Telstra Dark Fibre Interface Specification

Telstra Dark Fibre

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COMMERCIAL IN CONFIDENCE

Telstra InfraCo

What's inside

Chapter 1
Purpose

The purpose of this Telstra Service Interface Specification (TSIS) document is to provide a customer-facing technical description of the Telstra Dark Fibre Service -.

Chapter 2
Scope

This document describes technical interface requirements and handoff point environment considerations for the Telstra Dark Fibre Service. It is intended to provide the relevant technical information that a Customer will need in order to interface their private equipment to, and to use, the Telstra Dark Fibre.

The document does not explain ordering, provisioning, operations, or maintenance aspects of the Telstra Dark Fibre Service. The rights, obligations, and processes relating to these aspects are described in the **Operations Manual** (OM).

Chapter 3
Audience

This TSIS document is intended for Customers who are considering purchasing, and/or who have already purchased Telstra Dark Fibre. It is anticipated that readers will have a working knowledge of Optical Fibre technology.

Chapter 4
Service description

The Telstra Dark Fibres provided by Telstra to the Customer are as described in the Telstra Dark Fibre Service Agreement.

The service is an un-lit single mode optical fibre pair between two Fibre Termination Points located at two sites - an A-End and a B-End.

The maximum allowable fibre distance will be dependent on the customer's A-End to B-End link loss and equipment capability, e.g. but not limited to LX 10 km, EX 40 km and ZX 80 km optical transceiver types.

The service has no electrical devices attached by Telstra, and therefore does not carry any traffic until connected to **Customer supplied** active optical transmission equipment.

The Telstra Dark Fibre is a **non-diverse** service. To achieve path diversity, two separate Telstra Dark Fibre services may be ordered, with a request that they be designed over diverse geographic paths. In such cases Telstra will endeavour to comply with the path diversity request but cannot guarantee that full end to end path diversity will be achievable at time of initial service delivery, or (as a result of maintenance activities) maintainable over time.

Chapter 5
Fibre characteristics

The optical fibre used for the Telstra Dark Fibre is a single mode, non-dispersion shifted, terrestrial optical fibre pair, which was designed at the time of original deployment to meet the relevant technical characteristics for single mode optical fibre cable current at the time of that deployment.

The optical fibre used by Telstra to deliver the Telstra Dark Fibre complies with ITU-T **G.652.D** as of August 2006 **(**and prior to that time **G 652.B)** and ITU-T **G.657.A2**

The light transmission characteristics of optical fibre can change over time, either as a result of natural fibre age degradation, or as a result of geological disturbance creating physical distortions in the fibre. The fibre in Telstra's network has been progressively deployed over time and thus the individual fibre sections utilised in making the end-to-end path of any Telstra Dark Fibre may vary in age. It should be assumed that a Telstra Dark Fibre will consist of a distribution of different aged fibre sections.

Except where noted, the characteristics provided in this section reflect Telstra's current specifications for newly deployed fibre. Fibre in Telstra's network is designed for a service life of up to 40 years.

5.1. Optical Attenuation

Maximum Fibre Loss @ 1310nm (initial fibre deployment)	**≤ 0.35** dB per kilometre (fibre path)
Maximum Fibre Loss @ 1310nm (end of fibre life)	**≤ 0.40** dB per kilometre (fibre path)
Maximum Fibre Loss @ 1490nm (initial fibre deployment)	**≤ 0.23** dB per kilometre (fibre path)
Maximum Fibre Loss @ 1490nm (end of fibre life)	**≤ 0.25** dB per kilometre (fibre path)
Maximum Fibre Loss @ 1550nm (initial fibre deployment)	**≤ 0.20** dB per kilometre (fibre path)
Maximum Fibre Loss @ 1550nm (end of fibre life)	**≤ 0.25** dB per kilometre (fibre path)
Maximum Fibre Loss @ 1625nm (initial fibre deployment)	**≤ 0.23** dB per kilometre (fibre path)
Maximum Fibre Loss @ 1625nm (end of fibre life)	**≤ 0.25** dB per kilometre (fibre path)
Maximum Connector Loss: *(e.g. end terminations and in-path patching connectors)*	**≤ 0.20** dB per connector
Maximum Splice Loss *(e.g. midpoint exchange splices and in-ground path splices)*	**≤ 0.10** dB per splice
Cable Cut-off Wavelength λcc	**≤ 1260** nm
Typical Polarisation Mode Dispersion (PMD)	**≤ 0.1** ps/√km

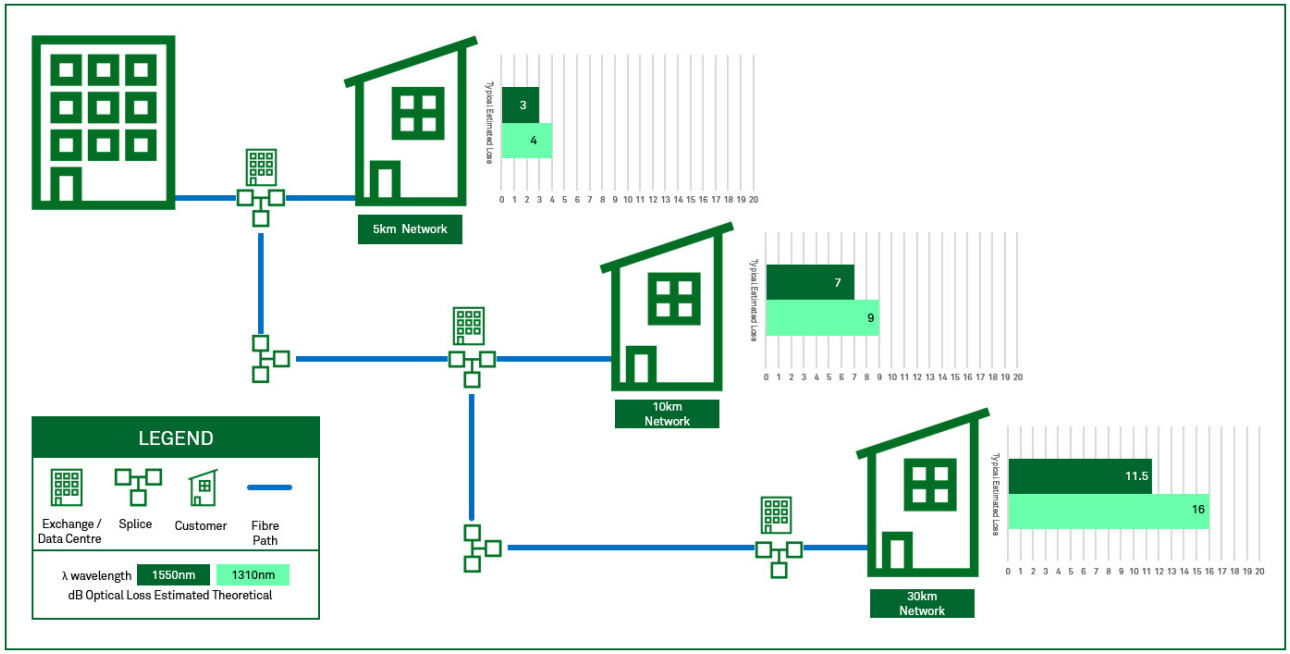


Figure 1. Typical estimated optical loss (dB) examples for Dark Fibre Links between sites in a metropolitan area.

5.2. Chromatic Dispersion

G.652

Zero Dispersion Wavelength λ_0	**1302** nm (min) to **1322** nm (max)
Zero Dispersion Slope (S_0) at λ_0	**≤ 0.092** ps/nm^2.km
Chromatic Dispersion Coefficient between 1285 & 1330nm	**≤ 3.5** ps/nm.km
Chromatic Dispersion Coefficient at 1550nm	**≤ 18** ps/nm.km
Chromatic Dispersion Coefficient at 1625nm	**≤ 22** ps/nm.km

G.657.A2

Zero Dispersion Wavelength λ_0	1300 nm (min) to 1324 nm (max)
Zero Dispersion Slope (S_0) at λ_0	≤ 0.092 ps/nm^2.km
Chromatic Dispersion Coefficient between 1285 & 1330nm	≤ 3.7 ps/nm.km
Chromatic Dispersion Coefficient at 1550nm	≤ 18.5 ps/nm.km
Chromatic Dispersion Coefficient at 1625nm	≤ 23 ps/nm.km

5.3. Physical Fibre Characteristics (new fibre)

Item	G.652	G657.A2
Core Material	Ge doped silica glass	
Core Mode Field Diameter @ 1310nm	9.2/9.1/9.0* ± 0.4 µm	8.8 ± 0.4 µm
Core Mode Field Diameter @ 1550nm	10.4/10.1* ± 0.5 µm (characterised)	9.8 ± 0.5 µm (characterised)
Cladding Material	Silica glass	
Cladding Diameter	125 ± 0.7 µm	

*The specification for Telstra Fibre Cable Core Mode Field Diameter has varied over time to align with fibre manufacturer's performance adjustments required to improve cable design, e.g. Prysmian Flextube.

5.4. Fibre Path End to End

Fibres for the Dark Fibre Services shall not be transposed at any point between and including at the A-end and Z-End. The Customer will be responsible to implement fibre transpositions as necessary beyond the SDP at either end.

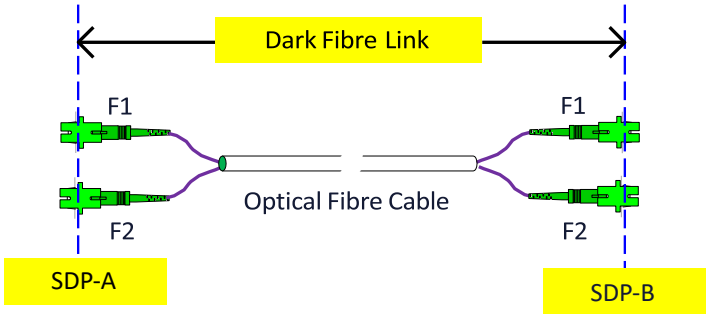


Figure 2 - Fibre Path End to End (no transpositions)

Chapter 6
Service delivery points

A Telstra Dark Fibre Service is provided as an end-to-end optical fibre link between two Fibre Termination Points at the nominated **Service Delivery Points**.

The Service Delivery Points are the only points at which Customer supplied optical line terminal equipment may be connected to the service.

The Service Delivery Points at the A-End and the B-End of the service are physically located at Optical Connectors provided by Telstra. Service Delivery Points may at Telstra's discretion be provided at the following site types:

Nodes	• Data Centres • Telstra Exchanges (Colo) • Other Customer aggregation sites
Points	• Business Premises • Other customer sites

(unless otherwise agreed by the parties in accordance with the Telstra Dark Fibre Service Agreement).

6.1. Optical Connectors

The physical interface provided by Telstra at each Service Delivery Point will use Telstra's standard optical connector unless Telstra notifies Customer in writing otherwise.

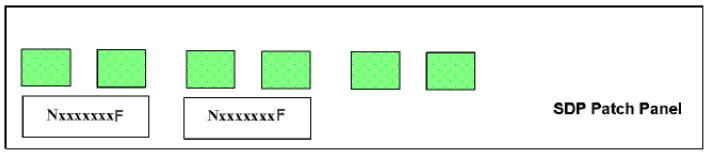
The standard optical connector currently used by Telstra is the "***SC type Angled Physical Contact***" (SCAPC) also commonly known as "**Angled SC**" or "**A/SC**" connector, as described in IEC 61754-4 (Fibre Optic Connector Interfaces – Part 4: Type SC Connector Family).

Telstra may at its discretion use different optical connectors in special circumstances.

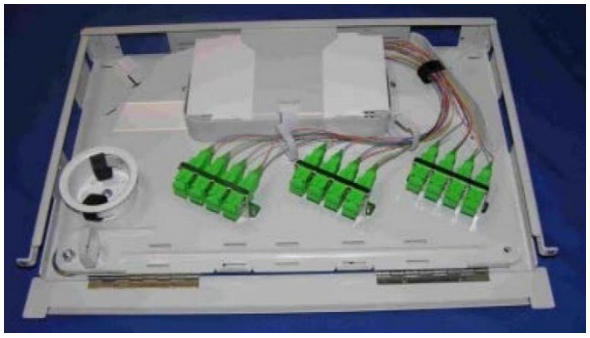
Customer is responsible for ensuring that any Customer supplied optical transmission equipment used in conjunction with a Telstra Dark Fibre is technically compatible with the Telstra Dark Fibre.

Telstra may use a variety of mounting arrangements for the optical connector at the Service Delivery Point. The **preferred** delivery mounting will be a rack mounted optical SDP tray type with SC/ACP connectors as shown below.

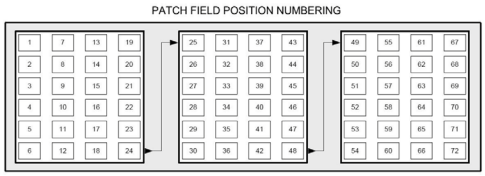
Labelling of services in the SDP tray will typically be as per the following diagram.



Alternative physical presentations which may be used in some locations include 24 fibre and 72 fibre OFTU panels:



24 fibre COFTU panel



72 fibre COFTU panel

In limited circumstances where Telstra's standard delivery arrangements are not available, the optical connector may at Telstra's discretion be presented in a "Customer Terminating Unit"

Where the Service Delivery Point is located in a third party **Data Centre**, the optical connector will be typically located in an data centre supplied demarcation frame - detailed handoff arrangements for these locations will vary depending the specific data centre rules. Final delivery of the optical service from the SDP to the customer rack in data centres will typically be implemented by the data centre support staff using a DC supplied "cross-connect" optical patch – in these cases the handoff at the customer rack may be ASC or LC type connector.

6.2. Service Delivery Point Diagrams

The Service Delivery Point will vary at each location. Common examples are explained to improve general understanding.

Telstra InfraCo Data Centres

Telstra Infraco operates various Data Centres (examples are Clayton, St Leonard's and Deakin). The Telstra Data Centre (DC) SDP will typically be located within the DC SMF (Sub Main Frame).

Connection of the Dark Fibre Service to the customer rack will be via an optical cross-connect from the SDP within the SMF (Sub Main Frame) to the DC Campus Fibre Frame (CFF). This will be implemented and recorded by the InfraCo DC staff.

Interconnections (Patching) traversing the DC e.g., OMF lead-in to OMF lead-in can be run by InfraCo Fibre staff.

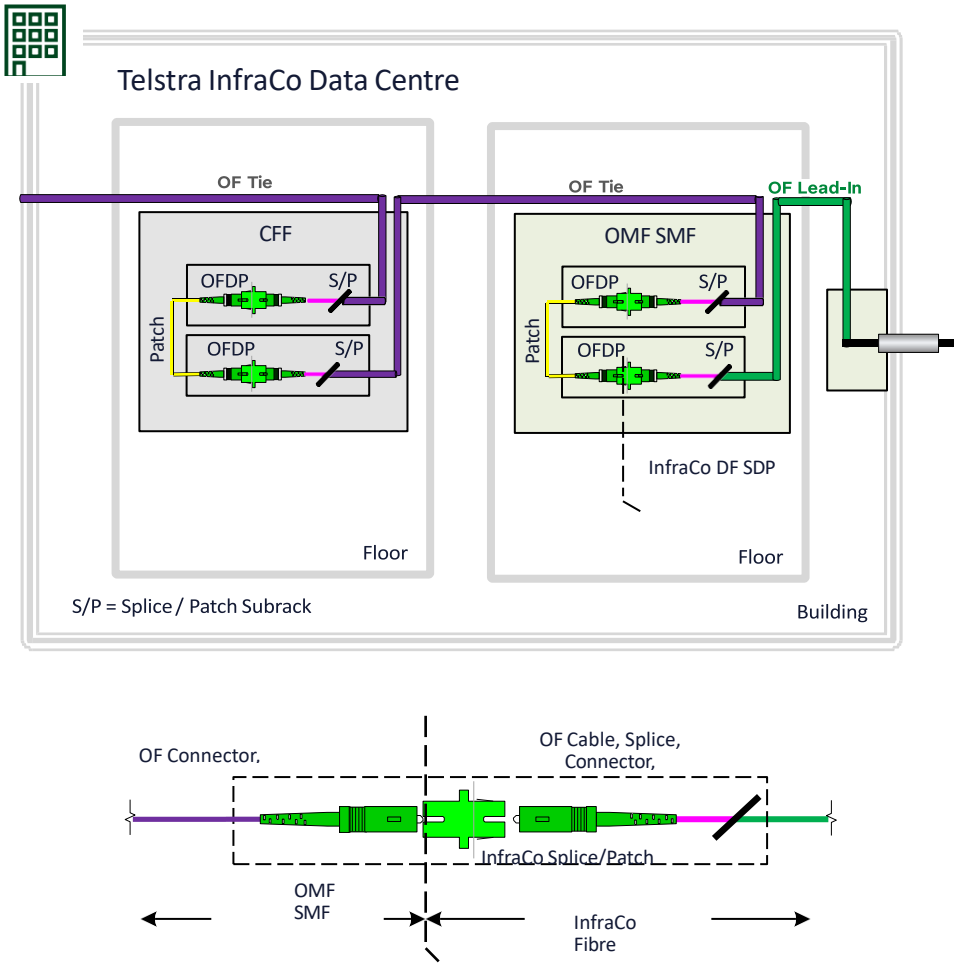


Figure 3 – DF SDP Telstra InfraCo DC site

3rd Party Commercial Data Centres

Within 3rd party Commercial Data Centers (DC) detailed handoff arrangements for these locations will vary depending on the specific Data Centre rules. Examples of 3rd Party Commercial Data Center brands are NextDC, Equinix, Global Switch and Fujitsu.

Where the DF SDP is delivered to the MMR (Meet Me Room) / IR (Interconnect Room) ODF the connection of the Dark Fibre service to the customer rack ODF in Data Centers will typically be implemented by the Data Centre support staff using a DC supplied optical cross-connect.

To reduce the delay from the time of completion of Dark Fibre services the final SDP location should be confirmed with the customer as soon as possible. The customer can then place the cabling order with the Data Centre.

Figure 29 below summarises the typical DC optical infrastructure and SDP locations to support Dark Fibres.

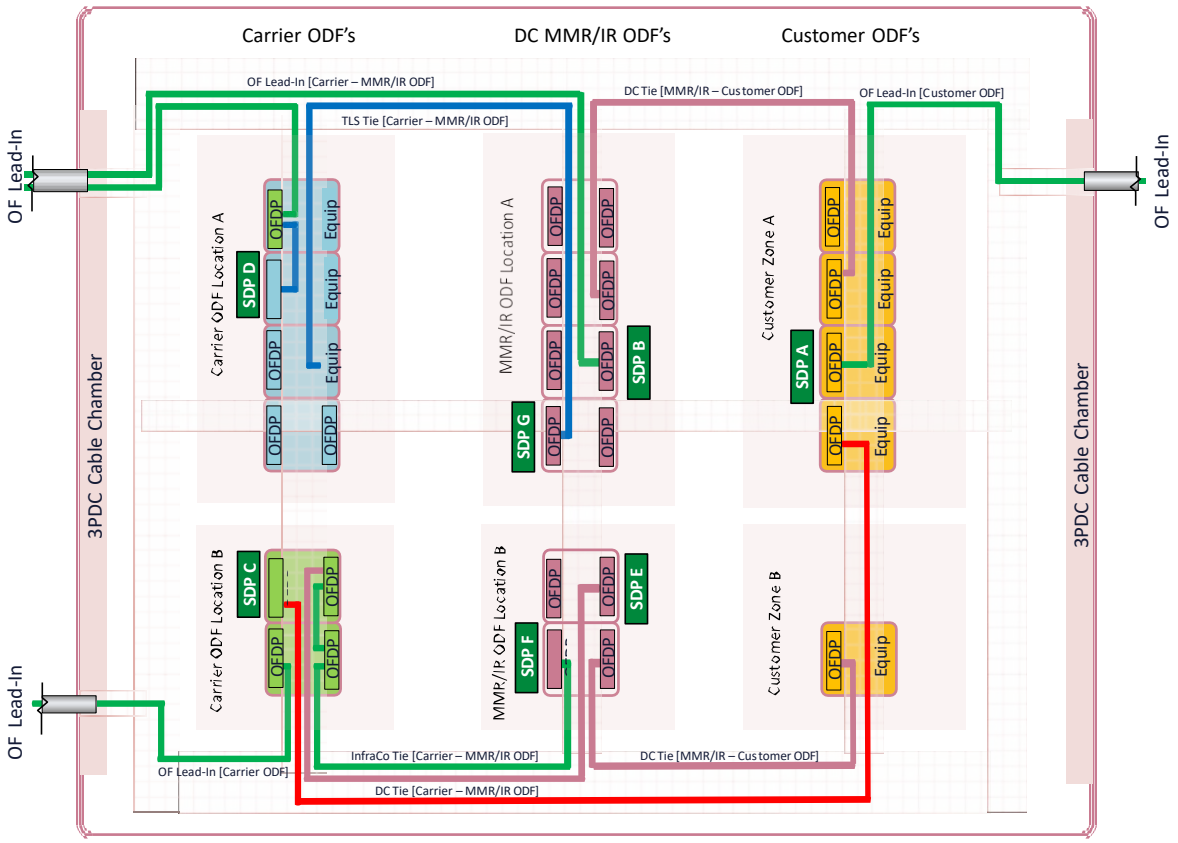


Figure 4 – 3PDC Cabling, OFDP and SDP's example.

SDP	Lead-In Location	Tie Location A	Tie Location B	Tie Ownership	SDP Location	Notes
SDP A	Customer OFDP	Nil	Nil	Nil	Customer OFDP	Lead-In direct to Customer OFDP. Note 1,2
SDP B	MMR OFDP	Nil	Nil	Nil	MMR OFDP	Lead-In direct to DC MMR/IR OFDP. Note 1,2
SDP C	Carrier OFDP	Carrier OFDP	Customer OFDP	Customer	Carrier ODF	Structured Cabling. Note 1,2,3
SDP D	Carrier OFDP	Carrier OFDP Note 4	TLS OFDP Note 4	TLS	TLS OFDP	Dark Fibre to TLS (Telstra Limited) OFDP. Note 2
SDP E	Carrier OFDP	Carrier OFDP	MMR OFDP	DC	MMR OFDP	Dark Fibre to MMR using DC Tie. Note 2
SDP F	Carrier OFDP	Carrier OFDP	MMR OFDP	InfraCo	MMR OFDP	Dark Fibre to MMR using InfraCo Tie. Note 2
SDP G	Carrier OFDP	Carrier OFDP	MMR OFDP	TLS	MMR OFDP	Dark Fibre to MMR using DC Tie. Note 2

Table 1 – 3PDC cabling and SDP scenarios.

Note 1 : Solution is by exception and could be subject to commercial terms. This solution will be made available via a Fibre
ISA or will be captured in the Feasibility Solution brief.

Note 2 : DC and Carrier infrastructure (Racks, Cables, OFDP) may be existing or newly installed.

Note 3 : Structured Cabling - The DF SDP will be presented in the Carrier ODF at the end of the simplex patch cords (SCAPC) interconnecting the InfraCo cable and customer's cable.

Customer is responsible (or InfraCo can arrange on the customers behalf) for the tie between the Carrier ODF and Customer ODF. The OFDP terminating the customers optical fibre cable at the Carrier ODF may be either an InfraCo supplied W&B 72F Splice/Patch subrack or Codecom supplied 72 or 144F CXD Chassis.

Customer shall advise customer tie on the order, InfraCo design will select the next available fibre/port. InfraCo patch, test and advise details in Delivery Document.

The OFDP terminating the customer tie will be modelled in MITS, MM & TPD, but the customer cable will not.

Note 4 : InfraCo OFDP to TLS Active Equip may be a Simplex or Ruggedised Patch cord.

Exchange Building

The physical interface provided by InfraCo at each SDP inside exchange buildings will depend on what optical connector type is the standard for the OFDP where the SDP is presented.

The standard optical connector currently used in OFDPs deployed by InfraCo in exchange buildings is SCAPC.

NBC – Network Building Co-location

The SDP is presented within the NBC rack using SCAPC connectors on a 72F Splice/Patch OFDP. Where requested the SDP SCAPC connector may be replaced by splicing on an applicable Pigtail for connection to the customers equipment.

Exchange NBC racks are designed for ISPs and resellers who offer services in specific geographic areas. ISPs and resellers can install their equipment within NBC racks located in selected network sites.

NBC racks are available in 600mm W x 600mm D and 600mm W x 1000mm D footprints with the choice of half height or full height. Usable space, half rack is 14 rack units, or 34 rack units for a full rack.

Each rack will be configured with fibre connectivity to an NBC OFDF. Half height racks have separate optical fibre ties back to the NBC OFDF and full height racks have one (1x) optical fibre tie back to the NBC OFDF.

All NBC racks are secured (locked), access to an individual NBC rack will use the Telstra One Card. Access is managed in Service Now (SNOW), a “One Card Access Request” application will be required for requesting new or changes to existing access.

Front – Half Height NBC Racks

Rear – Half Height NBC Racks

Internal – NBC Half Height Rack

Figure 5 – NBC half height rack Photos

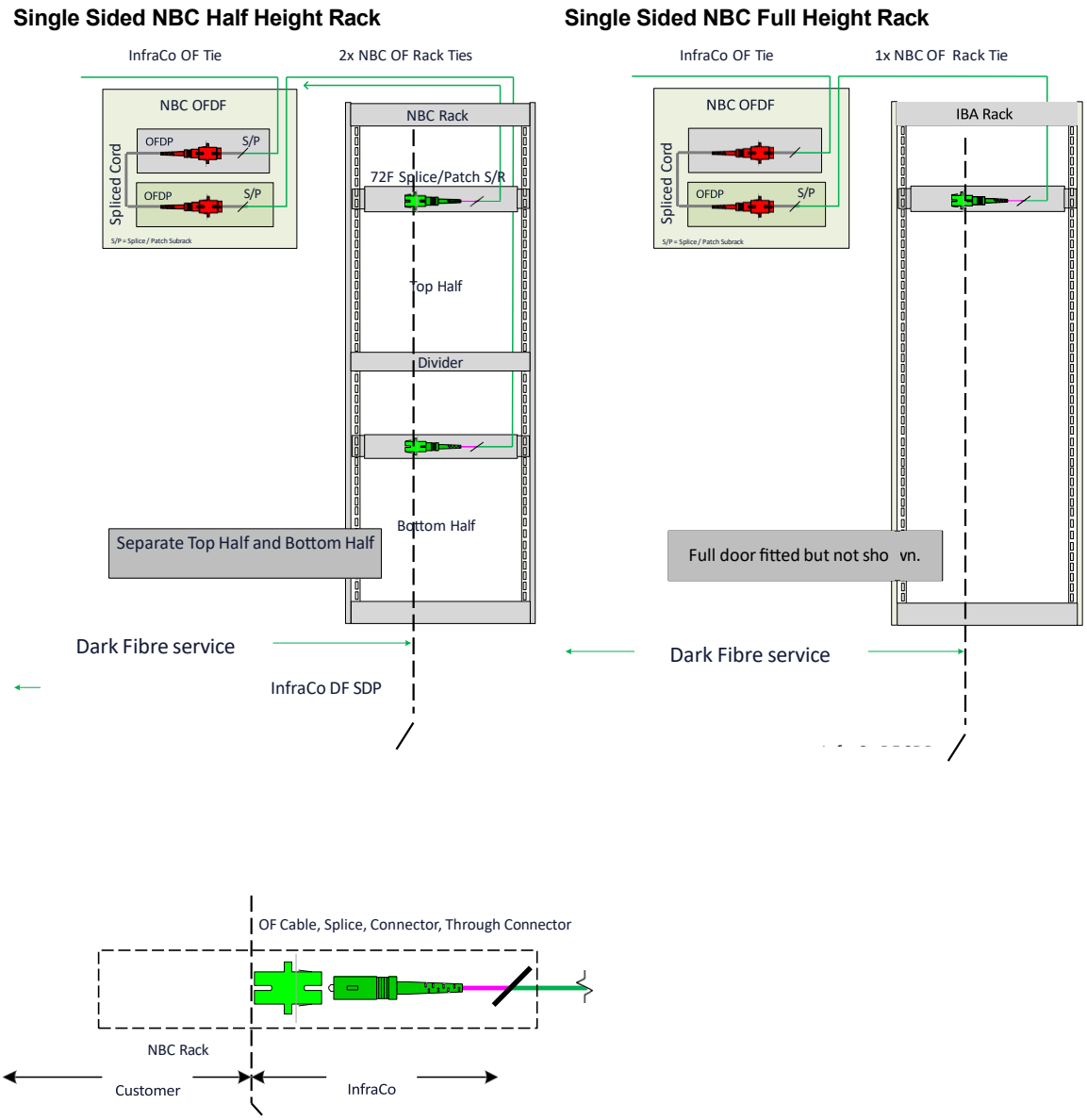


Figure 6 – NBC half and Full Height racks, SDP SCAPC.

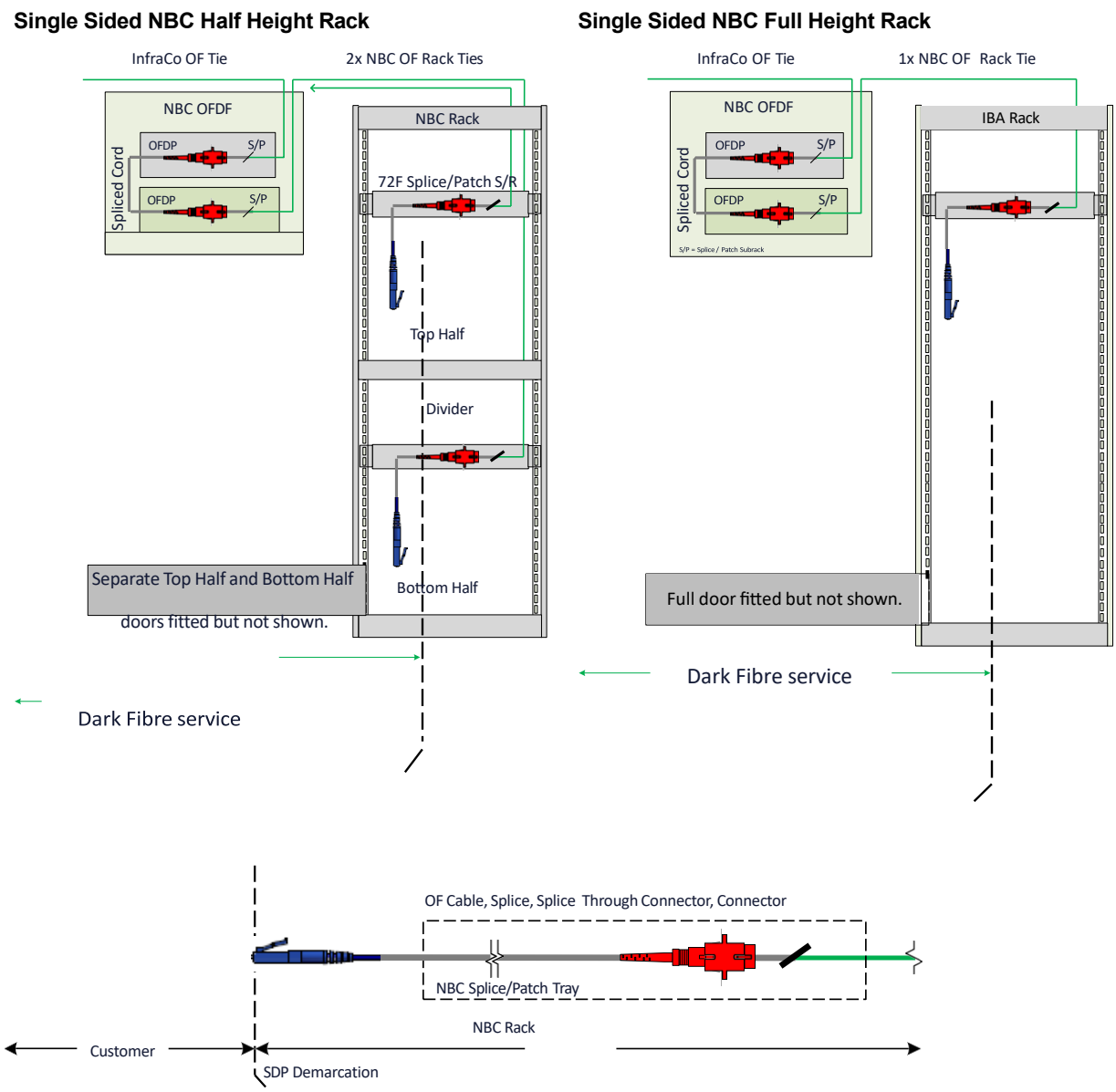
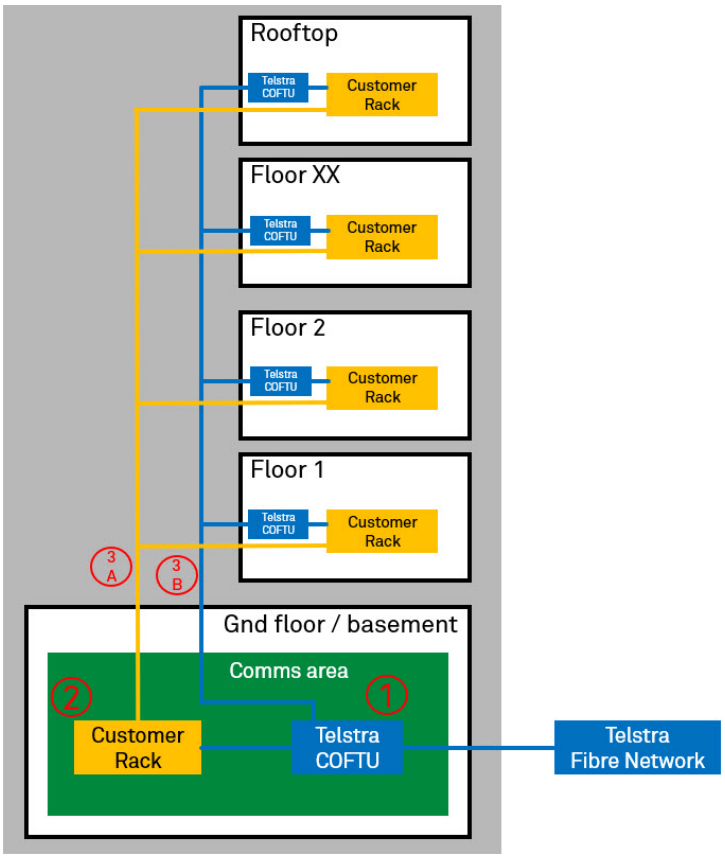


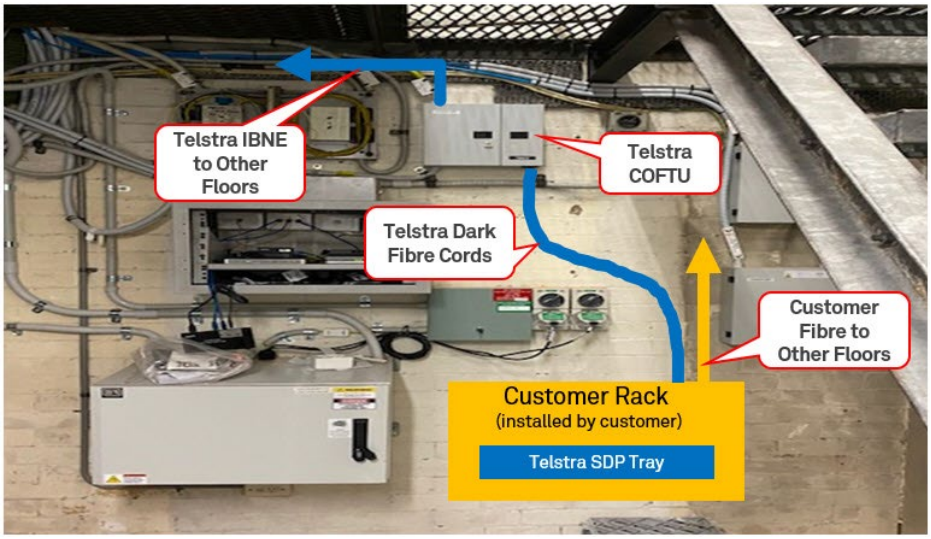
Figure 7 – NBC half and Full Height racks, SDP spliced pigtail

Business Premise

Business Premise include single and multiple level buildings.



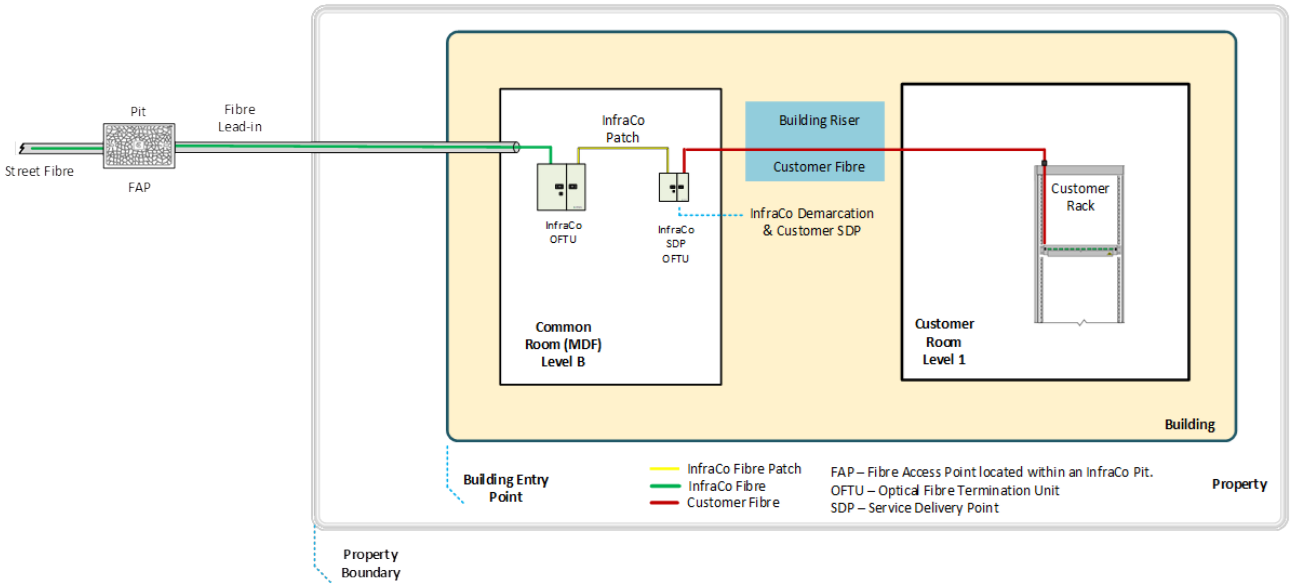
Common Area



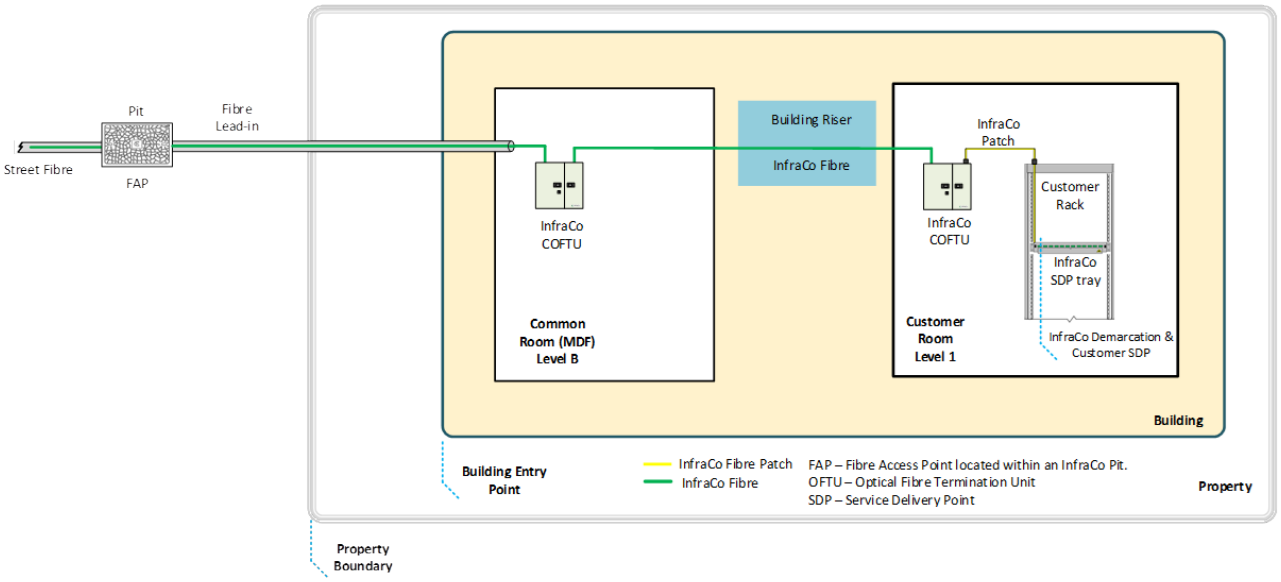
1. Network Boundary / Service Delivery Point is in the common area / main distribution frame (MDF) normally located in the basement or ground floor .
2. The fibre service would typically be presented in a SDP tray installed in a customer equipment rack within the common area.
3. To access upper floor or rooftop COFTU two options can apply:
   A. The customer can organise and deliver fibre from the common area / MDF to their rack.
   B. Telstra can provide for a charge the In-Building Network Extension (IBNE). Once a field visit has been completed and the height, length and path calculations have been completed, a quote for for building cable extension will be emailed to you for approval prior to work commencing.

Telstra InfraCo Demarcation Diagrams – Business Premise

InfraCo demarcation and SDP in Common area.



InfraCo demarcation and SDP in Customers area.



Chapter 7
Laser Safety and Power Limits of Customer Equipment

Customer **must** ensure that any Customer Equipment connected to a Telstra Dark Fibre:

1. complies with the **laser safety** requirements specified in:

ITU-T Specification G.664	*Optical safety procedures and requirements for Optical transport systems;*
IEC 60825-1	*"Safety of Laser Products - Equipment Classification and Requirements". (Australian Standards - AS/NZS 2211.1:2004);*
IEC 60825-2	*"Safety of Optical Fibre Communication Systems". (Australian Standards - AS/NZS 2211.2:2006);*
AS/NZS 60950	*(Safety of Information Technology Equipment); and*
AS/NZS 2967:2010	*"Optical fibre communication cabling systems safety";*

2. is fitted with an **automatic power reduction** system which will, **in the event of a break** in the optical path of the Telstra Dark Fibre, automatically turn off or reduce the power of the emitting lasers in the system in such a way as to ensure that the accessible emission level of laser radiation at any stage of operation on or with a Telstra Dark Fibre at any point (including commissioning and maintenance situations) **does not exceed Class 1M levels** (as defined in IEC 60825-1). [See also Section 9 – Optical Fibre Safety Procedures]; and
3. does not at **any time** exceed a maximum transmitted optical power level of **500mW**, and
4. does not exceed the location Hazard level of Class 1M (as defined in IEC 60825-2) at any point in the fibre link, under normal or fault conditions (even when a fibre break occurs).

Chapter 8
Patch Cords

Customer or their Data Centre operator is responsible for providing and maintaining any optical patch cords required to connect from the Telstra Dark Fibre termination point (the Optical Connector at the Service Delivery Point) to the Customer's private optical transmission equipment.

Patch cords must be designed to connect with Telstra's Optical Connector at the Service Delivery Point. Simplex patchcord cables conforming to IEC 60794-2-50 are generally suitable for this purpose.

Chapter 9
Optical Fibre Safety Procedures

Telstra expects the customer or their suppliers to enforce appropriate fibre safety handing procedures.

9.1. Live Working

“Live working” on fibres for maintenance should only be performed when the radiation level from the live fibre end is Class 1 or Class 1M at the point of live work. Customer must ensure that the laser radiation at the point of work falls within this classification.

Co-ordination between Telstra fibre repair teams and Customer personnel may be necessary to ensure safe power levels within Class 1M is achieved during the maintenance work (when necessary)

It is preferable to work with **no** power propagating in the fibre where this is possible.

9.2. Use of Optical Fibre Viewing Devices

Commercially available **video fibre scopes** (e.g. JDSU P5 or similar) may be used by Customer personnel for viewing fibre connector endfaces at equipment optic ports, optical patch panels, connectorised cable tails or anywhere there is a possibility of laser radiation being present. Inspecting fibre endfaces via a video scope is considered safe because the image is viewed indirectly on a PC/Laptop screen or LCD display. Thus a video fibre scopes is the preferred method of inspection of all connector ends irrespective of whether any laser radiation is present or not.

Chapter 10
References

Document	Title
AS/NZS 60950	Safety of Information Technology Equipment
CISPR22	Information technology equipment - radio disturbance characteristics - limits and methods of measurement
IEC 61754-4	Fibre Optic Connector Interfaces – Part 4: Type SC Connector Family
IEC 60825-1	Safety of Laser Products - Equipment Classification and Requirements (Australian Standards - AS/NZS 2211.1:2004)
IEC 60825-2	Safety of Optical Fibre Communication Systems (Australian Standards - AS/NZS 2211.2:2006)
IEC 60794-2-50	Optical fibre cables - Part 2-50: Indoor cables - Family specification for simplex and duplex cables for use in terminated cable assemblies
IEC 61300-3-35	IEC standard for failure thresholds that define defects limits for each zone on fibre connector endfaces for single-mode and multimode connectors
IEC 61754-4	Fibre Optic Connector Interfaces – Part 4: Type SC Connector Family
ITU-T Rec G.652	Characteristics of a single-mode optical fibre and cable
ITU-T Rec G.654	**Characteristics of a cut-off shifted, single-mode optical fibre and cable**
ITU-T Rec G.655	**Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable**
IEC/TR 60825-14	**Safety of Laser Products – Part 14: A user's guide Issue 2011 and future updates**

Chapter 11
Definitions

In the event of an inconsistency between this TSIS and the Agreement, the Agreement will prevail to the extent of these inconsistencies.

In this TSIS, unless the contrary intention appears:

1. terms not defined in this TSIS, but which are defined in the Agreement have the same meaning in this TSIS; and
2. the following words have the meanings set out below.

Agreement means the Telstra Enterprise Agreement entered into by Telstra and the Customer.

Carrier has the meaning given by section 7 of the Telecommunications Act.

Customer means the legal entity that acquires the Service from Telstra under the Agreement.

Exchange means a building housing telephone switching equipment of Telstra.

IBNE means In-Building Network Extension cable.

IEC means International Electrotechnical Commission

Metro means the classification given to each ESA in the ESA List for the purposes of determining some of the Charges for the Service.

Network, means a system, or series of systems, that carries, or is capable of carrying communications by means of guided or unguided electromagnetic or optical energy.

ODF means Optical Distribution Frame

SC means standard connector

SCAPC means SC type angled physical contact.

Service Delivery Point means the location at which the Service terminates and is available for interconnection with Customer private equipment.

Telstra means Telstra Corporation Limited

TSIS means this Telstra Service Interface Specification.

Un-lit means a passive fibre bearer i.e. one which does not intrinsically include and is not at the time of delivery attached to, any form of optical light source.