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Suppliers' Information Note

For The BT Network

Ethernet Access Direct (EAD) inc EAD Enable and Ethernet Access Direct Local Access

Service & Interface Description

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1. Introduction

This Suppliers' Information Note (SIN) describes the interface provided with the Openreach Ethernet Access Direct (EAD) services. Also provided is some general information on the EAD product family and some physical aspects of the NTE being deployed for Ethernet Access Direct customer orders.

EAD services are high speed, point-to-point data circuits that are permanently connected and available 24 hours a day, 365 days per year. EAD provides secure links between combinations of end user sites, Communications Providers' (CPs') sites and BT exchanges. EAD Local Access product provides a secure link between an end user site or a CP site and the fibre serving BT exchange site, with the circuit terminating at a CP presence at that serving exchange (e.g. BT Locate space).

From a technical perspective, EAD products are similar to existing *Extension Services* products marketed by Openreach.

Any specific technology mentioned in this document is current as of today. However it may be subject to change in the future. Should the specification of the interface be changed, this will be notified by a new issue of this SIN. Openreach reserves the right to adapt technology to deliver EAD and EAD Local Access services as new developments are made. All services are delivered over an uncontended transmission path.

2. Service Outline

The EAD service is a point-to-point data service offering high bandwidth connectivity over a standard radial distance up to 25km between sites. This radial (or point-to-point) distance can result in physical line plant route distances of up to 40km.

From 1 March 2013, Extended Reach variants are available at 10, 100 and 1000 Mbit/s for new EAD orders placed via the Equivalence Management Portal (EMP). This offers radial distances up to 45km between sites. This radial (or point-to-point) distance can result in physical line plant route distances of up to 86km.

Orders placed via eCo-x are limited to the EAD 1000ER product only with a maximum radial distance of up to 35km between sites and route distance limitation of 66km route.

EAD offers to provide a secure link between a combination of end user sites, Communications Provider's (CP's) network at a CP's sites and BT exchanges, with the circuit terminating at a CP presence at that serving exchange (e.g. BT Locate space).

Synchronous Ethernet (SyncE) is an optional feature of the EAD service available via the Openreach EMP platform only. SyncE is available for EAD 100Mbit/s and EAD 1Gbit/s services for Local Access, Standard and Extended Reach (up to 66km line plant route distance only), including Resilience Options. SyncE is not supported at 10Mbit/s.

EAD SyncE will transport a clock input through the network to produce a matching clock output at the other end of the service. Providing and maintaining the timing source is the CP's responsibility.

EAD Enable will support a Communications Provider (CP) to provide their audit/ assurance process in order to offer a Business Impact Level 3 (IL3) service that can be assured to Communications-Electronics Security Group (CESG) level 3-3-4.

By the supply of EAD Enable standard IL3 is not guaranteed by Openreach. Such accreditation is the responsibility of the Communications Provider

At a BT site the EAD Enable circuit terminates at a CP presence within that serving exchange (e.g. BT Licensed / MUA space) EAD Enable can terminate within a MUA space, however the suitability of this as a 'secure' solution should be agreed between the CP and their customer, for example, for a CP to achieve IL3 accreditation it may be possible that the MUA area is not suitable due to the access provided to other customers into this area.

EAD Enable products will NOT proactively monitor for any alarm conditions. Openreach will provide limited outputs from the NTE to enable the CP to detect alarms e.g optional Optical Power Degradation alarm. The CP will need to integrate these alarms with any alarm systems they may have.

The CP will be responsible for any initial fault diagnosis activity, using its own diagnostic capability to determine whether a fault is likely to fall within the Openreach access network. A list of those alarms can be found in the product description available on the Openreach web site.

EAD Local Access only provides access as far as the fibre serving exchange and, as this is the only exchange involved, radial distances between exchanges are not applicable. EAD Local Access provides a secure link between either an end user site or Communications Provider's (CP's) network at a CP's site and the fibre serving BT exchange site, with the circuit terminating at a CP presence at that serving exchange (e.g. BT Locate space).

For enquiries concerning connection availability between particular sites and for further information on the EAD service please contact your Openreach Sales Relationship Manager or refer to the EAD Product description, available on the Openreach web site.

The client interface offered on EAD services (including SyncE), i.e. the Network Terminating Equipment (NTE) will be dependant on the bandwidth speed selected.

Product Selected	EAD / EAD Local Access 10	EAD / EAD Local Access 100	EAD / EAD Local Access 1000
Interface(s) Offered	10 BaseT (Not SyncE)	100 BaseTX	1000 BaseLX (SMF) 1000 BaseSX (MMF)
Connector Types	RJ45	RJ45	Dual LC

Client interfaces offered on the EAD NTE are Full Duplex only. The uncontended transmission path is routed via the Openreach network.

A schematic of the EAD service is shown in Figure 1 and EAD Local Access is shown in Figure 2. The diagrams depict current technology and delivery, and this is subject to change.

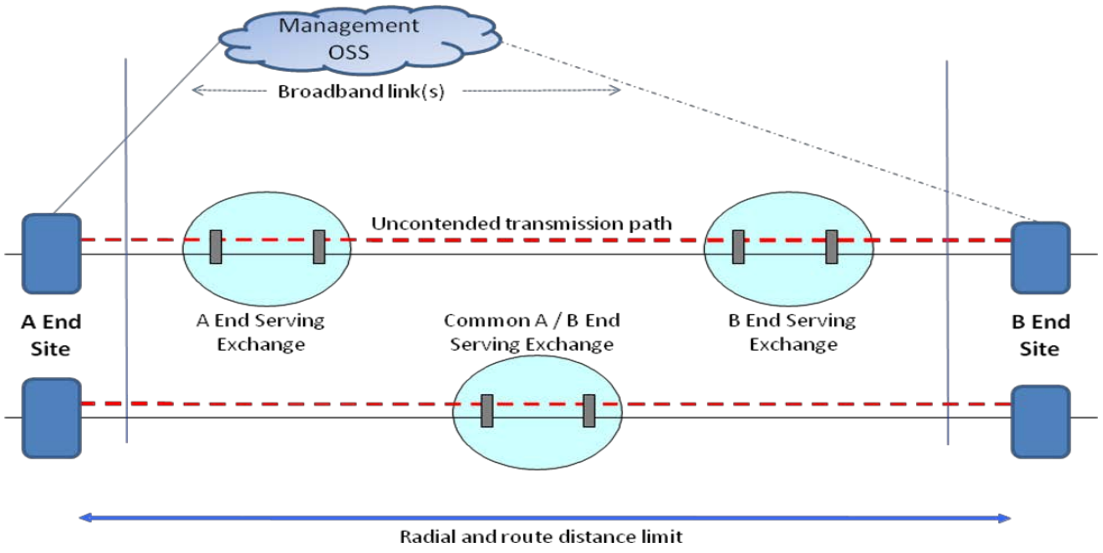

Figure 1. EAD Service Configuration

Note. Figure 1 depicts two separate circuit scenarios, not a combined service. The upper schematic represents an EAD circuit where each end is served from different BT exchanges. The lower schematic represents an EAD circuit where each end has a common BT serving exchange.

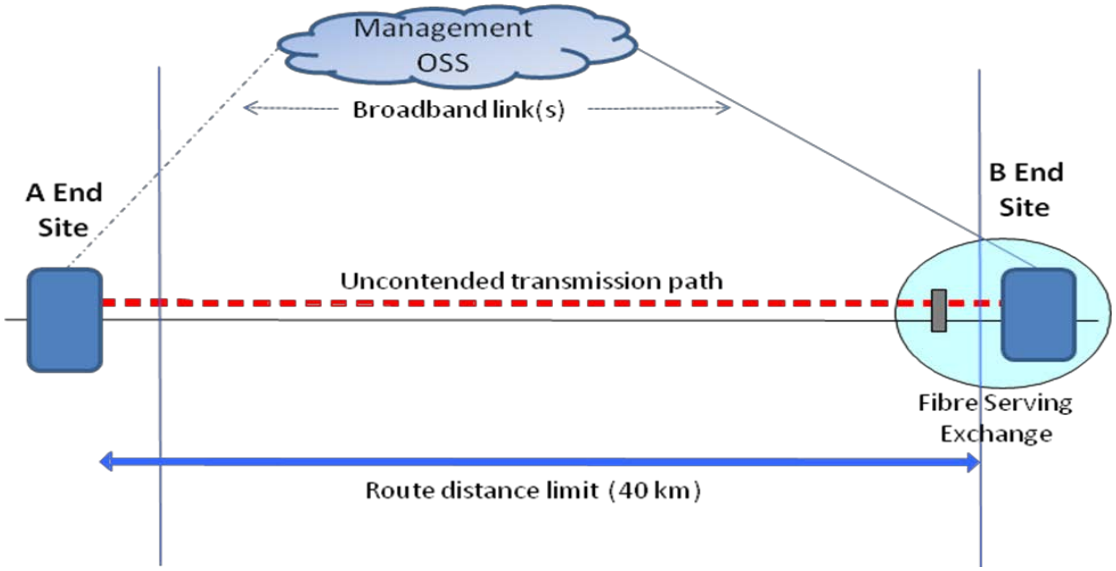

Figure 2. EAD Local Access Service Configuration

Note. Figure 2 depicts an EAD Local Access circuit scenario
Note - EAD Enable has no Openreach management OSS

In most cases EAD/EAD Local Access will be used to interconnect two Ethernet, Fast Ethernet or Gigabit Ethernet LANs on physically distant sites. The EAD/EAD Local Access services are connected for operational support purposes to an Openreach management platform.

3. EAD Service Features

3.1 General

The EAD NTE is capable of transmitting frames conforming to IEEE 802.3[1] with frame sizes from 64 bytes to a maximum of 2000 bytes as specified in IEEE 802.3[1] and amendment IEEE 802.3as[5]. This is to maintain compatibility with a number of frame tagging formats, including VLAN tagging as specified in IEEE 802.1q[4].

The service is transparent to VLAN tags and will forward VLAN tagged frames in the same way as standard (untagged) frames.

On a SyncE enabled service one additional frame per second will be sent with the customer traffic on the remote end access port to provide information on the status of the synchronisation.

Due to the use of a 4 byte overhead for management purposes, a SyncE enabled EAD1Gbit/s circuit is expected to have a reduction of throughput of up to 1%, when compared with standard EAD1Gbit/s circuit for Customer Ethernet frames sizes of 400 bytes and above. For Customer Ethernet frame sizes smaller than 400 bytes the throughput reduction increases to approximately 6% for 64 bytes frames.

Note: The EAD NTE will pass 9000 byte frames on 1000BaseLX and 1000BaseSX interfaces only however as this is not yet a recognised Ethernet standard, BT will not validate usage at this level until such time as the IEEE provide an endorsement and published standard for jumbo frames and we have tested against it.

3.2 Frame Forwarding Behaviour

The EAD service does not include IEEE 802.1d[2] Bridging functionality, which allows for the Learning and Filtering of traffic packets destined for those hosts connected at the local end.

Therefore Ethernet frames that would normally be filtered by IEEE 802.1d[2] bridging functionality, are instead forwarded across the EAD link.

3.3 EAD Transparency Restrictions

All Ethernet frames are passed across the EAD link, other than the following list of known exceptions:

1. Transport of EFM OAM PDUs as defined by IEEE 802.3[1] over EAD is not supported

   The EAD service uses EFM OAM PDUs internally for the purposes of OAM. And as per the IEEE802.3[1] standards defined behaviour for EFM equipment, the end to end transport of customer EFM OAM PDUs over the EAD link is blocked.

2. Transport of Ethernet flow control / Pause frames over EAD is not supported

   Note: This restriction does not currently apply to EAD links using 1U high NTE to 1U high NTEs.

3. Transport of Auto-negotiation messages over the EAD link is not supported.

   Auto-negotiation messages are exchanged and terminated between the NTE's client interface and the customer equipment to which it is directly connected.

3.4 Auto-Negotiation and Duplex Settings

The NTE customer interface will require customer equipment Ethernet interface to be set to Auto-negotiate. The NTE will advertise its speed and duplex settings, however the NTE will not allow

speed or duplex settings to be set by customer equipment.

However on special request, an EAD link can be offered with auto-negotiation switched off at both ends of the link for EAD 10 and EAD 100 services (both EAD standard and EAD local variants. Where such configurations are offered it will be necessary to have customer equipment at both ends

of the link set to 10 Full Duplex or 100 Full Duplex (as appropriate) with auto-negotiation switched off. Refer to section 4.1 regarding impact that switching auto-negotiation off, has on MDI/MDI-X auto-cross capability.

Auto-negotiation operation supported by EAD is specified in IEEE 802.3[1].

The EAD service is 'Full Duplex'. Half duplex operation is not supported by EAD therefore customer equipment must support Full Duplex operation.

3.5 Link Loss Forwarding

The EAD NTE is offered with both Network Link Loss Forwarding and User Link Loss Forwarding. Network Link Loss Forwarding is applied to the service by default. The User Link Loss Forwarding is a selectable option, as is the link failure notice direction (i.e. A to B end or B to A end).

3.5.1 Network Link Loss Forwarding

When a break is detected on the Openreach network link, the client interface port is shut down to indicate the state of the infrastructure. This continues until such time as the network break is repaired.

3.5.2 User-User Link Loss Forwarding

User-User Link Loss Forwarding allows the notification of failure of a NTE at one end of an EAD service to be propagated to a suitably configured customer device at the other end of the same service. Available as a selectable unidirectional service only, User Link Loss Forwarding is notified at the time of provision.

For EAD customer to CP connections, it is recommended that this functionality is activated from the CP's PoP to the End User customer site. This means that the EAD circuit is only impacted by User Link Loss Forwarding only if problems occur at the CP's equipment at the CP PoP site end of the circuit. If problems occur at the end user customer's equipment, the circuit will not be impacted.

Where User-User Link Loss Forwarding is present on an EAD SyncE service the intrusive remote test may not operate correctly unless active customer connection is made at both ends of the service.

3.6 SyncE

EAD SyncE will transport a clock input through the network to produce a matching clock output at the other end of the service. Providing and maintaining the timing source is the CP's responsibility.
EAD SyncE supports;

- Synchronisation at the Physical layer, ITU – T G.8261 [7]
- Supports clock requirements as specified in ITU – T G.8262 [8]
- Supports messaging requirements as specified in ITU T G.8264 [9]
- BIT's interface compliant to ITU – T G.703 (2M) [10]
- For any circuit, only one end can be the timing source; daisy chaining of timing is not supported
- Multiple timing domains on the same chassis are not supported

Timing input options
BITS SSM is the only supported Synchronisation input option. BITS OUT is enabled on the remote end of the service.
Timing for synchronisation can be provided via a BITS-IN interface by means of an external clock directly cabled from, for example, an SSU (Station Synchronisation Unit).

SyncE configuration format

- Line Type: E1
- Line Code: E1 HDB3
- Frame Format: E1 CRC4
- SA Bit: Bit 4
- QL mode enabled

4. Customer Interface

4.1 General

This SIN should be read in conjunction with SIN 360, Ethernet Customer Interfaces. The customer equipment Ethernet interface must conform to IEEE 802.3[1], support Full Duplex operation and have auto-negotiation enabled.

10BaseT and 100BaseTX interfaces, can use existing 10BaseT, Category 5 cabling. 1000BaseLX uses single-mode fibre and 1000BaseSX uses multimode fibre.

The EAD NTE uses 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 if it is used instead of a straight one (or vice-versa). However in the event that the EAD link is configured without auto-negotiation enabled, MDI/MDI-X autocross is no longer available on the end of the EAD link terminated by an EAD Modular Shelf or the 1U-high GE201 NTE used for Synchronised Ethernet services. The 1U-high CPMR NTE used for standard EAD services will still support MDI/MDI-X autocross when auto-negotiation is switched offThe RJ-45 interface on EAD Modular shelf or 1U-high GE201S NTE used for services configured without auto-negotiation enabled, will have standard pin assignments used for BES/WES services described in Figure 3, section 3.1 of SIN 432 [6].

4.2 Connector

The client interface is the Network Termination Point (NTP), i.e. the point of connection on the Openreach Network Terminating Equipment (NTE) for connecting CPE or CP equipment. This is the Service demarcation point between the Openreach network and the customers' equipment.

The client interface consists of a RJ-45 type socket for 10 Mbit/s and 100 Mbit/s EAD services or dual LC sockets for 1000 Mbit/s EAD services. The RJ-45 type connector is as specified in the IEEE 802.3[1] specifications.

The CP or End User provides the suitable connecting cords between the NTE and their own equipment. For Category 5 cabling this is limited to a maximum cable length of 100 metres. For multimode fibre cabling this is limited to a maximum cable length of 220 metres, in the case of 62.5/125 micron fibre and 500 metres in the case of 50/125 micron fibre. For single-mode fibre cabling this is limited to a maximum cable length of 10000 meters.

Attention is drawn to the Intellectual Property Rights (IPRs) set out in the preface of this agreed International standard. It is the responsibility of the supplier of CPE or CP equipment to ensure that

they have the necessary rights from the owner of the IPR. The IPR owner has stated that it is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world.

For EAD SyncE the T1/E1 External Clock Input connector (labelled BITS IN) and T1/E1 External Clock Output connector (labelled BITS OUT) are both front mounted RJ-48c balanced 120 Ohm connectors. Refer to the following for the BITS IN (T3) and BITS OUT (T4) connector pin assignments.

RJ48c BITS-IN (T3) Input Connector

Pin	Number	Signal	Description
B1	RRING	Receive	Ring
B2	RTIP	Receive	Tip
B3	GND	Ground	
B4	—	—	
B5	—	—	
B6	GND	Ground	
B7	GND	Ground	
B8	GND	Ground	

RJ-48c BITS-OUT (T4) Output Connector

Pin	Number	Signal	Description
B1	—	—	
B2	—	—	
B3	GND	Ground	
B4	TRING	Transmit	Ring
B5	TTIP	Transmit	Tip
B6	GND	Ground	
B7	GND	Ground	
B8	GND	Ground	

5. Transmission

The NTEs connected to the Openreach network provide an uncontended transmission path.

6. Environmental specifications

The Temperature and humidity range of the environment used to house the NTE must not exceed the following:

1. 1U high NTE (non-SyncE)
   0 to 40 degrees Celsius and humidity range of 0 to 90% non-condensing.

2. 1U high NTE (SyncE) GE201s

The GE201S has heat sinks at the rear and must be mounted so that it will not be in contact with any other object. Care must be taken to avoid touching the heat sink whilst in operation.

Permitted location operating parameters for the FSP150 GE201S range (which is temperature hardened) are:

- Ambient Room temperature range: 0ºC to +40ºC
- Humidity: Humidity 5% to 95% non-condensing (with a maximum absolute humidity of 0.024 kg of water/kg of dry air)

Please refer to the EAD product description for details of physical space requirements.

3. 4U high 16-slot NTE chassis (non-SyncE or SyncE)

0 to 40 degrees Celsius and humidity range of 0 to 90% non-condensing.

7. Power supply

7.1 General

By placing a order with Openreach the customer has accepted the conditions placed by BT. In relation to powering of equipment, the customer must comply with the requirements of BS7671 and the details giving within the 'DC Power Planning and Installation Guide for WES-BES Products' document.

The Openreach NTE is locally powered and offers AC or DC power options. The CP will be required to provide either dual local 50 Hz AC supply in the form of standard 13 Amp power socket(s); or dual -50V DC power distributions and Earth connections, with all wiring colour schemes conforming to BS7671 (IEEE Wiring Regulations). It will be the customers' responsibility to ensure that the power supplies are fused and safe for Openreach to use. These should be in close proximity to the NTE installation location.

7.2 Installation and Testing

In addition to the NTE and Chassis powering requirements below, a spare 50Hz AC mains supply 13A socket should also be provided in close proximity to the NTEs, to power BT test equipment during both initial commissioning and subsequent maintenance support activities. A 50Hz AC mains supply 13A socket should also be provided in close proximity to the NTE for the management router. Note: For cases where an EAD circuit is delivered using a 15 slot chassis at both ends of the link, a management router connection will be required at both ends.

7.3 AC Power Connection

AC power connection between Openreach equipment and the power socket will be made using a standard IEC320 C13-14 power lead fitted with a standard 13A plug. The NTE itself has dual power supply units internally, and requires two AC mains supply socket running off the same phase.

- **For most installations:**
  This will require two mains connections for each NTE provided, and the consumption of the Openreach NTE and power unit chassis in this managed service arrangement will be no more than 50 Watts per NTE. An additional AC mains supply socket will be required for the management router.

- **For larger installations (at Openreach discretion):**
  At Openreach's discretion, where a large number of systems of one type are being deployed, a 15-slot NTE chassis version may be deployed. This will require two mains connections for each 15 slot chassis provided. The consumption with a maximum number of 15 service cards provided will be no more than 220 Watts per chassis. An additional AC mains supply socket will be required for the management router.

7.4 DC Power Connection

The DC In-Line (Molex) connector is specified as the standard method of connecting DC power by Openreach, and represents the “Demarcation Point” between Openreach and the customer. At its site, the customer is required to provide suitable power and earth connection to, and be responsible for the

supply, wiring and labelling to, the demarcation point. Openreach will not supply or install the DC distribution system as part of the standard Ethernet installation.

- **Customer-provided wiring up to the Openreach specified In-Line connector**

  Wiring, MCB isolation or fuse (i.e. C Type MCB or Cartage Fuse), must be provided by the customer, up to and including the DC in-line connector, as per BT's requirements stated within the 'DC Power Planning and Installation Guide for WES-BES Products' document with respect to;

  i. Correctly rated MCB/Fuse,
  ii. Correct labelling of wiring and MCB/fuse positions compliant with BS 7671,
  iii. Correct size of cable for required voltage drop at required maximum current,
  iv. Separately fused isolatable A & B power supplies, as detailed in the 'AC/DC Power Planning and Installation Guide ' document.

  An additional AC mains supply socket will be required for the management router. Currently the management router is AC powered only.

7.5 Additional Details

For further details on the provision of DC Power, see the 'AC/DC Power Planning and Installation Guide ' available on the Openreach Ethernet website.

If there is a conflict between DC power information contained in the 'AC/DC Power Planning and Installation Guide and the SIN document, the order of precedence shall be as follows:

(a) AC/DC Power Planning and Installation Guide
(b) SIN

8. Further Information

For enquiries concerning connection availability between particular sites and for further 'sales and marketing' information on EAD services, please contact your Openreach Sales relationship Manager, or see the Openreach site listed on the SINet Useful Contacts page at http://www.sinet.bt.com/sinet/Usefullinks/index.htm

9. References

[1]	IEEE 802.3	IEEE standards for Local and Metropolitan Area Networks-Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer specifications	2005
[2]	IEEE 802.1d	IEEE Recommendations for Bridging: Learning and Forwarding	-
[3]	IEEE 802.3x	IEEE Standards for Local and Metropolitan Area Networks: Specification for 802.3 Full Duplex	1997
[4]	IEEE 802.1q	IEEE Recommendations for Virtual LANs	1998
[5]	IEEE 802.3as	IEEE standards for Local and Metropolitan Area Networks-Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer specifications	2006

		Amendment 3: Frame format extensions	
[6]	SIN 432	Openreach Wholesale Extension Services 10 and wholesale end to end services Local Reach (WES/WEES l0LR)	2009
[7]	ITU–T G.8261	Timing and Synchronization Aspects in Packet Networks	
[8]	ITU–T G.8262	Timing characteristics of a synchronous Ethernet equipment slave clock	
[9]	ITU–T G.8264	Distribution of timing information through packet networks	
[10]	ITU–T G.703 (2M)	Physical/electrical characteristics of hierarchical digital interfaces	

For further information or copies of referenced sources, please see document sources at: http://www.btplc.com/sinet/Documentsource/index.htm. .

10. Abbreviations

100BaseTX	100Mbit/s twisted pair interface defined in IEEE 802.3
10BaseT	10Mbit/s Base-band twisted pair “Ethernet/IEEE 802.3” technology
BES	Backhaul Extension Service
CP	Communications Provider (Providers of Electronic Communications Services)
CPE	Customer Premises Equipment
CSMA/CD	Carrier Sense Multiple Access / Collision Detection
EAD	Ethernet Access Direct
EFM	Ethernet in the First Mile
ESM	Ethernet Synchronisation Message
IPR	Intellectual Property Rights
ITU-T	International Telecommunications Union For Telecommunications (formerly CCITT)
LAN	Local Area Network
LLF	Link Loss Forwarding
MAC	Media Access Control (& Hardware Device Address)
Mbit/s	Mega (10^6) bits per second
MCB	Mini Circuit Breaker
MDI	Medium Dependant Interface
MDI -X	Medium Dependant Interface Crossover
NTE	Network Terminating Equipment
NTP	Network Terminating Point
OAM	Operations Administration and Management
PDU	Protocol Data Unit
SIN	Suppliers’ Information Note
SHDS	Short Haul Data Service
SSM	Sync Status Message
VLAN	Virtual Local Area network
VoIP	Voice Over Internet Protocol (application)
WES	Wholesale Extension Service

11. History

Issue	Date	Details
Issue 1.0	25 March 2009	First issue
Issue 1.1	29 May 2009	Specified the AC mains power sockets required for the management router etc. Also editorials for clarification.
Issue 1.2	12 November 2009	General document update following Industry feedback
Issue 1.3	13 November 2009	Editorial corrections to the Contents list
Issue 1.4	19 October 2010	Updated due to the launch of a new product feature on EAD, allowing auto negotiate to be turned off
Issue 1.5	October 2011	Updated due to the launch of EAD Enable
Issue 1.6	August 2012	Addition of text relating to EAD Extended Reach. Correction of chassis temperature upper limit in section 6; Correction of URL of AC/DC power guide. And Correction of term '16-slot chassis' to refer to '15-slot chassis instead'.
Issue 1.7	August 2013	Update to text relating to EAD Extended Reach products
1.8	April2014	Update to include SyncE and change of SINet site url.

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