WHOLESALE REFERENCE OFFER*

WHOLESALE TOTAL BROADBAND

PRODUCT SPECIFICATION

*Fibrus offer wholesale total broadband in areas where public funding has been used to build the Network. Fibrus Networks is currently building the Network to achieve optimal performance and to support future Services. Fibrus Networks will inform you of product availability during the onboarding and ordering process.

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1. Introduction

This is the Reference Product Specification for Fibrus Wholesale Total Broadband as defined in the table below. The document defines a set of processes that encompasses Network Deployment, Order Handling, Wholesale Billing and Service Management. Fibrus provides an active Layer 3 pure fibre broadband access service to homes and businesses in Northern Ireland providing ultrafast connectivity with downstream speeds from 50Mb/sup to 1000Mb/s and enables wholesale access in areas where public funding has been used.

This Product Specification is designed for use by Retail Service Providers (RSPs) who are RSPs of Fibrus Networks (Fibrus). For information on how to become a RSP with Fibrus please see our guide *How to Become a Wholesale Customer* available at https://hyperfastni.com/wholesale-partners or https://hyperfastgb.com/wholesale-partners.

This document should be read in conjunction with the current Fibrus Networks Wholesale Services Framework Agreement, Wholesale Total Broadband Price List, Wholesale Access Service Level Agreement, Installation Services and Wholesale Access Order & Fulfilment documentation, which are available on the Fibrus website at https://hyperfastni.com/wholesale-partners or https://hyperfastgb.com/wholesale-partners.

Fibrus' approach is to enable wholesale customers to self-serve their customer requirements via direct digital access to the systems capable of high-volume transactions alongside dedicated relationship management to ensure their needs are met and to deal with specific requirements. The Operator Wholesale Gateway (OWG) is the ordering and fault management system for Fibrus wholesale products and services.

2. Wholesale Total Broadband

2.1 Overview

Fibrus is a Northern Irish company providing full fibre connectivity to premises across

Northern Ireland and specific locations in GB, offering high quality services to Retail Service Providers (RSPs) who wish to avail of the benefits of Fibrus Networks' network.

Wholesale Total Broadband products have been developed by Fibrus to provide RSPs with ultrafast services for 'last mile' reach into areas of Northern Ireland where Fibrus has built networks. The customer last mile services are delivered using GPON (or XGS PON) technology via full fibre active Layer 3 connectivity. Connectivity from the end customers demarcation point is delivered over the Fibrus network directly to the internet.

Fibrus Wholesale Total Broadband provides a Layer 3 service between the Fibrus Optical Network Termination (ONT) and the internet. Our Wholesale Total Broadband Products provide the ability for RSPs to connect end customers directly to the internet, without the need to interconnect with Fibrus. Fibrus will provide IP addressing, routing and transit direct to the internet. The RSP provides the appropriate and approved Customer Premises Equipment (CPE) and Fibrus will instal the CPE on behalf of the RSP.

2.2 Bandwidth Options

Fibrus offer both Asymmetrical and Symmetrical Wholesale Total Broadband products to RSPs. Asymmetrical services are offered in four bandwidth profiles as shown in the table below.

Wholesale Total Broadband – Asymmetric Products	***Description***
Wholesale Total Broadband 50/20	50 Mb/s downstream; 20 Mb/s upstream
Wholesale Total Broadband 100/30	100 Mb/s downstream; 30 Mb/s upstream
Wholesale Total Broadband 300/100	300 Mb/s downstream; 100 Mb/s upstream
Wholesale Total Broadband 1000/300	1000 Mb/s downstream; 300 Mb/s upstream

Table 1: Fibrus Wholesale Total Broadband Asymmetric Products

Fibrus symmetrical connectivity services are offered in six different bandwidth profiles and are shown in the table below.

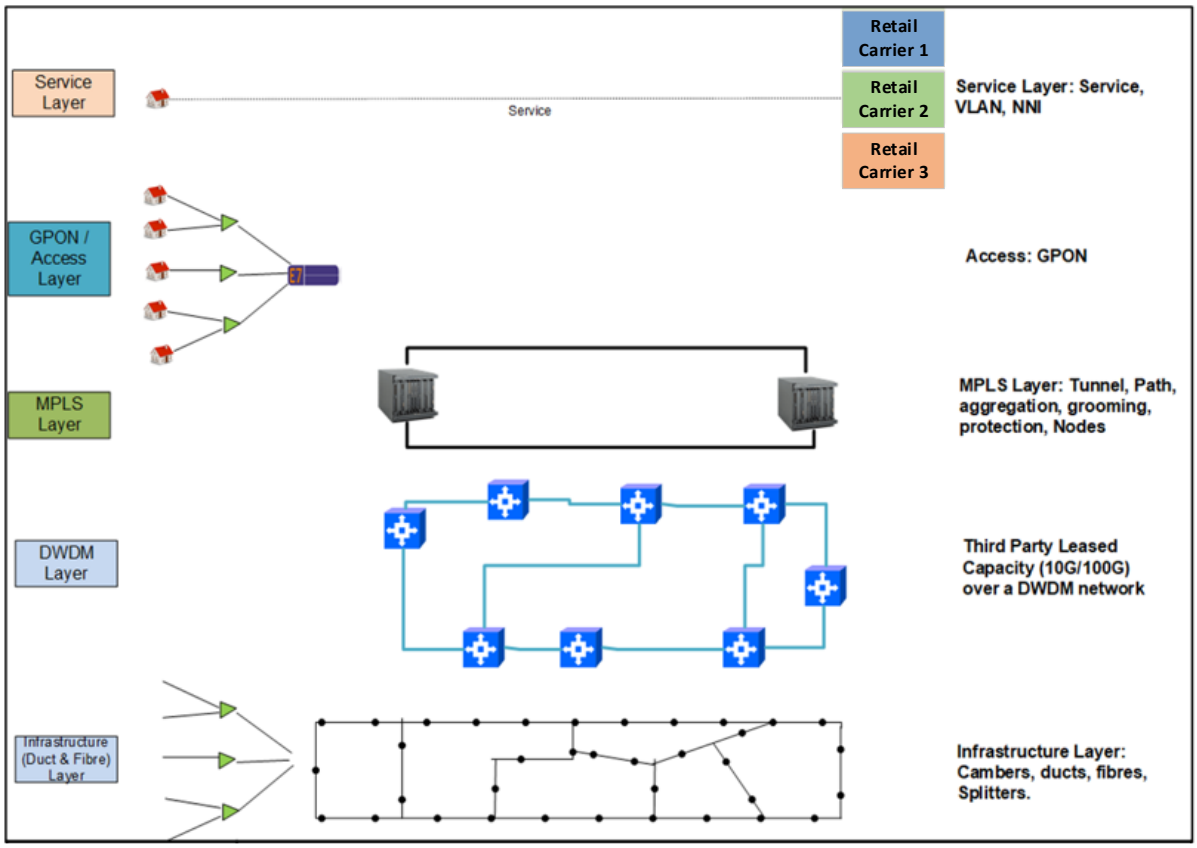
Wholesale Total Broadband Symmetric Products	**Description**
Wholesale Total Broadband 100/100	100 Mb/s downstream; 100 Mb/s upstream
Wholesale Total Broadband 200/200	200 Mb/s downstream; 200Mb/s upstream
Wholesale Total Broadband 300/300	300 Mb/s downstream; 300 Mb/s upstream
Wholesale Total Broadband 350/350	350 Mb/s downstream; 350 Mb/s upstream
Wholesale Total Broadband 600/600	600 Mb/s downstream; 600 Mb/s upstream
Wholesale Total Broadband 1000/1000	1000 Mb/s downstream; 1000Mb/s upstream

Table 2: Fibrus Wholesale Total Broadband Symmetric Products

The SLA for the Asymmetrical products is aligned to the Fibrus 'standard' service level. The SLA for the Symmetrical products is aligned to the Fibrus 'plus' service level, The SLAs are defined in the Wholesale Access Service Level Agreement Specifications document available at https://hyperfastni.com/wholesale-partners or https://hyperfastgb.com/wholesale-partners).

2.3 Wholesale Total Broadband Product Features

Fibrus Wholesale Total Broadband utilises GPON Access Network technology to provide full fibre connectivity to each premise via designated cabinet locations across NI and GB with a resilient backhaul solution. The Wholesale Total Broadband service utilises a number of network and infrastructure layers to deliver the end-to-end service. This is depicted in the figure following. in Figure 1 below.



- **Passive Infrastructure Layer** – Fibre, Ducts, Chambers and Splitters using Fibrus and Openreach PIA.
- **Active Network Layer** – GPON access network, fully resilient Dense Wave Division Multiplexing (DWDM) infrastructure and Next Generation Network (NGN) Multi-Protocol Label Switching (MPLS) network.
- **Service Layer** – provides the end-to-end logical service, to deliver connectivity from customer ONT to Network Service Suppliers Interconnect handoff.

Each customer circuit provides a seamless end to end broadband access service between the service termination point in the end customer premises to the Internet. Service termination in the customer premises is the Optical Network Terminal (ONT) which acts as the demarcation point between Fibrus and the Retail Service Providers responsibilities.

2.3.1 MTU

A maximum MTU of 1500 bytes is supported by Fibrus end to end.

2.3.2 VLAN Tagging

The Internet service is provided untagged from the Fibrus ONT to the RSPs CPE. Tagged frames

sent to the Fibrus ONT will be discarded.

2.3.3 Bandwidth Targets

Fibrus capacity manages the network and monitor bandwidth using our network management toolset. Fibrus networks perform network upgrades on backhaul links when aggregate bandwidth utilisation exceeds 70% on the 95th percentile. RSPs should expect to receive the purchased bandwidth profile on both asymmetrical and symmetrical products for most of the service period. We target minimum bandwidth speeds in times of congestion across our products to RSPs.

2.4 End-customer Service Presentation

End-customer presentation will be the Fibrus ONT, currently this is the Nokia G-010G-Q ONT, a standards-based Full-Service access (FSAN), ITU-T GPON Compliant modem. It is a 2.5 Gbps GPON small form factor service delivery terminal that delivers broadband connectivity to the subscriber. This high-performance terminal features one Gigabit Ethernet 1000Base-T interface. The ONT is subject to change due to network evolution.

The ONT terminates a GPON fibre optic link at the subscriber's premises and provides an industry-standard interface for the customer premises equipment. The ONT enables subscribers to receive gigabit broadband data and IP video on a single fibre. The ONT establishes a strategic network termination point for the delivery and control of broadband services.

Figure 3 – For illustration - Nokia G-010G-Q ONT

2.5.1 Customer Premises Equipment (CPE)

The Fibrus ONT, currently Nokia G-010G-Q ONT for GPON delivery, is the Fibrus demarcation point

to our service. The RSP will connect their CPE to the Gigabit Ethernet port. The RSP is responsible for sizing the CPE to the appropriate bandwidth to ensure the customer can avail of the full throughput of the access tail on a per site basis. The RSP must provide a CPE in front of any hosts or devices on the site. To prevent MAC exhaustion Fibrus restricts the number of MAC addresses learnt per ONT to 8. A switch (not acting as a layer 3 gateway for local hosts) cannot be plugged directly into the ONT.

The Retail Service Provider is responsible for management and monitoring of the customer CPE.

2.5.2 CPE Standards

Within each end user's premise, Fibrus terminate the optical connection on a layer 2 ONT. The connection to the end user is an IEEE 802.3-compliant ethernet port on the Fibrus ONT. The Fibrus ONT is the demarcation point of the Fibrus service. The RSP connects their CPE to the ethernet port on the Fibrus ONT. The RSP or end user must not alter, interfere with, or otherwise modify the Fibrus ONT or its fibre connectivity. The RSP must supply and use a Cat 5e ethernet cable to connect the CPE to the Fibrus ONT.

It is the RSPs responsibility to ensure that their CPE complies with all UK (Great Britain and Northern Ireland) regulations on electrical safety, wireless compliance, and IEEE 802.11 wireless standards. The CPE installed by the RSP must be capable of supporting the bandwidth profile purchased for the end user, on the CPEs wired and wireless interfaces.

During fault diagnostics Fibrus will remove the RSP's CPE from the Fibrus ONT and test from the ethernet port of the ONT. Fibrus networks supports a maximum of 8 MAC addresses per connection. CPE with more than 8 MAC addresses or rotate MAC addresses may experience connectivity loss.

CPE must operate as a residential gateway - providing layer 3 termination for services within the end users' premises. The CPE must be capable of supporting IPv4 and IPv6 (with prefix delegation). The CPE must not act as a layer 2 bridge. Fibrus reserves the right to disconnect CPE & connections where:

- the CPE appears to have been compromised

- an un-authorised device has been connected to the ONT which appears to be causing a network fault
- attack or intrusion attempts are detected

RSPs should have remote management control of their CPE; either via TR69 or alternative method. This remote management should support the running of remote diagnostics such as Speedtest from the primary CPE. Fibrus will not take speed tests run from end user client devices as proof of a fault or issue. This remote management should also facilitate the upgrade of software in the event of security vulnerabilities that would potentially give threat actors vectors to attack end user or Fibrus Network devices.

All CPE must be installed with software that is up to date and protected against any known vulnerabilities or CVEs on the CPE platform.

3. Fibrus Wholesale Total Broadband Service Ordering & Installation

The ordering and fulfilment process is detailed in the Wholesale Access Order & Fulfilment document and summarised below. Fibrus has developed the Operator Wholesale Gateway (OWG) to provide functionality for Service Fulfilment and Service Assurance processes to RSPs.

3.1 Overview of Operator Wholesale Gateway (OWG)

The OWG is the interface for RSPs to place and manage all orders related to provision and amending service for Wholesale Total Broadband to end customers. RSPs can access the OWG via a Portal or defined API giving direct access to the same status and customer service information that is available to Fibrus. This enables RSPs access to the vital information they require to effectively manage their customers. RSPs can access relevant order types; provide, cease, upgrade and downgrade services for their end customers. Management of access is provided by Fibrus' wholesale team and it is the RSPs responsibility to administer and assure appropriate use by their personnel.

3.2 Service Fulfilment Process

The Service Fulfilment process has the below key elements for successful completion:

- *Collate the mandatory required information to complete the order - RSP*
- *Enter the data into the OWG and select the required address / services - RSP*
- *KCI 1: Validate and accept the order – Fibrus email*
- *KCI 3: Confirmed Delivery Date (CDD) – Fibrus email*
- *Deliver CPE to end customer premises before CDD – RSP*
- *CDD will be more than 5 working days after KCI 3 is sent to the RSP*
- *Complete the validated order (including field or in-home work as required) - Fibrus*
- *KCI 5: Update the RSP on order completion – Fibrus email*

3.3 Customer Premise Installation

On successful completion of the order entry and validation sub-processes, the appropriate network and service activations will be completed by Fibrus systems following which a field engineer will be dispatched to complete the connection (unless an in-situ connection already exists). Further information is available in the Installation Services documents available at https://hyperfastni.com/wholesale-partners or https://hyperfastgb.com/wholesale-partners).

To connect the end customer premise to the network, Fibrus need to bring a fibre optic cable from the Fibrus Distribution Point (DP) located closest to the property to the location in the property where the customer requires the Optical Network Termination (ONT) to be located. The ONT must be fixed to a wall inside the property, close to a power socket. Our fibre optic cable runs through a hole drilled in the wall, down into the ground or up to the eaves where it will then run back to connect to the network.

3.3.1 ONT Location

If the ONT is located away from the point of entry into the property, Fibrus will run internal cable to the point where the ONT is to be fixed. This cable will be up to 3m in length (unless the RSP has placed a special order which may incur additional cost).

Before commencing the installation, the technician will ask the customer representative (who must be authorised to make the decision and over 18 years of age) to agree the route of the fibre

optic cable into the property. The technician will record the agreed plan for the installation on a form and ask the customer present to sign to confirm that they accept the route.

Please ensure that the route of the installation is within the boundaries of the property. If Fibrus are asked to install across a route which is not believed to have the necessary consents or permission, Fibrus will not be able to carry out the installation and there may be a cancellation charge to the RSP for a failed installation.

There must be someone over the age of 18 at the property during the installation.

3.4 Escalation Process

Should an RSP wish to escalate a service order this can be done by contacting their Relationship Manager. Orders may only be escalated where they are beyond SLA parameters.

4. Service Management

Fibrus operates to a principle of enabling RSPs to manage their customers directly. The OWG provides RSPs with direct access to monitor end customer service and network performance, initiate, track and close trouble tickets via the OWG Portal or defined API. As such, it is a fundamental principle that RSPs must prove any service issues or faults are outside its own network and equipment before raising a trouble ticket.

RSPs will be provided with access to assist them in trouble shooting service problems for end customers with direct access to the same information available to Fibrus wholesale team.

Where an RSP cannot identify and remediate the customer issue, a trouble ticket can be raised within OWG for the attention of Fibrus.

4.1 Trouble Ticket Resolution Process

Trouble tickets should only be raised when the RSP has identified the trouble as being within the Fibrus network or cannot localise the source of the customer trouble. The five key steps in trouble ticket resolution are:

- Trouble ticket reported – RSP
- Trouble diagnosis and isolation – Fibrus
- Trouble repair - Fibrus
- Trouble ticket updated and closed – Fibrus
- Customer updated – RSP

To complete diagnosis and repair the Fibrus wholesale team may be required to contact the end customer directly e.g. for access. Fibrus will not open or close tickets directly with end customers.

4.2 Escalation Process

Where an RSP requires to escalate a trouble ticket for resolution this can be done by contacting their Wholesale Relationship Manager. Trouble tickets may only be escalated where they are beyond SLA parameters.

4.3 Outages

Planned Outages

It is recognised that Planned Outages are a necessary, normal and regular occurrence. Where a Planned Outage will impact on the Wholesale Total Broadbands provided to an RSP, the RSP will be notified by email, including a description of the outage, customer impact, date, time and expected duration. Fibrus will endeavour at all times to carry out Planned Outages during the preferred hours of 00:00 to 06:00.

Unplanned Outages

Where an outage occurs that impacts on multiple end-customers, Fibrus will inform RSPs to enable them manage operations and customer expectations effectively.

5 Pricing & Billing

All connection, usage and recurring charges associated with the provision of the Wholesale Total Broadband are charged on the next billing cycle following completion of an order. All charges are as defined in the contractual agreement with the RSP and/or as published in the

Wholesale Total Broadband Price List.

Queries regarding billing and charges must be raised with the Wholesale Relationship Manager for resolution.