SIN 506

Issue 1.5
November 2017

Suppliers' Information Note

For The BT Network

Fibre to the Premises (FTTP) Generic Ethernet Access
Service and Interface Description

This SIN is available in Portable Document Format (pdf) from: http://www.btplc.com/sinet/

Enquiries relating to this document should be directed to: sinet.helpdesk@bt.com

1. Service Outline

1.1 General

Openreach will provide the Generic Ethernet Access/Fibre to the Premises (GEA-FTTP) and Fibre Voice Access (FVA) products, part of Openreach's Next Generation Access (NGA) portfolio, over a shared passive fibre optic infrastructure. .

This Suppliers' Information Note (SIN) provides details relevant to CPs regarding connectivity and interfaces.

It should be noted that the information contained within this SIN might be subject to change due to either the results of BT developments, or due to feedback from customers. Please check with the http://www.btplc.com/sinet/ site to ensure you have the latest version of this document.

Further information regarding the product trial and pilot product launch can be obtained by contacting your Openreach Commercial Business Manager.

1.2 Service Availability

GEA-FTTP will provide an 'always on' Virtual LAN (VLAN) between the Optical Line Termination (OLT) equipment in a BT exchange and each Optical Network Termination (ONT) device in the End User premises. This 'VLAN' will be able to carry data communication signals after the CP has successfully ordered service for delivery to its End User(s).

GEA-FTTP Brownfield will consist of:

- Physical network connectivity between the end user premises and the Openreach point of handover to CP networks (GEA 'lit fibre' circuit)

- A 'Data Port' Ethernet VLAN offering the following bandwidths in Mbit/s:

Product	Downstream Peak	Downstream Prioritised	Upstream Peak	Upstream Prioritised
GEA-FTTP 40/2	40	15	NA	2
GEA-FTTP 40/10	40	15	NA	10
GEA-FTTP 40/15	40	20	NA	15
GEA-FTTP 55/10	55	20	NA	10
GEA-FTTP 80/20	80	30	NA	20
GEA-FTTP 100/15	100	20	NA	15
GEA-FTTP 110/15	110	20	NA	15
GEA-FTTP 100/30	100	30	NA	30
GEA-FTTP 160/30	160	110	NA	30
GEA-FTTP 220/20	220	30	NA	20
GEA-FTTP 330/20	330	40	NA	20
GEA-FTTP 330/30	330	40	NA	30
GEA-FTTP 330/50	330	110	NA	50
GEA-FTTP 500/165	500	220	165	110
GEA-FTTP 1000/220*	1000	330	220	110

FVA will provide a VLAN between the OLT equipment in a Openreach Point of Handover in a BT exchange and each ONT device in the user premises. This 'VLAN' will be able to carry voice data communication signals after the CP has successfully ordered service for delivery to its user(s). The VLAN will be terminated at the Analogue Telephone Adaptor (ATA) within the ONT.

This product provides an ATA/SIP User Agent within the ONT itself, enabling an end user to simply plug their analogue phone or existing wiring into the voice port on the ONT.

One VLAN can support a maximum of two FVA lines per ONT.

1.2.1 Downstream policing

Each individual GEA-FTTP connection is policed by Openreach on ingress to the GEA Cablelink to the product rate. The details of the policing rates and associated burst sizes are detailed below:

Product			Policing parameters			
Peak rate (Mbps)	Prioritised rate (Mbps)	Sub-Product	CIR (kbps)	CBS (B)	PIR (kbps)	PBS (B)
0.256	0.256	FVA	256	7000	256	7000
0.512	0.512	FVA	512	14000	512	14000
40	15	GEA-FTTP	15040	16000	40000	71000
55	20	GEA-FTTP	20032	16000	55040	83000
80	30	GEA-FTTP	30016	20000	80000	100000
100	20	GEA-FTTP	20032	16000	100032	112000
100	30	GEA-FTTP	30016	20000	100032	112000
110	20	GEA-FTTP	20032	16000	110016	118000
160	110	GEA-FTTP	110016	37000	160000	142000
220	30	GEA-FTTP	30016	20000	220864	166000
330	40	GEA-FTTP	40000	22000	330048	204000
330	110	GEA-FTTP	110016	37000	330048	204000
500	220	GEA-FTTP	220032	52000	500032	251000
1000	330	GEA-FTTP	330048	64000	1000000	354000

Table 1 : GEA-FTTP policing parameters

The policing behaviour is described below:
- If the CP sends a range of 802.1p marked traffic (0,1,2,3,4) for the GEA data service downstream to the GEA Cablelink, the following will be observed for bursts:
  - 802.1p = 0 marked traffic will have access to half of PBS & CBS
  - 802.1p = 1,2,3 or 4 marked traffic will have access to the full PBS & CBS
- If more than PIR is sent, then random drop across 802.1p = 0 and demoted 802.1p = 1,2,3 & 4 (i.e. the CP sent traffic marked as discard ineligible above the CIR rate) will be seen

- The policers act on the full packet, apart from the IFG & pre-amble i.e. VLAN tags, SA/DA, FCS

1.3 GEA Cablelink

The GEA Cablelink Product will be offered for the CP to order connectivity to the L2S in the same Point of Handover building.

This will comprise

- A 1Gbit/s Ethernet port into the L2S. The Gigabit Ethernet (GE) interface will be set to auto-negotiate, 1000Base-LX (SingleMode only); or

- A 10 Gbit/s Ethernet port into the L2S. The 10 Gigabit Ethernet interface will be set to 10000Base-LR (SingleMode only); and

- Fibre connection from the port on the L2S to the location within the same Point of Handover specified by the CP

CPs will need to specify as part of the ordering process the location of their equipment/presence to which the connection should be made.
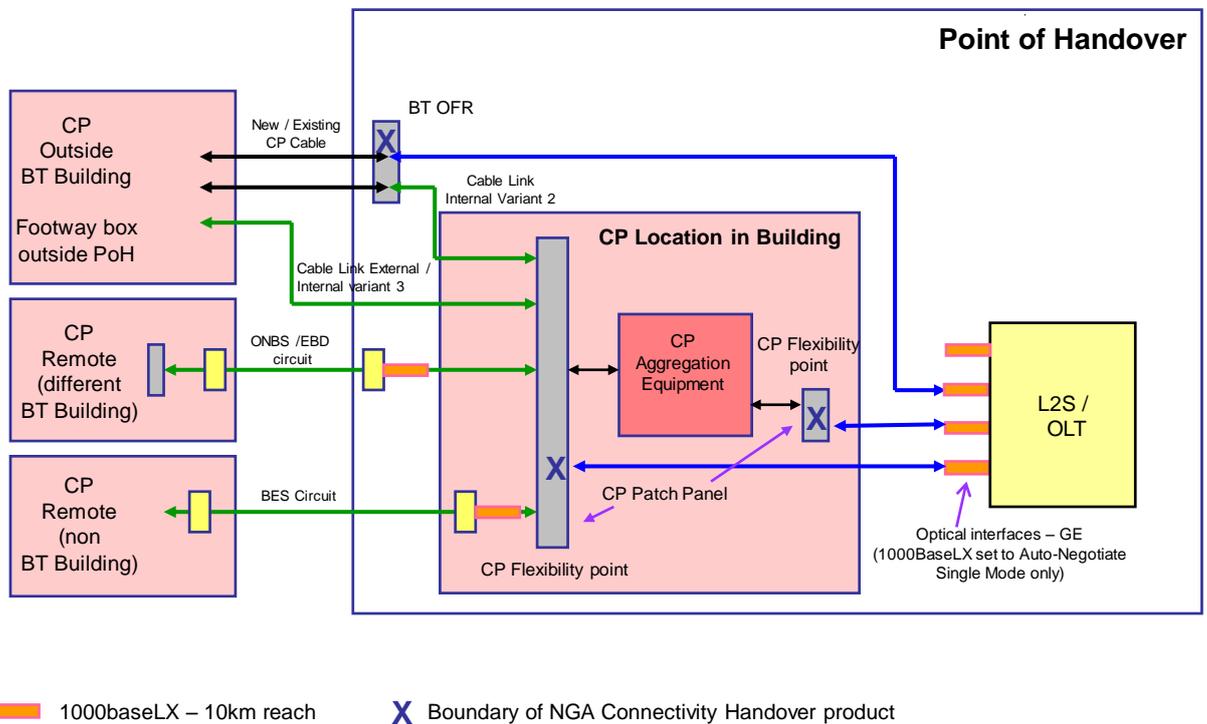
Figure 1 - GEA Network and Connectivity Link

2. Interface Descriptions

2.1 GEA Cablelink

2.1.1 Physical connection

The identified interface option and location for the GEA Cablelink will need to be specified by the CP, either:

- CP owned and provided Interface Panel, or

- CP owned and provided equipment interface (Ethernet port).

The interface is the connector on the end of the Openreach fibre tail.

The following physical optical interface connector types only are supported for connection to the CP provided identified interface:

- FC/PC

- LC

- SC

Note - Angled connectors are NOT supported.

The physical interface must be specified on the order request. Any conversion of interfaces is the CP's responsibility, i.e. the CP must provide interface converters on its card or at the interface panel, if necessary. Openreach engineers must be provided with access to the identified interface point (whether that is an interface panel or the CP's actual interface card itself) for both fulfilment and assurance purposes.

GE and 10GE Single-Mode interfaces are described in SIN 360 **Error! Reference source not found.**.

More information about the GEA Cablelink product can be found in the GEA Cablelink Product Description on the Openreach Portal
 (see http://www.openreach.co.uk).

2.1.2 Ethernet framesize

The maximum supported Ethernet frame size is 1530 bytes (excluding IFG and pre-amble)

2.1.3 VLAN Tagging Options at the GEA Cablelink for GEA-FTTP and FVA

2.1.3.1 Openreach added tags

On the GEA Cablelink, all traffic will be presented using single or double tagged on a per connection basis. Both options can be used on the same GEA Cablelink on a per GEA order basis. The tagging option to use for a specific GEA order is explicitly selected by the CP when ordering.

The VLAN used for End User traffic is referred to as a Customer VLAN or "C-VLAN".

A CP may optionally choose to use an additional level of VLAN tagging so that C-VLANs can be grouped within another VLAN, referred to as a Service VLAN or "S-VLAN".

- Single Tagged Handover
    - The Outer VLAN is the C-VLAN.
    - The Outer VLAN will carry the EU traffic and will have a tag in the range 2 to 3000 or 3071 to 4094[*]. Openreach will allocate the lowest available unused tag.

- Double Tagged Handover
    - The Outer VLAN is the S-VLAN, and the Inner VLAN is the C-VLAN.
    - Outer VLAN tag(s) must be requested via a Modify order against a GEA Cablelink (GEA Cablelink provision must be complete) before they can be used in a GEA order.
        - The Outer VLAN will have a tag in the range 2 to 3000 or 3071 to 4094.
            - The CP can specify the tag to be added; or
            - Openreach will allocate the lowest available unused tag if the CP does not specify the tag.
    - Where double tagging is required the CP must include the Outer VLAN tag value in the GEA order.
    - The Inner VLAN will carry the EU traffic and will have a tag in the range 2 to 4094. Openreach will allocate the lowest available unused tag.

2.1.3.2 CP added tags

For GEA-FTTP, CPs can optionally add tags in the downstream direction and these will be transported transparently through to the EU CPE. These are denoted as 'X-VLANs'

For FVA, CPs cannot add tags in the downstream direction.

For GEA-FTTP, EU CPE can add tags in the upstream direction and these will be transported transparently through to the CP, with the exception of tag 0 which will be removed by Openreach (see section 2.26 - Upstream priority marking - for more details).

For FVA tags cannot be added in the upstream direction.

2.1.4 Ethertype

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[*] *Please note, Values between 3001 and 3070 are reserved for GEA Multicast.*

The Outermost VLAN Ethertype is configurable to 0x81-00 (default) or 0x88-A8 (as per IEEE802.1ad**Error! Reference source not found.**. This applies to the GEA Cablelink as a whole and irrespective of single or double tagging of the GEA services carried.

2.1.5 Downstream Priority Marking

2.1.5.1 GEA-FTTP Downstream Priority Marking

CPs can use the C-VLAN Priority Code Point (PCP) field[5] on downstream GEA-FTTP traffic on the Customer VLAN. PCP values 0, 1, 2, 3 and 4 are supported. PCP values 5, 6 and 7 are not supported and will be re-marked to 4.

In the event of congestion within the Openreach network, the markings will be used to identify which frames can be dropped first for a particular End User. PCP traffic marking is optional.

In order to allow Openreach to ensure that under congestion conditions traffic is discarded according to the CPs marking, with "can drop" traffic being dropped ahead of "should not drop" traffic, the following scheme will be used.

2.1.5.1.1 Per EU / Intra EU frame drop prioritisation

The C-VLAN PCP markings are used to identify the order in which traffic can be dropped.
- o   PCP = '4, 3,2,1' = "Should Not Drop" (no drop priority differentiation between these four markings except on egress from the GPON port, and on the ONT LAN port)
- o   PCP = '0' = "Can Drop"

Where Double Tagging is used, the markings must be applied to the Inner C-VLAN.

The PCP field allows the CP to influence which frames are dropped first under congestion, thus allowing loss sensitive applications to have greater protection and at the same time allow best-efforts applications to benefit from full network capacity when it is available, but at the risk of frame loss. Openreach will remark the PCP field to ensure each EU has fair access to the available network capacity as follows:

- When an end-user's "Should not drop" marked traffic is supplied below the prioritised rate, then some of that end-users "Can drop" frames will be arbitrarily promoted to "Should not drop" so that, if possible, the "Should not drop" traffic rate equals the prioritised rate.

- Where an end-user's traffic is marked "Should not drop" and exceeds the prioritised rate, then some of that end-users frames will be arbitrarily demoted to "Can drop" so that the rate of "Should not drop" traffic equals the prioritised rate.

Therefore for optimal performance the CP should ensure loss-sensitive traffic is marked "Should not drop" and kept within the prioritised rate of the end-user's service.

2.1.5.2 FVA Downstream Priority Marking

FVA services have been allocated 802.1p value 7 (highest). This, in combination with mapping FVA Service Flows to the highest priority queues throughout the FTTP network, ensures that FVA traffic is scheduled above network management and GEA Data traffic. FVA traffic is allocated the same priority upstream and downstream.

2.1.6 Downstream shaping

The CP is expected to shape the downstream traffic to match the product downstream rate (see section 1.2) in order to avoid excessive traffic loss.

2.1.7 Intermediate Agent/DHCP Relay Agent

Where PPPoE is detected, additional tags will be inserted into the upstream flow (PADI) by the Intermediate Agent (IA) in the OLT. Any existing tags of the same type from the CPE will be overwritten. The IA tags will be removed by the OLT in the downstream direction (i.e. from the PADO, PADS messages).

Where DHCPv4 is detected, the OLT will insert Option 82 Agent information field into the upstream flow (DHCP Discover). The Option 82 field will be removed by the OLT in the downstream response (DHCP Offer).

Where DHCPv6 is detected, the OLT will employ a Lightweight DHCPv6 Relay Agent (LDRA) at certain locations to insert Options 17, 18 and 37 into the upstream flow (e.g. DHCP Solicit):

- Option 17 'Vendor-specific Information": Includes sub-options for reporting line characteristics such as line rate
- Option 18 'Interface-ID option': Used to identify the interface
- Option 37 'Remote-ID option': Used to identify the client

The Option fields will be removed by the OLT in the downstream response (e.g. DHCP Offer).

The following information will be supplied.
Note - any information in these fields from the end user will be over-written.

- **Agent Remote ID** – 63 character field – value is either
  - Value supplied by CP during provide / modify
    - From character set – a~z A~Z 0~9 @ . _ - ( ) / + : (Note space character is NOT supported)
    - Invalid characters in the order will cause order rejection

or
  - DeviceName/S VLAN ID/Frame No_Slot No_Port No/uservlan/C VLAN ID if the CP does not set a value to be used

- Changes if the port is changed for any reason – cannot be guaranteed to be constant
- Any value supplied from any modem will be over-written
- **Agent Circuit ID**
  - access-Node-Identifier xpon frame/slot/port :ontid.gemport.c-vlan-id
    - The "frame/slot/port" value will change if port used is changed eg after port / card failure

2.1.7.1 DHCPv4/v6 Port Numbers

The expected UDP port numbers in the DHCP messages are detailed in the table below:

Scenario	Expected Destination MAC address towards server	UDP Port numbers towards ONT	UDP Port numbers from ONT
DHCPv4	Broadcast	Dst: 67, Src: 68	Dst: 68, Src: 67
DHCPv6	Multicast	Dst: 546, Src: 547	Dst: 547, Src: 546
DHCPv4 L2 Relay	Broadcast	Dst: 67, Src: 68	Dst: 68, Src: 67
DHCPv4 L3 Relay	Unicast	Dst: 67, Src: 67	Dst: 67, Src: 67
DHCPv6 L2 Relay	Multicast	Dst: 546, Src: 547	Dst: 547, Src: 546
DHCPv6 L3 Relay	Unicast	Dst:547, Src: 547	Dst:547, Src: 547

Table 2 : UDP port numbers for DHCP

The use of other UDP port numbers may result in the DHCP packets being silently discarded by the Openreach network.

2.1.7.2 Inverted DHCP/PPPoE

The scenarios shown in the diagram below, where a DHCP Server or BRAS is located at an End Users premises served by FTTC or FTTP are not currently supported by the GEA Data service. This may result in dropped session initiation frames and will result in the below scenarios not being able to successfully operate.
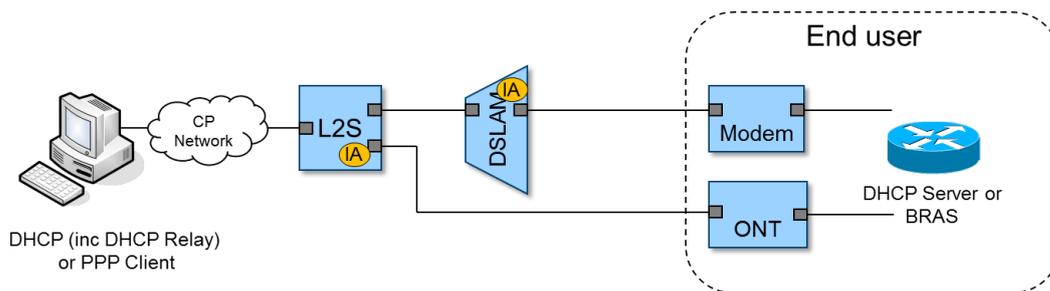
Figure 2 – Inverted DHCP/PPPoE

2.1.8 Ethernet OAM

CPs can send Ethernet OAM information end-to-end across their GEA-FTTP connection at MD Levels 3 and above. For FVA connections only Level 2 (up to the ONT) is available for CPs.

CPs can also test their GEA-FTTP circuits end-to-end between the CP's equipment and the ONT. To do this CPs must use Multicast Loopback Messages (MC LBMs) as described in ITU-T Y.1731[8] at MD Level 2 with a destination MAC address of 01-80-C2-00-00-32. The MC LBMs must be transmitted at a maximum rate of 1fps.

Working overview of OAM as follows:

OAM Interworking Overview

- Openreach to use Level 1 for OAM between L2S and ONT
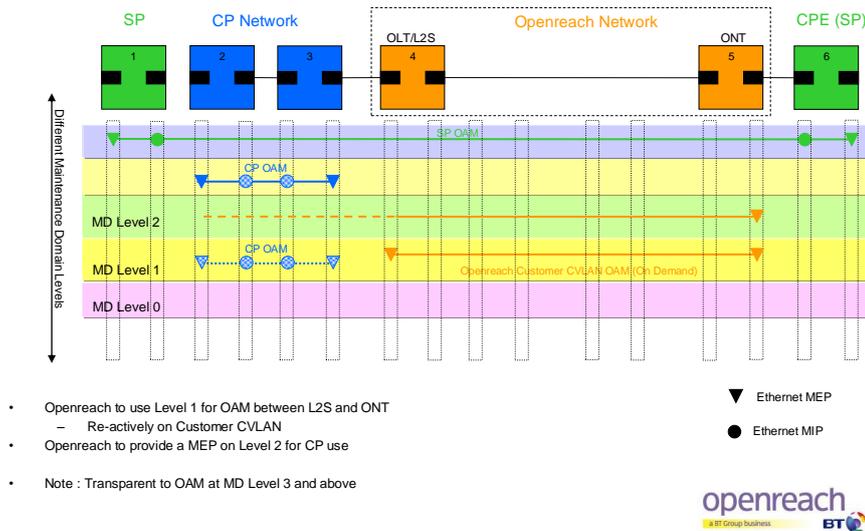   - Re-actively on Customer CVLAN
- Openreach to provide a MEP on Level 2 for CP use

- Note : Transparent to OAM at MD Level 3 and above

▼ Ethernet MEP
● Ethernet MIP

CP OAM Interworking Overview

Legend:
DMAC: Destination MAC address
LBM: Loopback Message
LBR: Loopback Reply
MC: Multicast
MEP: Maintenance Endpoint
SMAC: Source MAC address
UC: Unicast

2) The MC LBMs forwarded as normal data traffic and subject to policing and VLAN remarking

1) CP transmits Multicast Loopback Message (MC LBM) at MD Level 2 with destination MAC address **01-80-C2-00-00-32.** The frame is tagged with the same VLAN ID(s) and 802.1p value of the connection to be tested

3) MC LBMs at MD Level 2 with the correct DMAC are dealt with by the ONT. All OAM messages at higher MD levels are passed transparently and messages at lower MD levels are discarded

5) The UC LBRs forwarded as normal data traffic and subject to policing and VLAN remarking

6) The LBR is forwarded over the CP handover port with the same VLAN ID(s) and priority marking(s) as normal traffic .

4) The ONT replies with a unicast LBR where the DMAC corresponds to the CP SMAC in the LBM. The LBR is tagged with the default C VLAN ID and priority as normal traffic

2.1.9 Transparency

GEA-FTTP will be transparent to all valid Ethernet frames except:

- 802.3x PAUSE[6] - Local link flow control protocol
- Slow Protocols - Set of protocols that includes LACP and 802.3ah OAM
- 802.1X Authentication[7] - Authentication protocol
- Physical layer signalling such as auto-negotiation

Protocol transparency is not applicable to FVA.

2.1.10 Frame duplication

CP equipment must observe Ethernet bridging rules. In particular frames sent from Openreach to the CP must not be reflected back to the Openreach network with source MAC unaltered. This applies both downstream at the Cablelink port and upstream at the modem or DSL port.

2.1.11 Multicast IP Group Addresses

Since the multicast MAC address is derived from the IP group address, CPs shall ensure that IP group addresses are unique in the lower 23 bits.

2.2 FVA Specifics

2.2.1 Digit Maps

Digit maps control the transmission of dialled digit information. The string defines the criteria to be met as digits are collected before an outgoing request. Openreach will have a set of digit maps which will be pre-loaded and CPs should only need to supply the appropriate digit map name as part of an FVA order. If the CP wishes to use their own digit map, they will need to be registered with Openreach.

2.2.1.1 Digit Map upload

CP can upload their own digit maps, for private numbering schemes etc., Digit maps cannot be updated or modified. They can only be added or deleted.

When uploading a digit map, the Inter Digit Timer (Long Digit Timer) and the Short Digit Timer (S) should also be provided. See [2] and ND1646 (Reference [3])

2.2.1.2 Number of digit map supported

Each ATA port can support a single digit map, the maximum number of digit maps per ONT is limited by the number of ATA ports it supports

2.2.2 Variable parameters

These are configurable parameters to be provided by the CP to the Openreach as part of the FVA order. See ND1646 (Reference [3])

IP addresses specified as variable parameters must confirm to the IPv4 standard. IPv6 is not currently supported.

2.2.3 Analogue Telephone Adaptor (ATA)

The FVA Service will support a single CP per ONT and a single voice service per ATA port..

For ATA capabilities and functionalities please refer to SIN 351[2].

### 2.2.4 Synchronisation

For FVA the head end 'OLT' will be synchronised to a BT synchronisation platform to support carrier grade voice services delivered via an ATA embedded within the ONT. The OLT will distribute synchronisation to all connected ATAs. Each OLT has internal clock with 4.6ppm accuracy. On BT clock source failure, ONT/ATA will lose its clock and revert to OLT free running clock.

2.3 ONT Technical Specification

The ONT provided is dependent on the active electronics deployed in the serving exchange.

2.3.1 1+1 ONT

The ONT will be supplied within an external enclosure that will also house a separate battery back up unit
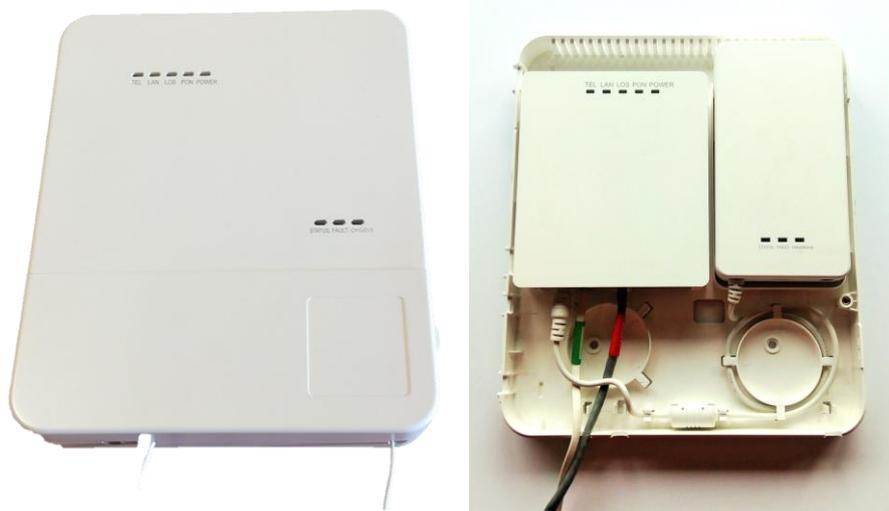
Figure 3 1+1 ONT enclosure

The ONT has:

• One 10/100/1000 Base-T Ethernet data interfaces

• Auto-negotiation and MDI/MDIX auto-sensing.

• Data transferring at wire-speed for all packet size.

• Built-in layer-2 switch

• One voice port, BT601A connector for FVA services

The technical specification of the interface connections provided by the ONT device for Ethernet physical interfaces are described in SIN 360 – Ethernet Customer Interfaces, Interface Characteristics.

2.3.2 4+2 ONT

Figure 4 – Type 1 ONT showing ports and LEDs

Figure 3 – Type 2 ONT showing ports and LEDs

The ONT has:

- Four 10/100/1000 Base-T Ethernet data interfaces
- Auto-negotiation and MDI/MDIX auto-sensing.
- Data transferring at wire-speed for all packet size.
- Built-in layer-2 switch
- Two voice ports, BT601A connectors for FVA services

The technical specification of the interface connections provided by the ONT device for Ethernet physical interfaces are described in SIN 360 – Ethernet Customer Interfaces, Interface Characteristics.

2.3.3 ONT Size

The dimensions (H $\times$ W $\times$ D) for the ONTs are:

1+1 Enclosure 134 mm x 115 mm x 25 mm

4+2 Type 1   195 mm $\times$ 155 mm $\times$ 34 mm.

4+2 Type 2   180mm x 124mm x 33mm

2.3.4 Power Supply

The power supply to the ONT will be a single, low voltage power interface including the capability for battery backup when available. The PSU will be suitable for use with standard domestic UK supplied 230V (AC). The power consumption is <12 W.

- ONT Power supply 11 – 14 V DC, 1 A
- Power adapter input 100 – 240 V AC, 50 – 60 Hz
  Power consumption Minimum: 6 W, Maximum: 12 W, Average: 7.5 W

2.3.5 Battery Backup Unit

The battery backup unit uses 4 2000 mAH-NiMH BYD rechargeable AA batteries 1.2V

2.3.6 Electrical Safety

The ONT is compliant with BS EN 60950-1 "Information technology equipment. Safety. General requirements": http://www.bsigroup.com.

2.3.7 ONT Housing

The ONT will be fixed to a wall within 1m of a fixed power socket.

2.3.8 Upstream shaping

- The CP is expected to shape the upstream traffic to match the chosen upstream rate – see section 1.2.

In addition, the CP should consider the impact of upstream capacity on its GEA Cablelink.

- Openreach will shape traffic into the GEA Cablelink. This shaping will treat all GEA-FTTP Data traffic equally. Specifically, it will not make use of any markings applied by the CPE.

- Openreach will not explicitly manage traffic at an individual inner tag or outer tag level.

2.3.9 Upstream priority marking

CPs can (optionally) prioritise upstream traffic from the CPE to the ONT by marking their traffic with IEEE 802.1p markings in a VLAN:

- 802.1p = 6 or 7 > High priority
- 802.1p = 4 or 5
- 802.1p = 2 or 3

- 802.1p = 0 or 1 > Low priority

High priority frames will be sent from the ONT ahead of the low priority frames via a strict priority queuing mechanism.

Handling of the VLAN tag varies.

- VLAN ID = 0 : VLAN tag is stripped out by the ONT (802.1p markings still used for prioritisation)
- VLAN ID ≠ 0 : VLAN tag will be forwarded to the CP (where this tag is forwarded, the CP must be able to handle this additional tag)

2.3.9.1 <u>FVA Upstream Priority Marking</u>

Both the FVA media and signalling traffic will be incorporated into the same CVLAN by the ATA, and the CVLAN will be marked with 802.1p priority seven (7). The voice media and signalling frames will therefore be scheduled at the same priority through the Openreach FTTP network. The ATA will however differentiate signalling and media via Differentiated Services Code Point (DSCP) values as per ND1646[3]. These are detailed in Table 3 below. The DSCP markings are not used in the Openreach network for any scheduling decisions, but can be used by the CP in their own network.

Traffic Type	Class	DSCP Marking
Media	EF	101 110 (46)
Signalling	AF31	011 010 (26)

Table 3 : DSCP mappings for FVA

3. <u>References</u>

[1]	SIN 360	Ethernet Customer Interfaces, Interface Characteristics.
[2]	SIN351	BT Public Switched Telephone Network (PSTN): Technical Characteristics Of The Single Analogue Line Interface
[3]	ND1646	ND1646 NGA-Telephony; Management V1.1.1 http://www.niccstandards.org.uk/publications/index.cfm
[4]	IEEE802.1ad	Virtual Bridged Local Area Networks, Amendment 4: Provider Bridges
[5]	802.1D-2004	IEEE Standard for Local and metropolitan area networks - Media Access Control (MAC) Bridges
[6]	802.3x	Flow Control
[7]	802.1x	Port Based Network Access Control

[8]	ITU-T Y.1731	OAM functions and mechanisms for Ethernet based networks

4. **Abbreviations**

ATA	Analogue Telephone Adaptor
BS EN	British Standards – English
CP	Communications Provider
CPE	Customer Premises Equipment
CVLAN	Customer VLAN
DHCP	Dynamic Host Configuration Protocol
DLM	Dynamic Line Management
DSCP	Differentiated Services Code Point
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
IEEE 802.1p	3 bit field within a VLAN used to indicate priority
EU	End User
FC/PC	Fixed Connection – fibre optic connector
FTTP	Fibre To The Premise
FVA	Fibre Voice Access
GEA	Generic Ethernet Access
ID	Identifier
IEEE	Institute of Electrical and Electronics Engineers
IFG	Inter-Frame Gap
L2S	Layer 2 Switch
LC	Local/Lucent Connector
MDI/MDIX	Medium Independent interface (cross-over) – Ethernet port connection
NGA	Next Generation Access
NTE	Network Termination Equipment
OAM	Operations, Administration, Maintenance
OLT	Optical Line Termination
ONT	Optical Network Termination device
PADI	PPPoE Active Discovery Initiation
PADO	PPPoE Active Discovery Offer

PADS	PPPoE Active Discovery Session- confirmation
PCP	Priority Code Point aka 802.1p priority
PSU	Power Supply Unit
PPM	Parts Per Million (Clock Accuracy)
PPPoE	Point to Point Protocol over Ethernet
QoS	Quality of Service
SC	Standard Connector
SIN	Suppliers' Information Note (BT Publication)
VLAN	Virtual Local Area Network
SVLAN	Service VLAN
1000 Base – LX	Single Mode

5. History

Issue	Date	Changes
1.0	October 2010	Date of first issue
1.1	January 2013	Updated to include FVA specific information and new GEA FTTP product rates
1.2	February 2013	Updated to add details of Inverted DHCP/PPPoE processing - Section 2.1.7.1
1.3	March 2015	Change SINet site references from http://www.sinet.bt.com to http://www.btplc.com/sinet/
1.4	December 2016	Added new GEA-FTTP product rates and 10G cablelink details
1.5	November 2017	Added new GEA-FTTP product rates, 1+1 ONT details and updated DHCP and policing information

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