nbn® Ethernet - Product Technical Specification

nbn® Ethernet Product Module

Wholesale Broadband Agreement

This document forms part of NBN Co's Wholesale Broadband Agreement, which is a Standard Form of Access Agreement for the purposes of Part XIC of the Competition and Consumer Act 2010 and constitutes nbn's Latest Standard Offer

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Wholesale Broadband Agreement

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5.0	First issued version of WBA 5	1 December 2023
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Roadmap

A roadmap describing the structure of this **nbn**® Ethernet Product Technical Specification follows for the assistance of RSP.

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1 Scope and purpose

1.1 Purpose

This **nbn**® Ethernet Product Technical Specification sets out the technical specifications for the **nbn**® Ethernet Product. It forms part of the **nbn**® Ethernet Product Module.

1.2 Scope

Sections 2 to 8 of this **nbn**® Ethernet Product Technical Specification describe the features of the **nbn**® Ethernet, as offered by **nbn**. Any differences in availability or performance of these features between access technologies are detailed in this **nbn**® Ethernet Product Technical Specification and the Network Interface Specifications, where necessary.

1.3 Definitions

Capitalised terms used but not defined in this **nbn**® Ethernet Product Technical Specification have the meaning given in the Dictionary.

If a capitalised term used in this document is not defined in the Dictionary, then that term has the ordinary meaning commonly accepted in the industry.

2 Introduction

2.1 Service Type Availability

This section provides a brief overview of the service types that RSP may choose to deploy using **nbn**® Ethernet.

2.1.1 Unicast Data Services

nbn® Ethernet supports the flexible delivery of unicast data services. **nbn**® Ethernet uses logical, Layer 2 circuits that provide transparency to network layer protocols such as IPv4 and IPv6 that enable access to a variety of higher-level data applications, including internet access and tunnelling protocols.

These unicast services provide physical point-to-multipoint (aggregated) connectivity between one or more UNIs located at a Premises and a centrally-aggregated NNI supplied to RSP by **nbn**.

2.1.2 IP-Based Telephony Services

RSP may choose to provision IP-based telephony services to End Users via:

- an ATA port (integrated into the NTD), with integrated SIP capabilities for legacy telephony applications (UNI-V) in relation to **nbn**® Ethernet (Fibre); or
- access to external, RSP-supplied ATA devices using (with a unicast data service) a UNI-D in relation to **nbn**® Ethernet (Fibre), **nbn**® Ethernet (Wireless), **nbn**® Ethernet (HFC), **nbn**® Ethernet (FTTC) or **nbn**® Ethernet (Satellite) or a UNI-DSL in relation to **nbn**® Ethernet (FTTB) or **nbn**® Ethernet (FTTN).

If RSP wishes to deliver IP-based telephony services, RSP must provide and manage its own IP-based telephony network capabilities that interface to, and operate across, the **nbn**® Network.

All IP-based protocols and functions that RSP utilises to implement IP-based telephony services which comply with this Agreement will pass transparently through the NNI, AVC, CVC and UNI-D or UNI-DSL Product Components. Where utilised in relation to **nbn**® Ethernet (Fibre) supplied to a Premises, the UNI-V will terminate all IP-based telephony protocols and functions within the F-NTD at the Premises and provide POTS services from the UNI-V electrical interface to the End User.

The **nbn**® Network supports the provision of voice-grade, IP-based telephony services through the use of specific traffic handling mechanisms that are tailored toward deterministic performance for real-time, conversational applications. The TC-1 traffic class is designed to accommodate the needs of IP-based telephony applications.

Capacity within this traffic class is available to RSP via the UNI-D in relation to **nbn**® Ethernet (Fibre), **nbn**® Ethernet (Wireless), **nbn**® Ethernet (HFC), **nbn**® Ethernet (FTTC) or **nbn**® Ethernet (Satellite), the UNI-DSL in relation to **nbn**® Ethernet (FTTB) or **nbn**® Ethernet (FTTN). Capacity within this class is also available via the UNI-V in relation to **nbn**® Ethernet (Fibre) only.

2.1.2.1 Legacy Telephony Applications

Using the UNI-V for **nbn**® Ethernet (Fibre), RSP may access the F-NTD's in-built ATA port to provide capabilities for supported legacy telephony applications. [1] A range of configuration options enable RSP to migrate an existing telephony service, with minimal impact to in-building wiring or equipment installed at the Premises.

The ATA function of the UNI-V converts legacy analogue telephony services on the End User-side of the port to and from IP-based services on the network-side of the port.

IP-based telephony services deployed using the UNI-V are automatically provisioned with a specific TC-1 capacity allocation.

RSP must interface its own IP-based telephony network with the IP-based telephony functions provided by the internal ATA of a UNI-V port. This will require integration testing between RSP and **nbn** prior to service deployment in accordance with this Agreement.

2.1.2.2 External ATA Device Support

Subject to the **nbn**® Ethernet Product Description, RSP may choose to deliver IP-based telephony services to a Premises using a dedicated, external ATA device using the UNI-D or UNI-DSL. The supply, powering and operation of this device are the responsibility of RSP.

Such devices will, subject to compatibility, appear to **nbn**® Ethernet as a regular data device.

RSP may choose to operate the AVC in a manner that recognises the relative priority of telephony traffic above other applications sharing the same AVC.

Under this deployment scenario, **nbn**® Ethernet is agnostic to the IP-based telephony protocols and data that RSP utilises for the delivery of IP-based telephony services to an End User.

When delivering IP-based telephony services using an external ATA through a UNI-D or UNI-DSL, RSP is able to utilise capacity from any available traffic class.

2.2 Class of Service (CoS) Architecture

The **nbn**® Network implements a number of traffic classes that are distinguished in capability and performance, designed to accommodate the widest variety of higher-layer applications. RSP may take advantage of these traffic classes to provide more tailored performance and effective utilisation of the **nbn**® Network.

2.2.1 Traffic Classes

Traffic is scheduled within the **nbn**® Network using strict priority, according to the traffic class. The available traffic classes are described in Table 1. [2]

[1] For information on supported voiceband data services, refer to section 4 of the Network Interface Specification – UNI-V.

[2] See section A.6.3 of Appendix A to this **nbn**® Ethernet Product Technical Specification for details on which traffic classes in Table 1 are supported on each network.

Traffic Class	Example Applications	Specification
TC-1	Voice	CIR
TC-2	Streaming standard and high definition video and real-time collaboration applications	CIR
TC-4	Best-effort data	PIR [3] (AVC) PIR [4] (CVC except in respect of Satellite Network) CIR [5] (CVC in respect of Satellite Network)

Table 1: Available Traffic Classes

RSP may use these classes to allocate service capacity in a manner that reflects the demands and operation of its end-to-end applications. The performance attributes of each respective traffic class are described in section 7.

Note that for traffic classes where RSP is required only to specify the CIR (i.e. for which the PIR is not specified), the PIR will be automatically set by **nbn** to align with the specified CIR according to the relevant traffic class.

For traffic classes which do not support a CIR (e.g. AVC TC-4), no CIR is provided.

2.2.1.1 TC-1 Description

The TC-1 traffic class is targeted towards real-time, interactive multimedia applications, with the following characteristics:

- Low bit-rate
- Low Frame Delay, Frame Delay Variation, Frame Loss

The attributes of this class are aligned to the characteristics of the DSCP Expedited Forwarding per-hop behaviour described in RFC4594.

TC-1 provides a committed level of premium capacity with limited ability to burst above its CIR, suitable for applications that require deterministic performance and are likely to be sensitive to packet loss.

2.2.1.2 TC-2 Description

The TC-2 traffic class is targeted towards real-time, interactive multimedia applications, with the following characteristics:

[3] TC-4 is implemented as PIR at the AVC, meaning that AVC TC-4 capacity is shared with other traffic classes across the UNI and is available for TC-4 when higher-priority traffic classes are not utilising it. As set out in the **nbn**® Ethernet Product Description, no defined PIR applies in respect of Wireless Plus. However, the other characteristics of TC-4 do apply to Wireless Plus.

[4] For **nbn**® Ethernet (other than **nbn**® Ethernet (Satellite)), TC-4 is implemented as PIR at the CVC, meaning that CVC TC-4 capacity is shared with other CVC and OVC traffic across the NNI.

[5] For **nbn**® Ethernet (Satellite), TC-4 is implemented as CIR at the CVC, meaning that CVC TC-4 capacity cannot be shared with other CVCs or traffic classes across the NNI.

- High bit-rates, and large Ethernet Frame Sizes
- Low Frame Delay, Frame Delay Variation, Frame Loss

The attributes of this class are aligned to the characteristics of the DSCP Assured Forwarding (**AF**) per-hop behaviour described in RFC4594.

TC-2 provides a committed level of premium capacity with limited ability to burst above its CIR, suitable for applications that require deterministic performance and are likely to be sensitive to Frame Delay Variation (FDV/jitter) and Frame Loss (FLR).

2.2.1.3 TC-4 Description

The TC-4 traffic class is targeted towards "best effort" applications, as characterised by the DSCP Default Forwarding per-hop behaviour, described in RFC4594.

2.2.2 Bandwidth Profile Parameter Considerations

This section describes the bandwidth profile parameters used within the **nbn**® Network.

2.2.2.1 Calculation of Information Rate

All Information Rate limitations, including as set out in this **nbn**® Ethernet Product Technical Specification, are enforced at the NNI interface between the RSP and the **nbn**® Network.

Where the bandwidth profile is equivalent to or greater than the negotiated Line Rate, a degraded useable payload will occur.

The Peak Information Rate for **nbn**® Ethernet is calculated on Layer 2 Ethernet service frames, over the series of bytes from the first bit of the Destination MAC Address through the last bit of the Frame Check Sequence. IEEE 802.3 physical-layer fields such as the preamble, start of frame delimiter and inter-frame gap are not included in the Bandwidth Profile.

This means the effective Layer 2 payload rate of the **nbn**® Network will degrade slightly for lowest-sized Ethernet service frames. This is the expected behaviour for Ethernet-based services for which the bandwidth profile is based on the service frame definitions in the relevant Network Interface Specification. It is the responsibility of RSP to accommodate any payload rate degradation as a result of Layer 2 Frame Sizes. Effectively, in compliance with the IEEE 802.3 standards, the Peak Information Rate is limited by capability depending on the Frame Size as described in Table 1.

Frame Size (Byte)	Maximum effective layer 2 Information Rate (Mbps)
64	735
128	838
986	970
1518	970
2000	970

Table 1: Maximum effective Layer 2 Information Rate range

2.2.2.2 Committed Burst Size

The CBS is set by **nbn** for each CIR specification, and cannot be modified. The CBS may differ between traffic classes, and may be specified differently for the UNI and NNI, and between the AVC and CVC.

The CBS is used by the policing functions of the **nbn**® Network at ingress to the **nbn**® Network to determine whether a stream of ingress data complies with the subscribed CIR. RSP is responsible for ensuring that all ingress traffic is shaped to comply with the CIR/CBS as specified for the required traffic class and interface, before presentation to the UNI or NNI as relevant. CBS values are set out in the Network Interface Specification – AVC.

2.2.2.3 Information Rate

The following traffic capacity will be carried through the **nbn**® Network without any performance objectives:

- Traffic in excess of the CIR;
- Traffic within the PIR; and
- Traffic for Wireless Plus.

Traffic that exceeds the PIR (or the potential maximum Information Rate for Wireless Plus) will be discarded at ingress to the **nbn**® Network.

PIR and the Wireless Plus Information Rate are subject to the limitations described in sections 3.2.2.3 and 3.3.2.2 of this **nbn**® Ethernet Product Technical Specification and sections 3 and 13 of the **nbn**® Ethernet Product Description.

2.2.2.4 Peak Burst Size

The PBS defines the length of a burst of Layer 2 traffic (either in bytes or milliseconds as set out in the Network Interface Specifications) that may be received at ingress to the **nbn**® Network for a burst of traffic that pushes the average Information Rate above the configured bandwidth profile for a PIR traffic class. Traffic in excess of the PBS will be discarded by the **nbn**® Network. The PBS is set by **nbn** for each PIR specification and for Wireless Plus, and cannot be modified.

The PBS is used by the policing functions of the **nbn**® Network at ingress to the **nbn**® Network to determine whether a stream of ingress data complies with the subscribed PIR. RSP is responsible for ensuring that all ingress traffic is shaped to comply with the PIR/PBS as specified for the required traffic class and interface, before presentation to the UNI or NNI as relevant.

2.2.2.5 Maximum Sustained Information Rate for HFC Home Ultrafast

Home Ultrafast on the HFC Network will be configured at the Layer 2 network management to a Maximum Sustained Information Rate of 750Mbps. The Maximum Sustained Information Rate is a best effort dimensioned capacity of Layer 2 Information Rate set by the traffic shaping functions of the **nbn**® Network. The traffic shaping functions employ a real time clock and transmission credit system that determines the potential burst duration based on AVC usage behaviour.

This means Home Ultrafast on the HFC Network will operate at most times with a Peak Information Rate of between 500 to 750Mbps but with the potential to burst up to the Peak Information Rate of

970Mbps (depending on but not limited to, the Frame Size and line speed capability - see section 2.2.2.1 for more information).

The potential burst durations for Home Ultrafast on the HFC Network will be between 1 to 50 seconds at least once a day and depending on AVC usage behaviour, where the greater the AVC idle time, the greater the potential burst duration at next AVC usage as described in Table 1. As described in section 2.2.2.1, inherent limitations of **nbn**® Ethernet in relation to service frame overhead means that the effective Layer 2 Peak Information Rate will be limited to, depending on the Frame Size, up to a maximum of 970Mbps (at 2,000 Byte Frame Size).

Where the potential burst duration is zero, traffic that exceeds the Maximum Sustained Information Rate may be queued and delayed within the **nbn**® Network.

AVC idle time (seconds)	Potential burst duration (seconds)
0	0
3	Up to 10
6	Up to 20
9	Up to 30
12	Up to 40
15	Up to 50

Table 1: Potential burst duration

2.2.3 Traffic Contention and Congestion Management

RSP may control End User experience of applications using the unicast functionality of **nbn**® Ethernet through contention applied through dimensioning of capacity between the AVC and CVC, subject to the conditions set out in the **nbn**® Ethernet Product Description.

Contention may be applied at the traffic class level, allowing RSP to independently control the economics and operation of each traffic class. This is controlled by RSP through careful dimensioning of AVC and CVC capacity, on a traffic class basis, to ensure a level of contention appropriate for each respective higher-layer application.

RSP must be aware of the implications of contending AVC and CVC components, as this will effectively degrade the performance of RSP Products and Downstream Products.

3 User Network Interface (UNI)

3.1 Overview

3.1.1 UNI Type

The **nbn**® Ethernet UNI Product Component has three variants:

- UNI-D: Ethernet UNI port for the purpose of data carriage
- UNI-DSL: VDSL2 UNI port for the purpose of data carriage
- UNI-V: Analogue POTS UNI port for the purpose of voice telephony service

The UNI type availability is dependent on the access technology deployed:

	Fibre Network	FTTB / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
UNI-D	Available	Not Available	Available	Available	Available	Available
UNI-DSL	Not Available	Available	Not Available	Not Available	Not Available	Not Available
UNI-V	Available	Not Available	Not Available	Not Available	Not Available	Not Available

Each UNI is logically connected to an NNI via an AVC.

Each UNI-D and UNI-DSL supports a single unicast AVC.

3.1.2 Addressing Mode

The UNI-D and UNI-DSL support four interface tagging and prioritisation addressing modes:

- Default-Mapped: untagged; activation enabled QoS
- DSCP-Mapped: untagged; DSCP enabled QoS
- Priority-Tagged: single tagged (null/unpopulated); 802.1p enabled QoS
- Tagged: single tagged (RSP provided); 802.1p enabled QoS

The availability of these options for addressing services at the UNI-D and UNI-DSL is summarised in section A.5.2 of Appendix A to this **nbn**® Ethernet Product Technical Specification and further detailed in the Network Interface Specification – UNI-D and Network Interface Specification – UNI-DSL.

Not all options for addressing mode are available on all networks.

UNI-V is configured to support only the DSCP-Mapped addressing mode for SIP traffic.

3.2 UNI-D

The UNI-D is an Ethernet interface in compliance with IEEE 802.3 standards. Each UNI-D is regarded as a fully independent interface, operating in total isolation from any other UNI residing on the same NTD or FTTC-NCD, except that the aggregate of all UNI-D Line Rates on:

- an NTD cannot exceed the relevant NTD throughput limit set out in section 13.3 of the **nbn®** Ethernet Product Description; and
- an FTTC-NCD cannot exceed the relevant FTTC-NCD throughput limit set out in section 13.4 of the **nbn®** Ethernet Product Description.

Detailed specifications are set out in the Network Interface Specification – UNI-D.

3.2.1 Physical Interface

The following interface modes are available via the UNI-D:

Interface modes	Fibre Network	HFC Network	FTTC Network	Wireless Network	Satellite Network
10/100/1000BASE-T/TX (electrical, auto-negotiated speed and full/half-duplex[6]	Available	Available	Available	Available	Available
100BASE-T (electrical, fixed speed, auto-negotiated full/half-duplex)	Available	Available	Not available	Available	Not available

The UNI-D must be associated with an active AVC at all times.

3.2.2 UNI-D Scalability Factors

The UNI-D is scalable in terms of capacity and services. Each UNI-D has two capacity metrics that define its ability to carry RSP Products and Downstream Products.

3.2.2.1 Line Rate

The UNI-D supports the following Ethernet Line Rates:

- 10Mbps

[6] Half-duplex is not supported on the 1000BASE-T/TX interface for **nbn®** Ethernet (Fibre), **nbn®** Ethernet (FTTC), **nbn®** Ethernet (HFC) or **nbn®** Ethernet (Wireless), or any interface for **nbn®** Ethernet (Satellite).

- 100Mbps
- 1000Mbps

The Line Rate sets the maximum bound on the information-carrying capacity of the link. RSP must be familiar with the inherent limitations of Ethernet in relation to the impact of framing overhead and asynchronous operation on bandwidth efficiency, and accommodate this within any capacity allocation.

By default, the UNI-D will be configured to auto-negotiate the Line Rate with the End User Equipment attached to the UNI-D. An active UNI-D may be configured by **nbn** as a 100Mbps interface if required by RSP. [7]

RSP is responsible for ensuring that the UNI-D is operating with a Line Rate that is sufficient to carry the requested AVC capacity, using auto-negotiation or, where available, a fixed Line Rate setting requested by RSP.

RSP is also responsible for the Duplex mode of the UNI-D.

3.2.2.2 Access Line Rate

For **nbn®** Ethernet (FTTC), the Access Line Rate sets the maximum bound on the information-carrying capacity of the copper pair between the **nbn®** Downstream Network Boundary and the **nbn®** Node.

The Access Line Rate achieved on the **nbn®** Copper Pair is determined by the xDSL Data Rate achieved on that **nbn®** Copper Pair and is subject to the limitations described in sections 3 and 13 of the **nbn®** Ethernet Product Description.

RSP must be familiar with the inherent performance characteristics of xDSL technologies.

The Access Line Rate will depend on:

- the **nbn®** Copper Pair line length and attenuation
- the number of other data services that share common network cable runs
- framing overheads, asynchronous operation and the impact on bandwidth efficiency
- the use of Downstream Power Back-off
- retransmissions
- operations and maintenance traffic

3.2.2.3 Information Rate

For **nbn®** Ethernet (FTTC), the UNI-D Information Rate is subject to the Line Rate. In a Premises at which **nbn** supplies **nbn®** Ethernet (FTTC), the Information Rate is further subject to any limitations of the Access Line Rate. As such a UNI-D is capable of supporting an Information Rate up to the lesser of the Line Rate or the Access Line Rate.

[7] Not supported for **nbn®** Ethernet (Satellite).

A UNI-D is capable of supporting an Information Rate up to the active Line Rate. For example, [8] a UNI-D that has an auto-negotiated Line Rate of 100Mbps is capable of supporting an AVC with a PIR of 100Mbps.

The Information Rate is also subject to the limitations described in sections 3 and 13 of the **nbn®** Ethernet Product Description. Note that once provisioned, AVC capacity will not be automatically re-adjusted as a result of changing Line Rates through auto-negotiation. Should a UNI-D auto-negotiate to a Line Rate less than the requested AVC rate, the End User may experience increased Frame Loss in excess of the Frame Loss targets for each traffic class on the provisioned AVC as set out in section 7.1.

3.2.3 AVC Support

For **nbn®** Ethernet (Fibre), the UNI-D functionally supports a single, bi-directional, unicast AVC.

For **nbn®** Ethernet (Wireless), **nbn®** Ethernet (HFC), **nbn®** Ethernet (FTTC) or **nbn®** Ethernet (Satellite), the UNI-D functionally supports a single, bi-directional, unicast AVC.

3.2.4 Resiliency

The UNI-D is an unprotected physical interface. If an unprotected UNI-D suffers a failure, all services being delivered across that UNI will be disrupted.

3.2.5 NTD Supply

RSP cannot directly order an NTD. The provision and operation of the NTD is the responsibility of **nbn** and is dependent on the access technology.

By default, in respect of a Premises at which **nbn** will supply **nbn®** Ethernet (Fibre), an internal F-NTD will be provided unless **nbn** determines that an external F-NTD is preferable in the circumstances or an End User indicates a preference for an external F-NTD during installation and agrees to any additional charges that may apply. This is described further in section 2 of the Network Interface Specification - Premises Network Devices.

nbn will provide a W-NTD in relation to a Premises at which **nbn** will supply **nbn®** Ethernet (Wireless), as described in section 3 of the Network Interface Specification - Premises Network Devices.

nbn will provide an S-NTD in relation to a Premises at which **nbn** will supply **nbn®** Ethernet (Satellite), as described in section 4 of the Network Interface Specification – Premises Network Devices.

nbn will provide an HFC-NTD in relation to a Premises at which **nbn** will supply **nbn®** Ethernet (HFC), as described in section 5 of the Network Interface Specification - Premises Network Devices.

NTDs are designed to operate within certain environmental conditions, which may be set out in the Network Interface Specification – Premises Network Devices. If an NTD is subjected to environmental conditions outside those expressly permitted, **nbn®** Ethernet Ordered Products

[9] Note that this is an illustrative example only, and does not take into account Ethernet protocol overhead.

supplied using the NTD may not perform in accordance with the **nbn**® Ethernet Product Description or this **nbn**® Ethernet Product Technical Specification.

3.2.6 FTTC-NCD

3.2.6.1 Supply

nbn will provide an FTTC-NCD in relation to a Premises at which **nbn** will supply **nbn**® Ethernet (FTTC), as described in section 6 of the Network Interface Specification - Premises Network Devices.

The provision and operation of the FTTC-NCD is the responsibility of **nbn**.

3.2.6.2 Reverse Power Feed

The FTTC-NCD provides a Reverse Power Feed to the **nbn**® DPU via the **nbn**® Copper Pair.

3.2.6.3 Co-existing Services and RSP provided equipment interoperability

RSP premises equipment which is not compatible with **nbn**® Ethernet (FTTC), including equipment relating to any legacy services (such as telephony handsets, modems and alarm diallers) must, to avoid causing **nbn**® Ethernet (FTTC) service interruptions:

- be physically unplugged from the Premises internal wiring connecting to the FTTC Network prior to installation of the FTTC-NCD; and
- remain unplugged from the Premises internal wiring connecting to the FTTC Network after installation of the FTTC-NCD.

See section 6 of the Network Interface Specification – Premises Network Devices for further details regarding the disconnection of equipment which is incompatible with **nbn**® Ethernet (FTTC).

3.3 UNI-DSL

The UNI-DSL is a VDSL2 interface in alignment with ITU-T G.993.2 (02/2020) and supporting standards. Each UNI-DSL is regarded as a fully independent interface, operating in total isolation from any other UNI-DSL interfaces.

Detailed specifications are set out in the Network Interface Specification – UNI-DSL.

3.3.1 Physical Interface

The availability of UNI-DSL physical interface relating to the **nbn**® Ethernet (FTTB) or **nbn**® Ethernet (FTTN) is specified in section 4 of the **nbn**® Ethernet Product Description.

3.3.2 UNI-DSL Scalability Factors

The UNI-DSL is scalable in terms of capacity and services. Each UNI-DSL has two capacity metrics that define its ability to carry RSP Products and Downstream Products.

3.3.2.1 Line Rate

The Line Rate sets the maximum bound on the information-carrying capacity of the link. The Line Rate achieved on the UNI-DSL is impacted by the reported DSL Actual Data Rate and is subject to the limitations described in sections 3 and 13 of the **nbn**® Ethernet Product Description.

RSP must be familiar with the inherent performance characteristics of VDSL2 and that achieved Line Rates will depend on:

- the copper pair line length and attenuation, including in-building cabling or lead-in length
- the state of copper wiring in-building or in the Premises
- the number of other data services that share common network cable runs
- framing overheads, asynchronous operation and the impact on bandwidth efficiency
- the presence of pre-existing exchange based services (e.g. ADSL) within a cable run and the use of Downstream Power Back-off
- G.Inp retransmissions
- the operation of SoS/RoC (Save our Showtime and Robust Overhead Channel) functionality.

The UNI-DSL will be configured to auto-negotiate Line Rates with the End User Equipment.

3.3.2.2 Information Rate

For DSL services the Information Rate is limited to the lesser of the aggregate AVC bandwidth and the actual Line Rate on the UNI-DSL. Note also that for VDSL2 the Line Rate and Information Rate are subject to VDSL2 Ethernet over copper framing overheads as defined in the ITU-T VDSL2 specification G.993.2.

The Information Rate is also subject to the limitations described in sections 3 and 13 of the **nbn**® Ethernet Product Description.

Note that once provisioned, AVC bandwidth profiles will not be automatically re-adjusted as a result of DSL negotiated Line Rates. Should a UNI-DSL auto-negotiate to a Line Rate less than the requested AVC rate, the End User may experience increased Frame Loss in excess of the Frame Loss targets for each traffic class on the provisioned AVC as set out in section 7.1.

3.3.2.3 CIR on DSL

Committed Information Rate (CIR) bandwidth profiles and performance targets are subject to the Line Rate at the UNI-DSL, where:

$TC\text{-}1_{CIR}$ + $TC\text{-}2_{CIR}$ + 1 Mbps ≤ Line Rate (for L2 Bitstream Capacity)

3.3.3 AVC Support

For **nbn**® Ethernet (FTTB) or **nbn**® Ethernet (FTTN), the UNI-DSL functionally supports a single, bi-directional, unicast AVC.

3.3.4 Resiliency

The UNI-DSL is an unprotected physical interface. If an unprotected UNI-DSL suffers a failure, all services being delivered across that UNI-DSL will be disrupted.

3.3.5 RSP Premises Equipment Supply

The provision and operation of an active device that interfaces with the Ethernet bitstream on the End User side of the downstream **nbn**® Network Boundary for **nbn**® Ethernet (FTTB) or **nbn**® Ethernet (FTTN), which is subject to Modem compatibility and registration as specified in section 33 of the **nbn**® Ethernet Product Terms and section 5.3.3 of the WBA Operations Manual, is the responsibility of RSP.

3.4 UNI-V

The UNI-V is only supplied as a variant of the UNI Product Component of **nbn**® Ethernet (Fibre).

The End User's side of the UNI-V is an analogue telephony interface provided off a port on the NTD in alignment with AS/CA S002:2010 standards. Detailed specifications of the physical analogue interface are set out in the Network Interface Specification – UNI-V.

nbn's side of the UNI-V is a VoIP SIP client interface provided by an internal ATA in the NTD in alignment with RFC3261 (SIP), RFC2327 (SDP), RFC3264 (SDP) and RFC3550 (RTP) standards. Detailed specifications of the logical VoIP interface are set out in the Network Interface Specification – UNI-V.

3.4.1 Initialisation and Configuration Protocols

The UNI-V utilises Unicast N:1 AVC TC-1 and Unicast N:1 CVC TC-1 for the transportation of voice packets.

The UNI-V uses DHCPv4 protocol to establish IP addressing and to identify TR-069 Auto-Configuration Server (ACS) bootstrap configuration details. RSP is required to provide an interoperable DCHPv4 server for the DHCPv4 client implementation on the UNI-V.

The UNI-V employs TC-1 and 802.1p/DSCP encoding mechanism for CoS.

The UNI-V utilises DSL Forum Technical Report 069 (TR-069), 098 (TR-098) and 104 (TR-104) protocols for RSP to further configure the SIP client implemented on the UNI-V. RSP is required to provide an interoperable ACS server to configure and manage the UNI-V SIP client.

The UNI-V supplies IPv4-based SIP services only. **nbn** currently intends to support IPv6-based SIP services in the future.

3.4.2 Call Features

The UNI-V supports a limited set of IP-based telephony features. It is the responsibility of RSP to interface to the UNI-V with a soft switch, located beyond the NNI, and complete the delivery of these features with complementary feature support within the RSP Network.

The IP-based telephony call features supported by the UNI-V are described as follows:

Any call feature not explicitly stated below is to be treated as an unsupported call feature of UNI-V.

Call Feature	Description / Sub-Features	Status
Basic POTs Service	• Outbound / inbound call • No answer	Supported

	• Abandoned call	
Voice Codecs (G.711ALaw)	• G.711ALaw • Voice Quality on local call: 80 - 93 • Packetisation: 20ms • Avg media bandwidth: 101 kbps • PSTN-equivalent: yes • Support for G.168 Section 7: CPE must conform to AS/CA S002:2010 Appendix A for echo canceller/suppressor disable tones.	Supported
Voice Codecs (Others)	• G.711MuLaw • G.729 • Any other codecs	Unsupported
Call Waiting	• Handling before accepting the second incoming call • Handling after accepting the second incoming call	Supported
Call Waiting Suspend (Single Call)	• New call • Existing call	Supported
Call Forward (supported)	• Busy • No answer • Unconditional	Supported
Call Forward (unsupported)	• Splash ring / ping ring • Special dial tone	Unsupported
Call Hold	• Handling before the second call is established • Handling after the second call is established	Supported
Hotline and Warmline Service	• Hotline Immediate Service • Warmline Service (RSP / AS Provisioned) • Warmline Service (End-User Provisioned) – also known as Delayed Hotline	Supported
Distinctive Ringing	Ring Cadence • DR0 (default) • DR1 • DR3 • DR6 • DR7 * Does not support "alert-info" header in outgoing SIP INVITE requests	Supported
DTMF	• In-Band Transmission • Out-of-Band RFC2833 Transmission	Supported

Fax Support (supported)	• Fax pass-through	Supported
Fax Support (unsupported)	• T.38 / Fax over IP	Unsupported
Calling Line Identification Presentation / Restriction	• CLIP: Presentation: publish source number in outbound calls • CLIR: Restriction: keep source number private in outbound calls	Supported
Calling Number Display	• First incoming call • Second incoming call	Supported
Message Waiting Indication	• Visual Message Wait Indicator	Supported
Emergency Call	• Priority setting for outbound calls (SIP INVITE) • Deny other incoming call during emergency call	Supported
Voice Band Data (VBD) Call	• Pass-through using G.711 with fixed jitter buffer size • Fax up to 9.6 kbps • TTY support • Tone detection for the disablement of echo suppression and echo cancellation	Supported
Ringer Equivalence Number (REN)	• Up to 3 per UNI-V	Supported
3-Way Calling / Conferencing	• Local mixing of RTP traffic on the NTD	Unsupported
Call Transfer	• Attended (Consultative) call transfer and Unattended (Blind) call transfer	Unsupported
Voice Activity Detection (VAD)	• Reduces voice bandwidth when there is no audio activity • Comfort noise generation	Unsupported
Decadic / Pulse Diallers		Unsupported

3.4.3 Layer 3 Connectivity

It is the responsibility of RSP to manage allocation of IP addresses and associated network parameters to the SIP user agent associated with each UNI-V. DHCP is used as the mechanism to manage address distribution.

RSP must provide DHCP server infrastructure and assign the following parameters:

- IP Address (IPv4)
- Subnet Mask (Option 1)

- Default Router Address (IPv4) (Option 3)
- DNS server (required if a hostname is used for proxy server SIP URI) (Option 6)
- ACS Server

Within the Fibre Network, DHCP Option 82 fields will be populated with the identifier of the AVC associated with a given UNI-V, using a format described in the Network Interface Specification – AVC.

4 Access Virtual Circuit (AVC)

4.1.1 Overview

The AVC implements the C-VLAN component of an IEEE802.1ad Provider Bridge, as further described in the Network Interface Specification – AVC. RSP may deliver multiple End User applications (such as voice and video) using a single AVC (and CoS to manage the capacity between applications).

The **nbn**® Ethernet AVC Product Component has two variants:

- Unicast 1:1 AVC – required for unicast data applications using the UNI-D or UNI-DSL
- Unicast N:1 AVC – required for unicast data applications using the UNI-V

The AVC type availability is dependent on the access technologies and UNI types:

AVC Type	Fibre Network	FTTB Network / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
Unicast, 1:1 [9]	Available on UNI-D	Available on UNI-DSL	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D
Unicast, N:1	Available on UNI-V	Not Available	Not Available	Not Available	Not Available	Not Available

AVCs are logically isolated from each other via the use of distinct S/C-VIDs, and are designed to be individually dimensioned by RSP from a set of selectable parameters according to the service needs of each End User.

An AVC is designed to be scaled in capacity (through its bandwidth profile), within the bounds of the product constructs and the physical limits of the underlying access network technology.

4.1.2 Access Loop Identification and Characterisation

RSP may optionally order a unicast AVC to have Access Loop Identification, and where applicable, Line Characteristic information inserted into DHCPv4, DHCPv6 and PPPoE upstream Layer 3 control packets in alignment with TR-101. This may assist RSP to identify the individual logical circuit to upstream devices beyond the NNI.

AVC information that can be included is:

- Access Loop Identification – identifying an **AVC Service ID.** The **AVC Service ID** means the value configured in the Circuit ID field in the relevant DHCPv4, DHCPv6 or PPPoE protocols.

[9] One AVC inclusive of multiple traffic classes may be supported per UNI-D or UNI-DSL. Refer to Appendix B.

- Access Loop Characterisation – identifying **actual data rate Upstream** and **actual data rate Downstream**

Access Loop Identification insertion is available on all access technologies subject to the control protocol used:

Control Protocol	Fibre Network	FTTB / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
DHCPv4	Available	Available	Available	Available	Available	Available
DHCPv6	Available	Available	Available	Available	Available	Not Available
PPPoE	Available	Available	Available	Available	Available	Available

Access Loop Characterisation insertion is only available on **nbn**® Ethernet (FTTB) and **nbn**® Ethernet (FTTN) and may be optionally included provided Access Loop Identification insertion is enabled:

Control Protocol	Fibre Network	FTTB / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
DHCPv4	Not Available	Available	Not Available	Not Available	Not Available	Not Available
DHCPv6	Not Available	Available	Not Available	Not Available	Not Available	Not Available
PPPoE	Not Available	Available	Not Available	Not Available	Not Available	Not Available

Detailed specifications for Access Loop Identification and Characterisation are set out in the Network Interface Specification – AVC.

4.1.3 AVC Bandwidth Profile Availability

4.1.3.1 Unicast 1:1 AVC Bandwidth Profile Availability

A Unicast 1:1 AVC comprises a combination of mandatory (TC-4) and optional (TC-1 and/or TC-2) traffic classes as described in section 3.1 of the **nbn**® Ethernet Product Description subject to availability by access technology as set out in sections 3.2 to 3.4 of the **nbn**® Ethernet Product Description.

A valid Unicast 1:1 AVC bandwidth profile comprises a combination of available upstream/downstream bandwidth profiles for each traffic class as specified from the available combinations in sections B.1 and B.2 to Appendix B. Availability by access technology for each Unicast 1:1 AVC bandwidth profile combination is also set out in sections B.1 and B.2 to Appendix B.

4.1.3.2 Unicast N:1 AVC Bandwidth Profile Availability

The Unicast N:1 AVC is available only to support the UNI-V and AVC TC-1 bundle as described in section 6 of the **nbn**® Ethernet Product Description.

The available Unicast N:1 AVC bandwidth profile on the UNI-V is the combination of AVC TC-4 0/0 Mbps (PIR) and AVC TC-1 0.15Mbps (CIR).

5 Connectivity Virtual Circuit (CVC)

5.1.1 Overview

The CVC implements the S-VLAN component of an IEEE802.1ad Provider Bridge, as further described in the Network Interface Specification - CVC. This is an Ethernet virtual circuit that provides connectivity from an NNI to a CSA. It is dimensioned with a specific, configured amount of bandwidth capacity to deliver a higher-layer service (or number of services) to a range of AVCs within a particular CSA.

The **nbn**® Ethernet CVC Product Component has two variants:

- 1:1 VLAN – required for 1:1 AVC unicast services delivered using the UNI-D or UNI-DSL interface
- N:1 VLAN – required for N:1 AVC unicast services delivered using the UNI-V interface

The CVC type availability is dependent on the access technologies:

CVC Type	Fibre Network	FTTB / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
1:1 CVC	Available	Available	Available	Available	Available	Available
N:1 CVC	Available	Not Available	Not Available	Not Available	Not Available	Not Available

The NNI, and all CVCs delivered through it, are specific to RSP. It is possible that RSP may have multiple CVCs within a CSA delivered using a number of NNI. CVCs are isolated from each other on an NNI via the use of distinct S-VIDs and can each be individually dimensioned according to the service needs of each CSA and each AVC contained within the CVC. Subject to section 1.1(e) of the **nbn**® Ethernet Product Description, different CVC types are able to co-exist on the same NNI.

5.1.2 AVC and CVC Scalability

RSP should consider AVC and CVC scalability in conjunction with contention. RSP may control End User experience through contention applied by dimensioning of capacity between the AVC and CVC subject to conditions set out in the **nbn**® Ethernet Product Description.

5.1.2.1 Unicast 1:1 CVC Scalability

A single unicast 1:1 CVC can support up to 4,000 unicast 1:1 AVCs, and is able to deliver AVCs to any UNI within a single CSA. [10] Each of the 4,000 unicast 1:1 AVCs is addressed using a single, unique C-VID, locally significant to the CVC. Subject to section 2.1(d) of the **nbn**® Ethernet Product

[10] Note that **nbn**® Ethernet (Satellite) is supplied in a separate single national CSA which geographically overlaps with the other CSAs that contain Premises served by other **nbn**® Network technologies.

Description, the number of CVCs that RSP may purchase in relation to a given CSA is limited only by the NNI resources that RSP has purchased for that CSA. Note that where RSP requires access to more than 4,000 AVCs in a given CSA, it is necessary to utilise more than one CVC.

5.1.2.2 Unicast N:1 CVC Scalability

As Unicast N:1 does not use C-VLANs there is no restriction on the number of unicast N:1 AVCs within a CSA that can be associated with a single unicast N:1 CVC at the NNI.

5.1.3 CVC Bandwidth Profile Availability

5.1.3.1 Unicast 1:1 CVC Bandwidth Profile Availability

The available unicast 1:1 CVC bandwidth profiles comprise a combination of available upstream/downstream bandwidth profiles for each traffic class as defined in sections 2.2 to 2.4 of the **nbn**® Ethernet Product Description, provided that the total combination of CVC bandwidth profiles is not zero. Those sections set out additional limitations that apply in respect of **nbn**® Ethernet (Satellite).

5.1.3.2 Unicast N:1 CVC Bandwidth Profile Availability

The available unicast N:1 CVC bandwidth profiles comprise the TC-1 traffic class bandwidth profiles set out in section 2.3(b) of the **nbn**® Ethernet Product Description.

5.1.4 CVC Contention Management

Subject to section 2.1(d) of the **nbn**® Ethernet Product Description, RSP should control AVC:CVC contention for the purpose of managing service utilisation. In the event of AVC:CVC congestion within unicast services, the **nbn**® Network will discard traffic in accordance with section 2.2.

6 Network-Network Interface (NNI)

Section 1 of the **nbn**® Ethernet Product Description describes the NNI Product Component and the NNI Group and NNI Bearer entities and their interrelationships. This section provides further product-level specification of the NNI Group, NNI Bearers, Redundancy Mode, NNI Link, V-NNI and the CVC support characteristics of the NNI Product Component.

Detailed network-level specifications are set out in the Network Interface Specification – NNI.

6.1 NNI Group and NNI Bearers

For 1Gbps and 10Gbps NNI Bearers an NNI Group can support up to 8 NNI Bearers.

For 100Gbps NNI Bearers an NNI Group can support up to 2 NNI Bearers in Single Chassis mode or up to 4 NNI Bearers in Diverse Chassis mode. [11]

All NNI Bearers within an NNI Group must be consistent with the group interface rate for that NNI Group [12] (i.e. 1Gbps, 10Gbps or 100Gbps).

6.2 Redundancy Mode

The NNI Group must be configured in one of the following redundancy modes:

- **Single Chassis** (where all NNI Bearers are connected to the same chassis)
- **Diverse Chassis** (where NNI Bearers are connected across a pair of chassis)

6.2.1 Single Chassis

When an NNI Group is configured in Single Chassis mode, all NNI Bearers of the NNI Group will be provisioned on the same chassis.

These NNI Bearers will operate in an N:1 protection mode, meaning that if any NNI Bearer within the NNI Group fails, the NNI Group will continue to operate at an aggregate capacity that is reduced by the capacity of the failed NNI Bearer.

6.2.2 Diverse Chassis

When an NNI Group is configured in Diverse Chassis mode, half of the NNI Bearers of the NNI Group will be provisioned on one (working) chassis, and the other half will be provisioned on a second (protect) chassis.

The NNI Group will operate in a 1:1 protection mode, meaning that if any NNI Bearer on the working chassis fails, traffic will be re-directed to the NNI Bearers on the protect chassis.

[11] Note that the addition of NNI Bearers to an NNI Group may result in the degradation of aggregate NNI Group link efficiency, as a result of IEEE802.3ad frame distribution.

[12] Optical characteristics may vary, providing the interface rate is consistent.

6.3 NNI Link

An NNI Link allows the reservation of an S-TAG pool and bandwidth profile from the NNI Group that the Linked NNI is configured to, enabling the RSP to assign this S-TAG pool and bandwidth profile to a V-NNI RSP. An NNI can support the maximum assignment of 4000 NNI Links.

RSP is not permitted to over-book S-TAGs or contend bandwidth within an NNI Group. Each S-TAG pool must be unique to an NNI Link or CVC, and the total bandwidth of all NNI Links linked to an NNI cannot exceed the bandwidth of the available NNI capacity.

6.4 V-NNI

Where RSP orders a V-NNI, the V-NNI will adopt the following characteristics:

- The V-NNI supports the association of a single NNI Link.
- Subject to **nbn** incorporating this functionality, the V-NNI will have visibility of the NNI Link operational Status.
- The V-NNI will obtain its S-TAG pool and bandwidth profile from the associated NNI Link.
- The V-NNI will inherit the redundancy mode of the NNI Group from which the NNI Link was created.
- The V-NNI does not support the use of NNI Group of NNI Bearers.

6.5 CVC Support

An NNI Group can support up to 4,000 CVCs in aggregate, including (subject to section 1.1(f) of the **nbn**® Ethernet Product Description) any mix of CVC types.

RSP is not permitted to:

- over-book CVC TC-1, CVC TC-2 or, in respect of the Satellite Network only, CVC TC-4 capacity in respect of an NNI; or
- order any single CVC TC-4 Product Component with capacity that exceeds the capacity of the associated NNI.

6.6 Service Support

RSP must not exceed the maximum number of Product Components, in aggregate, supported in an NNI Group set out in this section (in this section 6.6, the **Bearer Limit**). The Bearer Limit operates in addition to the limitation set out in section 6.5.

For the purpose of this section 6.6, the Bearer Limit includes the total number of Unicast 1:1 AVCs, OVCs, and Unicast N:1 CVCs associated with an NNI Group.

6.6.1 100Gbps NNI Bearers

The Bearer Limit for an NNI Group of 1 x 100Gbps NNI Bearer in Single Chassis mode is 31,000.

The Bearer Limit for an NNI Group of 2 x 100Gbps NNI Bearers in Single Chassis mode is 62,000.

The Bearer Limit for an NNI Group of 2 x 100Gbps NNI Bearers in Diverse Chassis mode is 31,000.

The Bearer Limit for an NNI Group of 4 x 100Gbps NNI Bearers in Diverse Chassis mode is 62,000.

6.7 Class of Service Support

The NNI Group will transparently support the traffic class and priority encoding/decoding model set out in section 2.2 and 3.1.2 and detailed in section 3 of the Network Interface Specification – CVC.

For NNI Groups configured as Single Chassis, the failure of one or more NNI Bearers may result in the discard of traffic due to insufficient NNI Group aggregate capacity to carry the provisioned CVC capacity. In such cases, traffic is designed to be discarded according to the priority as indicated at the CVC level.

7 Network Performance

7.1 Traffic Class Performance

nbn will aim to achieve the following standards (on an individual traffic class basis) for each traffic class:

Traffic Class	Network	Frame Delay (One-Way)	Frame Delay Variation	Frame Loss [13]
TC-1	Fibre Network	≤ 6msec	≤ 3msec	≤ 0.01%
	FTTB Network FTTN Network	≤ 25msec	≤ 10msec	≤ 0.04%
	FTTC Network	≤ 25msec	≤ 10msec	≤ 0.04%
	HFC Network	≤ 25msec	≤ 10msec	≤ 0.04%
	Wireless Network	≤ 40msec	≤ 50msec	≤ 0.04%
	Satellite Network	≤ 370msec	≤ 25msec	≤ 0.04%
TC-2	Fibre Network	≤ 6msec	≤ 10msec	≤ 0.01%
	FTTB Network FTTN Network	≤ 25msec	≤ 16msec	≤ 0.04%
	FTTC Network	≤ 25msec	≤ 16msec	≤ 0.04%
	HFC Network	≤ 25msec	≤ 16msec	≤ 0.04%
TC-4	Not Applicable	Not Applicable	Not Applicable	Not Applicable

7.2 Limitations on the Standards for Traffic Class Operations Performance

The performance of traffic class operations as specified in section 7.1 will only apply under the following conditions:

Traffic Class	Layer 2 Frame Size at NNI (Bytes) [14]	Frame Rate	CVC Traffic Class Capacity Utilisation
TC-1	250	Periodic <=CIR	≤ 70%
TC-2	1500	Periodic <=CIR	≤ 70%

Frame Delay guidance is provided between UNI and NNI distances less than 100km. In the case of UNI to NNI distance > 100km, an extra allowance of 1.4msec latency per additional 200km air path (as the crow flies) distance (or part thereof) is required.

[13] Frame Loss targets will only be met where the CBS is less than the specified limits at both the AVC and CVC level as described in section 2.2.2.2 and any applicable Network Interface Specification.

[14] Service frames are accepted up to the maximum Frame Size as described in section 3.4 of the Network Interface Specification – NNI.

The performance of traffic class operations does not apply to:

- services utilising the UNI-V over the Fibre Network because they are subject to additional performance-affecting processing which will impact end-to-end performance
- **nbn**® Ethernet (FTTB) Ordered Products or **nbn**® Ethernet (FTTN) Ordered Products, where the Line Rate is not capable of supporting the provision of all AVC TC-1 and AVC TC-2 bandwidth profiles ordered by RSP in respect of that Ordered Product (see section 3.3.2)
- **nbn**® Ethernet (FTTC) where the Access Line Rate or the Line Rate of the UNI-D is not capable of supporting the provision of all AVC TC-1 and AVC TC-2 bandwidth profiles ordered by RSP in respect of that Ordered Product (see section 3.2.2).

The Layer 2 Frame Size and Frame Rate values must result in a data stream which is less than or equal to the subscribed Traffic Class CIR or any other circumstance in which the speed, performance or stability of an Ordered Product is affected by any matters set out in sections 3 or 13 of the **nbn**® Ethernet Product Description.

Each traffic class must be validated in the presence of no other traffic from other traffic classes within the AVC.

7.3 TC-4 Traffic Performance Characteristics

Traffic class 4 is designed for applications that can benefit from a peak capacity and can tolerate variable throughput. TC-4 offers capacity as a PIR, with the exception of Wireless Plus, which does not have a defined PIR. TC-4 does not support a CIR.

The performance of RSP Products that use AVC TC-4s as an input will vary depending on factors both within and outside of the **nbn**® Network. RSP should use suitable higher-layer intelligent flow control mechanisms to achieve optimum results for RSP Products that use AVC TC-4s as an input. The particular access technology used to deliver **nbn**® Ethernet will also have an impact on TC-4 performance.

For AVC TC-4 bandwidth profiles of Home Superfast, 250/100 Mbps, 500/200 Mbps, Home Ultrafast and 1000/400 Mbps offered over **nbn**® Ethernet where a 10Gbps or 100Gbps NNI is in use, an AVC peak burst in excess of 100 consecutive Ethernet frames may cause increased Frame Loss in the downstream if RSP does not use a suitable higher-layer intelligent flow control mechanism.

8 Orderable Attributes

8.1 Access Components

Access Components, for the purposes of this **nbn**® Ethernet Product Technical Specification, only comprise each instance of the UNI and AVC Product Components supplied by **nbn** to RSP to use as an input to an RSP Product or Downstream Product.

Available Product Components are tabled below:

	UNI Type	Available associated AVC
Fibre Network	UNI-D	Unicast
	UNI-D + UNI-V	Unicast (separately with each UNI-D and UNI-V)
Wireless Network	UNI-D	Unicast
HFC Network	UNI-D	Unicast
FTTC Network	UNI-D	Unicast
Satellite Network	UNI-D	Unicast
FTTB Network / FTTN Network	UNI-DSL	Unicast

Each Access Component is delivered using two sets of attributes:

- **configuration attributes** – provided through Product Templates
- **service attributes** – provided through Product Order Forms for each AVC order [15]

This section describes the Access Components in the context of configuration and service attributes.

8.1.1 Configuration Attributes

The following tables detail all AVC and UNI attributes which must be specified within a Product Template, for the delivery of the relevant Access Components.

RSP may construct its end-to-end service from a combination of these configuration attributes and service attributes selected in relation to each Ordered Product.

Certain settings required to interface to the **nbn**® Network must be decided at time of On-boarding during the solution definition phase, and captured in a Product Template. These details cannot be tailored for each specific Ordered Product.

[15] The term "service attributes" is used to describe the technical elements which are required to deliver Product Features as described in the **nbn**® Ethernet Product Description and elsewhere in this **nbn**® Ethernet Product Technical Specification.

Product Templates apply to the Access Components only. Product Templates, combined with per-Ordered Product service attributes selected in a Product Order Form at time of order, are required for **nbn** to supply an Ordered Product.

8.1.1.1 UNI Configuration Attributes

The following set of configuration attributes are available for the UNI. These parameters are captured during the solution definition phase, as part of the On-boarding process.

Component	Configuration Attribute	Configuration Attribute Options
UNI	UNI Type	UNI-D
		UNI-DSL
		UNI-V (only available for **nbn**® Ethernet (Fibre))
	VLAN Addressing Mode	Default-Mapped (UNI-D/UNI-DSL only) [16]
		DSCP-Mapped
		Priority-Tagged (UNI-D/UNI-DSL only)
		Tagged (UNI-D/UNI-DSL only)

Table 2: UNI Configuration Attributes

8.1.1.2 AVC Configuration Attributes

The following set of configuration attributes are available for the AVC. These parameters are captured during the solution definition phase, as part of the On-boarding process.

Component	Configuration Attribute	Configuration Attribute Options
AVC	AVC Type	Unicast 1:1 (UNI-D/UNI-DSL only)
		Unicast N:1 (UNI-V only)
	Bandwidth Profile	Specified from the available bandwidth profiles in Appendix B

Table 3: AVC Configuration Attributes

8.1.2 Service Attributes

This section describes the service attributes relating to the technical operation of the service that RSP must select for each Access Component, at the time of ordering an Ordered Product. Note that the number and type of service components will be determined by the Product Template.

[16] Note the limitations on addressing mode and AVC traffic class combinations in Appendix B.

8.1.2.1 Access Component Attributes

The following service attributes must be specified, where applicable, at time of order for each AVC and UNI Product Component:

Component	Service Attribute	Specification (Provided by RSP)
Access Service [17]	"Service Restoration SLA" (Service Fault rectification Service Level)	Standard (Default)
		Enhanced-12
		Enhanced-12 (24/7)
		Enhanced-8
		Enhanced-8 (24/7)
		Enhanced-6
		Enhanced-6 (24/7)
		Enhanced-4
		Enhanced-4 (24/7)
		Enhanced (90 Day)–12 (24/7)
	Priority Assist (Downstream Priority Assistance Service)	No (Default)
		Yes
	Battery Backup Service	Yes [18]
		No

Table 4: Service Attributes for Access Service

8.1.2.2 UNI-V Service Attributes

The following service attributes must be specified at time of order for the UNI-V (for **nbn**® Ethernet (Fibre) only):

Component	Service Attribute	Specification (Provided by RSP)
UNI-V	NTD UNI-V Port Number	0: Assigned by **nbn** (default)

Table 5: Service Attributes for UNI-V

[17] Refer to the **nbn**® Ethernet Service Levels Schedule and the **nbn**® Ethernet Product Description for details of supported service options that are available.

[18] Where RSP has specified the Battery Backup Service in respect of an Ordered Product supplied to a UNI on the affected F-NTD, **nbn** will provide a notification of the alarm to RSP as set out in the WBA Operations Manual as part of the Battery Backup Service.

8.1.2.3 UNI-D Service Attributes

The following service attributes must be specified at time of order for the UNI-D:

Component	Service Attribute	Specification (Provided by RSP)
UNI-D	NTD UNI-D Port Number	0: Assigned by **nbn** (default) 1 – 4: Request Specific UNI-D Port on NTD (if > 1 available)
	FTTC-NCD UNI-D Port Number	0: Assigned by **nbn** (default): Note this attribute cannot be specified by RSP.
	Physical Interface	AUTO (Speed)/AUTO (Duplex) 100Mbps/AUTO (Duplex) [19]

Table 6: Service Attributes for UNI-D

8.1.2.4 UNI-DSL Service Attributes

The following DSL service attributes must be specified at time of order:

Component	Service Attribute	Specification (Provided by RSP)
UNI-DSL	DSL Stability Profile [20]	Standard - means the standard VDSL2 line profile.
		Stable - means a VDSL2 line profile designed to optimise layer 1 stability, for example through an increased noise margin and G.Inp retransmission buffer.

Table 7: Service Attributes for UNI-DSL

Note that DSL Mode is VDSL2 and cannot be changed.

8.1.2.5 Unicast AVC Service Attributes

The following service attributes must be specified at time of order for each unicast 1:1 AVC:

Component	Service Attribute	Specification (Provided by RSP)
AVC	CVC ID	CVC ID
	C-VID at NNI (1:1 AVC only)	0 – 4000 [21]

[19] This specification is not available for **nbn**® Ethernet (Satellite).

[20] Note that **nbn** may apply a Repair Profile as described in the WBA Operations Manual. This profile is applied by **nbn** and is not selectable by RSP.

[21] The value of zero indicates that **nbn** will select the C-VID, and does not indicate that a C-VID of zero may be used.

Component	Service Attribute	Specification (Provided by RSP)
	C-VID at UNI-D/UNI-DSL [22] (1:1 AVC only)	2 – 4004 (for **nbn**® Ethernet (Fibre), **nbn**® Ethernet (FTTB), **nbn**® Ethernet (FTTN), **nbn**® Ethernet (FTTC) and **nbn**® Ethernet (HFC)) 2 – 4001 (for **nbn**® Ethernet (Wireless) and **nbn**® Ethernet (Satellite))
	Bandwidth Profile	Specified from the available unicast AVC bandwidth profiles in Appendix B
	Access Loop Identification Active	Active / Inactive If Active Insert DSL line rate (used in DHCP or PPP response [RFC 4679 support]) (for **nbn**® Ethernet (FTTB) and **nbn**® Ethernet (FTTN) only)
	TPEP Web Optimisation [23] (**nbn**® Ethernet (Satellite) only)	ON (Default) / OFF
	TPEP TCP Optimisation (**nbn**® Ethernet (Satellite) only)	ON (Default) / OFF
	Interface mode	Default-Mapped / Priority-Tagged / Tagged / DSCP Mapped

Table 8: Service Attributes for Unicast 1:1 AVC

The following service attributes must be specified at time of order for each unicast N:1 AVC:

Component	Service Attribute	Specification (Provided by RSP)
AVC	CVC ID	CVC ID

Table 9: Service Attributes for Unicast N:1 AVC

8.1.2.6 Modification of an AVC bandwidth profile and service interruption

RSP may modify an AVC TC-4 bandwidth profile in accordance with the WBA Operations Manual. There will be a brief service interruption when the Modify Order is processed.

[22] Required only for UNI-D/UNI-DSL mode configured in Tagged mode.

[23] Selecting TPEP Web Optimisation will also enable TPEP TCP Optimisation.

8.2 CVC Service Attributes

There is no Product Template required for a CVC. Table 10 describes the set of service attributes which are generic to all CVC variants (except where called out specifically).

Component	Attributes	Attribute Description	Selectable Options
End-Point Identification	NNI Group identification [24]	Identification of the NNI that the CVC is to be terminated on.	NNI Group identification (Existing)
	B-END CSA	Identification of the CSA that the CVC is terminated on.	CSA identification [25]
S-TAG Mapping	S-TAG (NNI)	RSP may choose a locally-significant S-TAG at the NNI. Optional parameter. If set to zero, **nbn** will assign the next available value.	Requested S-TAG (0 for **nbn**-supplied S-TAG) Default = 0 S-TAG: (1 – 4000)
Satellite CVC Minimum AVC threshold (**nbn**® Ethernet (Satellite))	CVC Class	RSP must choose this attribute at the time of ordering a CVC for **nbn**® Ethernet (Satellite). This attribute determines the minimum number of provisioned AVCs required before RSP can order an increased CVC bandwidth profile. [26]	CVC Class-0 (Default) CVC Class-1 (Premium) CVC Class-2 (Premium)

Table 10: Generic CVC Service Attributes

The allocation of S/C-VID values at the NNI must be co-ordinated between RSP and **nbn**.

When requested by RSP as part of a Product Order Form for a CVC or AVC, **nbn** will allocate each new CVC/AVC an internally-generated S/C-VID. This S/C-VID value will be returned to RSP in accordance with the WBA Operations Manual, and must be used for accessing the CVC/AVC at the NNI.

RSP may optionally elect to nominate the S/C-VID used to address each CVC/AVC service instance through the NNI by specifying a S/C-VID in the Product Order Form for the CVC/AVC, for the purpose of further alignment to its own backhaul network addressing schemes. Note that RSP is encouraged to use **nbn**'s S/C-VID allocations, which will be unique to RSP's service. This will avoid any potential for S/C-VID mismatch between RSP and **nbn**.

For service addressing modes at the NNI that rely on MAC addressing for forwarding within the **nbn**® Network, the allocation of a C-VID is not required.

[24] Refer to section 8.4 of this **nbn**® Ethernet Product Technical Specification.

[25] **nbn**® Ethernet (Satellite) operates from a single centralised POI and covers the entire Satellite Network footprint as a single CSA.

[26] See the **nbn**® Ethernet Product Description for further details.

8.2.1 Unicast 1:1 CVC

Each unicast 1:1 CVC order must specify each of the service attributes listed in Table 11 below, in addition to those configuration attributes detailed in Table 10.

Component	Attributes	Attribute Description	Network	Selectable Options
Bandwidth profile	Bandwidth profile	CVC_TC-1_CIR (upstream and downstream)	All	Refer to Appendix B
		CVC_TC-2_CIR (upstream and downstream)	All	Refer to Appendix B
		CVC_TC-4_PIR (upstream and downstream)	Fibre, FTTB, FTTN, FTTC, HFC and Wireless	Refer to Appendix B
		CVC_TC-4_CIR (upstream and downstream)	Satellite	Refer to Appendix B

Table 11: 1:1 Unicast CVC Additional Service Attributes

8.2.2 Unicast N:1 CVC

Each unicast N:1 CVC order must specify each of the service attributes listed in Table 12 below, in addition to those configuration attributes detailed in Table 10.

Component	Attributes	Attribute Description	Selectable Options
Bandwidth profile	Bandwidth profile	CVC_TC-1_CIR (upstream and downstream)	Refer to Appendix B

Table 12: N:1 Unicast CVC Additional Service Attributes

8.3 NNI Service Attributes

8.3.1 NNI Group

The NNI Group has the following attributes:

- Location
- Interface Rate
- Redundancy Mode
- Set of NNI Bearers
- Layer 2 Functional Characteristics

8.3.1.1 NNI Group Location

The location of the NNI Group must be specified at time of NNI Group creation.

In order to change the location of an NNI Group (i.e. re-locate NNI Bearers to a different location), it is necessary to purchase a new NNI Group in the intended location, and transition existing AVCs and CVCs from the previous NNI Group. Once completed, the previous NNI Group may be cancelled.

8.3.1.2 NNI Group Interface Rate

A new NNI Group will be configured with a group interface rate that determines the interface rate of each NNI Bearer within the NNI Group. The following group interface rates are available:

- 1Gbps
- 10Gbps
- 100Gbps (not available for **nbn**® Ethernet (Satellite))

The group interface rate is set through the selection of the first NNI Bearer (Single Chassis mode), or pair of NNI Bearers (Diverse Chassis mode) at the time the NNI Group is created (each mode is described in section 6).

The group interface rate is fixed per NNI Group and will restrict the type of NNI Bearer that can be added to the NNI Group. For example, if the NNI Group is created with an initial NNI Bearer operating at 1Gbps, then any further NNI Bearers added to this group must also have an interface rate of 1Gbps.

In order to change the group interface rate of an NNI Group (for example, change all 1Gbps NNI Bearers to either 10Gbps or 100Gbps), it is necessary to purchase a new NNI Group in the intended group interface rate and associated NNI Bearers, and migrate existing AVCs and CVCs from the previous NNI Group. Once completed, the previous NNI Group can be disconnected. At Upgraded POIs, this can be requested by RSP by way of an NNI Upsize Migration in the circumstances set out in the WBA Operations Manual.

8.3.1.3 NNI Group Redundancy Mode

The NNI Group must be configured in one of the following redundancy modes:

- **Single Chassis** (where all NNI Bearers are connected to the same chassis)
- **Diverse Chassis** (where NNI Bearers are connected across a pair of chassis)

In order to change the redundancy mode of an NNI Group:

- at an Upgraded POI from Single Chassis to Diverse Chassis mode, RSP may request an NNI Diversity Upgrade in the circumstances set out in the WBA Operations Manual; or
- in all other circumstances, RSP must purchase a new NNI Group in the intended redundancy mode and transition existing AVCs and CVCs from the previous NNI Group. Once completed, the previous NNI Group may be ~~cancelled~~disconnected.

8.3.1.4 NNI Group Orderable Attributes Summary

A summary of attributes that must be specified for each NNI Group order is shown in Table 13.

Component	Attributes	Attribute Description	Selectable Options
Service details	Physical Location	Physical location of NNI	POI Site
NNI Group Attributes	TPID	Ability to specify the S-TAG TPID used for service frames across the NNI	0x88A8 (default)
			0x8100
	Redundancy Mode	Physical interface type	Single Chassis (default)
			Diverse Chassis

Table 13: NNI Group Orderable Attributes

Each successful NNI Group order is intended to yield an **nbn**-supplied NNI Group identification.

8.3.2 NNI Bearer

8.3.2.1 NNI Bearer Ordering

NNI Bearers are ordered through an NNI Group (refer to section 6).

A feasibility check will be required upon addition of any NNI Bearer to an NNI Group, to determine whether the number of allowable NNI Bearers within the NNI Group has been exceeded.

nbn initially provisions each completed NNI Bearer order to RSP in an administratively "down" state. **nbn** will change this to an "up" state in co-ordination with RSP.

The following activities may be performed on an NNI Group, with respect to the set of NNI Bearers:

- establish a new NNI Group through ordering at least one NNI Bearer (Single Chassis mode) or at least one pair of NNI Bearers (Diverse Chassis mode)
- modify an existing NNI Group through Activating/disconnecting NNI Bearer(s)
- disconnect an existing NNI Group – all underlying NNI Bearers and NNI Links will be automatically disconnected.

For NNI Groups configured as Single Chassis, NNI Bearers may be ordered as single interfaces.

For NNI Groups configured as Diverse Chassis, NNI Bearers must be ordered in pairs, with each NNI Bearer of each pair provisioned on different chassis.

For NNI Groups comprising 1Gbps Ethernet interfaces, **nbn** intends to use reasonable endeavours to provide the ability to seamlessly scale an NNI Group up to four NNI Bearers. Beyond four NNI Bearers, **nbn** intends to schedule an Outage with RSP unless **nbn** notifies RSP that an Outage is not necessary.

For NNI Groups comprising 10Gbps or 100Gbps Ethernet interfaces, **nbn** intends to schedule an Outage with RSP in order to augment the NNI Group with additional NNI Bearers unless **nbn** notifies RSP that an Outage is not necessary.

8.3.2.2 NNI Bearer Orderable Attributes

Each NNI Bearer order must specify each of the service attributes listed in Table 14.

Component	Attributes	Attribute Description	Selectable Options
Service details	NNI Group	The NNI Group to which the NNI Bearer is intended to be associated	NNI Group identification
NNI Bearer	Type	Physical interface type	1000BaseLX
			1000BaseEX
			10GBaseLR
			10GBaseER
			100GBaseLR4 [27]
			100GBaseER4 [28]

Table 14: NNI Bearer Service Attributes

Each successful NNI Bearer order will yield an **nbn**-supplied NNI Bearer identification, which will indicate a physical port on the **nbn** ODF to which the NNI Bearer has been cabled.

RSP must separately acquire the necessary facilities access rights to connect the NNI Bearer to RSP's backhaul transmission cables or RSP Active Equipment.

8.3.3 NNI Link

8.3.3.1 NNI Link Ordering

The following activities may be performed on an NNI Group with respect to NNI Links:

- Establish a new NNI Link by specifying the range of S-TAGs, bandwidth and the V-NNI RSP;
- Modify an existing NNI Link by updating of the S-TAG pool and bandwidth (subject to there being sufficient spare capacity on the associated Downstream V-NNI to accommodate the Modification). Updating the V-NNI RSP is only possible if the NNI Link is not linked to a Downstream V-NNI.
- Cancel an existing NNI Link.

The pool of S-TAGs will be validated to ensure that it is not currently assigned to an existing NNI Link or CVC.

The bandwidth of the NNI Link (refer to section B.7) will be validated to confirm it is unused and within the NNI Group capacity before the NNI Link order is accepted.

Cancelling of an existing NNI Link is permitted only when not used by a Downstream V-NNI.

8.3.3.2 NNI Link Orderable Attributes

A summary of attributes that must be specified for each NNI Link order is shown in Table 15.

[27] Not available for **nbn**® Ethernet (Satellite).

[28] Not available for **nbn**® Ethernet (Satellite).

Component	Attributes	Attribute Description	Selectable Options
Service details	NNI Group	The NNI Group to which the NNI Link is intended to be associated	NNI Group identification
NNI Link Attributes	S-TAG pool	Range of S-TAG values associated with the NNI Link	Start of pool, greater than or equal to 1 End of pool, less than or equal to 4000
	Bandwidth	NNI Link Bandwidth	Refer to section B.7
	V-NNI RSP	RSP name belonging to the V-NNI RSP	RSP name

Table 15: NNI Link Service Attributes

Each successful NNI Link order will be assigned an **nbn**-designated NNI Link identification number.

8.3.4 V-NNI

8.3.4.1 V-NNI Ordering

The following activities may be performed by RSP for a V-NNI:

- Create a new V-NNI by selecting from a list of possible NNI Links.
- Cancel an existing V-NNI.

A V-NNI can be associated with one Upstream NNI Link. The Upstream NNI Link attributes (S-TAG pool and bandwidth) will be displayed during the V-NNI ordering process.

Cancelling of an existing V-NNI is permitted after associated CVCs have been cancelled.

8.3.4.2 V-NNI Orderable Attributes

A summary of attributes that must be specified for each V-NNI order is shown in Table 16.

Component	Attributes	Attribute Description	Selectable Options
V-NNI Attributes	NNI Link ID	The NNI Link which will be associated to the V-NNI	NNI Link ID

Table 16: V-NNI Service Attributes

Each successful V-NNI order will be assigned an **nbn**-designated V-NNI identification number.

Appendix A Access Technology Compatibility

nbn supplies the **nbn**® Ethernet by means of:

- the Fibre Network (using fibre (GPON) technology);
- the FTTB Network or the FTTN Network or the FTTC Network (using copper xDSL technology);
- the HFC Network (using Hybrid Fibre Coaxial technology);
- the Wireless Network (using fixed wireless technology); and
- the Satellite Network (using geo synchronous satellite technology),

as further described in the **nbn**® Ethernet Product Description.

Any service supplied by **nbn** in respect of a Premises may be supplied using any **nbn**® Network as described in this Product Technical Specification. The network which will be used will be determined by **nbn**, based on the location of the Premises. **nbn** will determine what Product Components, Product Features and level of performance can be offered.

This section describes the restrictions on the availability and differences in performance of Product Features.

A.1 Service Type Availability

This section describes the availability of features described in section 2.1.

Service Type	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
Unicast data services	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
IP-based telephony services (External ATA)	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
IP-based telephony services (Integrated ATA)	Available on UNI-V	Not Available	Not Available	Not Available	Not Available	Not Available

Table 17: Service Type Availability by nbn® Network

A.2 Product Feature Availability

A.2.1 Service Level Options

This section describes the availability of features described in section 8.1.2.1.

Service Level Option	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
Service Fault Rectification – standard	Available	Available	Available	Available	Available	Available
Service Fault Rectification– Enhanced-12	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification– Enhanced-12 (24/7)	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification– Enhanced-8	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification– Enhanced-8 (24/7)	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification– Enhanced-6	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification– Enhanced-6 (24/7)	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification– Enhanced-4	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification–	Available	Not Available	Available	Available	Not Available	Available

Service Level Option	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
Enhanced-4 (24/7)						
Downstream Priority Assistance Service	Available	Not Available	Available	Available	Not Available	Available
Enhanced (90 Day) – 12 (24/7)	Available	Not Available	Available	Available	Not Available	Available

Table 18: Service Level Option Availability by nbn® Network

A.3 NNI Availability

The NNI Product Component as described in section 6 is available across the **nbn**® Network.[29] Subject to Table 19 below, there are restrictions in the ability to deliver NNI features as a result of the type of **nbn**® Network.

NNI Feature	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
NNI with NNI Bearers	Available	Available	Available	Available	Available	Available
V-NNI with NNI Link	Available	Available	Available	Available	Not Available	Available

Table 19: NNI Feature Availability by nbn® Network

A.4 CVC Availability

This section describes the availability of features as described in section 5.

CVC Type	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/N
1:1 Unicast	Available	Available	Available	Available	Available	Available
N:1 Unicast	Available	Not Available	Not Available	Not Available	Not Available	Not Available

Table 20: CVC Type Availability by nbn® Network

[29] NNI availability in respect of **nbn**® Ethernet (Satellite) is limited to a single centralised POI located in Eastern Creek, NSW, and is subject to section 1.1(f) of the **nbn**® Ethernet Product Description.

A.5 UNI Feature Availability

A.5.1 UNI Type Availability

UNI Type	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
UNI-D	Up to 4 UNI-D per NTD [30]	Up to 4 UNI-D per NTD [31]	1 UNI-D per NTD [32]	1 UNI-D per FTTC-NCD	Up to 4 UNI-D per NTD [33]	Not Available
UNI-DSL	Not Available	Not Available	Not Available	Not Available	Not Available	One single UNI-DSL port (not on an NTD)
UNI-V	Up to 2 UNI-V per NTD	Not Available	Not Available	Not Available	Not Available	Not Available

Table 21: UNI Type Availability by nbn® Network

A.5.2 Addressing Mode Availability

UNI Mode	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
Default-Mapped TC-4	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
Default-Mapped TC-1	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
Default-Mapped TC-2	Available on UNI-D	Not Available	Available on UNI-D [34]	Available on UNI-D	Not Available	Available on UNI-DSL
DSCP-Mapped	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
Priority-Tagged	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL

[30] See the **nbn**® Ethernet Product Description and the **nbn**® Ethernet Fair Use Policy for limitations on UNI availability on certain **nbn**® Network types.

[31] See the **nbn**® Ethernet Product Description and the **nbn**® Ethernet Fair Use Policy for limitations on UNI availability on certain **nbn**® Network types.

[32] Although the CM8200B variant of the HFC-NTD is physically equipped with two UNI-D ports (UNI-D1 and UNI-D2), only UNI-D1 port is available for use at this point in time. Typically, the UNI-D2 port will be covered with a sticker.

[33] See the **nbn**® Ethernet Product Description and the **nbn**® Ethernet Fair Use Policy for limitations on UNI availability on certain **nbn** Network types.

[34] The CM820B variant of the HFC-NTD does not support the Default Mapped TC-2 Addressing Mode.

UNI Mode	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
Tagged	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL

Table 22: Addressing Mode Availability by nbn® Network

A.6 AVC Feature Availability

A.6.1 AVC Type

This section describes the availability of features described in section 4.

AVC Type	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
1:1 Unicast	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
N:1 Unicast	Available on UNI-V	Not Available	Not Available	Not Available	Not Available	Not Available

Table 23: AVC Feature Availability – AVC Type by nbn® Network

A.6.2 Access Loop Identification

This section describes the availability of the Access Loop Identification feature for unicast AVCs (described in section 4.1.2).

AVC Traffic Class	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
IPv4 DHCP Option 82	Available on UNI-D Available on UNI-V	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
IPv6 DHCP Option 18	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
IPv6 DHCP Option 17	Not Available	Not Available	Not Available	Not Available	Not Available	Available on UNI-DSL
PPPoE IA Insertion	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL

Table 24: AVC Feature Availability – Access Loop Identification by nbn® Network

A.6.3 Bandwidth Profile - Traffic Class

This section describes restrictions on the availability of a traffic class according to access technology.

AVC Traffic Class	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
TC-1	Available on UNI-D Available on UNI-V	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
TC-2	Available on UNI-D	Not Available	Available on UNI-D [35]	Available on UNI-D	Not Available	Available on UNI-DSL
TC-4	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL

Table 25: AVC Feature Availability – Traffic Class by nbn® Network

A.6.4 Bandwidth Profile – Unicast 1:1 AVC TC-1

This section describes restrictions on the availability of AVC TC-1 bandwidth profiles (described in section 4.1.3.1) according to access technology.

Bandwidth Profile (TC-1)	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
0 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
0.15 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
0.3 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
0.5 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
1Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
2Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
5Mbps	Available on UNI-D	Not Available	Available on UNI-D [36]	Available on UNI-D	Not Available	Available on UNI-DSL

Table 26: Unicast 1:1 AVC Feature Availability – Bandwidth Profile (TC-1) by nbn® Network

[35] The CM820B variant of the HFC-NTD does not support the TC-2 Traffic Class.

[36] The CM820B variant of the HFC-NTD does not support the TC-1 5Mbps bandwidth profile.

A.6.5 Bandwidth Profile – Unicast N:1 AVC TC-1

This section describes restrictions on the availability of TC-1 AVC bandwidth profiles (described in section 4.1.3.2) according to access technology.

Bandwidth Profile (TC-1)	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
0.15 Mbps	Available on UNI-V	Not Available	Not Available	Not Available	Not Available	Not Available

Table 27: Unicast N:1 AVC Feature Availability – Bandwidth Profile (TC-1) by nbn® Network

A.6.6 Bandwidth Profile – Unicast 1:1 AVC TC-2

This section describes restrictions on the availability of AVC TC-2 bandwidth profiles (described in section 4.1.3.1) according to access technology.

Bandwidth Profile (TC-2)	Fibre	Wireless	HFC [37]	FTTC	Satellite	FTTB/FTTN
0 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
5 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
10 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
20 Mbps	Available on UNI-D	Not Available	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL
30 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
40 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
50 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
60 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
70 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
80 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
90 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
100 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

[37] The CM820B variant of the HFC-NTD does not support the TC-2 Traffic Class.

Table 28: Unicast 1:1 AVC Feature Availability – Bandwidth Profile (TC-2) by nbn® Network

A.6.7 Bandwidth Profile – Unicast 1:1 AVC TC-4

This section describes restrictions on the availability of unicast 1:1 AVC TC-4 bandwidth profiles (described in section 4.1.3.1) according to access technology.

Bandwidth Profile (TC-4)	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
0 Mbps	Available subject to UNI-V order being in place [38]	Not Available	Not Available	Not Available	Not Available	Not Available
12/1 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
25/5 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
25/5-10 Mbps	Not Available	Not Available	Not Available	Not Available	Not Available	Available on UNI-DSL
25/10 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Not Available
50/20 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Not Available
25-50/5-20 Mbps	Not Available	Not Available	Not Available	Not Available	Not Available	Available on UNI-DSL
Home Fast	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
Wireless Plus	Not Available	Available on UNI-D	Not Available	Not Available	Not Available	Not Available
25-100/5-40 Mbps	Not Available	Not Available	Not Available	Not Available	Not Available	Available on UNI-DSL
50-100/20-40 Mbps	Not Available	Not Available	Not Available	Available on UNI-D	Not Available	Not Available
100/40 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Not Available	Not Available	Not Available
Home Superfast	Available on UNI-D	Not Available	Available on UNI-D	Not Available	Not Available	Not Available
250/100 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

[38] Upon order of the UNI-V by RSP, the UNI-V is automatically provisioned by **nbn** with TC-1 capacity. A TC-4 bandwidth profile of 0 Mbps can only be ordered when a UNI-V is provisioned with associated TC-1 capacity.

Bandwidth Profile (TC-4)	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
500/200 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
Home Ultrafast	Available on UNI-D	Not Available	Available on UNI-D	Not Available	Not Available	Not Available
1000/400 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

Table 29: AVC Feature Availability – Bandwidth Profile (TC-4) by nbn® Network

Note: To be read subject to section 2.2.2 of this **nbn**® Ethernet Product Technical Specification and section 13 of the **nbn**® Ethernet Product Description.

Appendix B Traffic Class Combinations

The bandwidth profiles in this Appendix B are subject to the specifications and limitations described in this **nbn**® Ethernet Product Technical Specification and the **nbn**® Ethernet Product Description.

B.1 Unicast 1:1 AVC Bandwidth Profiles for nbn® Ethernet (Fibre), nbn® Ethernet (Wireless), nbn® Ethernet (HFC) and nbn® Ethernet (Satellite)

This table shows the valid combinations that may be used to populate the bandwidth profile (upstream and downstream) for a unicast 1:1 AVC for **nbn**® Ethernet (Fibre), **nbn**® Ethernet (Wireless), **nbn**® Ethernet (HFC) and **nbn**® Ethernet (Satellite). The bandwidth profile to be used for a unicast 1:1 AVC must be selected by RSP at the time of order.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
1	12	1	0	0	UNI-D	4	Y	All
2	12	1	0	0.15	UNI-D	1 [40]	Y	All
3	12	1	0	0.3	UNI-D	1 [41]	Y	F/H/W
4	25	5	0	0	UNI-D	4	Y	All
5	25	5	0	0.15	UNI-D	-	Y	All
6	25	5	0	0.3	UNI-D	-	Y	F/H/W
7	25	5	0	0.5	UNI-D	1	Y	F/H
8	25	10	0	0	UNI-D	4	Y	F/H
9	25	10	0	0.15	UNI-D	-	Y	F/H
10	25	10	0	0.3	UNI-D	-	Y	F/H
11	25	10	0	0.5	UNI-D	-	Y	F/H
12	25	10	0	1	UNI-D	1	Y	F/H

[39] Certain AVC bandwidth profiles have dependencies on the UNI-D operating mode.

[40] For this bandwidth profile, the Default-Mapped addressing mode is only available on the UNI-D in respect of **nbn**® Ethernet (Fibre), **nbn**® Ethernet (HFC) and **nbn**® Ethernet (Satellite).

[41] For this bandwidth profile, the Default-Mapped addressing mode is only available on the UNI-D in respect of **nbn**® Ethernet (Fibre) and **nbn**® Ethernet (HFC).

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
13	25	10	5	0	UNI-D	2	Y	F/H
14	25	10	5	0.15	UNI-D	-	Y	F/H
15	25	10	5	0.3	UNI-D	-	Y	F/H
16	25	10	5	0.5	UNI-D	-	Y	F/H
17	50	20	0	0	UNI-D	4	Y	F/H
18	50	20	0	0.15	UNI-D	-	Y	F/H
19	50	20	0	0.3	UNI-D	-	Y	F/H
20	50	20	0	0.5	UNI-D	-	Y	F/H
21	50	20	0	1	UNI-D	-	Y	F/H
22	50	20	0	2	UNI-D	1	Y	F/H
23	50	20	5	0	UNI-D	-	Y	F/H
24	50	20	5	0.15	UNI-D	-	Y	F/H
25	50	20	5	0.3	UNI-D	-	Y	F/H
26	50	20	5	0.5	UNI-D	-	Y	F/H
27	50	20	5	1	UNI-D	-	Y	F/H
28	50	20	5	2	UNI-D	-	Y	F/H
29	50	20	10	0	UNI-D	2	Y	F/H
30	50	20	10	0.15	UNI-D	-	Y	F/H
31	50	20	10	0.3	UNI-D	-	Y	F/H
32	50	20	10	0.5	UNI-D	-	Y	F/H
33	50	20	10	1	UNI-D	-	Y	F/H
34	50	20	10	2	UNI-D	-	Y	F/H
35	Home Fast	Home Fast	0	0	UNI-D	4	Y	F/H
36	Home Fast	Home Fast	0	0.15	UNI-D	-	Y	F/H
37	100	40	0	0	UNI-D	4	Y	F/H
38	100	40	0	0.15	UNI-D	-	Y	F/H
39	100	40	0	0.3	UNI-D	-	Y	F/H
40	100	40	0	0.5	UNI-D	-	Y	F/H
41	100	40	0	1	UNI-D	-	Y	F/H
42	100	40	0	2	UNI-D	-	Y	F/H
43	100	40	0	5	UNI-D	1	Y	F/H
44	100	40	5	0	UNI-D	-	Y	F/H
45	100	40	5	0.15	UNI-D	-	Y	F/H

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
46	100	40	5	0.3	UNI-D	-	Y	F/H
47	100	40	5	0.5	UNI-D	-	Y	F/H
48	100	40	5	1	UNI-D	-	Y	F/H
49	100	40	5	2	UNI-D	-	Y	F/H
50	100	40	5	5	UNI-D	-	Y	F/H
51	100	40	10	0	UNI-D	-	Y	F/H
52	100	40	10	0.15	UNI-D	-	Y	F/H
53	100	40	10	0.3	UNI-D	-	Y	F/H
54	100	40	10	0.5	UNI-D	-	Y	F/H
55	100	40	10	1	UNI-D	-	Y	F/H
56	100	40	10	2	UNI-D	-	Y	F/H
57	100	40	10	5	UNI-D	-	Y	F/H
58	100	40	20	0	UNI-D	2	Y	F
59	100	40	20	0.15	UNI-D	-	Y	F
60	100	40	20	0.3	UNI-D	-	Y	F
61	100	40	20	0.5	UNI-D	-	Y	F
62	100	40	20	1	UNI-D	-	Y	F
62	100	40	20	2	UNI-D	-	Y	F
63	Home Superfast	Home Superfast	0	0	UNI-D	4	Y	F/H
64	Home Superfast	Home Superfast	0	0.15	UNI-D	-	Y	F/H
65	250	100	0	0	UNI-D	4	Y	F
66	250	100	0	0.15	UNI-D	-	Y	F
67	250	100	0	0.3	UNI-D	-	Y	F
68	250	100	0	0.5	UNI-D	-	Y	F
69	250	100	0	1	UNI-D	-	Y	F
70	250	100	0	2	UNI-D	-	Y	F
71	250	100	0	5	UNI-D	-	Y	F
72	250	100	5	0	UNI-D	-	Y	F
73	250	100	5	0.15	UNI-D	-	Y	F
74	250	100	5	0.3	UNI-D	-	Y	F
75	250	100	5	0.5	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
76	250	100	5	1	UNI-D	-	Y	F
77	250	100	5	2	UNI-D	-	Y	F
78	250	100	5	5	UNI-D	-	Y	F
79	250	100	10	0	UNI-D	-	Y	F
80	250	100	10	0.15	UNI-D	-	Y	F
81	250	100	10	0.3	UNI-D	-	Y	F
82	250	100	10	0.5	UNI-D	-	Y	F
83	250	100	10	1	UNI-D	-	Y	F
84	250	100	10	2	UNI-D	-	Y	F
85	250	100	10	5	UNI-D	-	Y	F
86	250	100	20	0	UNI-D	-	Y	F
87	250	100	20	0.15	UNI-D	-	Y	F
88	250	100	20	0.3	UNI-D	-	Y	F
89	250	100	20	0.5	UNI-D	-	Y	F
90	250	100	20	1	UNI-D	-	Y	F
91	250	100	20	2	UNI-D	-	Y	F
92	250	100	20	5	UNI-D	-	Y	F
93	250	100	30	0	UNI-D	2	Y	F
94	250	100	30	0.15	UNI-D	-	Y	F
95	250	100	30	0.3	UNI-D	-	Y	F
96	250	100	30	0.5	UNI-D	-	Y	F
97	250	100	30	1	UNI-D	-	Y	F
98	250	100	30	2	UNI-D	-	Y	F
99	250	100	30	5	UNI-D	-	Y	F
100	250	100	40	0	UNI-D	2	Y	F
101	250	100	40	0.15	UNI-D	-	Y	F
102	250	100	40	0.3	UNI-D	-	Y	F
103	250	100	40	0.5	UNI-D	-	Y	F
104	250	100	40	1	UNI-D	-	Y	F
105	250	100	40	2	UNI-D	-	Y	F
106	250	100	40	5	UNI-D	-	Y	F
107	250	100	50	0	UNI-D	2	Y	F
108	250	100	50	0.15	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
109	250	100	50	0.3	UNI-D	-	Y	F
110	250	100	50	0.5	UNI-D	-	Y	F
111	250	100	50	1	UNI-D	-	Y	F
112	250	100	50	2	UNI-D	-	Y	F
113	250	100	50	5	UNI-D	-	Y	F
114	500	200	0	0	UNI-D	4	Y	F
115	500	200	0	0.15	UNI-D	-	Y	F
116	500	200	0	0.3	UNI-D	-	Y	F
117	500	200	0	0.5	UNI-D	-	Y	F
118	500	200	0	1	UNI-D	-	Y	F
119	500	200	0	2	UNI-D	-	Y	F
120	500	200	0	5	UNI-D	-	Y	F
121	500	200	5	0	UNI-D	-	Y	F
122	500	200	5	0.15	UNI-D	-	Y	F
123	500	200	5	0.3	UNI-D	-	Y	F
124	500	200	5	0.5	UNI-D	-	Y	F
125	500	200	5	1	UNI-D	-	Y	F
126	500	200	5	2	UNI-D	-	Y	F
127	500	200	5	5	UNI-D	-	Y	F
128	500	200	10	0	UNI-D	-	Y	F
129	500	200	10	0.15	UNI-D	-	Y	F
130	500	200	10	0.3	UNI-D	-	Y	F
131	500	200	10	0.5	UNI-D	-	Y	F
132	500	200	10	1	UNI-D	-	Y	F
133	500	200	10	2	UNI-D	-	Y	F
134	500	200	10	5	UNI-D	-	Y	F
135	500	200	20	0	UNI-D	-	Y	F
136	500	200	20	0.15	UNI-D	-	Y	F
137	500	200	20	0.3	UNI-D	-	Y	F
138	500	200	20	0.5	UNI-D	-	Y	F
139	500	200	20	1	UNI-D	-	Y	F
140	500	200	20	2	UNI-D	-	Y	F
141	500	200	20	5	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
142	500	200	30	0	UNI-D	-	Y	F
143	500	200	30	0.15	UNI-D	-	Y	F
144	500	200	30	0.3	UNI-D	-	Y	F
145	500	200	30	0.5	UNI-D	-	Y	F
146	500	200	30	1	UNI-D	-	Y	F
147	500	200	30	2	UNI-D	-	Y	F
148	500	200	30	5	UNI-D	-	Y	F
149	500	200	40	0	UNI-D	-	Y	F
150	500	200	40	0.15	UNI-D	-	Y	F
151	500	200	40	0.3	UNI-D	-	Y	F
152	500	200	40	0.5	UNI-D	-	Y	F
153	500	200	40	1	UNI-D	-	Y	F
154	500	200	40	2	UNI-D	-	Y	F
155	500	200	40	5	UNI-D	-	Y	F
156	500	200	50	0	UNI-D	-	Y	F
157	500	200	50	0.15	UNI-D	-	Y	F
158	500	200	50	0.3	UNI-D	-	Y	F
159	500	200	50	0.5	UNI-D	-	Y	F
160	500	200	50	1	UNI-D	-	Y	F
161	500	200	50	2	UNI-D	-	Y	F
162	500	200	50	5	UNI-D	-	Y	F
163	500	200	60	0	UNI-D	2	Y	F
164	500	200	60	0.15	UNI-D	-	Y	F
165	500	200	60	0.3	UNI-D	-	Y	F
166	500	200	60	0.5	UNI-D	-	Y	F
167	500	200	60	1	UNI-D	-	Y	F
168	500	200	60	2	UNI-D	-	Y	F
169	500	200	60	5	UNI-D	-	Y	F
170	500	200	70	0	UNI-D	2	Y	F
171	500	200	70	0.15	UNI-D	-	Y	F
172	500	200	70	0.3	UNI-D	-	Y	F
173	500	200	70	0.5	UNI-D	-	Y	F
174	500	200	70	1	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
175	500	200	70	2	UNI-D	-	Y	F
176	500	200	70	5	UNI-D	-	Y	F
177	500	200	80	0	UNI-D	2	Y	F
178	500	200	80	0.15	UNI-D	-	Y	F
179	500	200	80	0.3	UNI-D	-	Y	F
180	500	200	80	0.5	UNI-D	-	Y	F
181	500	200	80	1	UNI-D	-	Y	F
182	500	200	80	2	UNI-D	-	Y	F
183	500	200	80	5	UNI-D	-	Y	F
184	500	200	90	0	UNI-D	2	Y	F
185	500	200	90	0.15	UNI-D	-	Y	F
186	500	200	90	0.3	UNI-D	-	Y	F
187	500	200	90	0.5	UNI-D	-	Y	F
188	500	200	90	1	UNI-D	-	Y	F
189	500	200	90	2	UNI-D	-	Y	F
190	500	200	90	5	UNI-D	-	Y	F
191	500	200	100	0	UNI-D	2	Y	F
192	500	200	100	0.15	UNI-D	-	Y	F
193	500	200	100	0.3	UNI-D	-	Y	F
194	500	200	100	0.5	UNI-D	-	Y	F
195	500	200	100	1	UNI-D	-	Y	F
196	500	200	100	2	UNI-D	-	Y	F
197	500	200	100	5	UNI-D	-	Y	F
198	Home Ultrafast	Home Ultrafast	0	0	UNI-D	4	Y	F/H
199	Home Ultrafast	Home Ultrafast	0	0.15	UNI-D	-	Y	F/H
200	1000	400	0	0	UNI-D	4	Y	F
201	1000	400	0	0.15	UNI-D	-	Y	F
202	1000	400	0	0.3	UNI-D	-	Y	F
203	1000	400	0	0.5	UNI-D	-	Y	F
204	1000	400	0	1	UNI-D	-	Y	F
205	1000	400	0	2	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
206	1000	400	0	5	UNI-D	-	Y	F
207	1000	400	5	0	UNI-D	-	Y	F
208	1000	400	5	0.15	UNI-D	-	Y	F
209	1000	400	5	0.3	UNI-D	-	Y	F
210	1000	400	5	0.5	UNI-D	-	Y	F
211	1000	400	5	1	UNI-D	-	Y	F
212	1000	400	5	2	UNI-D	-	Y	F
213	1000	400	5	5	UNI-D	-	Y	F
214	1000	400	10	0	UNI-D	-	Y	F
215	1000	400	10	0.15	UNI-D	-	Y	F
216	1000	400	10	0.3	UNI-D	-	Y	F
217	1000	400	10	0.5	UNI-D	-	Y	F
218	1000	400	10	1	UNI-D	-	Y	F
219	1000	400	10	2	UNI-D	-	Y	F
220	1000	400	10	5	UNI-D	-	Y	F
221	1000	400	20	0	UNI-D	-	Y	F
222	1000	400	20	0.15	UNI-D	-	Y	F
223	1000	400	20	0.3	UNI-D	-	Y	F
224	1000	400	20	0.5	UNI-D	-	Y	F
225	1000	400	20	1	UNI-D	-	Y	F
226	1000	400	20	2	UNI-D	-	Y	F
227	1000	400	20	5	UNI-D	-	Y	F
228	1000	400	30	0	UNI-D	-	Y	F
229	1000	400	30	0.15	UNI-D	-	Y	F
230	1000	400	30	0.3	UNI-D	-	Y	F
231	1000	400	30	0.5	UNI-D	-	Y	F
232	1000	400	30	1	UNI-D	-	Y	F
233	1000	400	30	2	UNI-D	-	Y	F
234	1000	400	30	5	UNI-D	-	Y	F
235	1000	400	40	0	UNI-D	-	Y	F
236	1000	400	40	0.15	UNI-D	-	Y	F
237	1000	400	40	0.3	UNI-D	-	Y	F
238	1000	400	40	0.5	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
239	1000	400	40	1	UNI-D	-	Y	F
240	1000	400	40	2	UNI-D	-	Y	F
241	1000	400	40	5	UNI-D	-	Y	F
242	1000	400	50	0	UNI-D	-	Y	F
243	1000	400	50	0.15	UNI-D	-	Y	F
244	1000	400	50	0.3	UNI-D	-	Y	F
245	1000	400	50	0.5	UNI-D	-	Y	F
246	1000	400	50	1	UNI-D	-	Y	F
247	1000	400	50	2	UNI-D	-	Y	F
248	1000	400	50	5	UNI-D	-	Y	F
249	1000	400	60	0	UNI-D	-	Y	F
250	1000	400	60	0.15	UNI-D	-	Y	F
251	1000	400	60	0.3	UNI-D	-	Y	F
252	1000	400	60	0.5	UNI-D	-	Y	F
253	1000	400	60	1	UNI-D	-	Y	F
254	1000	400	60	2	UNI-D	-	Y	F
255	1000	400	60	5	UNI-D	-	Y	F
256	1000	400	70	0	UNI-D	-	Y	F
257	1000	400	70	0.15	UNI-D	-	Y	F
258	1000	400	70	0.3	UNI-D	-	Y	F
259	1000	400	70	0.5	UNI-D	-	Y	F
260	1000	400	70	1	UNI-D	-	Y	F
261	1000	400	70	2	UNI-D	-	Y	F
262	1000	400	70	5	UNI-D	-	Y	F
263	1000	400	80	0	UNI-D	-	Y	F
264	1000	400	80	0.15	UNI-D	-	Y	F
265	1000	400	80	0.3	UNI-D	-	Y	F
266	1000	400	80	0.5	UNI-D	-	Y	F
267	1000	400	80	1	UNI-D	-	Y	F
268	1000	400	80	2	UNI-D	-	Y	F
269	1000	400	80	5	UNI-D	-	Y	F
270	1000	400	90	0	UNI-D	-	Y	F
271	1000	400	90	0.15	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [39]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
272	1000	400	90	0.3	UNI-D	-	Y	F
273	1000	400	90	0.5	UNI-D	-	Y	F
274	1000	400	90	1	UNI-D	-	Y	F
275	1000	400	90	2	UNI-D	-	Y	F
276	1000	400	90	5	UNI-D	-	Y	F
277	1000	400	100	0	UNI-D	-	Y	F
278	1000	400	100	0.15	UNI-D	-	Y	F
279	1000	400	100	0.3	UNI-D	-	Y	F
280	1000	400	100	0.5	UNI-D	-	Y	F
281	1000	400	100	1	UNI-D	-	Y	F
282	1000	400	100	2	UNI-D	-	Y	F
283	1000	400	100	5	UNI-D	-	Y	F
284	Wireless Plus	Wireless Plus	0	0	UNI-D	4	Y	W
285	Wireless Plus	Wireless Plus	0	0.15	UNI-D	-	Y	W
286	Wireless Plus	Wireless Plus	0	0.3	UNI-D	-	Y	W

Table 30: Unicast 1:1 AVC Bandwidth Profiles - nbn® Ethernet (Fibre), nbn® Ethernet (Wireless), nbn® Ethernet (HFC) and nbn® Ethernet (Satellite)

Notes:

- **nbn** may limit the availability of bandwidth profiles with TC-1 capacities greater than 1 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-1 capacity. RSP must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-1 capacities greater than 1 Mbps in relation to each Premises.
- **nbn** may limit the availability of bandwidth profiles with TC-2 capacities greater than 10 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-2 capacity. RSP must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-2 in relation to each Premises.

- **nbn** may limit the availability of bandwidth profiles with TC-4 capacities greater than 100 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-4 capacity. RSP must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-4 capacities greater than 100 Mbps in relation to each Premises.
- Only a subset of bandwidth profiles is available in relation to each of **nbn**® Ethernet (Fibre), **nbn**® Ethernet (Wireless), **nbn**® Ethernet (HFC) and **nbn**® Ethernet (Satellite). Additional restrictions may apply to the supply of certain of those bandwidth profiles.
- To be read subject to section 2.2.2 of this **nbn**® Ethernet Product Technical Specification and section 13 of the **nbn**® Ethernet Product Description.

B.2 Unicast 1:1 AVC Bandwidth Profiles for nbn® Ethernet (FTTB) and nbn® Ethernet (FTTN)

This table shows the valid combinations that may be used to populate the bandwidth profile (upstream and downstream) for a unicast 1:1 AVC for **nbn®** Ethernet (FTTB) and **nbn®** Ethernet (FTTN). The bandwidth profile to be used for a unicast 1:1 AVC must be selected by RSP at the time of order.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-DSL Supported Interface Mode [42]	
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged
1	12	1	0	0	UNI-DSL	4	Y
2	12	1	0	0.15	UNI-DSL	1	Y
3	12	1	0	0.3	UNI-DSL	1	Y
4	25	5	0	0	UNI-DSL	4	Y
5	25	5	0	0.15	UNI-DSL	-	Y
6	25	5	0	0.3	UNI-DSL	-	Y
7	25	5	0	0.5	UNI-DSL	1	Y
8	25	5-10	0	0	UNI-DSL	4	Y
9	25	5-10	0	0.15	UNI-DSL	-	Y
10	25	5-10	0	0.3	UNI-DSL	-	Y
11	25	5-10	0	0.5	UNI-DSL	-	Y
12	25	5-10	0	1	UNI-DSL	1	Y
13	25	5-10	5	0	UNI-DSL	2	Y
14	25	5-10	5	0.15	UNI-DSL	-	Y
15	25	5-10	5	0.3	UNI-DSL	-	Y
16	25	5-10	5	0.5	UNI-DSL	-	Y
17	25-50	5-20	0	0	UNI-DSL	4	Y
18	25-50	5-20	0	0.15	UNI-DSL	-	Y
19	25-50	5-20	0	0.3	UNI-DSL	-	Y
20	25-50	5-20	0	0.5	UNI-DSL	-	Y
21	25-50	5-20	0	1	UNI-DSL	-	Y
22	25-50	5-20	0	2	UNI-DSL	1	Y
23	25-50	5-20	5	0	UNI-DSL	-	Y
24	25-50	5-20	5	0.15	UNI-DSL	-	Y
25	25-50	5-20	5	0.3	UNI-DSL	-	Y

[42] Certain AVC bandwidth profiles have dependencies on the UNI-DSL operating mode.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-DSL Supported Interface Mode [42]	
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged
26	25-50	5-20	5	0.5	UNI-DSL	-	Y
27	25-50	5-20	5	1	UNI-DSL	-	Y
28	25-50	5-20	5	2	UNI-DSL	-	Y
29	25-50	5-20	10	0	UNI-DSL	2	Y
30	25-50	5-20	10	0.15	UNI-DSL	-	Y
31	25-50	5-20	10	0.3	UNI-DSL	-	Y
32	25-50	5-20	10	0.5	UNI-DSL	-	Y
33	25-50	5-20	10	1	UNI-DSL	-	Y
34	25-50	5-20	10	2	UNI-DSL	-	Y
35	Home Fast	Home Fast	0	0	UNI-DSL	4	Y
36	Home Fast	Home Fast	0	0.15	UNI-DSL	-	Y
37	25-100	5-40	0	0	UNI-DSL	4	Y
38	25-100	5-40	0	0.15	UNI-DSL	-	Y
39	25-100	5-40	0	0.3	UNI-DSL	-	Y
40	25-100	5-40	0	0.5	UNI-DSL	-	Y
41	25-100	5-40	0	1	UNI-DSL	-	Y
42	25-100	5-40	0	2	UNI-DSL	-	Y
43	25-100	5-40	0	5	UNI-DSL	1	Y
44	25-100	5-40	5	0	UNI-DSL	-	Y
45	25-100	5-40	5	0.15	UNI-DSL	-	Y
46	25-100	5-40	5	0.3	UNI-DSL	-	Y
47	25-100	5-40	5	0.5	UNI-DSL	-	Y
48	25-100	5-40	5	1	UNI-DSL	-	Y
49	25-100	5-40	5	2	UNI-DSL	-	Y
50	25-100	5-40	5	5	UNI-DSL	-	Y
51	25-100	5-40	10	0	UNI-DSL	-	Y
52	25-100	5-40	10	0.15	UNI-DSL	-	Y
53	25-100	5-40	10	0.3	UNI-DSL	-	Y
54	25-100	5-40	10	0.5	UNI-DSL	-	Y
55	25-100	5-40	10	1	UNI-DSL	-	Y
56	25-100	5-40	10	2	UNI-DSL	-	Y
57	25-100	5-40	10	5	UNI-DSL	-	Y
58	25-100	5-40	20	0	UNI-DSL	2	Y
59	25-100	5-40	20	0.15	UNI-DSL	-	Y
60	25-100	5-40	20	0.3	UNI-DSL	-	Y

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-DSL Supported Interface Mode [42]	
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged
61	25-100	5-40	20	0.5	UNI-DSL	-	Y
62	25-100	5-40	20	1	UNI-DSL	-	Y
63	25-100	5-40	20	2	UNI-DSL	-	Y

Table 31: Unicast 1:1 AVC Bandwidth Profiles - nbn® Ethernet (FTTB) and nbn® Ethernet (FTTN)

Notes:

- **nbn** may limit the availability of bandwidth profiles with TC-1 capacities greater than 1 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-1 capacity. RSP must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-1 capacities greater than 1 Mbps in relation to each Premises.
- **nbn** may limit the availability of bandwidth profiles with TC-2 capacities greater than 10 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-2 capacity. RSP must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-2 in relation to each Premises.
- Additional restrictions may apply to the supply of certain of these bandwidth profiles.

B.3 Unicast 1:1 AVC Bandwidth Profiles for nbn® Ethernet (FTTC)

This table shows the valid combinations that may be used to populate the bandwidth profile (upstream and downstream) for a unicast 1:1 AVC for **nbn**® Ethernet (FTTC). The bandwidth profile to be used for a unicast 1:1 AVC must be selected by RSP at the time of order.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [43]	
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged
1	12	1	0	0	UNI-D	4	Y
2	12	1	0	0.15	UNI-D	1	Y
3	12	1	0	0.3	UNI-D	1	Y
4	25	5	0	0	UNI-D	4	Y
5	25	5	0	0.15	UNI-D	-	Y
6	25	5	0	0.3	UNI-D	-	Y
7	25	5	0	0.5	UNI-D	1	Y
8	25	10	0	0	UNI-D	4	Y
9	25	10	0	0.15	UNI-D	-	Y
10	25	10	0	0.3	UNI-D	-	Y
11	25	10	0	0.5	UNI-D	-	Y
12	25	10	0	1	UNI-D	1	Y
13	25	10	5	0	UNI-D	2	Y
14	25	10	5	0.15	UNI-D	-	Y
15	25	10	5	0.3	UNI-D	-	Y
16	25	10	5	0.5	UNI-D	-	Y
17	50	20	0	0	UNI-D	4	Y
18	50	20	0	0.15	UNI-D	-	Y
19	50	20	0	0.3	UNI-D	-	Y
20	50	20	0	0.5	UNI-D	-	Y
21	50	20	0	1	UNI-D	-	Y
22	50	20	0	2	UNI-D	1	Y
23	50	20	5	0	UNI-D	-	Y
24	50	20	5	0.15	UNI-D	-	Y
25	50	20	5	0.3	UNI-D	-	Y
26	50	20	5	0.5	UNI-D	-	Y
27	50	20	5	1	UNI-D	-	Y

[43] Certain AVC bandwidth profiles have dependencies on the UNI-D operating mode.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode [43]	
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged
28	50	20	5	2	UNI-D	-	Y
29	50	20	10	0	UNI-D	2	Y
30	50	20	10	0.15	UNI-D	-	Y
31	50	20	10	0.3	UNI-D	-	Y
32	50	20	10	0.5	UNI-D	-	Y
33	50	20	10	1	UNI-D	-	Y
34	50	20	10	2	UNI-D	-	Y
35	Home Fast	Home Fast	0	0	UNI-D	4	Y
36	Home Fast	Home Fast	0	0.15	UNI-D	-	Y
37	50-100	20-40	0	0	UNI-D	4	Y
38	50-100	20-40	0	0.15	UNI-D	-	Y
39	50-100	20-40	0	0.3	UNI-D	-	Y
40	50-100	20-40	0	0.5	UNI-D	-	Y
41	50-100	20-40	0	1	UNI-D	-	Y
42	50-100	20-40	0	2	UNI-D	-	Y
43	50-100	20-40	0	5	UNI-D	1	Y
44	50-100	20-40	5	0	UNI-D	-	Y
45	50-100	20-40	5	0.15	UNI-D	-	Y
46	50-100	20-40	5	0.3	UNI-D	-	Y
47	50-100	20-40	5	0.5	UNI-D	-	Y
48	50-100	20-40	5	1	UNI-D	-	Y
49	50-100	20-40	5	2	UNI-D	-	Y
50	50-100	20-40	5	5	UNI-D	-	Y
51	50-100	20-40	10	0	UNI-D	-	Y
52	50-100	20-40	10	0.15	UNI-D	-	Y
53	50-100	20-40	10	0.3	UNI-D	-	Y
54	50-100	20-40	10	0.5	UNI-D	-	Y
55	50-100	20-40	10	1	UNI-D	-	Y
56	50-100	20-40	10	2	UNI-D	-	Y
57	50-100	20-40	10	5	UNI-D	-	Y
58	50-100	20-40	20	0	UNI-D	2	Y
59	50-100	20-40	20	0.15	UNI-D	-	Y
60	50-100	20-40	20	0.3	UNI-D	-	Y
61	50-100	20-40	20	0.5	UNI-D	-	Y
62	50-100	20-40	20	1	UNI-D	-	Y
63	50-100	20-40	20	2	UNI-D	-	Y

Table 32: Unicast 1:1 AVC Bandwidth Profiles - nbn® Ethernet (FTTC)

Notes:

- **nbn** may limit the availability of bandwidth profiles with TC-1 capacities greater than 1 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-1 capacity. RSP must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-1 capacities greater than 1 Mbps in relation to each Premises.
- **nbn** may limit the availability of bandwidth profiles with TC-2 capacities greater than 10 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-2 capacity. RSP must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-2 in relation to each Premises.
- Additional restrictions may apply to the supply of certain of these bandwidth profiles.

B.4 Unicast N:1 AVC Bandwidth Profiles

This table shows the valid combinations that may be used to populate the bandwidth profile (upstream and downstream) for a unicast N:1 AVC, as required for UNI-V operation. Note that the unicast N:1 AVC bandwidth profile is automatically set by **nbn** as per the single profile listed in this table.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode
1	0	0	0.15	UNI-V	N/A

Table 33: Unicast N:1 AVC Bandwidth Profiles

B.5 CVC Bandwidth Profiles

B.5.1 Unicast 1:1 and N:1 CVC Bandwidth Profiles

The bandwidth profile for a unicast CVC may be constructed by independently selecting the TC-1, TC-2 and TC-4 capacities, from the following tables, provided that the total combination of CVC bandwidth profiles is not zero. [44]

Profile Number	CVC_TC-1 (Mbps)
1	0
2	5
3	10
4	20
5	25
6	30
7	40
8	50
9	60
10	80
11	100
12	120
13	150
14	200
15	250
16	300
17	400
18	500

Table 34: Unicast CVC TC-1 Bandwidth Profile Capacities [45]

Profile Number	CVC_TC-2 (Mbps)
1	0
2	5
3	10
4	20
5	25

[44] Provided the selected combination does not exceed the capacity within an NNI Group as described in section 6.3.

[45] Available for unicast CVC services configured as N:1 or 1:1.

Profile Number	CVC_TC-2 (Mbps)
6	30
7	40
8	50
9	60
10	80
11	100
12	120
13	150
14	200
15	250
16	300
17	400
18	500
19	600
20	700
21	800
22	900
23	1000

Table 35: Unicast CVC TC-2 Bandwidth Profile Capacities [46]

Profile Number	CVC_TC-4 (Mbps)
1	0
2	100
3	150
4	200
5	250
6	300
7	400
8	500
9	600
10	700
11	800
12	900

[46] Available for unicast CVC services configured as 1:1 only.

Profile Number	CVC_TC-4 (Mbps)
13	1000
14	1100
15	1200
16	1300
17	1400
18	1500
19	1600
20	1700
21	1800
22	1900
23	2000
24	2100
25	2200
26	2300
27	2400
28	2500
29	2600
30	2700
31	2800
32	2900
33	3000
34	3100
35	3200
36	3300
37	3400
38	3500
39	3600
40	3700
41	3800
42	3900
43	4000
44	4100
45	4200
46	4300
47	4400
48	4500
49	4600
50	4700

Profile Number	CVC_TC-4 (Mbps)
51	4800
52	4900
53	5000
54	5100
55	5200
56	5300
57	5400
58	5500
59	5600
60	5700
61	5800
62	5900
63	6000
64	6100
65	6200
66	6300
67	6400
68	6500
69	6600
70	6700
71	6800
72	6900
73	7000
74	7100
75	7200
76	7300
77	7400
78	7500
79	7600
80	7700
81	7800
82	7900
83	8000
84	8100
85	8200
86	8300
87	8400
88	8500

Profile Number	CVC_TC-4 (Mbps)
89	8600
90	8700
91	8800
92	8900
93	9000
94	9100
95	9200
96	9300
97	9400
98	9500
99	9600
100	9700
101	9800
102	9900
103	10,000

Table 36: Unicast CVC TC-4 Bandwidth Profile Capacities [47]

[47] Available for unicast CVC services configured as 1:1 only.

B.6 CVC Class Attributes for nbn® Ethernet (Satellite)

The AVC-related bandwidth profile for each unicast CVC supplied for **nbn**® Ethernet (Satellite) may be selected from the following table.

CVC TC-4 Bandwidth (Mbps)	Minimum number of AVCs that must be associated with each Satellite CVC TC-4		
	CVC Class-0 (Default)	CVC Class-1 (Premium)	CVC Class-2 (Premium)
0	0	0	0
100	0	0	0
125	202	166	151
150	273	231	209
175	344	296	267
200	415	361	325
225	486	426	383
250	557	491	441
275	628	556	499
300	699	621	557
325	770	686	615
350	841	751	673
365	912	816	731
400	983	881	789
425	1054	946	847
450	1125	1011	905
475	1196	1076	963
500	1267	1141	1021
525	1338	1206	1079
550	1409	1271	1137
575	1480	1336	1195
600	1551	1401	1253
625	1622	1466	1311
650	1693	1531	1369
675	1764	1596	1427
700	1835	1661	1485

CVC TC-4 Bandwidth (Mbps)	Minimum number of AVCs that must be associated with each Satellite CVC TC-4		
	CVC Class-0 (Default)	CVC Class-1 (Premium)	CVC Class-2 (Premium)
725	1906	1726	1543
750	1977	1791	1601
775	2048	1856	1659
800	2119	1921	1717
825	2190	1986	1775
850	2261	2051	1833
875	2332	2116	1891
900	2403	2181	1949
925	2474	2246	2007
950	2545	2311	2065
975	2616	2376	2123
1000	2687	2441	2181

Table 37: Satellite unicast CVC TC-4 Bandwidth Profile Capacities and Minimum AVC Thresholds [48]

[48] Available for unicast CVC services configured as 1:1 only and subject to the minimum AVC thresholds per CVC Class for **nbn**® Ethernet (Satellite): see sections 2.2(d) and 2.2(e) of the **nbn**® Ethernet Product Description.

B.7 NNI Link Bandwidth Profiles

The bandwidth profile for a NNI Link may be constructed by selecting the NNI Link capacity from the following table.

Profile Number	NNI Link (Mbps)
1	100
2	200
3	300
4	400
5	500
6	600
7	700
8	800
9	900
10	1000
11	1100
12	1200
13	1300
14	1400
15	1500
16	1600
17	1700
18	1800
19	1900
20	2000
21	2100
22	2200
23	2300
24	2400
25	2500
26	2600
27	2700
28	2800
29	2900
30	3000
31	3100
32	3200
33	3300
34	3400
35	3500
36	3600

Profile Number	NNI Link (Mbps)
37	3700
38	3800
39	3900
40	4000
41	4100
42	4200
43	4300
44	4400
45	4500
46	4600
47	4700
48	4800
49	4900
50	5000
51	5100
52	5200
53	5300
54	5400
55	5500
56	5600
57	5700
58	5800
59	5900
60	6000
61	6100
62	6200
63	6300
64	6400
65	6500
66	6600
67	6700
68	6800
69	6900
70	7000
71	7100
72	7200
73	7300
74	7400
75	7500
76	7600

Profile Number	NNI Link (Mbps)
77	7700
78	7800
79	7900
80	8000
81	8100
82	8200
83	8300
84	8400
85	8500
86	8600
87	8700
88	8800
89	8900
90	9000
91	9100
92	9200
93	9300
94	9400
95	9500
96	9600
97	9700
98	9800
99	9900
100	10000
101	11000
102	12000
103	13000
104	14000
105	15000
106	16000
107	17000
108	18000
109	19000
110	20000
111	21000
112	22000
113	23000
114	24000
115	25000
116	26000

Profile Number	NNI Link (Mbps)
117	27000
118	28000
119	29000
120	30000
121	31000
122	32000
123	33000
124	34000
125	35000
126	36000
127	37000
128	38000
129	39000
130	40000
131	41000
132	42000
133	43000
134	44000
135	45000
136	46000
137	47000
138	48000
139	49000
140	50000
141	51000
142	52000
143	53000
144	54000
145	55000
146	56000
147	57000
148	58000
149	59000
150	60000
151	61000
152	62000
153	63000
154	64000
155	65000
156	66000

Profile Number	NNI Link (Mbps)
157	67000
158	68000
159	69000
160	70000
161	71000
162	72000
163	73000
164	74000
165	75000
166	76000
167	77000
168	78000
169	79000
170	80000

Table 38: NNI Link Bandwidth Profile Capacities