cannot be cleaned, contact **nbn** for NTD replacement if the NTD bulkhead connector cannot be cleaned.
4. Replace dust caps whenever connectors are not connected to an outlet or port.

Optical Signal Level Check

This particular test procedure assumes that the existing NTD is being re-located and is not to be utilised for new NTD installation.

1. Check that the NTD and the PSU (either PS/B or PS/S) indicator lights are operating correctly, as shown in *Fibre User Guide* and *Power Supply Unit and Battery Backup* guide available on **nbn** website
2. Use a PON power meter to test signal levels at the NTD:
3. Ensure the power meter readings are between these ranges: (it is preferable that the readings be taken prior to moving the NTD)
 - a. 1310 nm (upstream) – between 0 dBm and +5
 - b. 1490 nm (downstream) – between -14 dBm and -26 dBm
 - c. If PON readings were taken prior to NTD move no more than +/- 1dB variation is expected.
4. Record the 1310 and 1490nm power level at the NTD.
5. If all readings are within the ranges specified above remove the PON power meter and connect fibre directly to the NTD.
6. All Activity lights should now be operating as per the user guide (this depends on what else is connected)
7. If there is a fault indication (Optical / Power or Alarm LED) check connections and if fault has not cleared log fault with Retail Service Provider who may raise a ticket with **nbn**



9 Activities not authorised Fibre network

This document does not authorise a Registered Cabler to do any of the following:

- Relocate, remove or replace the PCD/ICD
- Relocate, remove or replace **nbn** lead-in cabling between pit and the PCD
- Disconnect the Lead in cable connection at the PCD/ICD
- Relocate, remove or replace **nbn lead-in cabling** between the pit and CTL or PDH
- Relocate, remove or replace **nbn internal premises cabling** between the building entry point and PCD/ICD or FWO (where ICD/PCD is not installed)
- Works within **nbn** fibre network outside the Property boundary
- Access, remove/relocate or work within a **nbn** Fibre Distribution Terminal (FDT)
- Access, remove/relocate or work within a Fibre Collector Distributor (FCD)
- Access, remove/relocate or work within a Premises Distribution Hub (PDH)
- Relocate a Fibre NTD or any **nbn** equipment to another premises
- Relocation of **nbn** fibre to another premises
- Use of non **nbn** approved fibre products
- Removal of PS/B

10 Approved Fibre equipment

nbn Fibre Wall Outlet (FWO)

The FWO is an indoor device

nbn Item Description: Warren and Brown FWO supplied with splice tray shuttered SC/APC through connect

nbn Item Code: 10002863

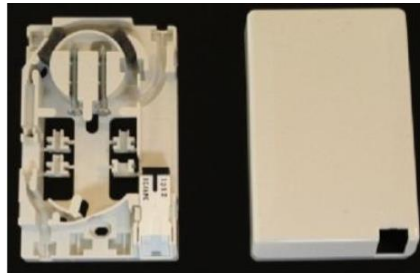


Figure 34 nbn FWO with inbuilt Through Adaptor SCA Simplex SM

nbn Through Adaptor

nbn approved through adaptor SCA Simplex SM Ceramic Sleeve green, No flanges

nbn Item Code: 10018115



Figure 35 SCA Through Adaptor

nbn Premises Installation Cable (PIC)

nbn approved PICs



Figure 36 nbn Patch lead (Premise cable)

Cable Type	Unit	Technology	Application
Premises Cable 4.8mm Indoor Outdoor LSZH G657A2 SC APC both ends 10m	Each	FTTP	Fibre/SDU
Premises Cable 4.8mm Indoor Outdoor LSZH G657A2 SC APC both ends 15m	Each	FTTP	Fibre/SDU
Premises Cable 4.8mm Indoor Outdoor LSZH G657A2 SC APC both ends 20m	Each	FTTP	Fibre/SDU
Premises Cable 4.8mm Indoor Outdoor LSZH G657A2 SC APC both ends 30m	Each	FTTP	Fibre/SDU
Premises Cable 4.8mm Indoor Outdoor LSZH G657A2 SC APC both ends 50m	Each	FTTP	Fibre/SDU
Premises Cable 2.9mm Indoor Outdoor LSZH G657A2 SC APC both ends 10m	Each	FTTP	Fibre/SDU
Premises Cable 2.9mm Indoor Outdoor LSZH G657A2 SC APC both ends 15m	Each	FTTP	Fibre/SDU
Premises Cable 2.9mm Indoor Outdoor LSZH G657A2 SC APC both ends 20m	Each	FTTP	Fibre/SDU
Premises Cable 2.9mm Indoor Outdoor LSZH G657A2 SC APC both ends 30m	Each	FTTP	Fibre/SDU
Premises Cable 2.9mm Indoor Outdoor LSZH G657A2 SC APC both ends 50m	Each	FTTP	Fibre/SDU
Premises Cable Jumper LSZH 2.9mm Indoor Outdoor Allwave Flex G657A2 Green	Each	FTTP	Fibre/SDU
Premises Cable Jumper LSZH 2.9mm Indoor Outdoor Allwave Flex G657A2 Green Simplex SCA W Green Grip Stub 15M	Each	FTTP	Fibre/SDU
Premises Cable Jumper LSZH 2.9mm Indoor Outdoor Allwave Flex G657A2 Green Simplex SCA W Green Grip Stub 20M	Each	FTTP	Fibre/SDU
Premises Cable Jumper LSZH 4.8mm Indoor Outdoor Allwave Flex G657A2 Green	Each	FTTP	Fibre/SDU
Premises Cable 2.9mm Indoor Outdoor LSZH G657A2 SC APC one end 75M	Each	FTTP	Fibre/MDU
Premises Cable 2.9mm Indoor Outdoor LSZH G657A2 SC APC one end 100M	Each	FTTP	Fibre/MDU
Premises Cable 2.9mm Indoor Outdoor LSZH G657A2 SC APC one end 150M	Each	FTTP	Fibre/MDU
Premises Cable 2.9mm Indoor Outdoor LSZH G657A2 SC APC one end 200M	Each	FTTP	Fibre/MDU
Premises Cable 4.8mm Indoor Outdoor LSZH G657A2 SC APC one end 75M	Each	FTTP	Fibre/MDU
Premises Cable 4.8mm Indoor Outdoor LSZH G657A2 SC APC one end 100M	Each	FTTP	Fibre/MDU
Premises Cable 4.8mm Indoor Outdoor LSZH G657A2 SC APC one end 150M	Each	FTTP	Fibre/MDU
Premises Cable 4.8mm Indoor Outdoor LSZH G657A2 SC APC one end 200M	Each	FTTP	Fibre/MDU
Premises Cable 2.9 to 3.0mm single fibre SC APC on both ends 75M	Each	FTTP	Fibre/MDU
Premises Cable 4.8mm single fibre SC APC on both ends 75M	Each	FTTP	Fibre/MDU
Premises Cable 3.0mm Indoor Outdoor Cordage Simplex EZ Bend G657A2 LSZH White	Each	FTTP	Fibre/MDU
Premises Cable 4.8mm IO LSZH G657A2 500MT Drum	Per Drum	FTTP	Fibre/MDU
Premises Cable 4.8mm Indoor Outdoor Cordage Simplex EZ Bend G657A2 LSZH White	Per Metre	FTTP	Fibre/MDU

Internal Connection Device (ICD)

nbn approved ICDs

nbn Item Code 10018114



Figure 37 ICD Supplied with SCA Through Connector

nbn Item Codes: 10002783 - For use with 3M one pass cabling



Figure 38 3M One Pass Point-of-Entry (PoE) box used as an ICD

nbn Field Installable Connector (FIC)

ONLY EVER TO BE USED IN THE PCD – DO NOT INSTALL IN THE NTD

nbn Item Description: Fujikura Mechanical Connector Field Installable A/SC connector 250um and 900um boot
nbn Item Code: 10014091

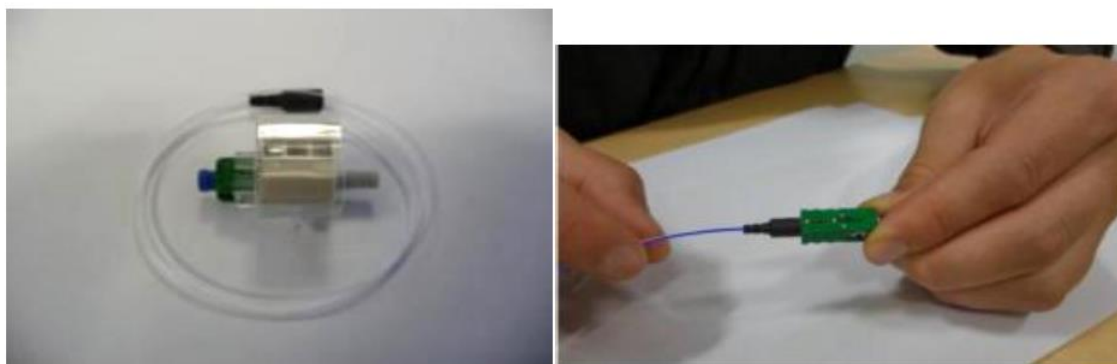


Figure 39 FIC

Fibre NTD and Power Supply

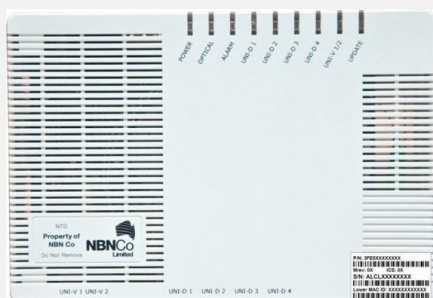
Below is an overview of nbn specified NTDs.

Indoor Fibre NTD (Option)

Part No/Type (Indoor Fibre NTD)

- Model No. I-240G-R and G-240G-P
- Part No. 3FE 55594 AB (I-240G-R) & 3FE 56159 AA (G-240G-P)
- Power Supply DUPS-1227G model for an Indoor NTD

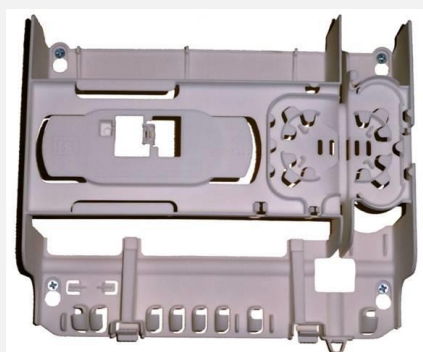
Top View



Front View



Indoor Fibre NTD Enclosure base (to mount to wall)



Outdoor Fibre NTD (Option)

Part No/Type (Outdoor Fibre NTD)

- Model No. O-240G-P
- Part No. 3FE 53516 AG



Indoor Fibre NTD Enclosure Cover

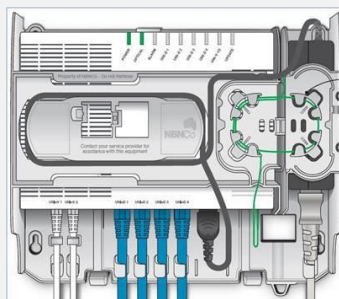
An enclosure provided by nbn for an indoor Fibre NTD and a PS/S. It consists of two parts: a base (on which the indoor Fibre NTD is mounted) and a cover



PS/S



Indoor Fibre NTD Enclosure with Indoor Fibre NTD, PS/S and cables



PS/B

- Power Supply DUPS-1227G model for an Indoor Fibre NTD



PS/B BB

- Energys Np-7 12v 7ah Battery fits into PS/B (shown to left)
- [FTTP Battery Backup Information Online](#)



PS/B 230V AC power cable



Figure 40 Outdoor and Indoor Fibre NTD and Power Supplies



11 Authorised activities HFC Network

Below describe authorised work boundaries of the Premises served by the HFC network. Such activities must be performed by a Registered Cabler subject to the general terms and conditions of Section 0 (General terms and conditions) above.

Scope of authorised work – nbn HFC Network

SDUs

Subject to the terms and conditions set out herein, **nbn** authorises a Registered Cabler to:

- do coaxial installation, modification and removal within premises for renovation, demolition or relocation of the building as per authorised work boundary nominated as illustrated in Figure 40
- install a nbn wall plate at a location that is preferred by the end-user and an RG-6 coaxial tie-cable run from the isolator output port to the wall plate
- install an HFC NTD and a short fly-lead to connect the HFC NTD to the wall plate
- follow the nbn installation standards, e.g., the 50m rule states the distance from a standard tap to the wall plate must be under 50m and ensure the RF signal level measured at the wall plate meets nbn specifications
- replace an existing 2-way splitter inside the PCD enclosure with a nbn approved 3-way splitter (for modified services)
- install and test the premises amplifier in the condition that an existing 3-way splitter should be replaced with a premises amplifier which has 4 coaxial output ports
- recover or remove the HFC network equipment e.g., HFC NTDs; fly-leads; splitters and premises amplifiers
- remove the 2-way splitter and connect the nbn NTD directly to the wall plate (if an existing Foxtel Pay TV is to be removed)
- remove unused ports, e.g. 4th port no longer required in premises amplifier and replace with appropriate splitter (2-way or 3-way)
- check the RF levels at all wall plates are within the specifications of the equipment connected to those wall plates (before conducting any modification)
- reduce the signal to the correct level at the wall plate by using only one attenuator (3, 6 or 10 dB) to achieve the correct reduction of signal level.
- ensure there is no disruption to any remaining services that are sharing the premises coaxial cable network



- ensure all equipment and components to be used in the HFC Network is in accordance to the approved coaxial equipment for the nbn HFC network as described in item 13 Approved Coaxial equipment
- ensure that any additions, changes or removals do not permanently disrupt existing coaxial services or reduce the performance of such services without the end-user's knowledge or approval

MDUs

Subject to the terms and conditions set out herein, **nbn** authorises a Registered Cabler to complete coaxial installation, modification and removal within premises for renovation, demolition or relocation of the building as per authorised work boundary nominated as illustrated in Figure 40 and Figure 41 perform MDU installation from the ICD to the wall plate inside the Premises (see table 1 for the maximum home run cable lengths)

to do cable installation between ICD and wall plate (if ICD is present and EU specifically requests the wall plate be re-located within the premises) following the 50m rule distance from the standard tap to wall plate and RF levels in the wall plate are within nbn specifications

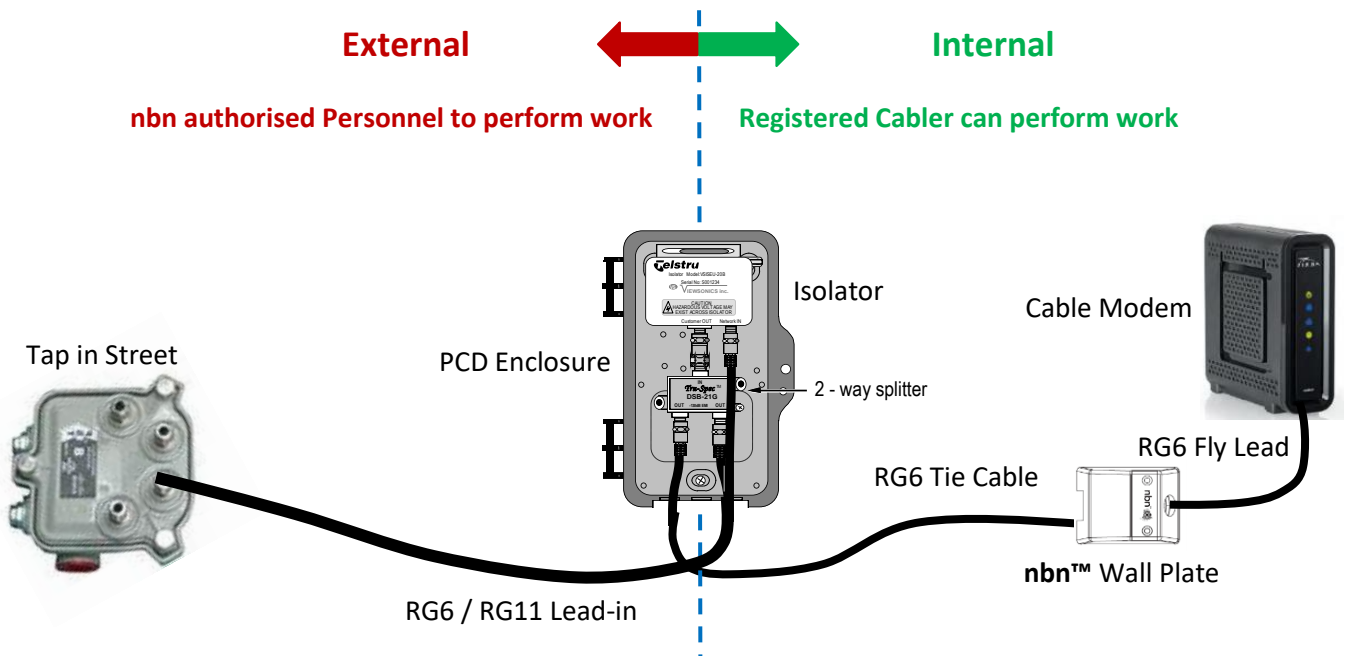
- disconnect multiple equipment installed, e.g., Telstra cable modems; Foxtel set-up boxes; HFC NTDs from the splitter near the wall plate without affecting the other services
- add a wall-plate, and or splitter or change a 2-way splitter to 3-way splitter or vice versa to improve the service performance
- check the RF levels at all wall plates are within the specifications of the equipment connected to those wall plates (before conducting any modification)
- reduce the signal to the correct level at the wall plate by using only one attenuator (3, 6 or 10 dB) to achieve the correct reduction of signal level.
- do small cabling changes between the first wall plate and equipment in other rooms within the premises
- to ensure all equipment and components to be used in the HFC Network is in accordance to the approved coaxial equipment for the Telstra-based and Optus-based components of the HFC network as described in section 13 Approved Coaxial equipment
- to ensure that any additions, changes or removals do not permanently disrupt existing coaxial services or reduce the performance of such services without the end-user's knowledge or approval

Tap Type	Typical Application	RG6	RG11
MDU	Multiple Storey MDUs	25m	35m
Standard	Cluster Complexes	50m	75m

Authorised Work Boundaries

The high-level diagram below (see

Figure 41) shows the authorised work boundary in a SDU served by the HFC network. A Registered Cabler fulfilling the criteria specified in this document is authorised to perform any such work during renovation, demolition or



relocation of the building.

Figure 41 nbn Coaxial Authorised Work Boundary - SDU

Coaxial Installation/Modification/Removal Options

SDUs

Overview

The HFC network includes passive and active branching, both at the Tap and the PCD or in some cases, the wall-plate. Setting out every design, installation, modification and removal permutation is beyond the scope of this document. To maintain traceability to a common set of standards and references as listed in Section 0 (Referenced documents), only an overview will be provided here with reference to the more detailed documents.

The following reference document is most relevant to this section for Telstra based coaxial networks.

Typical Coaxial Installations and Modifications

When an end-user requires an **nbn**-delivered service to be connected, a **nbn** wall plate (which will have a **nbn** logo printed on it), may be installed at a location that is preferred by the end-user and an RG-6 coaxial tie-cable run from the Isolator output port to the wall plate. A new HFC NTD package will include a **nbn** CM8200 DOCSIS3.1 HFC NTD and a short fly-lead to connect the HFC NTD to the wall plate. The HFC NTD package will also include a 2-way splitter which is not required in this scenario.



As part of the coaxial tie-cable, wall-plate and HFC NTD installation, the Registered Cabler must follow **nbn** installation practices and ensure that the RF signal level measured at the wall plate meet **nbn** requirements. In some cases, if the cable distance between the PCD and the wall plate is too long (e.g., a battle-axe block), the RF signal level may not meet **nbn** specifications. In such cases, a competent and trained Registered Technical is required to install an optional **nbn** approved premises amplifier (fitted to a large PCD enclosure) and associated plug-pack power supply that must be plugged into a suitable GPO that is not likely to be disturbed. If the GPO is not close to the PCD and amplifier, then a power inserter must be installed in-line with the coaxial cable and close to the GPO where the power plug-pack is located.

If an end-user requires multiple retail services over coaxial cable from one or more Carriage Service Providers / RSPs then multiple wall-plates will be required, along with a passive splitter or an active premises amplifier which is installed in the PCD enclosure (on the output side of the Isolator). Alternatively, the end-user may have an existing third-party cable modem, and/or a third-party Pay-TV set-top-box installed before a **nbn** provided service and HFC NTD is required by the end-user. Co-existence with third party services can exist for up to 18 months after an HFC area is declared ready for service. In this scenario, the Registered Cabler will need to replace an existing 2-way splitter inside the PCD enclosure with a **nbn** approved 3-way splitter. This is considered a “modification” to an existing service or services.

Re-location of the 2-way splitter from the PCD to the end-user side of a wall plate is permitted at the commencement of the co-existence period. Note: The existing third-party coaxial service is disrupted for a minute or so while the 2-way splitter is being installed. The existing coaxial cable is reconnected to one port of the splitter and the HFC NTD and fly-lead connected to the other port of the splitter. **Caution:** this simpler method of adding a **nbn** provided RSP service to an existing wall plate should not be used where there is already a 2-way, or 3-way splitter installed in the PCD enclosure. Concatenating splitters can result in unacceptable signal levels to the connected equipment, thus not only affecting the new HFC network service, but also any other existing coaxial service. In such cases, an existing two-way splitter in the PCD should be replaced with a 3-way splitter or an existing 3-way splitter should be replaced with a premises amplifier which has 4 coaxial output ports. The latter may be required where the end-user already has:

- a cable modem plus two Pay TV set-top-boxes and wall plates; or
- a Pay TV set-top-box, one HFC NTD for connecting to a 1st RSP and wants a 2nd HFC NTD to connect to a 2nd RSP (e.g., to a granny flat).

A premises amplifier must only be installed by a competent Registered Cabler experienced in the installation and testing of such equipment. In many cases, the existing small PCD enclosure will need to be replaced with a large PCD enclosure. This task must be implemented by a **nbn** DP and *cannot* be carried out by a Registered Cabler. This will require temporary removal of the existing Isolator from the lead-in cable while the PCD enclosure is being replaced.

Coaxial Installation Modification and Removals

nbn authorises a Registered Cabler to **recover or remove** the following HFC network equipment, subject to 0(General terms and conditions):

- HFC NTDs
- fly-leads
- splitters
- premises amplifiers and associated voltage adapters.



When any of the HFC network equipment items are removed, the Registered Cabler must ensure there is no disruption to any remaining services that are sharing the premises coaxial cable network.

If an existing Foxtel Pay TV service is to be removed and there is a 2-way splitter installed the Cabler is authorised to remove the 2-way splitter and connect the **nbn** NTD directly to the wall plate. There will be loss of **nbn** ethernet service for a minute or so because of this equipment removal. Removing the splitter will increase the HFC NTD signal level by typically 4dB, which more often than not, is a good thing. **Caution:** This can also have a negative impact on performance if the signal level is already too high. Removing the 2-way splitter could cause the HFC NTD to saturate, thus causing errors or loss of service.

If a premises amplifier that was installed to provide a 4th port is no longer required, it can be removed and replaced with a 2-way or 3-way passive splitter. The benefit of doing this is that the voltage adapter is no longer required to power the premises amplifier. Before this is done, Registered Cablers need to check the RF levels at all wall plates before the amplifier is removed. Taking into account the extra loss introduced by the 2-way or 3-way splitter, the Cabler needs to confirm that the resultant RF signal levels at all wall plates are within the specifications of the equipment connected to those wall plates.

Registered Cabler's Modification & Removal Responsibilities

When installing, relocating or removing HFC network equipment, Registered Cabler acknowledges that:

- It may be necessary to add a splitter, change a 2-way splitter to a 3-way splitter or add a new premises amplifier, or to remove any of these equipment's.
- During renovations, it may be necessary to relocate the PCD enclosure. If this is the case, a **nbn** DP must carry out such works, who may be required to install a new lead-in cable from the Tap. The Registered Cabler is not authorised to relocate or modify the PCD enclosure.
- The procedures undertaken by the Registered Cabler must consider always the existing coaxial services that are already operational at the Premises.
- The end-user must be made aware of any necessary coaxial service disruptions required to:
 - complete a new wall plate connection;
 - relocate a wall plate; or
 - remove equipment (e.g., a premises amplifier that is no longer needed and wanted).An agreed time should be scheduled with the end-user for any such disruptions to occur.
- The Registered Cabler must ensure that any additions, changes or removals do not permanently disrupt existing coaxial services or reduce the performance of such services without the end-user's knowledge or approval.
- The Registered Cabler must not inadvertently or deliberately, permanently disrupt or reduce the quality of an existing coaxial service.

MDUs

Overview

MDUs differ from SDUs in the following ways: **1)** the Tap is installed in a common area inside a Security Wall Box with CX50 hard-line coaxial cable connecting to the street coaxial network via a Directional Coupler; **2)** one Isolator per Premises is installed in the Security Wall Box; **3)** generally there is no intermediate PCD enclosure, except for horizontal MDUs, such as residential estates; **4)** an ICD is installed outside the Premises; **5)** RG6 or

RG11 lateral coaxial cable runs from the Isolator output to the ICD; **6)** Internal cabling runs from the ICD to the wall plate inside the Premises (see table 1 for the maximum home run cable lengths); **7)** there is no premises splitter inside the Security Wall Box, instead a splitter when required is always installed after the wall plate; and **8)** all the above is constructed and tested by the **nbn** DP, leaving ~~so~~ items 6 and 7 for the Registered Cabler to perform installation

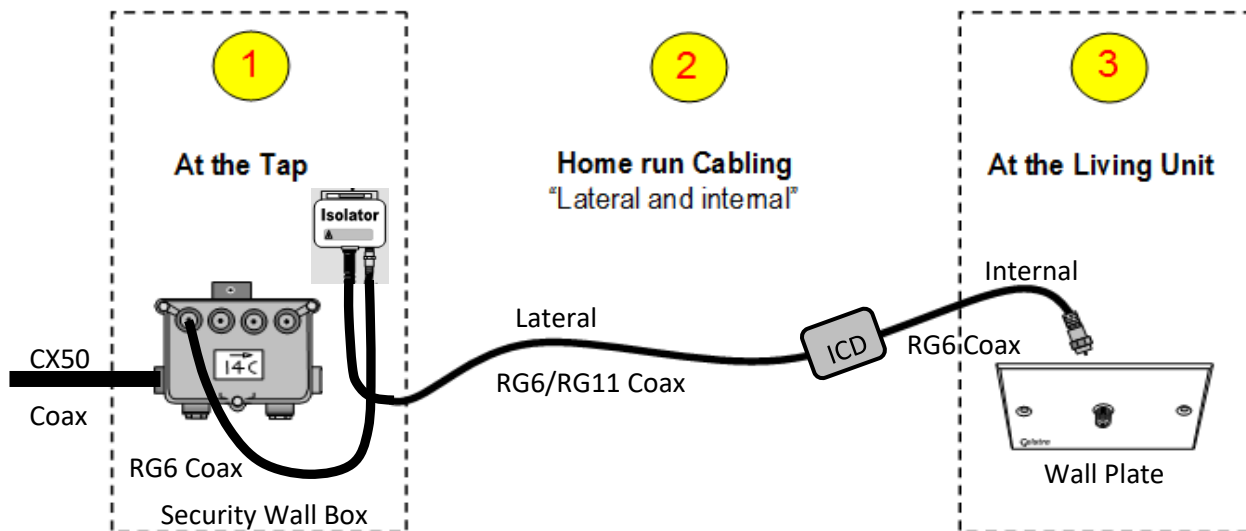


Figure 42 MDU Equipment and Cabling (Coax)

The purpose of the ICD is three-fold:

- i. to terminate a RG11 lateral (where required for low loss) with a barrel connector / joiner (inside the ICD) so that a smaller and easier to run RG6 cable connects into the Living Unit and to the wall plate;
- ii. to complete all of the **nbn** cable installations to the relevant Premises during the one construction build without entering the Premises; and
- iii. so that a RSP service can be activated rapidly once requested by the end-user.

Typical Coaxial Installations and Modifications

A typical coaxial installation includes: wall plate; optional 2-way or 3-way splitter; HFC NTD; and the internal cabling of RG6 coaxial cable from the ICD to the wall plate.

Beyond the wall plate, the MDU Premises equipment and installation is fundamentally the same as for a SDU.

For the MDU scenario, a registered Cabler should not modify the cable between the ICD and wall plate unless the EU specifically requests the wall plate be re-located within the premises.

As for the SDU scenario, additional services can be added by connecting RSP equipment (including a cable modem) via a fly-lead to an unused splitter port. At most 3 devices can be connected using a 3-way splitter. Premises amplifiers are not generally provided for using inside Premises.

For MDUs that have previously been connected to the Telstra coaxial network, there may be some existing Telstra BigPond and Foxtel Pay-TV services. Adding a 3rd HFC network service for a RSP or replacing the existing Telstra BigPond cable modem with an HFC NTD is similar to that of a SDU.



Coaxial Installation Removals

If multiple Telstra cable modems, Foxtel set-top-boxes and/or HFC NTDs are installed, the Registered Cabler must disconnect these from the splitter near the wall plate without affecting the other services. The Registered Cabler must not remove the splitter unless greater RF signal is sought to improve the performance of the remaining coaxial services. If the Registered Cabler removes a splitter or changes a 3-way splitter to a 2-way splitter, the Registered Cabler must complete this process as quickly as possible.

Registered Cabler's Modification & Removal Responsibilities

When installing, relocating or removing coaxial services from the ICD to and within a Premises, the Registered Cabler acknowledges that:

- It may be necessary to add a wall plate, add a splitter or change a 2-way splitter to a 3-way splitter.
- There may also be a need to remove a splitter or change a 3-way splitter to a 2-way splitter to improve the service performance.
- Small cabling changes may also be required between the first wall plate and equipment in other rooms within the Premises.
- The Registered Cabler must consider at all times the existing coaxial-fed services that are already operational.
- The end-user must be made aware of any necessary coaxial service disruptions required to:
 - complete a new wall plate connection;
 - relocate a wall plate; or
 - relocate or remove equipment.
- The Registered Cabler must ensure that any additions, changes or removals shall not permanently disrupt existing coaxial services or reduce performance of such services without end-user's knowledge or approval.
- Registered Cablers must not inadvertently or deliberately, permanently disrupt or reduce the quality of an existing coaxial service.

Testing and minimum specifications

All tools must be regularly maintained, and test equipment must be calibrated in accordance with the manufacturer's recommendations.

All hand-held power equipment must be electrically tested and tagged in accordance with all applicable legislation and local requirements.

Test Instrument

The following Test Instruments or equivalent are required to perform signal measurements.

Manufacturer or Primary supplier	Manufacturer Product Code	Description
Sunrise	CM3000	DOCSIS 1 & 3 - Digital Signal Level Meter Annexure A Option



Manufacturer or Primary supplier	Manufacturer Product Code	Description
Trilithic	Seeker Lite 2	RF Leakage detector. Needs to be programmed to Telstra specification to operate at 124.2375MHz with 20Hz AM tag detection. SW - Seeker Lite2 Profile Telstra_01.set
Viavi	ONX620V	DOCSIS 3.0/3.1 – Digital Signal Level Meter (Cable Modem function not active); SW Version 3.6.20
Viavi	ONX620	DOCSIS 3.0/3.1 – Digital Signal Level Meter - SW Version 3.6.20

Service Test (Check)

- Utilising a suitable HFC test instrument verify the following at the **nbn** HFC NTD (typical values shown in table below):
 - Downstream Signal Level
 - Upstream Signal Level
 - Downstream Mean Error Ratio (MER)
 - Upstream MER at the CMTS
 - Signal Leakage (1 meter from item under test)
- Remove HFC test instrument and reconnect **nbn** HFC NTD.
 - Check LED operation
 - Check with the end user that all services are operational (i.e. phone / internet)

If the receive signal level at the wall plate is too high compared to the required values shown in Table Y, it must be attenuated (lower the signal level) so that it is below the maximum levels.

Use a 3, 6, or 10 dB attenuator to reduce the signal to the correct level at the wall plate. Use only one attenuator to achieve the correct reduction of signal level.

If the transmit signal level at the wall plate is too high, remediate to reduce the equipment and cable losses between the Tap and the wall plate. nbn authorised personal will be required to implement any necessary equipment or cable changes between the Tap and the PCD.

If the transmit signal level at the wall plate is too low, use a 3, 6, or 10 dB fixed attenuator or approved step attenuator to increase the transmit signal to the correct level at the wall plate. Use only one attenuator to achieve the correct increase in signal level.

If there is a fault indication (No Sync / service / signal level fail) check connections and if fault cannot be cleared, log a fault with **nbn** (or RSP)

Metric	Description	Impaired	Healthy	Specification/Reference
DS MER	Downstream Modulation Error Ratio	< 34.5 dB	=> 34.5 dB	Required to support specified BER at 256 QAM
US MER	Upstream Modulation Error Ratio	< 30 dB	=> 30 dB	Required to support specified BER at 64 QAM



DS Pre-FEC BER	Bit Error Ratio at the cable modem prior to Forward Error Correction	1.01E-8 or worse	1.0E-8 or better	
DS Receive Level	Electrical input to the cable modem	<-6 or >+9 dBmV/ch	=> -6 to <=+9 dBmV/ch	
US Transmit Level	Electrical output from the cable modem (6.4MHz wide channel)	<33 or >53 dBmV/ch	=>33 to <=53 dBmV/ch	
Signal Leakage	Customer connection items (includes from the isolation box to each wall plate)	=> 21 μ V/m (at 1m from the source)	<= 20 μ V/m (at 1m from the source)	



12 Activities not authorised HFC network

This document does not authorise a Registered Cabler to do any of the following:

- Relocate, remove or replace the PCD
- Relocate, remove or replace **nbn** lead-in cabling between the Tap and the PCD
- Disconnect the **nbn** Lead-in cable connection at the PCD
- Use of non **nbn** approved coaxial equipment (refer to Section 13 -14 for details)
- Re-locate or modify the Isolator
- Modification or re-location of any support structures e.g. underground ducting, riser brackets
- Install a premises amplifier and the associated plug-pack power supply if the cable distance between the PCD and the wall plate is too long (e.g. battle-axe block)

13 Approved Coaxial equipment

Approved Coaxial equipment for the Telstra-based and Optus based components of the HFC network detailed in the document referred to below.

Note: After the co-existence period, the Telstra and Optus HFC network will be managed and maintained by nbn HFC Network.

13.1 Wall Box

The PCD is used to house the Isolator, splitter and in the case of the CG1000N any amplifiers

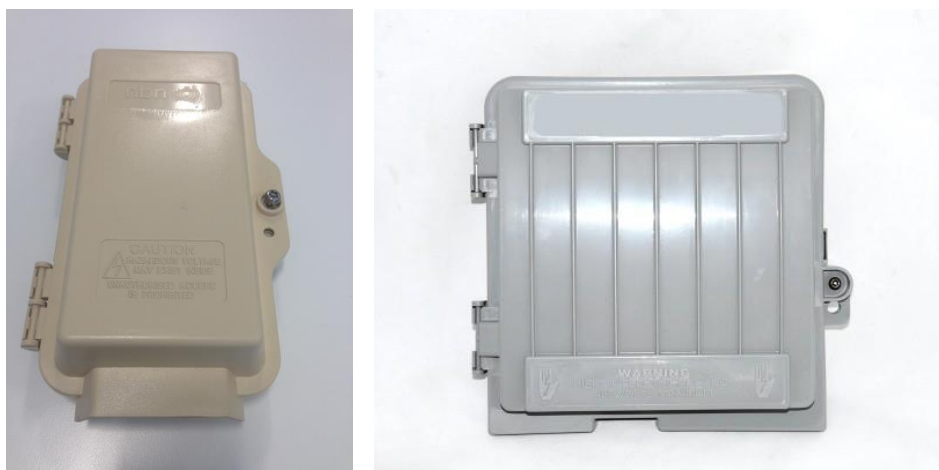


Figure 43 Typical PCDs

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Madison Technologies	CG 1000	Large Isolation Box – Customer Premises
Madison Technologies	CG1000N	Large PCD – Customer Premises with nbn logo
Madison Technologies	MT1322B	Small PCD – Customer Premises with nbn logo
Madison Technologies	MT 1010	Telephony Wall Box with standard Phillips head screw

13.2 ICD

The ICD used for MDUs construction is shown below and contains a barrel and F connectors

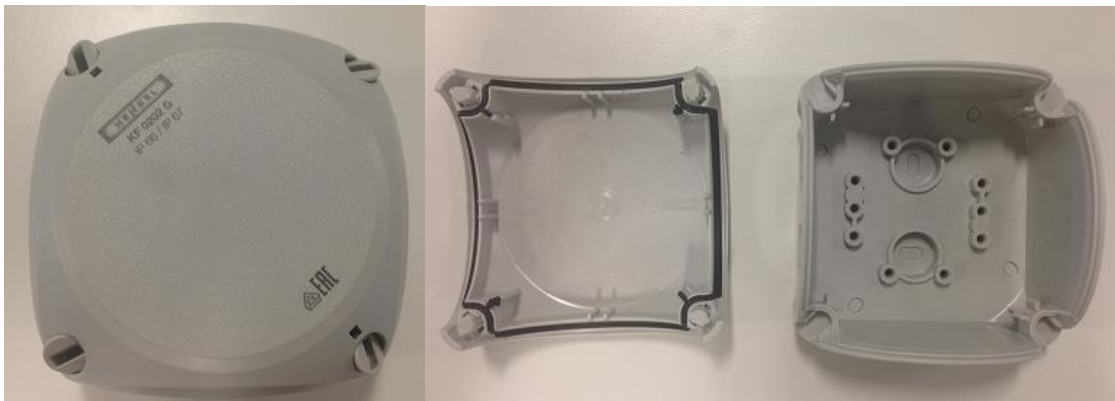


Figure 44 Hensel ICD

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Hensel	KF 200 G	ICD Enclosure

13.3 Passive Devices

Isolator

Isolators are present at each premises, historically there have been several versions and the one listed below is the current isolator issued by **nbn** at the time of publication. Note: there are upgraded 1GHz isolators under testing which will be deployed.



Figure 45 Typical Isolator

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Zinwell	ZN-AU	Isolator, electrical, F (female) connector ports, single output, 1 GHz rating
Sumnet / NEE	CS-4002	
Sumnet	CS6601	

Splitters

2 and 3-way splitters are used to provide additional connection points to wall plates or secondary services such as Foxtel or BigPond.



Figure 46 Typical 2 and 3 way splitters

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Tru-Spec	DSB-21G	Splitter, even 2 way, 3.7 dB insertion loss per leg, F (female) connector ports. 1 GHz rating
Tru-Spec	TSB-21G	
Steren	201-102	
Digitap	002DWSB	
Antronix	CMC2002H-A	
Zinwell	MSG-2A	
CableCor	L1.3.1	

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Tru-Spec	TSB-31-G/B	Splitter, even 3 way, 5.5 dB insertion loss per leg, F (female) connector ports. 1 GHz rating
Digitap	1003DWSB	
Antronix	CMC2003BH-A	
Zinwell	MSG-313LT-B	
CableCor	L.1.3.2	

Attenuators

A passive device that reduces the signal level by a predetermined amount. Attenuation values of 3, 6, and 10 db are the most commonly used.



Figure 46 Typical attenuators

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Tru-Spec Bitek (Digitek) Holland	FAM-3 08AF03 FAM-3	Attenuator Fixed - 3 dB, max. insertion loss variation 0.5 dB, F (male) to F (female)
Tru-Spec Bitek (Digitek) Holland	FAM-6 08AF05 FAM-6	Attenuator Fixed - 6 dB, max. insertion loss variation 0.5 dB F (male) to F (female)
Tru-Spec Zinwell Holland	FAM-10 AT-10 FAM-10	Attenuator Fixed - 10 dB, max. insertion loss variation 0.5 dB, F (male) to F (female)
C-Cor	BC496	Attenuator Fixed - 3 dB, Belling Lee (male) to Belling Lee (female)
C-Cor	BC500	Attenuator Fixed - 6 dB, Belling Lee (male) to Belling Lee (female)
PPC	SSA3-85	3dB step attenuator
PPC	SSA6-85	6dB step attenuator
PPC	SSA10-85	10dB step attenuator

Filters

High Pass Filters are used to isolate upstream frequencies for subscribers who do not require return path services.

High Pass Filters also prevent ingress noise from propagating back to the node and disrupting active upstream services.



Figure 47 Typical filters

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Pacific Broadband Networks)	RPS-65C	Return Path Band Stop Filter 5-65MHz, pass 87-862MHz, rejection 5-65MHz >35dB
PPC	SHP3-80	Filter High Pass, 80MHz

13.4 Premises Amplifier

The premises amplifier is used to provide additional in-home RF signal, it provides additional RF out ports for multiple device connection.



Figure 48 Typical premises amplifier

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Zinwell	HDA-PIAU	Power inserter and 14V DC power pack

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Zinwell	14vDC300/1	Power adapter
Zinwell	HDA-RA6-4AU-M	Amplifier, with active return, shock protected, remote powering, 4 outputs with female F port connector interface (14V DC powered)
PPC	PPC-5-U/U-65/85	Amplifier, with active return, shock protected, remote powering, 4 outputs with female F port connector interface (15V DC powered)
C-Cor	D.PWRKIT	FD41SD-15-400 DC C-Cor plug pack CableCOR 50VDC/0.5A max power inserter
C-Cor	A.PPC AMPKIT	Kit containing PPC-5-U/U-65/85 and D.PWRKIT

13.5 Drop and indoor Cables

Drop cables can be either RG6 or RG11 and available in underground (flooded), aerial (with messenger wire) and indoor (low smoke).

Internal Cable



Figure 49 Typical RG6 and RG11 Quadshield cable

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
CommScope Belden PCT Amphenol / TFC Matchmaster Jonas Australia	F11SSV 1617A A11QS - BVV T11Q - VB/B 06MM-E11Q CRG11BQ	RG11 Quadshield, minimum of 60% inner & 40% outer braid, Black PVC jacket - non flooded, Copper clad steel centre conductor solid, gas expanded PE dielectric

PPC C-Cor	P11IQVRMN B102	
CommScope	F11SSVV	RG11 Quad Shield, 60% inner & 40% outer braid, Black flame-retardant PVC jacket – non-flooded Copper clad steel solid
CommScope Belden Belden PCT Amphenol / TFC Matchmaster Jonasa Australia PPC C-Cor	F6TSV 9118 YJ52452 A6TS – BVV T6T77 – VB/B 06MM-E6T CRG6UBT P6IT77VRMN B109	RG6 Tri-shield, minimum of 60% braid, Black PVC jacket – non-flooded Copper clad steel centre conductor solid, gas expanded PE dielectric
CommScope	F6TSVV	RG6 Tri Shield, 60% inner & 40% outer braid, Black flame-retardant PVC jacket – non- flooded. Copper clad steel solid centre conductor, foam PE dielectric
CommScope	F6SSVV	RG6 Quad Shield, Black flame-retardant PVC jacket – non-flooded Copper clad steel solid centre conductor, foam PE dielectric

Underground Cable



Figure 50 RG6 Tri-shield flooded cable

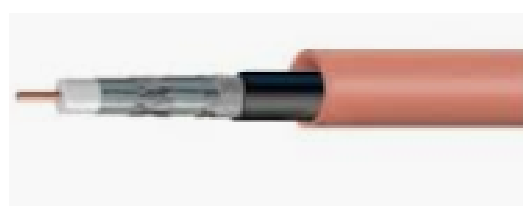


Figure 51 RG11 Quadshield flooded cable

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
CommScope Belden PCT Amphenol / TFC Matchmaster Jonasa Australia PPC C-Cor	F11SSEF 1618A A11QS - BF T11Q - FEB 06MM-E11QF CRG11BQF P11IQEFRMY B104	RG11 Quadshield, minimum of 60% inner & 40% outer braid. Black PE jacket – flooded. Copper clad steel centre conductor solid, gas expanded PE dielectric
CommScope TFC Belden PCT Amphenol / TFC	F677TSEF XP 26H6 1837A A6TS - BF T6T77 - FEB	RG6 Tri-shield, minimum of 60% braid, Black PE jacket - flooded. Copper clad steel centre conductor solid, gas expanded PE dielectric.

Matchmaster Jonas Australia PPC C-Cor	06MM-E6TF CRG6UBTF P6IT77EFRM B111	
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Aerial Cable



Figure 52 Typical Aerial cable

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
CommScope; Belden PCT Amphenol / TFC Matchmaster Jonas Australia PPC C-Cor	F11SSVM-APD 1620AM A11QS - BVMF T11Q - LTVB - 072M/B 06MM-E11QFM CRG11BQFM P11IQV2CRMN B108	RG11 IM Quadshield, minimum of 60% inner & 40% outer braid, Black PVC jacket, non-flow flooding. Copper clad steel centre conductor solid, gas expanded PE dielectric, 1.8mm diameter steel messenger wire.
CommScope Belden PCT Amphenol / TFC Matchmaster Jonas Australia PPC C-Cor	F6TSVM-APD 1616AM A6TS - BVMF T6T77 - LTVB - 051M/B 06MM-E6TFM CRG6UBTFM P6IT77VMFRMN B110	RG6 IM Tri-shield, minimum of 60% braid, Black PVC jacket – non-flow flooded. Copper clad steel centre conductor solid, gas expanded PE dielectric, 1.3mm diameter steel messenger wire.

13.6 F Connectors F Connectors are used on RG6 and RG11 cables. Any unconnected F port must be capped off with an F terminator.

Adaptors / Terminators



Figure 53 Example F Connectors / Adaptors

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
PPC	FMBLF	Adaptor - F male to Belling Lee female
PPC	CF81GHZM	Adaptor - F female to F female port
Jonsa Australia	APF/F	Adaptor – F Male to F Male
Jonsa Australia	APF/FFR3N	Adaptor – right angle
PPC	RAPLUS	Adaptor – right angle
PPC	TR75S	Terminator, 75 ohm, f port soldered
Jonsa Australia	APFDM1	Terminator, 75 ohm, f port soldered, with additional rubber 'O' ring

Compression Crimp Connectors



Figure 54 Example Compression Crimp connectors

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
PPC (C-Cor)	EX6XL	RG6 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield)
PPC(C-Cor)	EX6XL-NBN	RG6 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield with NBN Logo)
PPC (C-Cor)	EX11	RG11 F-connector integral pin, compression crimp, indoor-outdoor, Universal fit (tri & quad)
PPC (C-Cor)	EX11RAFM	RG11 right angle F-connector, compression crimp - indoor /outdoor. Universal fit (tri & quad shield)
PPC (C-Cor)	EX6XL: PLUS	RG6 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield)



Manufacturer or Primary Supplier	Manufacturer Product Code	Description
F-CONN	FS6U	RG6 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield)
PCT (Jonsa Australia)	TRSF-6L	RG6 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield) with FOXTEL logo
PCT (Jonsa Australia)	TRSN-6L	RG6 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield) with nbn logo
PCT (Jonsa Australia)	TRS-6L-RA	RG6 right angle F-connector, compression crimp - indoor /outdoor. Universal fit (tri & quad shield)
PCT (Jonsa Australia)	TRSN-6LRA	RG6 right angle F-connector, compression crimp - indoor /outdoor. Universal fit (tri & quad shield), nbn logo
PCT (Jonsa Australia)	TRSF-11L	RG11 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield) with FOXTEL logo
PCT (Jonsa Australia)	TRSN-11L	RG11 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield) with nbn logo
PCT (Jonsa Australia)	DRS-11-RA	RG11 right angle F-connector, compression crimp - indoor /outdoor. Universal fit (tri & quad shield)
ICM (Hills)	DB6U-L (BC80490)	RG6 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield)
Corning - Cablecon	CX3-4.9	RG6 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield)
Corning - Cablecon	7.0QM	RG6 F-connector, compression crimp indoor-outdoor, Universal fit (tri & quad shield)
ICM (Hills)	FS11V-SL (BC89237F)	RG11 F-connector, compression crimp indoor-outdoor, Universal fit

13.6 Wall Plates

Wall plates can be mounted in to either the skirting board or flush mount against a wall. Below is an image of a typical skirting mount version. Note: Optus HFC networks require the use of a self-terminating F81 barrel.



Figure 47 Typical skirt mount wall plate

Manufacturer or Primary Supplier	Manufacturer Product Code	Description
Jonsa Australia	APO2FNBN3	Wall outlet plate, white, flush mounted, single output F female to F female, nbn logo . F81 joiner to conform to Telstra specification
Jonsa Australia	APO1FNBN3	Skirting outlet plate, white, single output F female to F female, nbn logo . F81 joiner to conform to Telstra specification.



14 Glossary

Term	Description
ACMA	Australian Communications and Media Authority
ANT	Analogue Network Termination
BCA	Building Code of Australia
BEP	Building Entry Point
CLP	Customer Lightning Protection (also known as OVP)
C/O	Change/Over
CPE	Customer Premises Equipment
DFN	Distribution Fibre Network
DP	Delivery Partner
DSL	Digital Subscriber Line
FDT	Fibre Distribution Terminal
FIC	Field Installable Connector
FTTP	Fibre To The Premises
FWO	Fibre Wall Outlet
GPO	General Power Outlet
GPON	Gigabit Passive Optical Network
HFC	Hybrid Fibre Coaxial
HS&E	Health, Safety & Environment
ICD	Internal Connection Device
IDU	Indoor Unit
ISDN	Integrated Services Digital Network
LFN	Local Fibre Network
MDF	Main Distribution Frame
nbn	NBN Co Ltd
NBP	Network Boundary Point



Term	Description
NCD	<p>Network Connection Device.</p> <p>A device supplied as part of the nbn™ FTTC service, that is used to provide a UNI-D (Ethernet) port to the user of service. This device includes a Reverse Power Feed (RPF).</p>
NTD	Network Termination Device
ODU	Outdoor Unit
OVP	Over Voltage Protection
Passive NTD	<p>Passive Network Termination Device.</p> <p>This means a passive or non-powered device that is:</p> <p>(a) provided by nbn to establish a demarcation point between nbn's network and customer cabling and/or equipment; and</p> <p>(b) permanently marked at manufacture with the words 'Network Termination Device' or the letters 'NTD'.</p>
PCD	Premises Connection Device
PIC	Premises Internal Cable
PS/B	Power Supply with Battery Backup
PS/S	Power Supply Standard
RSP	Retail Service Provider
SDU	Single Dwelling Unit
TO	Telecommunications Outlet
UNI	User Network Interface
UNI-D	User Network Interface – Data
UNI-V	User Network Interface – Voice
VDSL	Very High Rate Digital Subscriber Line
WBA	Wholesale Broadband Agreement
WHS	Workplace Health & Safety
WNTD	Wireless Network Termination Device