CHORUS

UFB Ready Property Guidelines

Volume 4 - Premises Wiring Minimum Requirement Recommendation

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Document Control

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1. Introduction

1.1.1. Objectives of Document

The objective of this Manual is to provide the design and deployment standards for developers for new property developments or subdivision within Chorus' UFB areas and areas with existing Chorus fibre infrastructure. This document is separated into 4 volumes which covers different topics of the network.

This document is Volume 4 which covers:

- The recommended internal cabling from the star wiring box to all outlets.

1.1.2. Intended Audience

The intended audience of this document are Chorus, Service Companies personnel, service providers, property developers and their contractors involved with the design and installation of optical fibre networks in new properties or property subdivision.

1.1.3. Chorus Network Specified Product (CNSP)

CNSP is an assessment and approval pathway for particular types of product and test equipment to ensure that a product meets criteria for:

- Whole of life performance
- Longevity, and
- Durability

Where a product is listed within the CNSP process, Chorus service partners must use that product from the approved supplier.

1.1.4. Contractual Reference

This document may be provided to Chorus Partners, Service Companies, Chorus Customers and 3rd party service providers for use alongside the relevant contracts for service or the relevant Standard Terms Determination.

Throughout this document, Chorus New Zealand is referred to as Chorus.

This document does not, in any way, vary the terms of the main contract between Chorus, Chorus service partners, 3rd party service providers, property developers or their representatives. If there is any conflict between the relevant contract and statements made in this document, the terms of the relevant contract shall prevail.

1.2. Related Reference Material

It is the responsibility of the contractor to research, understand and abide by the relevant national or local compliance standard as applicable to the location and tasks. The table below lists the national and international standards that may be associated or referenced within this standard. This list is not exhaustive.

Document No.	Document Title
AS/NZS 1367	Coaxial cable and optical fibre systems or the RF distribution of analogue and digital television and sound signals in single and multiple dwelling installations
AS/NZS 3000	Electrical Installations
AS/NZS 3080	Telecommunications installations – Generic cabling for commercial premises
ANZS3084-2003	Telecommunications Installations standard.
AS/NZS 3085	Telecommunications installations - Basic requirements
AS/NZS 3086	Telecommunications installations – Integrated telecommunications cabling systems for small office/home office premises
AS/NZS 3112	Approval and test specification - Plugs and socket-outlets
AS/NZS ISO / IEC 15018	Information technology - Generic cabling for homes
AS/NZS ISCO / IEC 24702	Telecommunications installations - Generic cabling - Industrial premises
IEEE 802.3 2012	Power over Ethernet

Document No.	Document Title
	TCF Premises Wiring - Cable Installers Guidelines for Telecommunication Services http://www.tcf.org.nz/library/85f5318d-fc71-409f-a04d-48ff414107f7.cmr

1.3. Occupational Safety and Health

1.3.1. Field Activity

Chorus prides itself on its quality installations for all customers. This company is fully cognisant of its health and safety obligations under the Health & Safety at Work Act 2015, including all its subornment legislation. The company provides fit for purpose equipment and complete our work to industry good practice standards.

All Service Providers engaged by Chorus are required to accept and apply the same high standards, ALL THE TIME.

We adopt work practice safety precautions that are proportionate to the specific risk exposure that each site may present. These include but are not limited to;

- Contracted Service Partners providing Chorus with project Specific Health and Safety Plans that include risk assessment prior to commencement of any works.
- Project specific safe work method statements or job safety analysis being created and shared with Chorus prior to commencement of works so that Chorus can ensure that any risks or the hazards that sit behind these, have been identified are managed properly.
- All persons undertaking associated works have appropriate levels of competency and training and that these meet the recognised industry standards and expectations.
- All incidents or events associated with the project are notified to Chorus within the agreed timelines and full investigations undertaken to identify root cause. This information can be shared with developers as required.
- Appropriate investigations and corrective actions are undertaken and completed to prevent recurrence after any significant event.
- All fibre and other waste material is to be removed from site and disposed, or recycled, in accordance with the Build Partner and Chorus environmental waste minimisation and management plans.

Technicians working on the Chorus network in customer premises including sub-divisions will be required to adhere to and comply with both their own company health and safety requirements, as well as the any developer's site specific protocols as required by the customer.

Technicians are responsible for establishing a robust hazard identification and management practice.

1.3.2. Optical Fibre Safety

This Chorus Build and Provisioning Programme provides supervision, of workers and/or site based safety supervisors with the general safety rules, task specific safety procedures and good practice industry standards for the installation of quality fibre optic cable systems, (cable handling, blowing, splicing, pulling, terminating testing and troubleshooting tasks as required for a great customer experience).

Our technicians take pride in their workmanship and this includes the appropriate steps to correctly dispose of fibre scraps carefully.

This is achieved with the use of disposable sharps containers that have a sealed lids.

Remembering that fibre scraps provide the same risk as would be experienced with glass splinters.

Handling cleaning chemicals and adhesives for quality checks are completed carefully and all Chorus technicians are familiar with the Material Safety Data Sheets (MSDS's) information pertaining to cleaning chemicals used.

Copies of further fibre optic safety and installation safe work method statements and a host of other safety related documentation can be made available to prospective subdivision developers upon request

1.4. Glossary of Terms Used

The following list describes some of the terms used in this document:

Term	Description
ABFFP	**Air Blown Fibre Flexibility Point** An enclosure which is installed in an underground pit. The enclosure houses an optical fibre splitter which acts as a flexible fibre network connectivity point.
ATA	**Analog Telephone Adapter**

Term	Description
	A device that connects regular telephones to a broadband network for voice over IP (VoIP) service. The ATA delivers dial-tone, manages the call setup and provides the conversion between voice signals from an analogue telephone and IP packets.
BDD	**Buried Distribution System** An oval underground pit which provides a storage and connectivity point for microducts or FATs
BUDI I-FFP	**Building Distribution Internal Fibre Flexibility Point** A wall-mounted enclosure which houses optical fibre splitters which acts as a flexible fibre network connectivity point. Typically used for MDU with up to 48 premises.
CCA	**Copper Clad Aluminium** A type of substandard wire used in Ethernet cable that is **NOT** recommended by Chorus. Such cable type will not achieve the performance requirements for high speed broadband.
CNSP	**Chorus Network Specified Product** A list of products which are technically approved by Chorus to ensure network compatibility and reliability.
CO	**Central Office** An exchange building which houses Chorus transmission equipment
Drop Cable	A 2F cable installed from the FFP or FAT in the Chorus distribution network. This is typically also referred to as the Service Lead.
ETP	**External Termination Point** An outdoor enclosure mounted on the side of a premise which provides a point of connectivity from the lead-in fibre cable and the premise fibre cable.
FAT	**Fibre Access Terminal** An enclosure which provides breakout access of Chorus' cables to the lead-in cables into premises.
FFP	**Fibre Flexibility Point** An enclosure which provides a connectivity point between the feeder fibres from the CO to the distribution fibre to premises.
FTTP	**Fibre To The Premise** Optical fibre network constructed pursuant to the UFB Initiative
GPON	**Gigabit Passive Optical Network** A type of telecommunications network that uses a point-to-multipoint FTTP which uses unpowered optical splitters to enable a single feeder optical fibre to serve multiple premises.
GPX I-FFP	**GPX Internal Fibre Flexibility Point** A wall-mounted enclosure which houses optical fibre splitters which acts as a flexible fibre network connectivity point. Typically used for MDU with more than 48 premises.
Handhole	A small pit that is installed at the premises boundary as the location where the lead-in pipe into the premises is terminated. It is also used as a location to join microducts.
IBDN	**In Building Distribution Network** The optical fibre distribution network within a building premise.
I-FFP	**Internal Fibre Flexibility Point** An FFP which is installed indoors, typically in a TER
ID	Internal Diameter
Lead-In Cable	The Lead-In Cable is a cable that is installed from the premises boundary to the building within the premises. This can be a large multi-fibre cable to feed an MDU or a Service Lead connecting a single unit such as an SDU
LFC	**Local Fibre Company** The operator of the local optical fibre network such as Chorus
MDU	**Multi Dwelling Unit** A building which has two or more premises such as an apartment building.
Microduct	A specially manufactured tube that is used for fibre installation through the blowing technique.
Micronet	An Ericsson System consisting of microducts and cables used by Chorus for the optical fibre distribution network.
NZCCPTS	New Zealand Committee for the Co-ordination of Power and Telecommunication Systems
OD	Outer Diameter
OFDF	**Optical Fibre Distribution Frame**

Term	Description
	An optical fibre distribution frame installed in the CO to provide connectivity between the Chorus active transmission equipment to the outside plant network.
OLT	**Optical Line Terminal** A GPON Access Node installed in Chorus' CO that provides for the delivery of UFB services. The GPON OLT is installed in Chorus exchange buildings
ONT	**Optical Network Terminal** A GPON network equipment installed in the customer premise that provides for the delivery of UFB services.
PE	Poly Ethylene
RGW	**Residential Gateway** Equipment installed in the premise connected to the ONT which is used to centralise communications.
ROW	**Rights of Way** More than one premises with separate ownership sharing a common access to the public roads.
RSP	**Regional Service Provider** Telecommunication companies who use Chorus' optical fibre network to create retail UFB-based services which are sold to residents, businesses, schools and health premises.
Ribbonet	An Ericsson System consisting of microducts and cables used by Chorus for the optical fibre distribution network.
SDU	**Single Dwelling Unit** A premises which has a single customer connections
Service Lead	A Service Lead is a cable that connects from the Chorus distribution network to a single premises. The Service Lead can be a Drop Cable or an Indoor Cable.
TER	**Telecoms Equipment Room** A location in an MDU where the lead-in cable terminates into an I-FFP and where the IBDN converges.
TSG	**The Subdivision Group** The Chorus contact point for property developers. Refer to the Chorus website www.chorus.co.nz for more details
TV	Television
UFB	**Ultra-Fast Broadband** FTTP broadband service providing high speed internet connectivity.
UPS	**Uninterrupted Power Supply** Battery pack which provides backup power supply to keep critical devices powered in the event of a power outage.
UTP	**Unshielded Twisted Pair** A type of twisted pair copper cabling used for carrying transmission signals
VOD	**Video On Demand** Video service where the end user is able to order videos on demand.
VoIP	**Voice Over IP** A methodology for the delivery of voice communication over IP network such as the internet.

2. Customer Premises Wiring

2.1. SDU Building Penetration

It is the responsibility of the installers to ensure that all building penetrations are sealed in accordance with the current version of the Building Code. The Building Code clause for External Moisture (E2) requires that buildings must be built to resist leaks, damp or the accumulation of external moisture in concealed spaces.

Acceptable Solution E2/AS1 is a supporting document to the Building Code clause for External Moisture. This solution provides one way of complying with the Building Code clause for External Moisture.

The link below is to the document "Acceptable Solutions and Verification Methods for New Zealand Building Code Clause E2 External Moisture". Refer to the section which outlines the general pipe and services penetration

https://www.building.govt.nz/building-code-compliance/e-moisture/e2-external-moisture

The figure below is a copy of figure 68 from the E2 compliance document. This details acceptable solutions effective from 1st January 2017. Installers must ensure that they comply with the current version of E2/AS1 as the current acceptable solution may differ from that shown below.

Note: *The information here is for reference only. Always check the Building Code for the latest rules and regulations.*

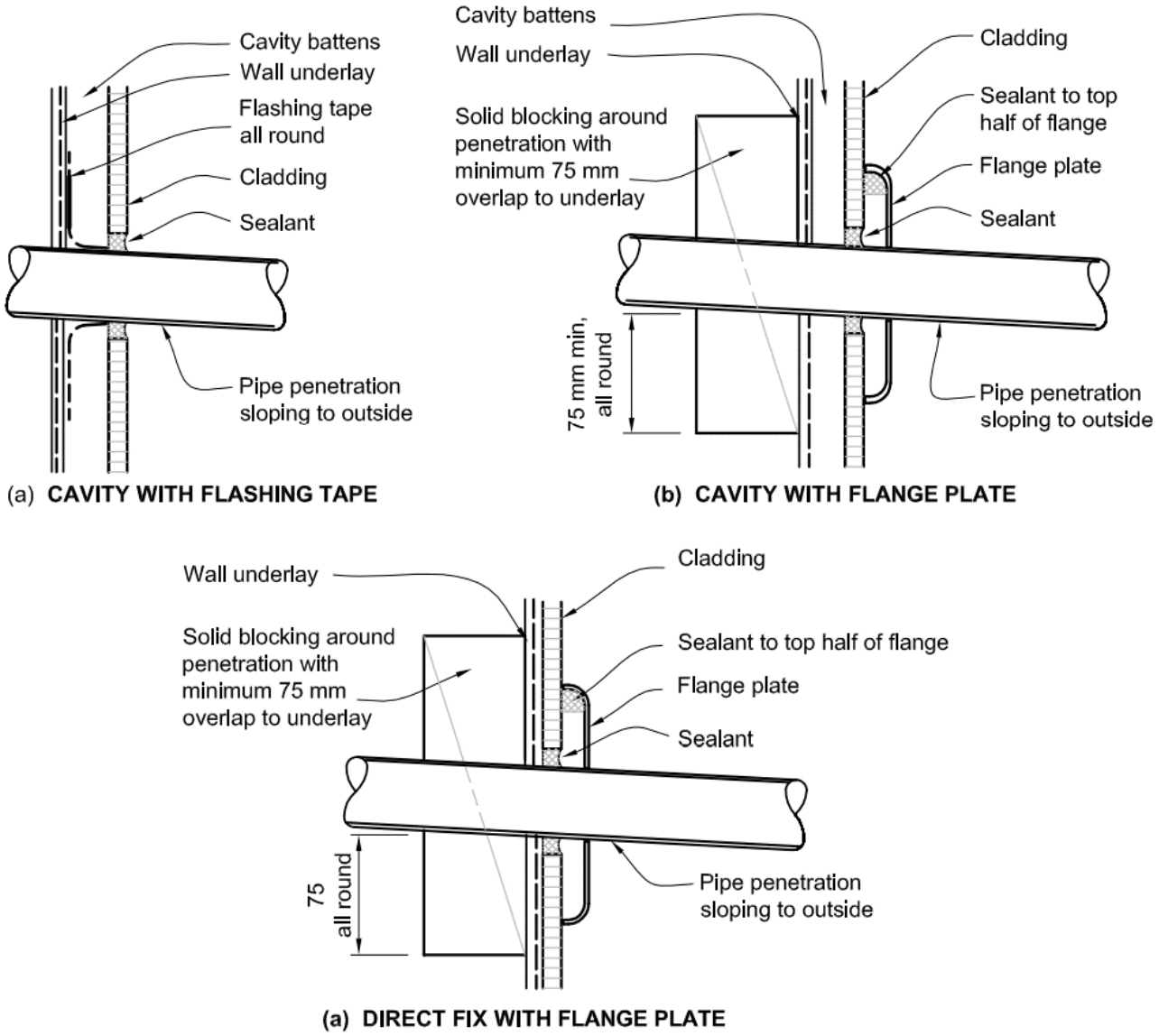


Figure 1. Building Penetration Guidelines

2.2. ETP to Star Wiring Box

For an SDU, an optical fibre cable needs to be routed from the ETP to the star wiring box to establish connection. It is recommended for a 20mm conduit to be installed with a Cat 6 Cable or Prysmian Optic@t composite cable pre-wired from the ETP to the star wiring box and accessible from both ends.

- If the premises is within a copper serving area, the Cat6 cable can be used to provide copper service
- If the premises is within a fibre servicing area, the Cat6 cable can be used as a draw cable, or the fibre from the composite cable can be used.

The ETP must be installed at a height of 300mm to 1500mm from ground level. The conduit must be installed within the range of the ETP install height.

As the ETP will be installed when the end customer requests for service, it is advisable for the conduit access hole from the external wall be temporarily sealed to prevent water ingress into the premises.

Leave at least 1.2m slack of cable at each end.

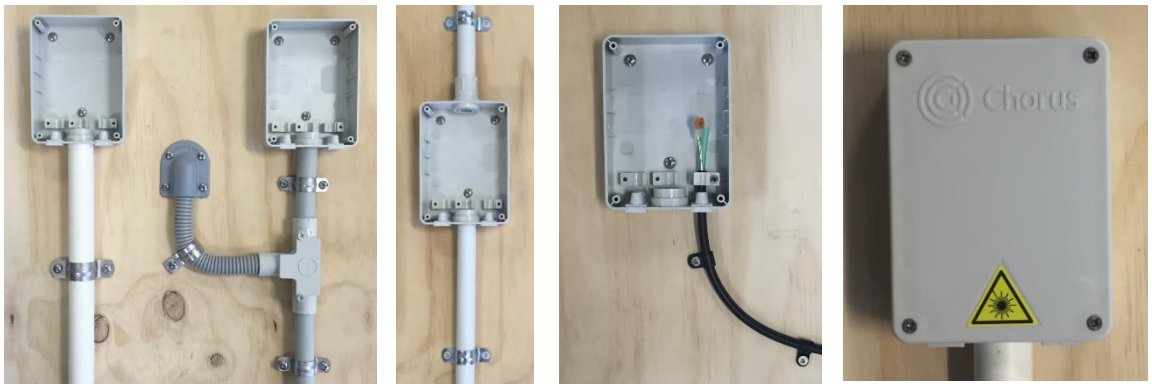


Figure 2. Example of ETP Mounted on Walls

2.3. FAT to Star Wiring Box

For an MDU, a Chorus approved and provided 2F optical fibre drop cable needs to be routed from the FAT to the star wiring box to establish connection. One drop cable is to be installed for each customer premises. It is advisable for the drop cable from the FAT to the star wiring box be installed in a conduit as it allows:

- A separation of optical fibre cable with other utilities
- Easy access to replace the drop cable in the cable in the future without breaking walls or ceilings.

The conduit needs to be continuous with swept bends. For longer runs, accessible inspection boxes at regular intervals will be preferable.

2.4. Internal Premises Cabling Recommendation

The following section outlines the recommended minimum premise wiring standards to enable an efficient distribution of UFB based services throughout the premise. This standard enables:

- A star configuration which has a centralised connectivity and test point
- Easy reconfiguration of services to be distributed throughout the premise.

2.4.1. Star Wiring Box

***Note**: This is the New Zealand Telecommunications Forum (TCF) and Chorus' MINIMUM home wiring recommendation. Depending on the conditions such as the premises design, intended equipment connectivity, connection flexibility, and network expansion capability, additional cables can be installed to the various rooms for any additional requirements.*

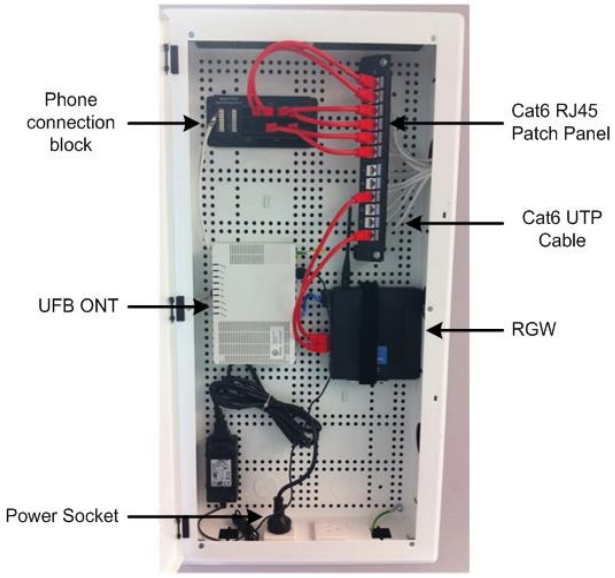
The star wiring recommendation is applicable for either fibre or copper broadband services and future-proofs the premises.

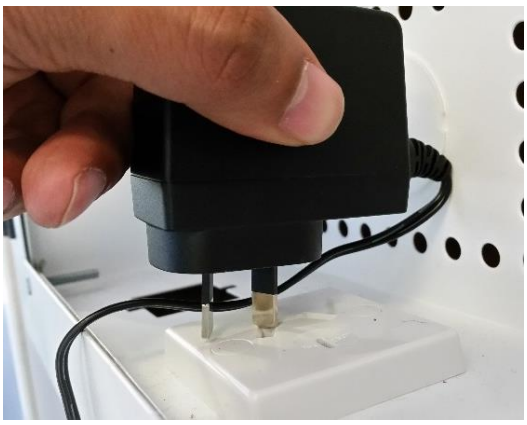
It is recommended for a Star Wiring Box with the following requirements, specification and functionality:

- It must not be installed in a location with poor ventilation e.g. close to a heat source or high humidity.
- A minimum dimension of H700mm x W350mm x D80mm with louvre door with at least one 20mm conduit routed to the ETP.
- Internally mounted typically set into the side wall of a utility room or garage with easy access & front working space.

- If required, have sufficient space to house a UPS for power critical equipment.
- Integrated with patch panels suitable for connection types throughout the premise for cross-connect functionality.
    - One Telephone Hub sufficient to provide connectivity to each room
    - 4x Ethernet jack points to the lounge, 2x Ethernet jack points to every other room.
- Be integrated with at least 3 power outlets to power equipment such as ONT, RGW, set top boxes and other centrally controlled devices.

  Note: *The power outlet orientation must* ***NOT*** *have the earth pin parallel to the door. This is to enable the ONT power plug to be terminated in the socket.*
- The RGW is not to be designed to be installed in the Star Wiring Box, especially if the box is metallic. A metallic Star Wiring Box will affect Wi-Fi performance.





The ONT power plug cannot be terminated into the power socket if the earth plug orientation is parallel with the star wiring box door.

Figure 3. Star Wiring Box & Power Socket Orientation

2.4.2. Recommended Cabling Standard

The internal cabling of the premises is the responsibility of the developer or premises owner.

It is important that such cabling is compatible and compliant with the New Zealand Telecommunications Carriers Forum recommendations and international standards.

Chorus has previously experienced low quality cable and substandard workmanship even in brand new houses.

Such low quality cabling will result in telephony and broadband services to experience reduced performance or in more severe cases, no service.

The premises owner will have to rectify any substandard cabling through their own contractor. It is advised for all home wiring to be tested and verified by qualified technicians before commissioning.

2.4.2.1. Substandard Cabling

Chorus recommends a minimum of Cat6 cabling to be installed if new cables are installed in the premises. Ensure that such cables and components are sourced from reputable suppliers or manufacturers.

In general, the quality of Cat6 cables is determined by factors such as the cable design, quality of the wires and the copper twist, while the quality of the components are determined by the material and contact.

An example of substandard wire quality is as shown below where a Copper Clad Aluminium (CCA) wire is used instead of full copper wires within the cable.

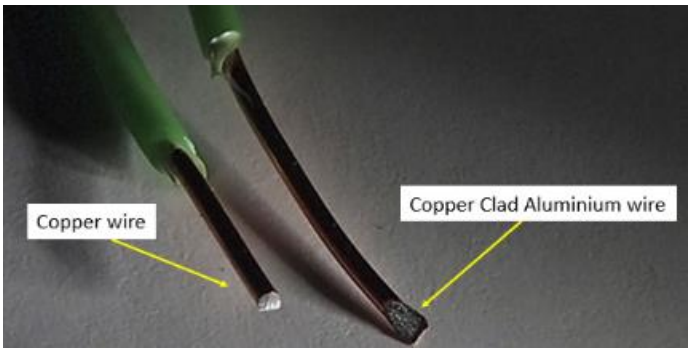


Figure 4. Example of Substandard Copper Wires in Cat6 Cable

2.4.2.2. Substandard Cable Installation & Termination

The performance of Cat6 cabling also depends on the proper installation and termination of the cable. A few main points on the cabling are:

- Ensuring that the cable is not bent over the minimum bending radius limit
- Ensuring that the cable is properly punched into keystones and crimped onto connectors
- Copper pairs are kept twisted as close as possible to the point of termination
- Cables are not installed too close to electrical cabling, causing interference.

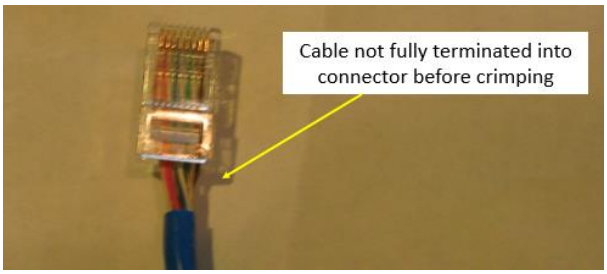


Figure 5. Example of Substandard Cat6 Cable Crimping & Punch Down

2.4.3. Premise Star Wiring

The recommended premise cabling are as follow:

Note1: *This is an example of a premise cabling for broadband services only.*

Note2: *This example does not include cabling for TV distribution through RF. For Coax cabling recommendation, please contact RF or satellite video content providers such as FreeView or SKY.*

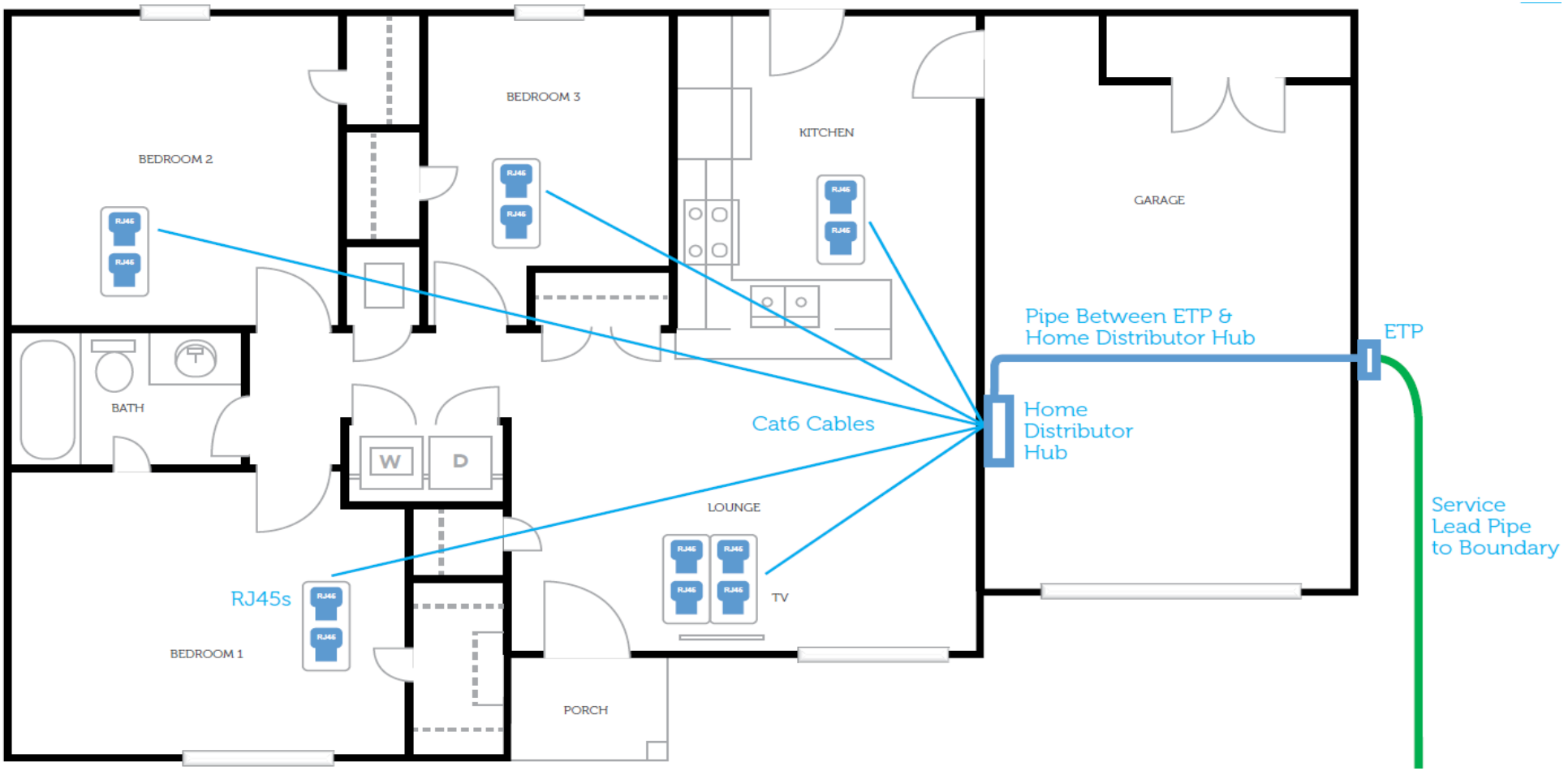


Figure 6. Example of Premise Broadband Cabling Recommendation

2.4.3.1. Example of Copper xDSL Connectivity

The diagram below shows an example of a copper xDSL connection through the star wiring box.

- The DSL splitter voice output is terminated to the telephone hub
  - The telephone hub multiple output is terminated to the jack points where telephony is required.
- The DSL splitter broadband output is terminated to the DSL modem
  - The DSL modem output is terminated to the jack points where broadband is required.

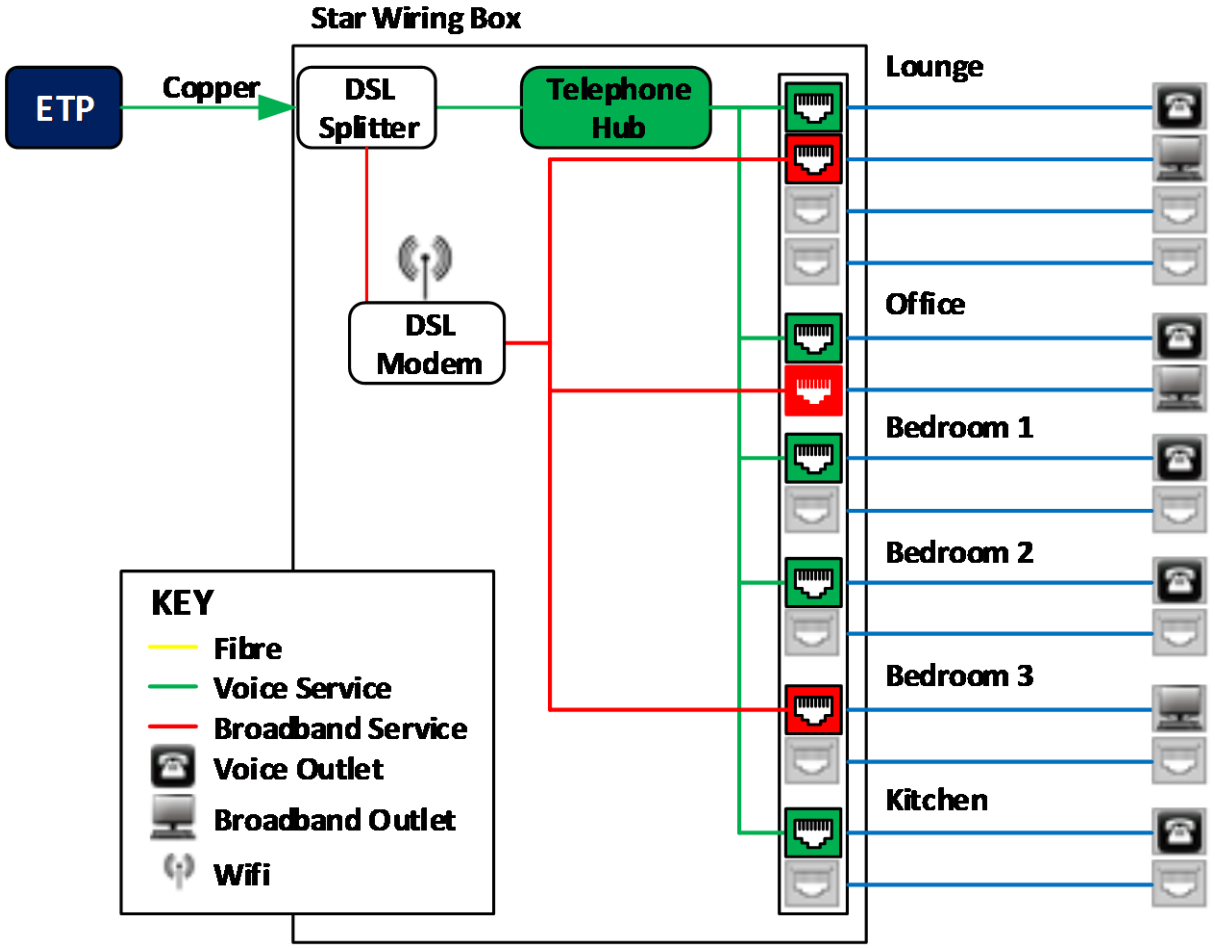


Figure 7. Example of Premise Broadband Cabling for Copper xDSL

2.4.3.2. Example of Fibre Connectivity with ATA from RGW

The diagram below shows an example of a fibre connection, with the ATA voice service from the RGW, through the star wiring box.

- The ONT Ethernet output is terminated to an RJ45 port to the RGW in the lounge area
  - The ATA voice output from the RGW is terminated back to the star wiring box which is then connected to the telephone hub
  - The telephone hub multiple output is terminated to the jack points where telephony is required.
- The Ethernet output from the RGW is terminated back to the star wiring box which is then connected to an Ethernet switch
  - The Ethernet switch output is terminated to the jack points where broadband is required.

  Note: *An Ethernet switch is required in this situation as there is insufficient jack points from the lounge to distribute Ethernet connections to the office and bedroom 3.*

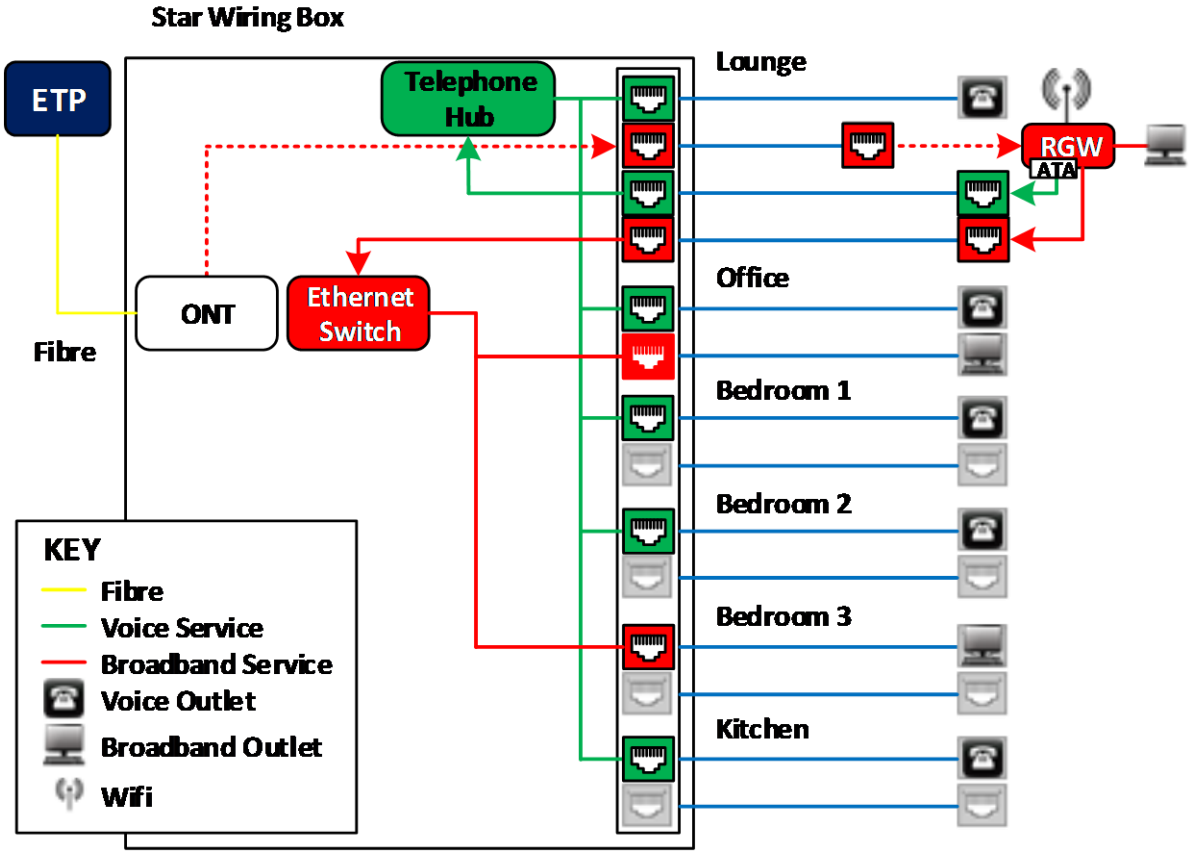


Figure 8. Example of Premise Broadband Cabling for Fibre with ATA from RGW

2.4.3.3. Example of Fibre Connectivity with ATA from ONT

The diagram below shows an example of a fibre connection, with the ATA voice service from the ONT, through the star wiring box.

- The ONT Ethernet output is terminated to an RJ45 port to the RGW in the lounge area
  - The Ethernet output from the RGW is terminated back to the star wiring box which is then patched to the jack points where broadband is required.

    Note: *An Ethernet switch is NOT required in this situation as there are two jack points from the lounge that can be used to directly patch to the office and bedroom 3.*
- The ATA voice output from the ONT is terminated to the telephone hub
  - The telephone hub multiple output is terminated to the jack points where telephony is required.

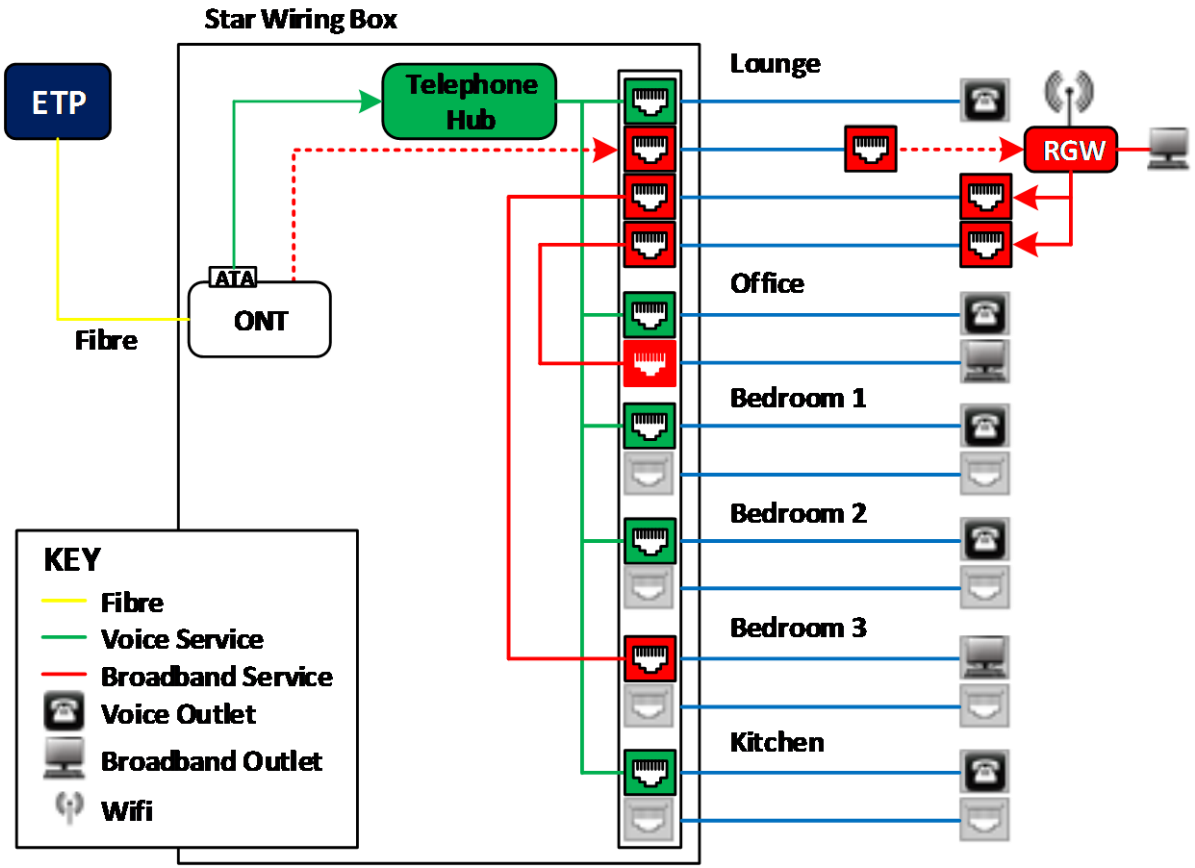


Figure 9. Example of Premise Broadband Cabling for Fibre with ATA from ONT