CHORUS

Chorus UFB Services Agreement
Bitstream Services: Service Description for
Hyperfibre

January 2022

CHORUS

Document Version History

Version	Date	Author	Description of Change
1.0	June 2021	Alan Mitford-Taylor	Initial offering.
2.0	January 2022	Alan Mitford-Taylor	Removal of CIP oversight

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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 Bitstream Services Operations Manual.

2   The Hyperfibre Service

2.1   The Hyperfibre Service is a high-speed multi-class bitstream service suitable for accessing a wide range of internet and bespoke applications and content delivered over a point to multipoint fibre access.

2.2   Hyperfibre comes in two service variants:

2.2.1   Hyperfibre 2 Service: A Bitstream 2-like Access-EVPL bitstream service that connects a UNI or Residential Gateway function in the End User premises to a single S-VLAN/C-VLAN on a UFB Handover Connection service located at the POI;

2.2.2   Hyperfibre 3a Service: 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,

where the UFB Handover Connection enables a Service Provider to access and interconnect with the LFC Network

2.3   A diagram of the configuration for the Hyperfibre Service is set out in Appendix A.

2.4   The Hyperfibre 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.

2.5   The Hyperfibre Service has the following key characteristics:

2.5.1   Support for two classes of traffic, High Traffic Class and Low Traffic Class:

Traffic Class	CIR	EIR
Low	= 0 Mbps	8000 ≥ 0 Mbps
High	100 ≥ 0 Mbps	= 0 Mbps

2.5.2   Supports tagged or untagged frames at the UNI;

2.5.3   Delivered using XGS-PON technology over the LFC's point-to-multipoint fibre;

2.6   The Hyperfibre 2 Service variant has the following key characteristics:

2.6.1   Includes an Ethernet bitstream service that allows a single VLAN to be passed transparently from the End User Premises, End User Tenancy or NBAP (as applicable) to the Service Provider.

2.6.2   Clause 3.10.3 provides an overview of the Service Templates that are initially offered, each consisting of a single Ethernet Access-EVPL bitstream OVC with a predefined bandwidth.

2.6.3   Includes an optional Residential Gateway function that allows the ONT to act as a Service Provider-managed Residential Gateway including Wi-Fi and RGW Voice.

2.6.4   Optionally inserts Circuit ID information in DHCP and PPPoE traffic upstream.

2.6.5   Is a variant of the Mass Market service specified in the TCF UFB Ethernet Access Service Description v33, 11 May 2017

2.7   The Hyperfibre 3a Service variant has the following key characteristics:

2.7.1   Includes an Ethernet bitstream service that allows up to 4093 VLANS to be passed transparently from the End User Premises, End User Tenancy or NBAP (as applicable) to the Service Provider.

2.7.2   Clause 1.1.1 provides an overview of the Service Templates that are initially offered, each consisting of a single Ethernet Access-EPL bitstream OVC with a range of predefined bandwidth options.

2.7.3   Is a variant of the Business service specified in the TCF UFB Ethernet Access Service Description v33, 11 May 2017

3   Hyperfibre Service and implementation activities

Installation Services

3.1   The Hyperfibre Service includes a Standard Install, where applicable, as set out in the Operations Manual. The LFC will provide Non-Standard Installs as an ancillary service.

3.2   The Hyperfibre Service includes a standard migration from GPON to Hyperfibre, where applicable, which includes:

3.2.1   Remove of the current GPON ONT and fibre pigtail;

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

3.2.3   Supply of XGS-PON port with its associated combiner in the LFC network; and

3.2.4   Reconfiguration, if applicable, of the Central Office fibre pigtail to enable connection to the XGS-PON port.

Termination Point

3.3   The Hyperfibre Layer 1 and Layer 2 termination points are set out in the Operations Manual.

3.4   If the Residential Gateway function is selected then the Customer Premises Layer 2 termination point is internal to the Hyperfibre ONT. The Residential Gateway function termination points are the physical ports on the Hyperfibre ONT.

3.5   Testing

3.6   The LFC will test the Fibre Lead-in from the Layer 1 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.

3.7   The LFC will perform a functional test of the Hyperfibre Service at the Layer 2 termination point at the Premises.

3.8 If the Residential Gateway function is selected then the LFC will, subject to service provider network configuration, perform a functional test of the Hyperfibre Service at the physical ports on the Hyperfibre ONT.

Additional Services

3.9 If the Service Provider requires additional services such as:

3.9.1 a Non-Standard Install, i.e. the installation of the Fibre Lead-in where there is no existing fibre cabling and the installation is outside the parameters set out in the Operations Manual;

3.9.2 any Premises wiring services; or

3.9.3 installation and testing of Service Provider equipment and services,

then the LFC may be able to provide the services in clauses 3.8.2 and 3.8.2 on request subject to terms to be agreed between the LFC and the Service Provider. The LFC will provide the Non-Standard Install referred to in clause 3.8.1 on terms as set out in this Service Description and the Operations Manual.

Core Hyperfibre Service

3.10 The core bitstream services provided as part of the Hyperfibre Service are as follows:

3.10.1 For Hyperfibre 2, One Access-EVPL, consisting of:

(a) An optional Residential Gateway function on the Hyperfibre ONT at the End User Premises;

(b) A single 802.1q VLAN (CE-VLAN) terminating on the UNI or the Residential Gateway function on the Hyperfibre ONT, as applicable;

(c) A single 802.1ad VLAN (Service VLAN ID/ Customer VLAN ID) terminating on the E-NNI at the POI.

(d) A QOS bandwidth profile that describes how traffic is carried between the UNI or Residential Gateway as applicable, and the E-NNI.

(e) Frames are classified based on 802.Q PCP flags as follows:

(i) Frames tagged with PCP = 5 will be treated as High Traffic Class;

(ii) Frames tagged with PCP = 0 will be treated as Low Traffic Class.

(iii) Untagged frames and frames tagged with PCP = 1, 2, 3, 4, 6 or 7 will be remarked as PCP 0 and treated as Low Priority.

(iv) The Residential Gateway function ports are untagged by default but can be set to tagged using by the End User using the Residential Gateway Web GUI. All frames upstream from the Residential Gateway function will be encapsulated and tagged with PCP = 0 and treated as Low Priority;

3.10.2 For Hyperfibre 3a, one Access-EPL, consisting of:

(a) A transparent VLAN (CE-VLAN) terminating on the UNI on the Hyperfibre ONT at the End User Premises;

(b) A single 802.1ad VLAN (Service VLAN ID) terminating on the E-NNI at the POI.

(c) A QOS bandwidth profile that describes how traffic is carried between the UNI and the E-NNI.

(d)   Frames are classified based on 802.Q PCP flags as follows:

(i)   Frames tagged with PCP = 1 , 2, 3, 4, 5, 6 and 7 will be treated as High Traffic Class;

(ii)   Untagged frames and frames tagged with PCP = 0 will be treated as Low Traffic Class.

(iii)   Downstream frames will use the S-tag PCP value for classification. Upstream frames will use the CE-VLAN PCP, if applicable.

3.10.3   The optional Residential Gateway function has the following key attributes:

(a)   All features and functions can be configured or managed by the End User through a Web Portal accessed via LAN ports.

(b)   A default per-Service Provider WAN Interface, configured remotely, to enable the Residential Gateway to communicate with the Service Provider Broadband Network Gateway (BNG);

(c)   One RJ-45 10 Gbps Ethernet LAN port that supports 100M/1G/2.5G/5G/10Gbps auto negotiation;

(d)   Four RJ-45 10/100/1000 Ethernet LAN port with auto negotiation and MDI/MDIX auto sensing;

(e)   Concurrent 802.11n 3x3 MIMO in 2.4GHz and 802.11ac 4x4 MIMO in 5GHz with support for multiple SSIDs;

(f)   Two POTS ports for carrier grade voice services configured with NZ tones and number plans. Voice frames are classified as High Traffic Class, and carried in-band with user data on the Access-EVPL. ;

(g)   Two USB 3.0 ports, accessible to all LAN devices;

(h)   An Access-EVPL bitstream service that provides WAN connectivity between the Residential Gateway function and a single VLAN located on the E-NNI;

(i)   A standard RGW feature-set, see Appendix C for more information.

3.10.4   The maximum bandwidths obtainable by an End User are limited by the physical connection speed they connect to the Hyperfibre ONT as detailed below:

(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)   Hyperfibre 2 Service speeds include a bandwidth overhead for Low Traffic Class to compensate for higher protocol encapsulation overheads. These overheads would not be observable to a device that is connected 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;

(f)   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.

3.10.5   The QOS bandwidth profiles treat frames as:

Type	Ingress	Transport
Low Traffic Class	CIR = 0 Mbps EIR = 0 - 8000 Mbps Policed at ingress based on EIR/EBS	Queued and weighted fairly under congestion conditions
High Traffic Class	CIR = 0 - 100 Mbps EIR = 0 Mbps Policed at ingress based on CIR/CBS	Strictly prioritised

3.11   The Hyperfibre Service includes the options, exercised by Service Request, to:

3.11.1   Enable Residential Gateway function, as per 3.9.3;

3.11.2   Enable Circuit ID, as specified in Broadband Forum TR-101/TR-156, per Hyperfibre 2 tail. If this feature is requested then Product Instance and TR-101 information will be embedded in DHCP and PPPoE traffic.

3.11.3   The Table 3.10.3 lists the initial Hyperfibre Service Templates are available:

3.11.4   Hyperfibre also supports a number of lower speed templates. These avoid the need for a truck roll where Customers on a Hyperfibre ONT want to move to a lower speed template plan, e.g. where a Customer have has moved into a new premises that has an intact Hyperfibre ONT. If a Customer wants a Bitstream 2/3/3a template not on this list, then they will need a truck roll a truck roll will be required to replace the Hyperfibre ONT with a standard GPON ONT.

3.11.5   Hyperfibre supports the Bitstream 2 templates listed in Table 3.10.5. These are identical to Bitstream 2 templates, apart from the following:

      (a)   ATA Voice is not supported.

      (b)   RGW Voice is supported in RGW mode only.

      (c)   If RGW mode is selected, then the Hyperfibre RGW function will be used. This has slightly different characteristics than the GPON RGW.

      (d)   The Max offer includes a bandwidth overhead, allowing Customers to observe speeds up to 1 Gbps.

3.11.6   Hyperfibre supports the Bitstream 3 templates listed in Table 3.10.5. These are identical to Bitstream 3a templates, apart from neither ATA Voice nor RGW Voice not being supported:

3.11.7   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 3.12.1 below.

Table 3.10.3														
Template	**Headline Rates [1]**				**Low Traffic Class PIR[2] (Gbps)**		**Low Traffic Class[6]**				**High Traffic Class[6]**			
	Low (Gbps)		**High (Mbps)**				**EIR**	**EBS**	**CIR**	**CBS**	**EIR**	**EBS**	**CIR**	**CBS**
	Down	**Up**	**Down**	**Up**	**Down**	**Up**	**Mbps**	**kB**	**Mbps**	**kB**	**Mbps**	**kB**	**Mbps**	**kB**
Home Hyperfibre2000[3]	2	2	0	0	2200	2200	2200	550	0	0	0	0	2.5	3.2
Small business Hyperfibre2000[4]	2	2	2.5	2.5	2200	2200	2200	550	0	0	0	0	2.5	32
Business Hyperfibre2000[4] Education Hyperfibre2000[5]	2	2	10	10	2200	2200	2200	550	0	0	0	0	10	32
			20	20			2200	550	0	0	0	0	20	32
			50	50			2200	550	0	0	0	0	50	32
			100	100			2200	550	0	0	0	0	100	63
Home Hyperfibre4000[3]	4	4	0	0	4400	4400	4400	1100	0	0	0	0	2.5	3.2
Small business Hyperfibre4000[4]	4	4	2.5	2.5	4400	4400	4400	1100	0	0	0	0	2.5	32
Business Hyperfibre4000[4] Education Hyperfibre4000[5]	4	4	10	10	4400	4400	4400	1100	0	0	0	0	10	32
			20	20			4400	1100	0	0	0	0	20	32
			50	50			4400	1100	0	0	0	0	50	32
			100	100			4400	1100	0	0	0	0	100	63
Home Hyperfibre8000[3	8	8	0	0	8400	8400	8400	2200	0	0	0	0	2.5	3.2
Small business Hyperfibre8000[4]	8	8	0	0	8400	8400	8400	2200	0	0	0	0	2.5	3.2
Business Hyperfibre8000[4] Education Hyperfibre8000[5]	8	8	10	10	8400	8400	8400	2200	0	0	0	0	10	32
			20	20			8400	2200	0	0	0	0	20	32
			50	50			8400	2200	0	0	0	0	50	32
			100	100			8400	2200	0	0	0	0	100	63

[1]   The headline rate is the Layer 2 bandwidth prior to the addition of the Low Traffic Class overhead described in section 3.9.4.

[2]   The Low Traffic Class PIR is the Layer 2 bandwidth including the addition of the Low Traffic Class overhead described in section 3.9.4.

[3]   Available for Residential Connections only.

[4]   Available for Residential or Business Connections with the appropriate Connection Charge and SLAs applying.

[5] Only available to an approved list of Education Priority Users agreed between the LFC and MBIE, provided on the LFC website and at
http://www.educationcounts.govt.nz/directories/list-of-nz-schools

[6]   EIR/EBS/CIR/CBS settings are symmetric, i.e. identical upstream and downstream.

Table 3.10.5															
	Headline Rates		Low Traffic Class PIR		Low Traffic Class Downstream				Low Traffic Class Upstream				High Traffic Class			
Template	Low	High	Down	Up	EIR	EBS	CIR	CBS	EIR	EBS	CIR	CBS	EIR	EBS	CIR	CBS
	(Mbps)	(Mbps)	(Mbps)	(Mbps)	Mbps	kB	Mbps	kB	Mbps	kB	Mbps	kB	Mbps	kB	Mbps	kB
Bitstream 2																
Evolve 100-20-2.5-2.5 hf	100/20	2.5/2.5	110	22	107.5	180	2.5	32	19.5	100	2.5	32	0	0	2.5	32
Consumer Max-500-2.5-2.5 hf	1000/500	2.5/2.5	1100	550	1097.5	250	2.5	32	547.5	180	2.5	32	0	0	2.5	32
Small Business Fibre 100-100-2.5-2.5 hf	100/100	2.5/2.5	110	115	107.5	180	2.5	32	112.5	180	2.5	32	0	0	2.5	32
Small Business Fibre Max-500-2.5-2.5 hf	1000/500	2.5/2.5	1100	550	1097.5	250	2.5	32	547.5	180	2.5	32	0	0	2.5	32
Evolve 200-20-2.5-2.5 hf	200/20	2.5/2.5	217	22	214.5	250	2.5	32	19.5	100	2.5	32	0	0	2.5	32
Bitstream 3																
Business 200 hf	200/200	2.5/2.5	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	2.5	32
	200/200	5/5	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	5	32
	200/200	10/10	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	10	32
	200/200	20/20	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	20	32
	200/200	30/30	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	30	32
	200/200	40/40	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	40	32
	200/200	50/50	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	50	32
	200/200	60/60	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	60	38
	200/200	70/70	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	70	44
	200/200	80/80	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	80	50
	200/200	90/90	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	90	57
	200/200	100/100	217	230	214.5	250	2.5	32	227.5	180	2.5	32	0	0	100	63
Business 50 hf	50/50	2.5/2.5	55	57.5	52.5	130	2.5	32	55	130	2.5	32	0	0	2.5	32
	50/50	5/5	55	57.5	52.5	130	2.5	32	55	130	2.5	32	0	0	5	32
	50/50	10/10	55	57.5	52.5	130	2.5	32	55	130	2.5	32	0	0	10	32
	50/50	20/20	55	57.5	52.5	130	2.5	32	55	130	2.5	32	0	0	20	32
	50/50	30/30	55	57.5	52.5	130	2.5	32	55	130	2.5	32	0	0	30	32
	50/50	40/40	55	57.5	52.5	130	2.5	32	55	130	2.5	32	0	0	40	32
	50/50	50/50	55	57.5	52.5	130	2.5	32	55	130	2.5	32	0	0	50	32

3.12   The Hyperfibre Service has similar characteristics to the other services within the UFB family of Bitstream services as identified below:

Attribute	Bitstream 2 Accelerate	Hyperfibre 2	Bitstream 3a Accelerate	Hyperfibre
Bitstream	Access-EVPL	Access-EVPL	Access-EVPL	Access-EVPL
High Priority	Yes	Yes, 0 or 2.5 Mbps	Yes, Selected	Yes, Selected
Low Priority	Yes	Yes	Yes	Yes
Service Bandwidths	Low Class from 30/10 Mbps up to 1000/500 Mbps High Class Priority up to 15/15 Mbps	Low Class from 2/2 Gbps up to 4/4 Gbps	Low Class from 50/50 Mbps up to 1000/1000 Mbps High Class Priority up to 100/100 Mbps	Low Class 4/4 Gbps High Class Priority up to 100/100 Mbps
MTU	2000 Bytes at ENNI 1996 Bytes at UNI	2000 Bytes at ENNI 1996 Bytes at UNI	2000 Bytes at ENNI 1996 Bytes at UNI	2000 Bytes at ENNI 1996 Bytes at UNI
MAC addresses	16	16	64	64
Number of available Ports	4 UNI standard 1 per Offer	Bridged 1 x 10Gbps UNI Residential Gateway 1 x 10Gbps port 4 x 1 Gbps port WiFi	4 UNI standard 1 per Offer	1 x 10Gbps UNI
L2CP support	No	No	No	No
Diversity	No	No	No	No
Service Levels	Standard or Enterprise	Standard or Enterprise	Enterprise	Enterprise
Mode	Bridged	Bridged or Residential Gateway	Bridged	Bridged

UNI – NNI characteristics

3.12.1   Bridged mode requires a dedicated UNI.

3.12.2   In Residential Gateway mode the Access-EVPL terminates on the Residential Gateway function. All ONT ports are associated to the Residential Gateway function. There is only one Residential Gateway function available per Hyperfibre ONT;

3.12.3   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. It is therefore the Service Provider's responsibility to shape and queue traffic appropriately.

New Service Template Options

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

3.13.1   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 3.12.2.;

(b)   Point to Point transparent VLAN (Access-EPL) service using High or High and Low Traffic Class combinations as set out in 3.12.2;

(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)   Residential Gateway function. Ports utilised by Residential 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.

3.13.2   Ethernet bitstream services consisting of High and Low Traffic Class bandwidth combinations can be created using the following standard building blocks:

(i)   High Traffic Class CIR in increments of 2.5 Mbps upstream and/or downstream; and

(j)   Low Traffic Class EIR in increments of 10 Mbps upstream and/or downstream.

3.14   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.

3.15   The LFC will comply with the Service Provider's request under clause 3.13 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

3.16   The Hyperfibre Service will support Service Provider remote access to the Hyperfibre Residential Gateway function via a Remote Management Platform (RMP) for appropriate configuration and management. A Service Provider may request particular management attributes via the Product Development Process

3.17   The Residential Gateway (RGW) function and WiFi can be configured locally by the End User via a Web GUI.

Service Requirements

3.18   To use the Hyperfibre Service the Service Provider must have the capability to access and interconnect with it, by one of the following:

3.18.1   co-locating Service Provider equipment at the POI using the UFB Handover Connection Service and Central Office and POI Co-location Service;

3.18.2   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;

3.18.3   connecting to a backhaul service at the POI; or

3.18.4   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. Hyperfibre may not be available in all locations

Additional Service Characteristics

3.19   The technical specification of the Hyperfibre Service is set out in Appendix B.

3.20   The LFC will provide certain support and other assistance including:

3.20.1   an electronic facility for submitting Service Requests;

3.20.2   an electronic facility for fault notifications; and

3.20.3   tools to assist the Service Provider in determining the location and availability of the Hyperfibre Service (pre-qualification),

each as more particularly set out in the Operations Manual.

3.21   The Hyperfibre Service specifically excludes:

3.21.1   the UFB Handover Connection Service;

3.21.2   provision or maintenance of any cabling or connection or active device:

(a)   beyond the Service Demarcation Points described in clauses 4.1 and clause 5.1; and

(b)   between the jack terminating the LFC provided Fibre Lead-in and the Hyperfibre 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;

3.21.3   the Residential Gateway (RGW) function and Wi-Fi which are separate services. Details of which are provided for information in Appendix C

3.21.4   configuration, monitoring, operation, on-going support or maintenance of Service Providers' or End User's applications, equipment or networks;

3.21.5   supply of AC mains & UPS power, accommodation space, heating, ventilating, and air conditioning and facilities at the POI or End User Premises or Service Provider Premises or NBAP (as applicable); and

3.21.6   The resale or resupply beyond the relevant End User Premises connected by the ONT or the use of the Hyperfibre Service for mobile or wireless site backhaul ("Prohibited Purposes"). Should the Hyperfibre Service be used for any Prohibited Purposes Chorus reserves the right in its sole discretion, after notification to the Service Provider and a reasonable period to remedy the issue:

(a)   to assess your usage as being more appropriate to another Chorus service and to move you to that alternative service; or

(b)   to restrict, suspend, or cancel in whole or in part any Hyperfibre Service.

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, 10G, ATA or WiFi ports on the Hyperfibre ONT.

4.2   The Hyperfibre 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 or Service Provider Premises or NBAP (as applicable) equipment (CPE) or the wiring at the End User Premises or Service Provider Premises or NBAP (as applicable) 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 Hyperfibre Service is delivered as a single VLAN (the logical Service Demarcation Point) per Access-EVPL or Access-EPL, as applicable, on the UFB Handover Connection located at the POI.
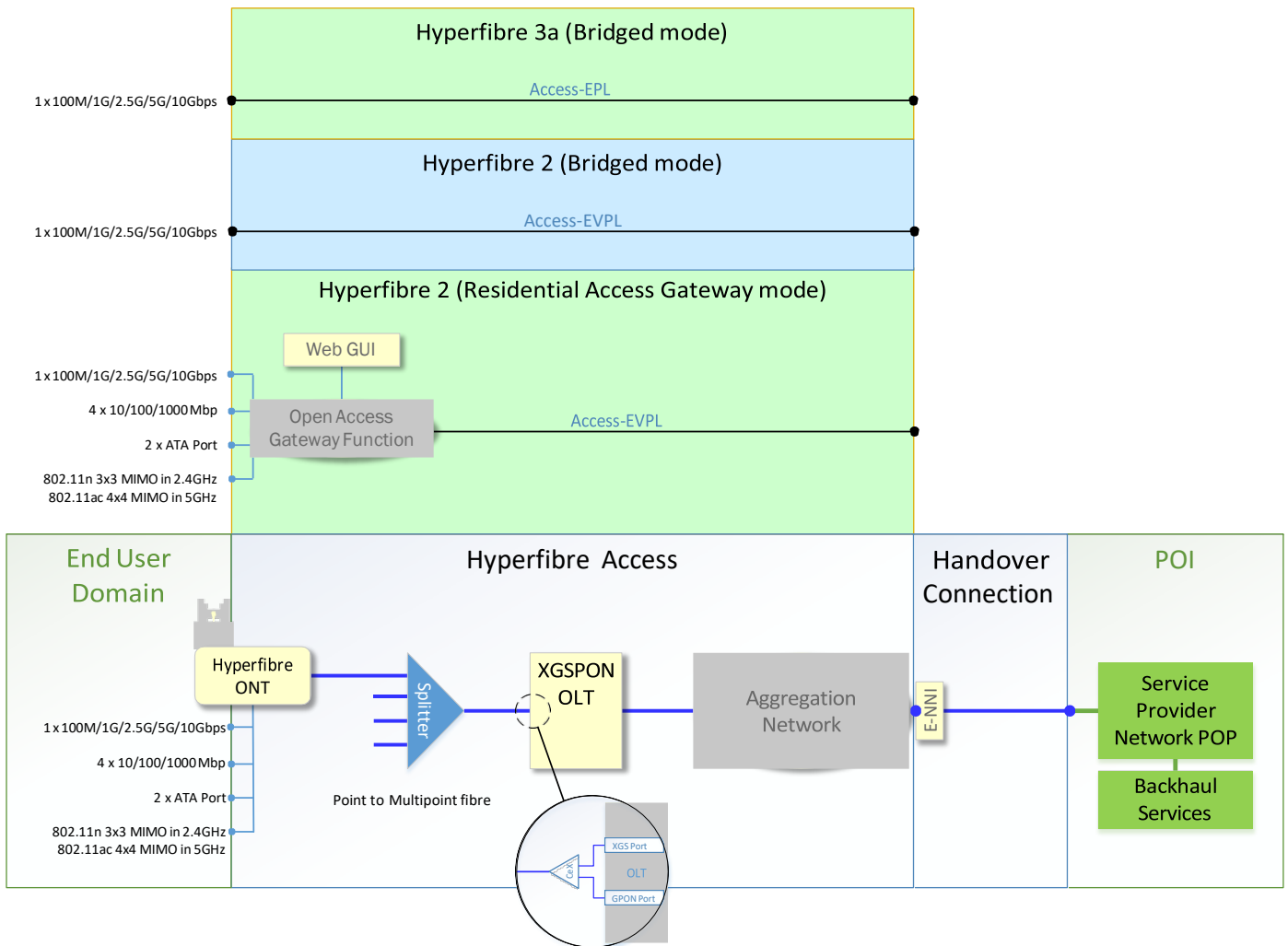
5.2   The physical Service Demarcation Point is the MOFDF in the POI, which is part of the UFB Handover Connection Service.

5.3   The UFB Handover Connection Service is a separate service and is a prerequisite to the supply of the Hyperfibre 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 Hyperfibre 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.

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 Hyperfibre Service and pricing applies between:
    - the interfaces on the Hyperfibre 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 Hyperfibre ONT located at the Customer Premises to the E-NNI at the POI.

- The point-to-multipoint fibre includes a Co-Existent element (CeX) that combines GPON and XGS-PON light sources on the same fibre.

- Access node and aggregation interconnection may use redundant links to meet Service Level requirements.

The Hyperfibre 2 service supports a single Access-EPL connects a UNI or Residential Gateway function located in the Hyperfibre ONT with a VLAN located at the E-NNI.

The Hyperfibre 3a service supports a single Access-EPL OVC that connects a UNI on the Hyperfibre ONT with a VLAN located at the E-NNI.

Appendix B – Technical Specification

Technical Specification	
Mode	Bridged or Residential Gateway Mode
Ethernet	Ethernet II or 802.3 untagged interface 802.1q tagged interface ARP = maximum 10 packets per second for each direction DHCP = 10 packets per second for each direction
UNI Port (Bridged Mode)	• 1 x 100M/1G/2.5G/5G/10GBase-T RJ-45 port;
Residential Gateway function ports	ONT supports: • 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 2.0 ports
UFB Handover Connection (E-NNI)	Ethernet: • 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.
Fibre Testing Layer 1	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. The methodology used will be based on bi-directionally testing all fibres in the Communal Network required to complete the service. Network test results are provided by agreement verifying performance features. Refer to the Direct Fibre Services Operations Manual for details. All Layer 1 network restoration testing will be LFC site OFDF to Premises termination point. Testing for power loss will be at either 1310 or 1550 nm and for the XGS-PON at 1277nm and 1578nm. In the event of a fault restoration testing will be to the standard in Optical Performance table below. The wavelengths of 1625 nm and 1650nm are reserved for network maintenance testing purposes, compliant with ITU-T L.41.

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

Appendix C – Residential Gateway function Specification

Function	Specification
Residential Gateway function Configuration and Management	Web GUI management (local) Remote Management Service (remote)
WAN Interface	ARP Upstream every 60s DHCP or PPPoE
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
ATA Voice *(RGW Mode only)*	SIP voice support Multiple voice Code DTMF dialling Echo cancellation (G.168) Fax mode configuration (T.30/T.38) Caller ID, call waiting, call hold, 3-way calling, call transfer, message waiting

Function	Specification
Residential Gateway functions	Triple-Play services, including voice, video and high-speed Internet access
	IP video distribution
	DHCP client/server
	DNS server/client
	DDNS
	Port forwarding
	Network Address Translation (NAT)
	Network Address Port Translation (NAPT)
	UPnP IGD2.0 support
	ALG
	DMZ
	IGMP snooping and proxy (v2/v3)
	Performance monitoring and alarm reporting
	IP/MAC/URL filter
	Multi-level firewall and ACL