

Chorus UFB Services Agreement Bitstream Services: Service Description for Bitstream 10GPON Field Trial

This service description describes the Bitstream 10GPON product variant available for the 10GPON Field Trial, which includes a configurable Open Access Gateway function that is remotely configured and managed by the Service Provider and/or End User.

The launch variant will allow Service Providers to consume 10GPON Access-EVPL Bitstream services with or without the Open Access Gateway function.

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1 Interpretation

- 1.1 References to clauses or sections are references to clauses or sections in this Service Description unless expressly provided otherwise. The definitions set out in the General Terms and the Operations Manual apply to this Service Description unless expressly provided otherwise.
- 1.2 References to the Operations Manual are references to the operations manual for the Bitstream Services.

2 The Bitstream 10GPON Service

- 2.1 The Bitstream 10GPON Service is a single class Bitstream service suitable for accessing a wide range of internet and bespoke applications and content delivered over a point to multipoint fibre access. Bitstream 10GPON is part of the UFB family of Bitstream services, E.g.

Bitstream 2	Based on the TCF Mass Market service.
Bitstream 2 Accelerate	Based on the TCF Mass Market service with enhanced low priority options.
Bitstream 10GPON	Based on the TCF Mass Market service, using XGS-PON technology.
UFB Handover Connection	Based on the TCF E-NNI specification.

- 2.2 A diagram of the configuration for the Bitstream 10GPON Service is set out in Appendix A. The Bitstream 10GPON Service provides a single Access-Ethernet Virtual Private Line (Access-EVPL) that connects an Open Access Gateway function in a XGS-ONT at the End User Premises to a UFB Handover Connection Service located at the POI that enables a Service Provider to access and interconnect with the LFC Network.
- 2.3 The Bitstream 10GPON Service is an input service which a Service Provider can combine with other LFC services (or with the Service Provider’s own network or wholesale services provided by other service providers) to provide fibre based telecommunications services to End Users.
- 2.4 The following features are not available for the field trial, but are expected to be available post field trial:
 - 2.4.1 A Bitstream 2-like Access-EVPL Bitstream service that connects a UNI in the End User premises to a single VLAN on a UFB Handover Connection service located at the POI;
 - 2.4.2 A Bitstream 2-like Access-EVPL Bitstream service that connects a WiFi UNI in the End User premises to a single VLAN on a UFB Handover Connection service located at the POI;

- 2.4.3 A Bitstream 3a-like Access-EPL Bitstream service that connects a UNI in the End User premises to a single S-VLAN on a UFB Handover Connection service located at the POI,
 - 2.4.4 The option to create modified or new Service Templates using 'core building blocks' and the Product Development Process.
 - 2.4.5 High Traffic Class of service, if there is demand;
 - 2.4.6 SFP UNI, to support 10GPON in Smart Locations and Data Centres (likely 2020); and
 - 2.4.7 Other features, if requested
- 2.5 The Bitstream 10GPON Service has the following key characteristics:
- 2.5.1 The Bitstream 10GPON Service includes an Open Access Gateway function combined with a single Access-EVPL Bitstream service delivered over XGS-PON. In particular:
 - (a) A Open Access Gateway function in the XGS-ONT located at the customer premises that Service Providers can remotely configure as an Residential Gateway (RGW) using TR-069; and
 - (b) An Access-EVPL Bitstream service that provides connectivity between the Open Access Gateway function and a single VLAN located on the E-NNI;
 - 2.5.2 Support for Low Priority Class of Traffic only
 - 2.5.3 One Service Template is offered initially. Clause 3.9 provides an overview of the Service Templates that are offered with the field trial;
 - 2.5.4 Supports untagged frames at the Open Access Gateway function physical interfaces. .
 - 2.5.5 Inserts Circuit ID information in DHCP (Version 4) and PPPoE traffic upstream.

3 Bitstream 10GPON Service and implementation activities

Installation Services

- 3.1 The Bitstream 10GPON Field Trial is only available to sites with an existing GPON ONT that has been installed as per the installation process in the operations manual;
- 3.2 The Bitstream 10GPON Trial Service includes a standard migration from GPON to XGS PON, which includes:
 - 3.2.1 Remove of the current GPON ONT and fibre pigtail;

- 3.2.2 Supply of the XGS-ONT and the supply and connection of a fibre pigtail between the ITP and the XGS-ONT. The XGS-ONT has a different footprint to the GPON ONT and will not be wall mounted.

Termination Point

- 3.3 The Bitstream 10GPON Layer 1 and Layer 2 termination points are set out in the Operations Manual for GPON, except that the Customer Premises Layer 2 termination point is internal to the XGS-ONT. The Open Access Gateway function termination points are the physical ports on the XGS ONT.

Testing

- 3.4 The LFC will test the Fibre Lead-in from the termination point at the Premises, as referred to in the Operations Manual, to the Central Office where the access node is located to ensure the fibre is within the technical specification for fibre set out in Appendix B.
- 3.5 The LFC will perform a functional test of the Bitstream 10GPON Service at the Open Access Gateway function termination point at the Premises.

Additional Services

- 3.6 If the Service Provider requires additional services such as:
- (a) any Premises wiring services; or
 - (b) installation and testing of Service Provider equipment and services,
- Then the LFC may be able to provide items (a) and (b) on request subject to terms to be agreed between the LFC and the Service Provider.
- 3.7 For the field trial, installation may include reconfiguration of existing CPE or the Open Access Gateway to get optimal use from the 10GPON services. This could include activities such as:
- (a) Setting up WiFi to allow devices to connect to the Open Access Gateway function;
 - (b) Setting up the existing RGW in bridge mode;

Core Bitstream 10GPON Service

- 3.8 The core Bitstream services provided as part of the Bitstream 10GPON Service are as follows:
- 3.8.1 One Access-EVPL, consisting of:
- (a) An Open Access Gateway function on the XGS-ONT at the End User Premises;
 - (b) A single 802.1q VLAN (CE-VLAN) terminating on the Open Access Gateway function;

- (c) A single 802.1ad VLAN (Service VLAN ID/ Customer VLAN ID) on the E-NNI at the POI.
 - (d) A QOS bandwidth profile that describes how traffic is carried between the Open Access Gateway and the E-NNI.
- 3.8.2 The Open Access Gateway function has the following key attributes:
- (a) All features and functions can be configured or managed by:
 - (a) the Service Provider using in-band TR-069; or
 - (b) the End User through a Web Portal accessed via LAN ports;
 - (b) One RJ-45 10 Gbps Ethernet LAN port that supports 100M/1G/2.5G/5G/10Gbps auto negotiation;
 - (c) Four RJ-45 10/100/1000 Ethernet LAN port with auto negotiation and MDI/MDIX auto sensing;
 - (d) Concurrent 802.11n 3x3 MIMO in 2.4GHz and 802.11ac 4x4 MIMO in 5GHz with support for multiple SSIDs;
 - (e) Two POTS ports for carrier grade voice services. These will not have NZ tones or number plans and are not recommended for use;
 - (f) Two USB 3.0 ports, accessible to all LAN devices;
 - (g) A standard RGW feature-set, see Appendix C for more information.
- 3.8.3 The maximum bandwidths obtainable by an End User are limited by the physical connection speed they connect to the XGS-ONT:
- (a) CPE will connect to the 10 Gbps Ethernet Port at 100Mbps, 1Gbps, 2.5Gbps, 5Gbps or 10Gbps using auto negotiation.
 - (b) CPE will connect to the 1 Gbps Ethernet Port at 10 Mbps, 100Mbps or 1Gbps using auto negotiation;
 - (c) Peak TCP/IP throughput is typically 80-90% of the physical connect speed due to higher-layer packet encapsulation, Ethernet preamble, frame delimiters and inter-frame gaps.
 - (d) WiFi connect speed could vary significantly due to the number, type and proximity of the devices, internal premises topography, physical premises characteristics and similar factors;
 - (e) Service speeds below 10Gbps include a bandwidth overhead for Low Priority to compensate for higher protocol encapsulation overheads. The size of the overhead is calculated as follows:

- (a) 8.5% overhead in Low Priority downstream, e.g. 1085 Mbps for a 1000 Mbps headline bandwidth;
- (b) 15% overhead in Low Priority upstream, e.g. 1150 Mbps for a 1000 Mbps headline bandwidth;
- (c) These overheads would not be observable to a device that is connected to the Open Access Gateway function at a physical line rate below this speed, i.e. a CPE device connected to a 1 Gbps port will be limited to the 1 Gbps physical connection speed;

This maximum bandwidth does not guarantee End Users will observe this speed for sustained periods as their experience is dependent on a number of external factors including, but not limited to, End User applications and local network, the Service Provider network and the location of the content they are accessing. This is particularly true for higher speeds (> 1 Gbps).

3.8.4 The QOS bandwidth profiles are low traffic class only, where:

- (a) Tagged traffic sent from the Service Provider are treated as follows:
 - (a) Frames tagged with PCP = 5 will be treated as High Traffic Class and discarded;
 - (b) Frames tagged with PCP = 0 will be treated as Low Traffic Class.
 - (c) Frames tagged with PCP = 1, 2, 3, 4, 6 or 7 will be remarked as PCP 0 and treated as Low Priority.
 - (d) Frames will be treated as follows:

Type	Ingress	Transport
Low Traffic Class	CIR = 0 EIR ≥ 0 Policed at ingress based on CBS/EBS	Queued and weighted fairly under congestion conditions Frames classified as EIR dropped first
High Traffic Class	CIR = 0 EIR = 0 Policed at ingress based on CBS	Discarded

- (e) Downstream traffic class is determined using the s-tag PCP setting although it is recommended that both the s-tag and c-tag is set to the same value.
 - (b) The Open Access Gateway function ports are untagged by default, but can be set to tagged via TR-069 or the End User GUI. All frames upstream from the Open Access Gateway function will be encapsulated and tagged with PCP = 0 and treated as Low Priority;
- 3.9 The Bitstream 10GPON Service includes the options, exercised by Service Request, to:
- 3.9.1 Enable Circuit ID, as specified in Broadband Forum TR-101/TR-156, per tail. If this feature is requested TR-101 information will be embedded in DHCP and PPPoE traffic.
 - 3.9.2 The following initial Service Templates are available:
 - (a) 10GPON Fibre 10-10, supporting 10Gbps Low Traffic Class bandwidth upstream and 10 Gbps Low Traffic Class bandwidth downstream;
 - 3.9.3 Further Service Templates may be developed in future to facilitate the availability of other bandwidth profiles built from separate building blocks which are detailed in clause 3.11 below.
- 3.10 The Bitstream 10GPON Service has similar characteristics to the other services within the UFB family of Bitstream services as identified below:

Attribute	Bitstream 2 Accelerate	Bitstream 10GPON
Bitstream	Access-EVPL	Access-EVPL
High Priority	Yes	No
Low Priority	Yes	Yes
Service Bandwidths	Low Class from 30/10 Mbps up to 1000/500 Mbps Low Priority + High Priority CIR up to 100/50 Mbps	Low Class from 1/1 Gbps up to 10/10 Gbps
MTU	2000 Bytes	2000 Bytes
MAC addresses	16	16
Number of available Ports	4 UNI standard 1 per Offer	1 x 10Gbps port 4 x 1 Gbps port WiFi

Attribute	Bitstream 2 Accelerate	Bitstream 10GPON
L2CP support	No	No
Diversity	No	No

Open Access Gateway function – NNI characteristics

- 3.10.1 There is one Open Access Gateway function per XGS ONT and thus the 10GPON field trial supports one Service Provider per Field Trial connection;
- 3.10.2 The sum of traffic profiles of all services delivered at a UFB Handover Connection Service can exceed the UFB Handover Connection Service line rate. If there is insufficient line rate to deliver the traffic then frames will be randomly discarded, based on their Class of Service precedence, and Service Levels for that Class of Service do not apply.

New Service Template Options (Not available for Field Trial)

3.11 A Service Provider may request that the LFC creates additional Service Templates as follows:

- 3.11.1 Following the field trial, additional Service Templates can be created using combinations of one more of the following set of standard building blocks:
 - (a) Point-to-Point single VLAN Ethernet Bitstream service (Access-EVPL) service using High and Low Traffic Class combinations as set out in the Service Description for the Bitstream 2 Accelerate Service. Multiple Access-EVPLs can be configured on the same or on different UNIs;
 - (b) Point to Point transparent VLAN (Access-EPL) service using High or High and Low Traffic Class combinations as set out in the Service Description for the Bitstream 3 Accelerate Service or the Bitstream 3a Accelerate Service noting that Access-EPL and Access-EVPL VLANS must be on separate UNIs;
 - (c) Multicast VLAN Ethernet Bitstream service (EMA) using High Traffic Class (CIR) only as set out in the Service Description for the Multicast Service;
 - (d) Open Access Gateway function, as described in this service description. Only one Open Access Gateway function is available per XGS-ONT. ATA Voice is only available with the Open Access Gateway function. Ports utilised by Open Access Gateway function are not available as Bitstream UNIs;
 - (e) UNI (10G Base-T) port;
 - (f) UNI (100/1000 Base-T) port;

- (g) WiFi; and
 - (h) Other services or attributes requested by the Service Provider and agreed by the LFC.
 - 3.11.2 Following the field trial, Ethernet Bitstream services consisting of High and Low Traffic Class bandwidth combinations can be created using the following standard building blocks:
 - (i) High Priority CIR in increments of 2.5 Mbps upstream and/or downstream;
 - (j) Low Priority CIR in increments of 2.5 Mbps upstream and/or downstream; and
 - (k) Low Priority EIR in increments of 10 Mbps upstream and/or downstream.
 - 3.12 Non Open Access Gateway function Bitstream Service Templates can be added as primary or secondary Service Templates and have the following characteristics:
 - 3.12.1 Primary Service Templates does not require the End User connection to consume any other Service Templates in order for the services to be provided.
 - 3.12.2 Secondary Service Templates can be added as an additional service to an End User who is already consuming one or more Primary Service Templates.
 - 3.12.3 If the primary Service Template is removed from an End User connection and one or more secondary Service Templates remain, then either a secondary Service Template needs to be changed to a primary Service Template, or all of the secondary Service Templates will be removed by the LFC.
 - 3.13 Requests for additional Service Templates will be implemented and delivered through the Product Development Process. The Product Development Process includes determination of pricing, development, testing and implementation.
 - 3.14 The LFC will comply with the Service Provider's request under clause 3.11 in a timely manner. In the event that demand for new Service Templates exceeds the LFC's capacity to deliver the new Service Templates then the LFC may prioritise the Service Template requests in accordance with the Operations Manual.
- Operations, Administration and Maintenance*
- 3.15 The Bitstream 10GPON Service will support Service Provider remote access to the XGS-ONT via a service management gateway for appropriate management. A Service Provider may request particular management attributes via the Product Development Process. This feature is not available for the field trial.

- 3.16 The Open Access Gateway (OAM) function and WiFi can be configured remotely by the Service Provider, using an Auto Configuration Servicer (ACS) and TR-069, or locally by the End Customer via a Web GUI.

Service Requirements

- 3.17 To use the Bitstream 10GPON Service the Service Provider must have the capability to access and interconnect with it, by one of the following:
- 3.17.1 co-locating Service Provider equipment at the POI using the UFB Handover Connection Service and Central Office and POI Co-location Service;
 - 3.17.2 connecting to third party co-location space at the POI using the UFB Handover Connection Service, and with the third party taking the Central Office and POI Co-location Service;
 - 3.17.3 connecting to a backhaul service at the POI; or
 - 3.17.4 by using the Direct Fibre Access Service to connect to Service Provider equipment at a remote location within the Central Office area.

The location of the POIs is detailed in the Operations Manual appendices. Bitstream 10GPON may not be available in all locations

Additional Service Characteristics

- 3.18 The technical specification of the Bitstream 10GPON Service is set out in Appendix B.
- 3.19 The LFC will provide certain support and other assistance as part of the Bitstream 10GPON Service Field Trial including:
- 3.19.1 a facility for submitting Service Requests;
 - 3.19.2 a facility for fault notifications; and
 - 3.19.3 Trial requirements to assist the Service Provider in determining the location and availability of the Bitstream 10GPON Service Field Trial (pre-qualification),

each as more particularly set out in the trial agreement.

- 3.20 The Bitstream 10GPON Service specifically excludes:
- 3.20.1 the UFB Handover Connection Service;
 - 3.20.2 provision or maintenance of any cabling or connection or active device:
 - (l) beyond the Service Demarcation Points described in clauses 4.1 and clause 5.1; and
 - (m) between the jack terminating the LFC provided Fibre Lead-in and the XGS ONT where that cabling or connection is not provided by the LFC and the LFC has not agreed to take responsibility for that cabling or connection;

- 3.20.3 configuration, monitoring, operation, on-going support or maintenance of Service Providers' or End User's applications, equipment or networks; and
- 3.20.4 supply of AC mains & UPS power, accommodation space, heating, ventilating, and air conditioning and facilities at the POI or End User Premises.

4 Service Demarcation Point at End User Premises or Service Provider Premises or NBAP (as applicable)

- 4.1 The Service Demarcation Point at the End User Premises is the physical 1G or 10G ports or WiFi ports on the XGS ONT.
- 4.2 The Bitstream 10GPON Service excludes the End User Premises wiring. If a fault reported by the Service Provider is found to be caused by the End User Premises equipment (CPE) or the wiring at the End User Premises beyond the Service Demarcation Point, then the Service Provider may be charged the "No fault found" Ancillary Charge in the Price List. Note the wiring should comply with the industry standard Premises wiring requirements which are available at www.tcf.org.nz.

5 Service Demarcation Point at POI

- 5.1 The Bitstream 10GPON Service is delivered as a single VLAN (the logical Service Demarcation Point) per Access-EVPL on the UFB Handover Connection located at the POI.
- 5.2 The physical Service Demarcation Point is the MOFDF in the POI, which is part of the UFB Handover Connection Service.
- 5.3 The UFB Handover Connection Service is a separate service and is a prerequisite to the supply of the Bitstream 10GPON Service i.e. Service Provider's must first purchase and then continue to maintain a UFB Handover Connection Service at all times while taking the Bitstream 10GPON Service.

6 LFC and Service Provider Responsibilities

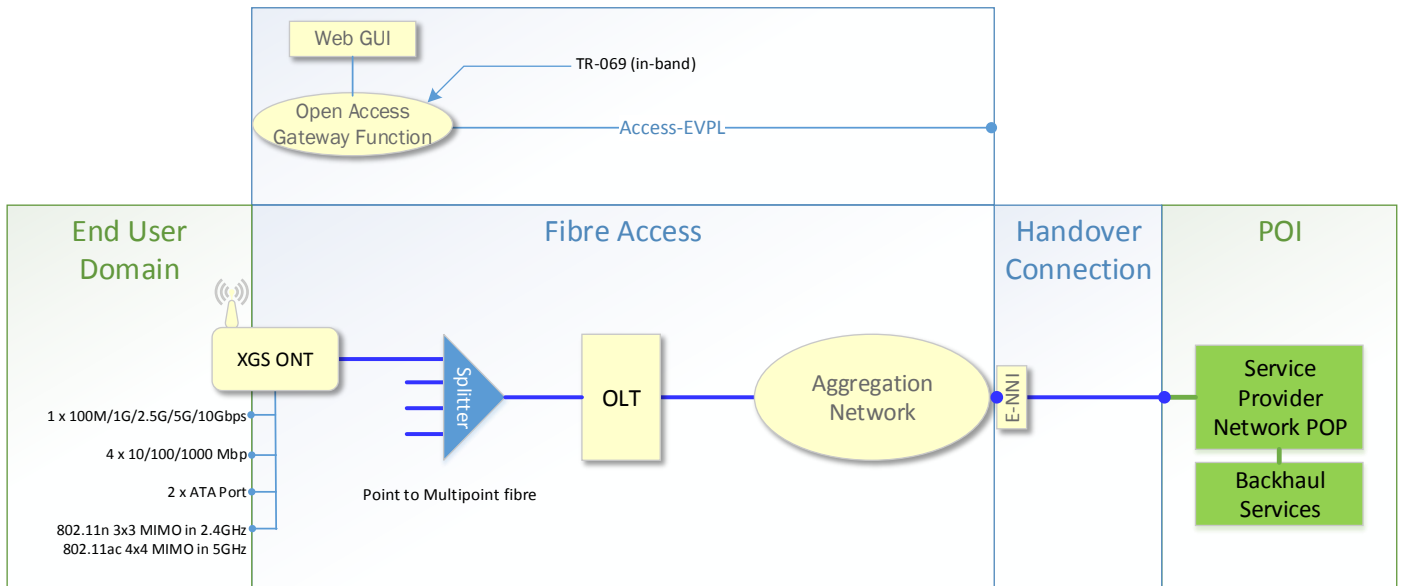
- 6.1 Other LFC and Service Provider responsibilities are detailed in the General Terms and the Operations Manual.

7 Bitstream 10GPON Service Levels

- 7.1 Service Levels for both the Layer 1 and Layer 2 components of the Bitstream 10GPON Service are set out in the Service Level Terms for the Bitstream Services, with the following exceptions:

- 7.1.1 Chorus will use reasonable endeavours to maintain a congestion free network for delivery of in-profile frames, subject to the following constraints:
- (a) Some inter-nodal or uplinks between OLT and the UFB Handover Connection may be constrained to 10 Gbps and may be shared by multiple customers based on standard lag hashing algorithms;
 - (b) The XGS PON is not part of the congestion free network. It provides 10 Gbps upstream and 10 Gbps downstream, shared by 4-16 Customers;
 - (c) The UFB Handover Connection is not part of the congestion free network and Service Providers need to manage contention to ensure maximum performance;
 - (d) Connectivity between the Open Access Gateway function and the End User CPE is not part of the congestion free network.
- 7.2 It is the responsibility of the End Customer to connect their CPE to the Open Access Gateway function, either via the 10Gbps Ethernet Port, a 10/100/1000 Mbps Ethernet Port or via WiFi. Chorus will use reasonable endeavours to resolve any connectivity performance issues but if an assure truck roll is requested and no fault is found with either the Chorus network equipment or connectivity within the Chorus network then a No Fault Found charge may be applied.
- 7.3 All ancillary service levels are reasonable endeavours, subject to resource availability;

Appendix A – Diagram



This is a generic diagram showing the standard configuration and Service Demarcation Points. It is not intended to represent every situation or detailed physical architecture. The following points should be noted:

- The Bitstream 10GPON Service and pricing applies between:
 - the interfaces on the Open Access Gateway function in the XGS-ONT located at the Customer Premises; and
 - The logical interface (VLAN) on the E-NNI at the POI.
- Service Levels (availability, network performance) apply from the physical interfaces on the XGS ONT located at the Customer Premises to the E-NNI at the POI.
- Access node and aggregation interconnection may use redundant links to meet Service Level requirements.

The Bitstream 10GPON Trial services supports a single Access-EVPL OVC that connects the Open Access Gateway function located in the ONT with a VLAN located at the E-NNI.

Future Bitstream 10GPON services are expected to support the delivery of multiple Service Templates from the same or different Service Providers, with one Open Access Gateway function

Appendix B – Technical Specification

Technical Specification	
Ethernet	Ethernet II or 802.3 untagged interface
Open Access Gateway function ports	ONT supports: <ul style="list-style-type: none"> • 1 x 100M/1G/2.5G/5G/10GBase-T RJ-45 port; • 4 x 10/100/1000Base-T RJ-45 ports; • 2 x ATA Port; • 802.11n 3x3 MIMO in 2.4GHz 802.11ac 4x4 MIMO in 5GHz • 2x USB 3.0 ports
UFB Handover Connection (E-NNI)	Ethernet: <ul style="list-style-type: none"> • 802.1ad VLAN (SVID, CVID); or • Double tagged QnQ.
VLAN	Point-to-Point (Access-EVPL, between v RGW function and E-NNI) MTU 2000 Bytes Unicast Frame Delivery = passed within service CIR/EIR Multicast Frame Delivery = passed within service CIR/EIR Broadcast Frame Delivery = passed within service CIR/EIR Layer 2 Control Protocols Processing = Initially none (but may be amended by LFC from time to time)
Fibre	External fibre must comply with ITU-T specification G.652D or 657A. Internal building fibre cables must meet appropriate fire regulations i.e. be Flame-Retardant, Non Corrosive, Low Smoke, Zero Halogen (FRNC/LSZH).
Connector Type	Fibre terminations must be SC/APC type connectors (complying with the IEC 61754-4 standard) or alternatively LC/APC also known as LCA type connectors (complying with the IEC 61754-20 standard) as appropriate.
Optic Path	Laser types and path characteristics are expected to be designed to a minimum standard which are contained in either IEEE 802.3 Section 5 standard or ITU-T G.984 standards.

Technical Specification	
Fibre Testing Layer 1	<p>All commissioning Layer 1 network testing (LFC site OFDF to end of Communal Network) is by OTDR at two wavelengths, 1310nm and 1550nm using Bi-Directional method in accordance with Chorus standard described in ND0556.</p> <p>The methodology used will be based on bi-directionally testing all fibres in the Communal Network required to complete the service.</p> <p>Network test results are provided by agreement verifying performance features. Refer to the Direct Fibre Services Operations Manual for details.</p> <p>All Layer 1 network restoration testing will be LFC site OFDF to Premises termination point.</p> <p>Testing for power loss will be at either 1310 or 1550 nm and for the 10GPON at 1277nm and 1578nm.</p> <p>In the event of a fault restoration testing will be to the standard in Optical Performance table below.</p> <p>The wavelengths of 1625 nm and 1650nm are reserved for network maintenance testing purposes, (live GPON network) compliant with ITU-T L.41.</p>

Technical Specification	
Optical Path performance	<p>Communal Network performance</p> <p>Total PON Insertion Loss (ITU-T G984) = $\leq 28.5\text{db}$</p> <p>Network Return Loss = $\geq 32\text{db}$</p> <p>LFC PON system margin (lifetime ageing factor) = 1.5db</p> <p>Total PON insertion Loss OLT to ONT design target is = $\leq 27.0\text{db}$ ($28.5\text{db} - 1.5\text{db}$)</p> <p>Optical Fibre Attenuation Co-Efficient (L) (ITU-T G.652. & G657.A) = $\leq 0.4\text{db/km}$</p> <p>Splice Loss (S) = $\leq 0.15\text{db}$</p> <p>Mated Connector loss (C) = $\leq 0.3\text{db}$</p> <p>Mated Connector Reflection = $\geq 55\text{db}$</p> <p>Total Insertion Loss of network (IL) is calculated from $IL = 0.4L + 0.15S + 0.3C$ (excluding PON splitter)</p> <p>Splitter performance</p> <p>1:64 = $\leq 20\text{db}$</p> <p>1:32 = $\leq 17\text{db}$</p> <p>1:16 = $\leq 14\text{db}$</p> <p>1:8 = $\leq 11\text{db}$</p> <p>1:4 = $\leq 7.3\text{db}$</p> <p>1:2 = $\leq 4.0\text{db}$</p> <p>10GPON components</p> <p>Co-existence module XGS-GPON-Common = $\leq 1.1\text{db}$</p>
Network Testing Layer 2	<p>Network test results will be limited during the field trial.</p> <p>Bitstream 10GPON PON diagnostics are not available through Check Mate or Line Test API</p>

Appendix C – Open Access Gateway function Specification

Open Access Gateway function Configuration and Management	TR-069 Web GUI management
Physical Interfaces	10 Gbps interface supports 100M/1G/2.5G/5G/10Gbps auto negotiation Four RJ-45 10/100/1000 Ethernet port with auto negotiation and MDI/MDIX auto sensing Two POTS ports for carrier grade voice services Two USB 3.0 ports, accessible to all LAN devices
WiFi	Concurrent 802.11n 3x3 MIMO in 2.4GHz and 802.11ac 4x4 MIMO in 5GHz 64/128 WEP encryption WPA, WPA-PSK/TKIP WPA2, WPA2-PSK/AES Multiple SSIDs
ONT Characteristics	Built-in layer 2 switch; Line Rate L2 traffic 512M RAM and 256M Flash WLAN on/off push button WPS on/off button
Ethernet	Traffic classification and QoS capability VLAN tagging/detagging and marking/remarking of IEEE 802.1p per Ethernet port. Forward Error Correction (FEC) Frame Check Sequence (FCS) error counter Ethernet-based Point-to-Point (PPPoE) Traffic classification and QoS capability Routed mode per LAN port

<p>ATA Voice</p> <p><i>Note that the ATA Voice service will not have NZ tones or number plans and use of ATA is not recommended.</i></p>	<p>SIP voice support</p> <p>Multiple voice Code</p> <p>DTMF dialling</p> <p>Echo cancellation (G.168)</p> <p>Fax mode configuration (T.30/T.38)</p> <p>Caller ID, call waiting, call hold, 3-way calling, call transfer, message waiting</p>
<p>Open Access Gateway functions</p>	<p>Triple-Play services, including voice, video and high speed Internet access</p> <p>IP video distribution</p> <p>DHCP client/server</p> <p>DNS server/client</p> <p>DDNS</p> <p>Port forwarding</p> <p>Network Address Translation (NAT)</p> <p>Network Address Port Translation (NAPT)</p> <p>UPnP IGD2.0 support</p> <p>ALG</p> <p>DMZ</p> <p>IGMP snooping and proxy (v2/v3)</p> <p>Performance monitoring and alarm reporting</p> <p>IP/MAC/URL filter</p> <p>Multi-level firewall and ACL</p>