



# SIN 476

Issue 1.14

April 2017

## Suppliers' Information Note

*For The BT Network*

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### BT Downstream 21CN Ethernet Services

#### Service Description

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# CONTENTS

<b>1. INTRODUCTION.....</b>	<b>4</b>
<b>2. SERVICE AVAILABILITY.....</b>	<b>4</b>
<b>3. BT ETHERNET SERVICE DESCRIPTION .....</b>	<b>4</b>
3.1 ETHERFLOW.....	6
<b>4. PHYSICAL PROPERTIES OF THE NTES.....</b>	<b>7</b>
4.1 ETHERWAY (FIBRE).....	7
4.1.1 EAD10, 100, 1000 & WES10, 100, 1000.....	7
4.1.2 WES10000.....	8
4.2 ETHERWAY COPPER.....	8
4.3 ETHERWAY EXCHANGE CONNECT .....	8
4.4 ETHERWAY RADIO.....	9
4.5 ETHERWAY SUPERFAST GEA.....	10
4.6 ETHERWAY DATA CENTRE BESPOKE ACCESS.....	11
4.7 ETHERWAY HULL BESPOKE ACCESS.....	11
4.8 ETHERWAY 10G BESPOKE ACCESS.....	11
5. ACCESS RESILIENCE OPTIONS .....	12
<b>6. INTERFACE TYPES AND CONNECTORS .....</b>	<b>13</b>
<b>7. AUTO-NEGOTIATE SETTINGS .....</b>	<b>14</b>
<b>8. NETWORK LINK LOSS FORWARDING.....</b>	<b>14</b>
<b>9. FRAME SIZES SUPPORTED.....</b>	<b>15</b>
<b>10. ETHERFLOW CONNECTED (ETHERNET VIRTUAL CONNECTIONS).....</b>	<b>16</b>
<b>11. ETHERFLOW DYNAMIC (E-LAN).....</b>	<b>16</b>
<b>12. ETHERFLOW CLASS OF SERVICE (COS).....</b>	<b>17</b>
12.1 CoS AND E-LAN SERVICES.....	18
12.2 CoS AND GEA SUPERFAST ETHERWAYS.....	19
12.3 CoS AND COPPER ETHERWAYS.....	19
<b>13. PORT TYPES.....</b>	<b>19</b>
<b>14. TRANSPARENCY.....</b>	<b>21</b>
14.1 ETHERFLOW CONNECTED (E-LINE).....	22
14.2 ETHERFLOW DYNAMIC (ELAN).....	22
14.3 ETHERWAY SUPERFAST GEA.....	23
<b>15. INTERFACE DESCRIPTIONS.....</b>	<b>23</b>
<b>16. REFERENCES.....</b>	<b>25</b>
<b>17. ABBREVIATIONS .....</b>	<b>25</b>
<b>18. HISTORY .....</b>	<b>28</b>

## **1. Introduction**

This Suppliers' Information Note (SIN) describes the BT Downstream 21CN Ethernet Services. The services offer access options using Ethernet accesses at different rates and using a range of access technologies. This document provides information about the service for use by Customer Premises Equipment (CPE) manufacturers and developers.

Note that "BT Downstream 21CN Ethernet Services" is shortened to "BT Ethernet" throughout this document. Also, various BT Lines of Business may market the 21CN Downstream Ethernet services using alternative names, but each will refer their documentation back to this SIN.

This SIN should be read in conjunction with access specific SINs detailed in Section 15.

## **2. Service Availability**

BT Ethernet is available across the United Kingdom of Great Britain & Northern Ireland, with the current exception of the Isle of Man.

BT Ethernet will be offered as "subject to survey". Excess construction charges will apply where appropriate.

Stand-by Power (Battery Back-Up) is not available for BT Ethernet - the customer can use their own UPS if desired.

For further information on service availability and tariffs please contact your company's BT Account Manager.

Contacts for further information can be found at <http://www.btplc.com/sinet/>

If you have enquiries relating to this document, then please contact: [sinet.helpdesk@bt.com](mailto:sinet.helpdesk@bt.com)

## **3. BT Ethernet Service Description**

BT Ethernet is an Ethernet VPN service (uses IEEE802.3 framing), which utilises BT's 21st Century Network to provide connectivity between two or more sites to form an Ethernet (Layer 2) Virtual Private Network. The E-Line topology of the VPN can be point-to-point (Ethernet Private Line) or hub and spoke (Ethernet Virtual Private Line). Meshed topologies can also be built

using point-to-point connections. The service is comprised of 2 fundamental building blocks; “Etherway” and “Etherflow Connected”.

Where E-LAN is deployed, an Any-to-Any topology is obtained. E-LAN and E-Line can co-exist on the same Etherway (exc. Radio) but E-LAN utilises “Etherflow Dynamic” virtual paths connected to a logical E-LAN CUG rather than a point to point “Etherflow Connected”.

See section 11 for further detail.

Etherways are access circuits that link a customer site to a port in a 21C Ethernet Point of Presence (PoP). Etherflow connections or “Etherflows” for short, are the logical Layer 2 connections/data transmission path from one customer site to another.

There are a variety of technologies that can be used to provide an Etherway:-

### **1. Etherway Copper**

- Ethernet First Mile (EFM - 802.3ah, ITU-T G.991.2 (G.SHDSL.bis)) defines how Ethernet can be transmitted over new media types using new Ethernet physical layer (PHY) interfaces, including voice-grade copper.
- BT’s EFM access solution uses up to eight bonded copper pairs, to offer a reliable and high performance access mechanism. In the event of one or more copper pairs suffering failure, the service will be maintained, however at a reduced rate using the remaining pairs. The bonded copper pair failures should be transparent to the end Customer although the overall SDSL bandwidth will reduce accordingly. Single pair service provisions would result in service impact. It should be noted that where possible BT minimises the impact of bonded pair failures to the end customer by over provisioning the SDSL bandwidth above the Committed Ethernet Rate (CIR) offered to the Customer.
- Uses Openreach LLU MPF copper products together with Ethernet First Mile (EFM - copper) electronics.

### **2. Etherway (fibre)**

- Uses Openreach fibre access based products; EAD10, EAD100, EAD1000, WES10, WES100, WES1000 & WES10000.
- When originally launched, Etherway (fibre) used Openreach WES products. Enhancements were made to the service so that from November 2009 new Etherway (fibre) orders consumed Openreach

EAD products. The differences are described throughout this document.

- In December 2010 however, a new 10Gbps Etherway fibre component was added to the portfolio which, in the absence of a 10Gbps EAD, is based upon Openreach WES10000.

### 3. Etherway Exchange Connect (EEC)

- Uses Openreach Cablelink products.

### 4. Etherway Radio

- 100Mbit alternative where Etherway (fibre) is not available or where high ECC charges apply.

### 5. Etherway Superfast GEA

- Uses Openreach GEA/FTTC/FTTP products.

### 6. Etherway Data Centre Bespoke Access

- Presents a 1GE or 10GE port directly off a 21C Ethernet PoP at a Data Centre via a patch panel. There is no requirement for a subsequent BT provided access product.

### 7. Etherway Hull Bespoke Access

- Presents 10M, 100M or 1GE services via the a 3<sup>rd</sup> party access provider from a Hull located 21C Ethernet PoP.

### 8. Etherway 10G Bespoke Access

- Uses Openreach OSA to provide 10G access services.

## 3.1 Etherflow

Etherflow comes in two variants:

1. “**Etherflow Connected**” (Point to Point Ethernet Virtual Connections [EVCs]).
2. “**Etherflow Dynamic**” provides a data transmission path from the customer site to a virtual Layer 2 LAN within the 21C network. It is a Layer 2 Ethernet service supporting broadcast and multicast applications (limitations apply – see Section 11). Etherflow Dynamic can be used with all Etherway access types (apart from Etherway Radio) and can be used alongside or as an alternative to point to point Etherflows.

## **4. Physical Properties of the NTEs**

### **4.1 Etherway (fibre)**

Uses Openreach fibre based access products; EAD10, EAD100, EAD1000, WES10, WES100, WES1000 & WES10000. This includes Local Access and Extended Reach variants.

#### **4.1.1 EAD10, 100, 1000 & WES10, 100, 1000**

Although WES has been used to provide Etherway (fibre) in the past, it is now no longer offered for new provides at these rates. EAD is now used.

Two versions of the NTE are used depending on the anticipated demand at the customer site.

**Slimline NTE** - The slimline NTE may be stand alone, be wall mounted or be rack mounted in a standard 19” cabinet and is 1U high. The slimline NTE would normally be deployed at small sites or where there is not likely to be more than four Openreach EAD products terminating.

- Dimensions: 439mm x 44mm x 270mm (W x H x D)
- Power Supply: Choice of 48V DC or 2 \* 50Hz AC 13amp power sockets are required running off the same phase
- Power Consumption 50 Watts

**Chassis NTE** - The modular chassis NTE is rack mounted in a standard 19” cabinet and is 4U high. Height consideration for fibre routing also needs to be considered. 1U is required for customer cable management and in each rack there needs to be space for a 4U fibre splicing tray.

The chassis NTE would normally be deployed at sites where there is likely to be four or more Openreach EAD products terminating in a twelve month period. Up to 15 NTE cards can be provided in a single chassis.

- Dimensions: 438mm x 175mm x 232mm (W x H x D)
- Power Supply: Choice of 48V DC or 2 \* 50Hz 240V AC 13amp power sockets are required running off the same phase
- Power Consumption: 220 Watts (fully loaded)

Note it is not possible to mix WES and EAD NTE cards in the same chassis

#### **4.1.2 WES10000**

The NTE supplied at the customer is a single slot standalone NTE.

- Power Supply: Choice of 48 Volt DC or 240 Volt 50Hz AC (2 \* 13amp power sockets are required running off the same phase)
- Power Consumption: 200 Watts

#### **4.2 Etherway Copper**

Uses Openreach LLU MPF copper products together with Ethernet First Mile (EFM - copper) electronics.

The NTE maybe stand-alone, be wall mounted or be rack mounted in a standard 19" cabinet and is 1U high.

- Dimensions: 216mm x 35mm x 197mm (W x H x D)
- Power Supply: 1 \* 50Hz AC 13amp power socket is required
- Power Consumption 12 Watts

EFM characteristics include:-

- Uses IEEE 802.3 ah standards[2]
- Uses ITU-T G.991.2 (G.SHDSL.bis) [3] technology
- Provides Symmetrical bandwidths that align with the ANFP (Access Network Frequency Plan)
- Delivers spectrally friendly symmetrical data rates
- Multi-pair operation provides more bandwidth and redundancy
- Each packet is fragmented & reassembled utilizing all circuits in 2BASE-TL bonded group

#### **4.3 Etherway Exchange Connect**

Uses Openreach 1Gbps or 10Gbps Cablelink products.

Services using this access type are restricted to CP's that have a presence in the BT PoP building.

Connectivity to this service is via a patch panel located in the multi user area of the exchange building. Bandwidth is available at 1Gbps and 10Gbps.

For identification of transmit and receive legs of Hydra cables, the convention is that transmission from BT Transmission equipment (e.g. DWDM) to the Customer Patch Panel will be to the Odd Fibre on the Cable Link.

Transmission from the Customer Patch Panel to BT Transmission equipment will always be to the Even Fibre i.e. 2, 4 & 6 on the Cable Link.

Please note, when repairing Hydra cables, please ensure this convention is followed.

#### **4.4 Etherway Radio**

The Radio system comprises both internal equipment and external equipment mounted aloft on the rear of the Antenna. The external equipment is powered directly from the internal equipment via a single coaxial cable.

#### **Indoor Equipment (INU)**

- Guaranteed  $-5^{\circ}$  to  $+45^{\circ}$  C
- Extended  $-5^{\circ}$  to  $+55^{\circ}$  C
- 44mm (1RU) x 482mm x 290mm (or 345mm with required recess bracket) [HxWxD]
- Weight ~4.2kg
- -48V DC, 50-54W (for a 1+0 system)

The internal equipment is designed to be installed within a rack using 19inch fixings. All connections are on the front of the INU. The INU can be mounted with the front face in line with the 19" fixings, or recessed 55mm to allow for the bending radius of the incoming cables.

It is recommended that a 5Amp fuse is fitted in line with the DC power to the INU.

#### **Outdoor Equipment (ODU)**

- Guaranteed  $-33^{\circ}$  to  $+55^{\circ}$  C
- Extended  $-50^{\circ}$  to  $+65^{\circ}$  C
- The AVIAT ODU dimensions are 287mm x 287mm

- The weight of the ODU is 6.4kg (14lb)
- The weight of a typical 0.3M dia Antenna is 6.5kg

The outdoor equipment consists of the ODU containing the electronics, which is attached to the Antenna. Typically the Antenna size will be 0.3M, 0.6M, 1.2M in diameter and is dependent on the link length.

## **Power**

- The input to the INU is -48volts. There is an optional wall mounted AC /DC power unit providing 75watts (DC) which is sufficient for a 1+0 radio system.

## **4.5 Etherway Superfast GEA**

Uses Openreach GEA/FTTC/FTTP products.

Two versions of the NTE are used depending on the access technology (FTTC or FTTP).

**For FTTP based connections** – The ONT (Optical Network Terminating unit) is a wall mounted device, deployed within the customer premises terminating the FTTP fibre.

- Dimensions: 155mm x 195mm x 34mm (W x H x D)
- Power Supply: 1 \* 50Hz AC 13amp power socket is required
- Power Consumption <12 Watts

### **For FTTC based connections**

FTTC customer presentation is currently via an Openreach VDSL modem or via a Communication provider (CP) provided VDSL modem (i.e. “Wires Only” GEA). SIN498 (Generic Ethernet Access Fibre to the Cabinet (GEA-FTTC)) provides details for both these deployment scenarios. Early in 2016, the Openreach modems will cease to be supplied by Openreach at which stage the customer presentation will be via the NTE5 (“Wires Only GEA”).

For Wires Only GEA access, The CP will require a micro-filter for correct functionality. Refer to SIN498 (Generic Ethernet Access Fibre to the Cabinet (GEA-FTTC)) for details.

## **4.6 Etherway Data Centre Bespoke Access**

Etherway Data Centre Bespoke Access allows the Data Centre Customer to connect directly to a 21C Ethernet PoP at 1Gb (via a Patch Panel).

It is the Customer's responsibility to provide the physical connectivity from the Patch Panel to their CPE.

## **4.7 Etherway Hull Bespoke Access**

Etherway Hull Bespoke Access allows customers within the Hull area to connect to a Hull located 21C Ethernet PoP using accesses provided by the local incumbent access provider.

## **4.8 Etherway 10G Bespoke Access**

The Openreach OSA NTE is supplied to provide a 10G DWDM bearer between the Customer Premise and the 21C Ethernet PoP. Customer interfaces will be offered via an optical patch panel or directly on a 1U or 7U NTE using Dual LC interfaces.

### 1U Chassis

- Dimensions: OSA 1U chassis requires a minimum of 5U space.
  - 1U for each chassis
  - 1U for the network management router
  - 1U for each customer panduit cable management
  - 1U for each customer patch panel
  - 1U for Network Patch Panel
  
- Power Supply:
  - NTE: 2 \* 240V (50Hz) AC 13amp power sockets are required

- Management Router: 1 \* 240V (50Hz) AC 13amp power socket is required (for non-RO1 services)
- Power Consumption: OSA 1U Chassis/cards consumes up to 240W (max). Plan for 44W.

## 7U Chassis

- Dimensions: OSA 7U chassis requires a minimum of 11U space.
  - 7U for each chassis
  - 1U for the network management router
  - 1U for each customer Patch panel
  - 1U for panduit cable management system
  - 1U for Network Patch Panel
- Power Supply:
  - NTE: 2 \* 240V (50Hz) AC 13amp power sockets are required
  - Management Router: 1 \* 240V (50Hz) AC 13amp power socket is required (for non-RO1 services)
- Power Consumption: OSA 7U Chassis/cards consumes up to 428W (max). Plan for 76W.

## 5. Access Resilience Options

Access Type	Etherway Copper	Etherway Fibre		Etherway Exchange Connect: 1Gbps & 10Gbps	Etherway Data Centre Bespoke Access	Etherway Hull Bespoke Access	Etherway 10G Bespoke Access	Etherway Radio	Etherway Superfast GEA
		10Mbps, 100Mbps & 1Gbps	10Gbps	1Gbps & 10Gbps	1Gbps	10Mbps, 100Mbps & 1Gbps	10Gbps	100Mbps	10Mbps, 100Mbps & 1Gbps
<b>Delivery Method</b>	EFM LLU MPF	WES* & EAD	WES	Cablelink	N/A	3 <sup>rd</sup> Party Access OLO	OSA	Radio	FTTC/FT TP
<b>Standard</b>	Y	Y	Y	Y	Y	<u>Y</u>	Y	Y	Y
<b>Protected</b>	N	Y	N	N	N	<u>N</u>	N	N	N
<b>Diverse</b>	N	Y	Y	Y	N	<u>N</u>	Y	N	N
<b>Diverse (Split Site)</b>	N	Y	Y	N	N	<u>N</u>	Y	N	N
<b>Diverse +</b>	N	Y	Y	N	N	<u>N</u>	Y	N	N

Diverse+ (Split Site)	N	Y	Y	Y	N	<u>N</u>	Y	N	N
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\* Not available for new supply

## Access Resilience Option Table

### 6. Interface Types and Connectors

Access Type	Interface(s)	Connector Types	Duplex Setting
<b>Etherway Copper</b>	10 Base-T MDI* 100Base-T MDI*	RJ45	Full Duplex Only
<b>Etherway (fibre) 10Mbps, 100Mbps</b>	10 Base-T MDI/MDI-X** 100Base-T MDI/MDI-X**	RJ45	Full Duplex Only
<b>Etherway (fibre) 1Gbps</b>	1000 Base-LX (SMF) 1000 Base-SX (MMF)	Dual LC	Full Duplex Only
<b>Etherway (fibre) 10Gbps</b>	10GBase-LR (SMF) – LAN PHY	SC/PC	Full Duplex Only
<b>Etherway Exchange Connect 1Gbps</b>	1000Base-LX (SMF)	SC/APC	Full Duplex Only
<b>Etherway Exchange Connect 10Gbps</b>	10GBase-LR (SMF) – LAN PHY	SC/APC	Full Duplex Only
<b>Etherway Radio</b>	100Base-T	RJ45	Full Duplex Only
<b>Etherway Superfast GEA (FTTP)</b>	10Base-T/100Base-T/1000Base-T	RJ45	Full Duplex Only
<b>Etherway Superfast GEA (FTTC)***</b>	10Base-T/100Base-T	RJ45	Full Duplex Only
<b>Etherway Data Centre Bespoke Access</b>	1000 Base-LX (SMF) 1000 Base-SX (MMF)	SC/PC	Full Duplex Only
<b>Etherway Hull Bespoke Access</b>	<u>10 Base-T</u> <u>100Base-T</u> 1000 Base-SX (MMF)	RJ45 -	Full Duplex Only
<b>Etherway 10G Bespoke Access</b>	10GBase-LR (SMF) – LAN PHY	SC/PC	Full Duplex Only

### Interface Types and Connector Table

\*The Etherway Copper NTE uses an MDI interface, i.e. a straight through cable is required (by default).

\*\*The WES & EAD NTEs use MDI/MDI-X autocross capability on the RJ45 port to automatically compensate for the use of an incorrect cable type, for example if a crossed Cat 5 Ethernet cable is used instead of a straight one (or vice-versa).

\*\*\*Where GEA-FTTC “Wires Only” presentation is provided, this will be via an NTE5.

## 7. Auto-negotiate Settings

Access Type	Etherway Copper	Etherway Fibre				Etherway Exchange Connect: 1Gbps & 10Gbps	Etherway Data Centre Bespoke Access	Etherway Hull Bespoke Access	Etherway 10G Bespoke Access	Etherway Radio	Etherway Superfast GEA
		10Mbps, 100Mbps	1Gbps	10Gbps	1Gbps & 10Gbps	1Gbps	10Mbps, 100Mbps & 1Gbps	10Gbps	100Mbps	10Mbps, 100Mbps & 1Gbps	
Delivery Method	EFM LLU MPF	WES	EAD	EAD, WES	WES	Cablelink	N/A	3 <sup>rd</sup> Party Access OLO	OSA	Radio	FTTC/ FTTP
Auto- neg setting	OFF	OFF	ON* (selectable)	ON*	N/A	ON*	N/A	ON*	N/A	OFF	ON**

### Auto-negotiation Setting Table

\* The customer's equipment needs to be set to Auto-negotiate "on" in order to work correctly with the Etherway service.

\*\* The customer's equipment needs to be set to Auto-negotiate "on" in order to work correctly with the Etherway service & the NTE will negotiate interface speed.

## 8. Network Link Loss Forwarding

For Etherway (fibre) 1Gbps using WES delivery, Network Link Loss Forwarding is signalled using C1/C2 auto-negotiate.

For Etherway (fibre) 10/100Mbps using WES delivery and for all Etherway (fibre) using EAD delivery, when a break is detected on the Etherway the client access port is shut down to indicate the state of the infrastructure. Note that in the event of a break detection, only the affected Etherway client port is shut down, all other client ports on the VPN remain operational.

On Etherway Copper, Etherway Exchange Connect, Etherway Data Centre Bespoke Access E& Etherway Superfast GEA, Network Link Loss Forwarding is not used.

For Etherway Radio, Network and User Link Loss Forwarding are both used. This means that, in addition to Network Link Loss Forwarding, loss of signal at an Ethernet client port is propagated to the client port on the remote end of the radio link.

For Etherway 10G Bespoke Access, Network Link Loss Forwarding is signalled using Local Fault as per IEEE802.3.

## 9. Frame Sizes Supported

On all Etherway types the minimum frame size supported is 64 bytes.

Access Type	Etherway Copper	Etherway Fibre				Etherway Exchange Connect: 1Gbps & 10Gbps	Etherway Data Centre Bespoke Access	Etherway Hull Bespoke Access	Etherway 10G Bespoke Access	Etherway Radio	Etherway Superfast GEA
		10Mbps, 100Mbps	1Gbps	10Gbps	1Gbps & 10Gbps						
Delivery Method	EFM LLU MPF	WES	EAD	EAD, WES	WES	Cablelink	N/A	3 <sup>rd</sup> Party Access OLO	OSA	Radio	FTTC/ FTTP
MTU*	1600	1548	2000	2000	2000	2000	2000	2000	2000	2000	1530 (FTTP) 1530 (FTTC)

<SIN 498 states that the maximum supported Ethernet frame size is 1530 bytes (excluding IFG and pre-amble and single/double tag – see **Error! Reference source not found.**)>

\* Maximum Transmission Unit

### Frame Sizes Supported Table

When an EVC routes between 2 different Etherway types the MTU supported is the lowest of the 2 access types.

## 10. Etherflow Bandwidth Sizes Supported

A range of Etherflow (Etherflow Connected & Etherflow Dynamic) bandwidths are available from 200kbps to 2.5Gbps. All Etherflow bandwidths can be used across all Etherway types up to the bandwidth of the Etherway itself. Etherflow bandwidths in excess of 1G are only supported off 10G Etherways.

### 10.1 Large Etherflows

Etherflow bandwidths greater than 1G, i.e. 1.5G, 2G and 2.5G are supported via a 10G Etherways. At the current time, large Etherflows are only offered on Etherflow Connected services.

These bandwidth options are only suitable where customer traffic uses multiple service flows within the 1.5G, 2G or 2.5G Etherflow, i.e. variations in the IP address or MAC address must be apparent. Large service flows and/or tunnelling of the IP traffic, such as some encryption protocols may result in customer traffic discard.

Two example encryption protocols where large Etherflow support should work are (i.e. where only the IP payload is encrypted and not the IP header):-

- Secure Sockets Layer (SSL VPN)
- IPSec (in transport mode)

An example where variations in the IP addresses will not be visible to BT systems is IPSec (in default tunnel mode).

## **11. Etherflow Connected (Ethernet Virtual Connections)**

There are limitations on the maximum number of Etherflows allowed per Etherway:

Interface Type	10 BaseT	100 BaseT	10/100/1000 BaseT	1000 BaseLX 1000 BaseSX	10Gb Base LR
Max. Number of EVCs	120	120	120	400	1500

### **Etherflow Connected Instances per Etherway Table**

Traffic is policed at the ingress port on the Ethernet switch in BT's 21CN PoP. If a customer selects Etherflow size(s) less than the Etherway bandwidth it is advisable to shape their traffic to the Etherflow size.

## **12. Etherflow Dynamic (E-LAN)**

Etherflow Dynamic service characteristics are defined below:

- All Etherways in a given E-LAN must have the same port status (Port / VLAN aware)
- Maximum of 50 Etherflow Dynamic EVC's per E-LAN<sup>1</sup>

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<sup>1</sup> In some circumstances more than 50 Etherflow Dynamic EVCs per ELAN may be permitted when specifically authorised by network design. For more details speak to product line.

- Maximum of 10 Etherflow Dynamic E-LAN's per Etherway
- Maximum of 1 Etherflow Dynamic from the same Etherway into an E-LAN
- Maximum of 2000 MAC addresses presented per E-LAN<sup>2</sup>.
- Maximum of 250Mbps Real Time traffic per Etherway
- Maximum of 500kbps Multicast traffic (not including Layer 2 Control Protocols) per Etherflow Dynamic. Etherflow Dynamic EVCs can be used on any Etherway type (Fibre, Copper & Exchange connect) and with all resilience options<sup>3</sup>.
- To ensure optimum performance of the Class of Service policy it is not recommended to mix Etherflow-connected and Etherflow-Dynamic EVCs on Etherway (copper)
- Ingress and Egress bandwidth (and associated Class of Service) needs to be appropriately dimensioned for the expected traffic flows
- All CPE devices on an E-LAN will be adjacent to each other in routing terms
- Layer 2 loops and broadcast storms need to be avoided

Interface Type	10 BaseT	100 BaseT	10/100/1000 BaseT	1000 BaseLX 1000 BaseSX	10Gb Base LR
Max. Number of Etherflow Dynamic instances per Etherway	10	10	10	10	10

**Etherflow Dynamic Instances per Etherway Table**

### **13. Etherflow Class of Service (CoS)**

Class of service markings allow customers to inform BT about the relative priority of their data packets. This ensures that in abnormal network conditions (such as fault situations), or if the customer sends too much data to an egress point, the customer's high priority traffic gets through.

There are four Etherflow CoS Options. Two are aware of customer CoS markings (Default-CoS and Multi-CoS) and two are not aware of customer markings (Standard and Premium).

1. Standard: Standard traffic is classified as Low Priority across the 21C Core. 20% of customer traffic is marked as In Contract with any remaining being marked out of contract. Out of contract traffic may be discarded in the event of network congestion.

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<sup>2</sup> If a customer sends more than 2,000 MAC addresses into the ELAN they risk poor performance.

<sup>3</sup> Though the customer will have to take steps to remove loops with some resilience options.

2. Premium: Premium traffic is classified as Medium Priority across the 21C core with 100% of traffic marked In Contract.
3. Default-CoS/Multi-CoS: (“Default-CoS” and ”Multi-CoS”, both use Ethernet 802.1p bits to mark the priority as shown in the following table:

<b>802.1p</b>	<b>Multi-CoS</b>	<b>Default-CoS</b>
<b>7</b>	Low Priority (In Contract)	Low Priority (In Contract)
<b>6</b>	Low Priority (In Contract)	Low Priority (In Contract)
<b>5</b>	High Priority	Low Priority (In Contract)
<b>4</b>	Low Priority (In Contract)	Low Priority (In Contract)
<b>3</b>	Medium Priority (In Contract)	Low Priority (In Contract)
<b>2</b>	Medium Priority (Out Contract)	Low Priority (In Contract)
<b>1</b>	Low Priority (Out Contract)	Low Priority (Out Contract)
<b>0</b>	Low Priority (In Contract)	Low Priority (In Contract)

**Class of Service Table**

With Multi-CoS, traffic is policed to the overall purchased bandwidth (so 100% of traffic can be In Contract) and the High Priority traffic is policed to the purchased amount of High Priority traffic.

With Default-CoS, traffic is policed to the overall purchased bandwidth. Only 20% of traffic can be marked In Contract. Traffic exceeding this will be treated as out of contract across the BT network. Out of contract traffic may be discarded in the event of network congestion.

If a customer chooses Port mode the BT CoS policy will interact with 802.1p bits sent in the data packet (which may be intended for customer only use).

If a customer chooses Port mode and does not place any 802.1p bit in the packet the BT CoS policy will transmit the packet through the Low Priority In Contract queue.

### **13.1 CoS and E-LAN services**

With E-LAN Etherflows, Broadcast and Multicast traffic from the customer is classified as Low Priority (In Contract) and limited to 500kbps.

In addition to classifying traffic based on the 802.1p value, the customer Layer 2 control traffic (ARP, IEEE group MAC addresses (e.g. STP) and IETF local network control traffic (e.g. OSPF)) shall be classified as Medium Priority (In Contract). Such traffic is rate limited to 500kbps.

<b>Control Traffic</b>	<b>Match Criteria</b>
<b>IETF IPv4 Local Control (inc. OSPF)</b>	MAC addresses 01-00-5E-00-00-00 to 01-00-5E-00-00-FF
<b>IETF IPv6 Local Control (inc. OSPF)</b>	MAC addresses 33-33-00-00-00-00 to 33-33-00-00-00-FF
<b>IEEE Group MAC Addresses</b>	MAC addresses 01-80-C2-00-00-00 to 01-80-C2-00-00-3F
<b>ARP</b>	Ethertype 0x0806

### **Layer 2 Control Traffic Table**

Note: The range of MAC addresses that includes IP control traffic also carries other IP multicast groups. If these groups are used by the customer then they will be classified as control traffic by the BT service. The customer should take steps to ensure they do not congest this multicast bandwidth otherwise they risk dropping some control traffic.

#### **13.2 CoS and GEA Superfast Etherways**

GEA Superfast Etherways only support two CoS options (Default-CoS and Multi-CoS). Standard and Premium are not supported on this Etherway type.

For CoS to work effectively on GEA superfast Etherways, the customer should use VLAN aware Etherways.

#### **13.3 CoS and Copper Etherways**

Customers using Copper Etherways for Default-CoS and Multi-CoS EVCs are advised to always mark their traffic priority, even when using Port based Etherways.

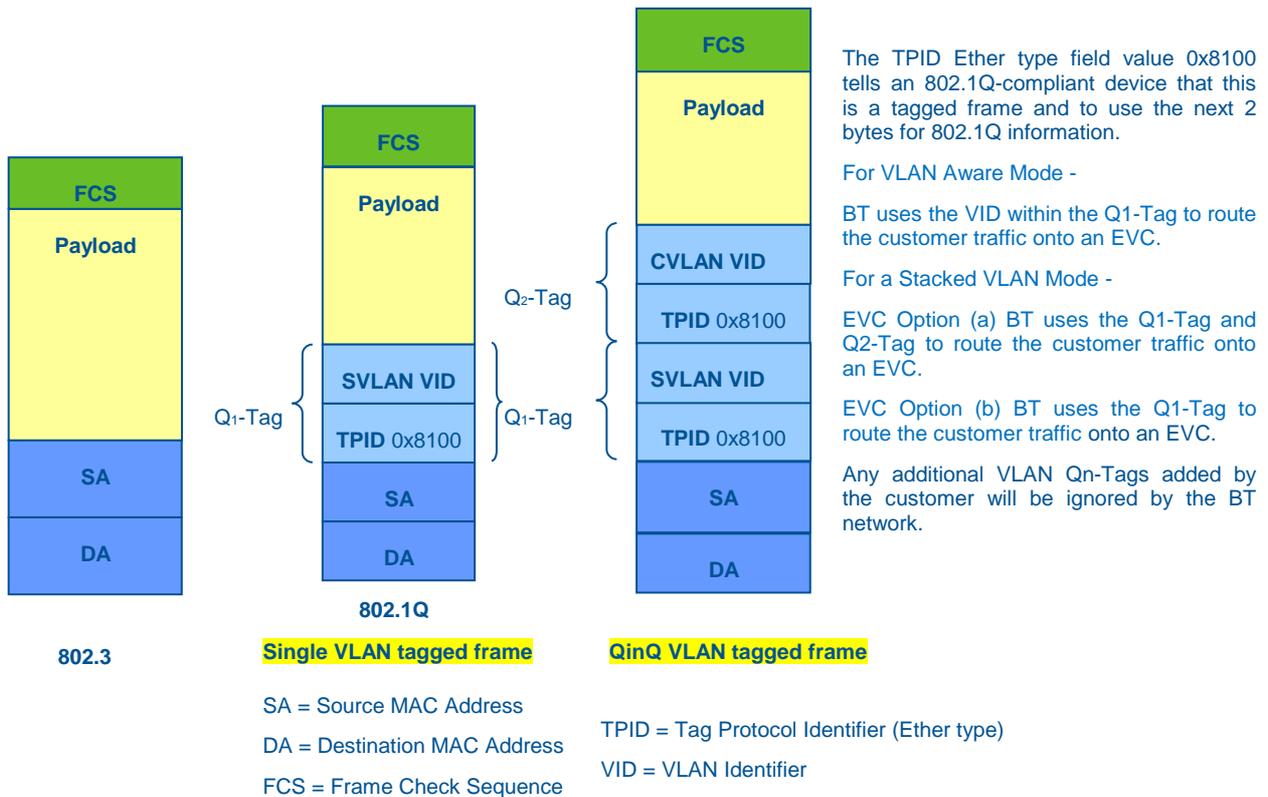
## **14. Port Types**

For each Etherway on an Ethernet VPN the customer can choose between three configuration options:

1. Port Mode (IEEE802.3) – The Etherway will be transparent to all VLAN tags sent by the customer. Only a single EVC can be provided through this configuration.

2. VLAN Aware (segmented) Mode (IEEE802.1q) – The customer will need to tag each frame with a VLAN ID in order to identify which EVC the frame is for.
3. Stacked VLAN Mode (IEEE802.1QinQ) – There are two options for ordering an EVC end-point that terminates on a Stacked VLAN Mode Etherway, as defined below. Note that EVC end-points using Option (a) and Option (b) can co-exist on the same ‘Stacked VLAN mode’ Etherway -
  - a. The customer specifies both the outer SVLAN identifier and the inner CVLAN identifier on the EVC order form. The customer will need to tag each frame with both the SVLAN and CVLAN in order to identify which EVC the frame is for.
  - b. The customer specifies the SVLAN identifier, and selects the ‘wildcard’ option for the CVLAN on the EVC order form. The customer will need to tag each frame with the SVLAN in order to identify which EVC the frame is for.

Note that VLAN IDs are unique to each Etherway only. If required, the same VLAN ID can be utilised multiple times on the same VPN. VLAN IDs must be in the range 1 to 4094. Where GEA is used, the range is 2 to 4094 as VLANid 1 is reserved as specified in the GEA SIN 498/506.



In VLAN aware mode the customer must identify each packet using a VLAN tag (using TPID 0x8100). When the frame gets to the BT's Ethernet Edge switch the traffic will be routed to the correct EVC and the tag will be discarded.

In Stacked VLAN Mode, the customer must identify each packet using either two VLAN tags (Option (a)) or one VLAN tag (Option (b)). Both tags should use TPID 0x8100. When the frame gets to the BT's Ethernet Edge switch, the traffic will be routed to the correct EVC and the tag(s) that were used to route the EVC will be discarded.

## 15. Transparency

## 15.1 Etherflow Connected (E-Line)

BT Ethernet is transparent to the Layer 2 protocols defined below.

Protocol Usage	Destination MAC Address	Layer 2 Control Protocol Handling
Customer Bridge Group Address:- - Spanning Tree STP,RSTP,MSTP	01-80-C2-00-00-00	Tunnelled and is transparent to the Service
All LANs Bridge Management Group Address	01-80-C2-00-00-10	Tunnelled and is transparent to the Service

### Etherflow Connected Transparency Table

All other Layer 2 protocols generated by the Customer are not guaranteed to be passed across the Etherflow Connected service. The customer should assume that they will be discarded.

All Layer 3 protocols generated by the Customer should be passed across the Etherflow Connected service transparently.

## 15.2 Etherflow Dynamic (ELAN)

The treatment of Ethernet control protocols across the E-LAN is outlined in the following table.

Protocol	Destination MAC	Port Based E-LAN	VLAN Based E-LAN
STP, RSTP, MSTP	01-80-C2-00-00-00	Tunnelled and is transparent to the Service	Discard*
GARP, MRP	01-80-C2-00-00-20 through 01-80-C2-00-00-2F	Tunnelled and is transparent to the Service	Discard*

### Etherflow Dynamic Transparency Table

\*These protocols are discarded if received on an interface for a VLAN based E-LAN and are untagged. If the protocols are tagged with the correct VLAN ID then they are Tunnelled. However, these IEEE protocols are normally transmitted untagged (not within a VLAN). The operation of the protocol if transmitted within a VLAN is not defined.

All other Layer 2 protocols generated by the Customer are not guaranteed to be passed across the Etherflow Dynamic service. The customer should assume that they will be discarded.

All Layer 3 protocols generated by the Customer should be passed across the Etherflow Dynamic transparently.

### **15.3 Etherway Superfast GEA**

When using a Superfast GEA Etherway, Customers are advised to take into account the following:-

- When GEA is used as an access to the BT Downstream 21CN Ethernet Service any IP multicast traffic MUST use a VLAN. If IP multicast traffic is not tagged, or tagged with a VLAN ID of 0, IGMP will not be forwarded transparently across the GEA.
- When GEA is used as an access to the BT Downstream 21CN Ethernet Service any DHCP will have the Option 82 Agent information added. This is added to DHCP that is sent from the GEA connected site and is removed if present from DHCP that is sent to the GEA connected site.
- When GEA is used as an access to the BT Downstream 21CN Ethernet Service any PPPoE traffic will result in additional tags to 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).

See SIN 498/506 for further details.

## **16. Interface Descriptions**

Refer to the following Supplier Information Notes:

- SIN 431/432 (WES 10)
- SIN 433 (WES100)
- SIN 436 (WES1000)
- SIN 460 (WES 10000)
- SIN 489 (OSA)
- SIN 492 (EAD)

- SIN 498 (GEA/FTTC)
- SIN 506 (GEA/FTTP)
- SIN 360 for Ethernet Customer Interfaces

Note that a SIN for Cablelink does not exist.

The customer provides connecting cables between the NTE and their own CPE.

## 17. References

[1]	SIN 360/460/492	Ethernet Customer Interfaces
[2]	IEEE 802.3 ah	EFM protocol
[3]	ITU-T G.991.2	SHDSL industry standard
[4]	IEEE P802.1p	Protocol used for QoS Marking Ethernet frames
	SIN 498	Generic Ethernet Access Fibre to the Cabinet (GEA-FTTC)

For information on where to obtain these referenced documents, please see the document sources list at <http://www.btplc.com/sinet/>

## 18. Abbreviations

21CN	21 <sup>st</sup> Century Network
ANFP	Access Network Frequency Plan
ARP	Address Resolution Protocol
BT	British Telecommunications plc
CC	Continuity Check
CoS	Class of Service
CPE	Customer Premises Equipment
C-VLAN	Customer Virtual Local Area Network
DWDM	Dense Wavelength Division Multiplexing
EAD	Ethernet Access Direct (Openreach product)
ECC	Excess Construction Charges
EFM	Ethernet in the First Mile
E-LAN	Ethernet LAN
E-LMI	Ethernet Local Management Interface
ETHD	Etherflow Dynamic (individual access into an E-LAN)

EVC	Ethernet Virtual Connection
FE	Fast Ethernet
GARP	Generic Attribute Registration Protocol
GigE	Gigabit Ethernet
INU	Indoor Unit of Radio transmission equipment
IEEE	Institute of Electronic and Electrical Engineers
LACP	Link Aggregation Control Protocol
LAN	Local Area Network
LAMP	Link Aggregation Marker Protocol
LLDP	Link Layer Discovery Protocol
LLU	Local Loop Unbundling (Openreach product)
LT	Link Trace
MAC	Medium Access Control
MD	Maintenance Domain
ME	Maintenance Endpoint
MEF	Metro Ethernet Forum
MPLS	Multi Protocol Label Switching
MSAN	Multi-Service Access Node
MSTP	Multiple Spanning Tree Protocol
NTE	Network Terminal Equipment.
NTP	Network Terminating Point
OAM	Operations And Maintenance
ODU	Outdoor Unit of Radio transmission equipment
OSA	Optical Spectrum Access
OSPF	Open Shortest Path First
PoP	Point Of Presence. In this context a 21C Ethernet Switch site
PWE3	Pseudo Wire Emulation Edge To Edge Router
RSTP	Rapid Signalling Transfer Point
SC/APC	An optical fibre connector type
SHDSL	Single pair High Speed Digital Subscriber

SIN	Supplier Information Note (BT Publication)
STP	Spanning Tree Protocol
SVLAN	Service Virtual Local Area Network
TPID	Tag Protocol Identifier
VDSL	Very high speed Digital Subscriber Line
VID	VLAN Identifier
VPN	Virtual Private Network
VLAN	Virtual Local Area Network
UNI	User Network Interface
WAN	Wide Area Network
WES	Wholesale Extension Service (Openreach product)
GEA	Generic Ethernet Access
FTTP	Fibre to the Premise
FTTC	Fibre to the Cabinet
ONT	Optical Network Termination device

## 19. History

Issue	Date	Changes
Issue 1.0	30 Nov 07	First published.
Issue 1.1	30 May 08	Updated to include WES10 and WES LA
Issue 1.2	17 Jul 08	Updated to include WES1000ER and Auto Negotiate info
Issue 1.3	31 Mar 09	Addition of Ethernet over copper services and update of VLAN tag information. Also minor editorials.
Issue 1.4	25 Sep 09	Updated to include details of EAD delivery and editorial changes
Issue 1.5	25 Nov 09	Updated to include Etherway Exchange connect
Issue 1.6	23 Aug 10	Clarification of IBH hydra cable transmit/receive identification.
Issue 1.7	March 11	Updated to include 10G access.
Issue 1.8	August 11	Updated to include Etherflow Dynamic (E-LAN)
Issue 1.9	March 12	Updated to include Etherflow Etherway Radio and Etherway Superfast GEA. Also CoS sections updated.
Issue 1.10	May 13	Updated to include 10G EEC, access resilience table, GEA transparency text updates, physical interface clarifications, QinQ text.
Issue 1.11	June 13	Updated to include Etherway Data Centre Bespoke Access
Issue 1.12	January 2015	Clarification on use of Eline and Elan EVC within ELAN topology. Update on planned Data Centre 10G access solution. Insert of information on treatment of Customer generated layer 3 protocols.  Change SINet site references from <a href="http://www.sinet.bt.com">http://www.sinet.bt.com</a> to <a href="http://www.btplc.com/sinet/">http://www.btplc.com/sinet/</a>
Issue 1.13	January 2016	Updated to include Etherway Hull Bespoke Access, Etherway 10G Bespoke Access, GEA FTTC Wires only and Large Etherflow detail.
Issue 1.14	April 2017	Editorial changes to ToC

**-END-**

