



# SIN 118

Issue 5.2  
August 2014

## Suppliers' Information Note

*For The BT Network*

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# BT LAN EXTENSION SERVICES 1, 2, 10 & 10 LOCAL REACH (LES 1, 2, 10 & 10LR) Service Description

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## **1 Introduction**

This Suppliers Information Note (SIN) describes the customer interface provided with the BT Local Area Network (LAN) Extension Services 1, 2 10, & 10 Local Reach (LES 1, 2, 10 & 10LR). Also provided is some additional general information on these LES Services, and on some of the physical aspects of the NTEs currently being deployed for new customer orders. This SIN is primarily intended to provide customer interface and service information to be used by Customer Premises Equipment (CPE) manufacturers and developers.

### **NB**

**The BT Global LES 1 and LES 2 services are no longer available for new supply. BT currently plans to complete the ongoing withdrawal of the LES 1 service in 2010.**

**The BT Global service LES 10 described in this SIN is now known as EES 10 and is delivered using Openreach Wholesale End to End Extension Service 10 (WEES 10), which is described in SIN 433.**

**Similarly, the BT Global service LES 10R described in this SIN is now known as EES 10R and is delivered using Openreach Wholesale End to End Extension Service 10R (WEES 10R), which is described in SIN 432.**

**However, details of both LES 10 and LES 10R remain available here in SIN 118 for reference.**

## **2 Service Outline & Options**

### **2.1 General**

The BT LAN Extension Services allow a user to interconnect Ethernet - CSMA/CD Local Area Network segments conforming to ISO/IEC 8802-3 (IEEE 802.3)<sup>[1]</sup> standards.

The LES 1, 2, 10 and 10LR services all operate at a data transmission rate of 10 Mbit/s between the NTEs, and offer a number of options of transmission distance range between the customer sites, customer interface, and data duplex operation. The actual service features and offering will depend upon the LES service chosen. The principle features for these services and the maximum distances are shown in Table 1, to enable comparison.

Depending upon the service chosen the appropriate type of Network Terminating Equipment (NTE) will be provided at both ends of the optical fibres terminated within the customer premises.

The optical fibre transmission path is routed via the BT network and is cabled directly between the customers' two premises.

BT does not offer any remote management on these services.

LAN Extension Service: LES	Principal Ethernet Network Service Characteristic:	Customer Interface Option:	Maximum allowable <b>Radial</b> Distances between Customer Premises / Sites: <i>(Note 1)</i>	Maximum <b>Route &amp; Range</b> Distances between Customer Premises / Sites: <i>(Note 2)</i>	Half / Full Duplex Operation:
1	Repeater	AUI – (D type Female)	-	2km <i>(Note 3)</i>	Half Duplex
2	Transceiver	AUI – (D type Male)	3.5km	4.5km <i>(Note 4)</i>	Half Duplex
		10Base T (RJ45)	3.5km	4.5km <i>(Notes 4 &amp; 5)</i>	Half Duplex
			3.5km	25km <i>(Note 6)</i>	Full Duplex
10	Bridge	10BaseT – (RJ45)	25km	40km	Full or Half Duplex
10LR	Bridge	10BaseT – (RJ45)	3.5km	10km	Full Duplex only

**Table 1 – List of Services & Principle Features**

Note 1. - This is the direct distance “as the crow flies” between the two customer site locations.

Note 2. - The maximum Route distance is the limiting factor of either the physical transmission limit between NTEs over the provided interconnecting fibre optic cables, or alternatively the maximum range that the service may be extended to due to other technical considerations (e.g. propagation or round trip delay).

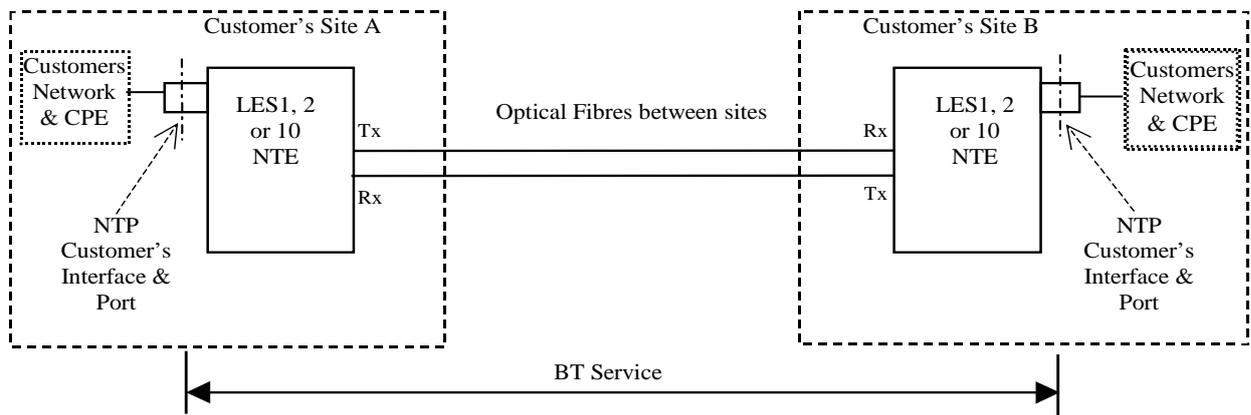
Note 3. - This represents a maximum transmission distance where the customer's cable network segments and cables are short. The minimum transmission distance is 1 km where the customers cable network segments and cables lengths are at a maximum.

Note 4. - Where the customer attachment is a local Ethernet Repeater then a maximum reach of 1km is recommended.

Note 5. - This is the maximum transmission range possible with customer’s CPE equipment operating in Half Duplex mode; greater ranges will result in data errors and poor throughput.

Note 6. - This extended transmission range is **only** possible with customer’s CPE equipment operating in Full Duplex mode.

A schematic of the LES 1, 2 10 & 10LR service arrangement is shown in Figure 1 below. Depending on equipment, a single fibre may be used to connect the network ports instead of a pair of network fibres, this has no impact on end-to-end performance.



**Figure 1 – Typical service configuration**

It is anticipated that customers will use these services for the interconnection of conventional Ethernet Hubs to workstations and the interconnection of their Local Area Networks.

LES 10 and 10LR service offers additionally the (Bridge) feature of automatically learning and filtering the transmission of traffic destined for the local end based on MAC addresses.

The overall design of the customer network and the included LES circuit will need to be within the normal operating ranges and parameters of Ethernet to operate satisfactorily.

Where the service offers a duplex option, both customer network ends and NTE should be configured for the same mode of operation (i.e. either Half or Full Duplex).

## 2.2 LES 1 Features

This service offers the full mode repeater functionality as indicated in the Repeater unit for 10Mb/s baseband networks clause 9 of ISO/IEC 8802-3 (IEEE 802.3)<sup>[1]</sup>.

The auto partition and reconnection feature is implemented, to limit the propagation of certain fault conditions on one cable segment to another.

*Note. The customer's AUI interface should not present the SQE signal to the repeater unit to ensure satisfactory operation. The AUI interface is Half-duplex.*

## 2.3 LES 2 Features

This service offers a bit transparent transceiver functionality, and as such does not undertake any retiming or reshaping of signals.

It is anticipated that customers would use this service between either repeaters or bridges in their Ethernet networks.

The RJ45 variant can support either Full or Half-duplex mode operation automatically depending upon the customer's own configuration and connected equipment. Both ends of the LES 2 circuit will need to operate in the same duplex mode (either Half or Full Duplex) for error-free performance.

Where packet-loss sensitive applications such as Voice Over IP (VOIP) are carried over Half-duplex network arrangements, it is recommended that the throughput does not exceed 40%, to prevent any packet loss due to collisions. This is a limitation of the Ethernet protocol in Half-duplex mode and not of the LES 2 NTE.

The LES 2 NTE is capable of transmitting frame sizes from 64 bytes to a maximum of 1548 bytes. This is to maintain compatibility with a number of frame tagging formats, in particular VLAN tagging as specified in IEEE 802.1q<sup>[4]</sup> with 1522 byte frame size.

## **2.4 LES 10 and 10LR Features**

This service includes the IEEE 802.1d<sup>[2]</sup> Bridging functionality, which allows for the Learning and Filtering of traffic packets destined for those hosts connected at the local end. Packets destined for these local end (MAC) addresses will not be forwarded across the transmission path to the distant end, after these (MAC) addresses have been learnt and until the system's Cache memory has been refreshed after a host has been removed.

The Full Duplex option is in accordance with IEEE 802.3x<sup>[3]</sup>. The LES 10 NTE is configured by BT to the customer's requirements of either Half or Full Duplex. The LES 10LR NTE is only offered with Full Duplex.

The LES 10 and 10LR NTE is capable of transmitting frame sizes from 64 bytes to a maximum of 1548 bytes. This is to maintain compatibility with a number of frame tagging formats, in particular VLAN tagging as specified in IEEE 802.1q<sup>[4]</sup> with 1522 byte frame size.

*Note. The definition of frame lengths includes the 4 byte CRC but does not include any preamble.*

Where packet-loss sensitive applications such as Voice Over IP (VOIP) are carried over Half-duplex network arrangements, it is recommended that the throughput should not exceed 40%, to prevent any packet loss due to collisions. This is a limitation of the Ethernet protocol in Half-duplex mode and not of the LES 10 NTE.

The LES 10 and 10LR NTE is now offered with an optional Link Loss Forwarding feature (LLF). BT enables this Link Loss Forwarding feature on installation and it allows a link failure on the network fibre side to be indicated across the customer interface, so that suitably configured customers' equipment can detect such a network failure. This is provided as a customer default option with new services and can be requested for existing circuits, subject to survey and an additional charge.

## **3 Customer Interface**

### **3.1 General**

The interface requirements are specified in ISO/IEC 8802-3 (IEEE 802.3)<sup>[1]</sup>.

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

The customer interface is present at the Network Termination Point (NTP), i.e. the point of connection between the BT Network Terminating Equipment (NTE) and the CPE interface.

The interface supports Ethernet, operating at 10 Mbit/s. The customer interfaces provided on the LES 1, 2, 10 & 10LR services are detailed below.

## **3.2 LES 1 & LES 2 Interface - AUI Interface Option**

The customer interface presented by the NTE are specified in the Physical Signalling (PLS) and Attachment Unit Interface (AUI) Clause 7 of ISO/IEC 8802.3 (IEEE 802.3)<sup>[1]</sup>.

The following information on the Connector Physical & Electrical Interface is provided for information and as a synopsis of these recommendations.

The customer provides the AUI connecting cables between the NTE and CPE and these should be no longer than 50m.

### **3.2.1 Connector Physical Interface**

#### **3.2.1.1 LES 1 NTE:**

Presents a 15 pin D type female connector complying with BS 6623:Part 3 1986<sup>[6]</sup>. The connector provides a mechanical latching arrangement as described in ISO/IEC 8802.3 (IEEE 802.3) Fig 7-20, Fig 7-19 and Fig 7-18 implementing Slide Latch Screw option.

#### **3.2.1.2 LES 2 NTE:**

Presents a 15 pin D type male connector complying with BS 6623:Part 3 1986<sup>[6]</sup>. The connector provides a mechanical latching arrangement as described in ISO/IEC 8802.3 (IEEE 802.3) Fig 7-20, Fig 7-18 implementing Locking Post option.

### **3.2.2 Electrical Interface**

The designation of circuits presented by the BT NTE on each service is described in Table 2.

Pin	Circuit	Use	LES 1 Designation for NTP	LES 2 Designation for NTP
3	DO-A	Data Out circuit A	generator	load
10	DO-B	Data Out circuit B	generator	load
11	DO-S	Data Out circuit shield		
5	DI-A	Data In circuit A	load	generator
12	DI-B	Data In circuit B	load	generator
4	DI-S	Data In circuit shield		
7	* CO-A	Control Out circuit A (optional)	generator	load
15	* CO-B	Control Out circuit B (optional)	generator	load
8	* CO-S	Control Out circuit shield (optional)		
2	CI-A	Control In circuit A	load	generator
9	CI-B	Control In circuit B	load	generator
1	CI-S	Control In circuit shield		
6	V <sub>C</sub>	Voltage Common		
13	VP	Voltage Plus	power source	power sink
14	VS	Voltage Shield		
Shell	PG	Protective Ground (Conductive Shell)		

\* - See Note 2

**Table 2 – LES 1 and LES 2 NTE Interchange Circuits**

Note 1. Circuit Designations - the allocation of "Generator", "Load", "Power Sink/Source", to each circuit in this Table refers to the NTE. The complimentary circuit designations will apply at the output port of the customer apparatus.

Note 2. Neither LES 1 nor LES 2 NTE implement the optional Control Out (CO) interchange circuit. If the customer apparatus does provide this circuit then: -  
a) It will not be carried across the LES service;  
b) It should conform to the limits laid down for load/generator type interchange circuits (as appropriate).

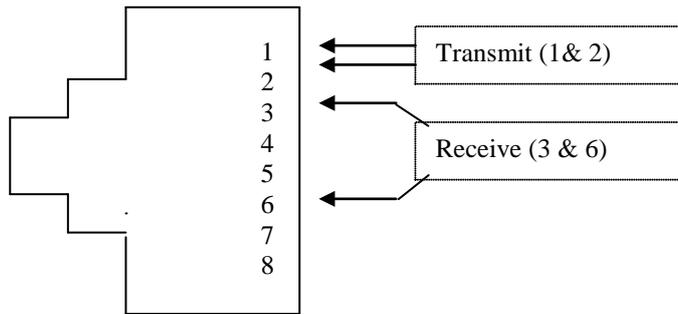
### 3.3 LES 2, 10 & 10LR Interface – RJ45 Interface Option

The interface requirements are specified in the 10BaseT Clause 14 of ISO/IEC 8802.3 (IEEE 803.2)<sup>[1]</sup>.

The Customer Interface connector on the NTE consists of a RJ-45 type socket.

The customer provides the Category 5 connecting cords between the NTE and CPE and these should be no longer than 100m.

The connector pin outs are shown for information in Figure 2.



Note: LES 10 and 10LR equipment is always compliant to the above, and LES 2 equipment when the “Crossover switch” is set to the “ON” condition.

**Figure 2 - LES 10 and 10LR NTE RJ45 Customer Connector Pin Out Connections**

## **4 Power Supply Requirements**

### **4.1 All Services & Installations for Testing Purposes**

In addition to the NTE and Chassis powering requirements below, a spare 50Hz AC mains supply 13amp 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.

### **4.2 LES 1 Service**

The LES 1 NTE is locally powered by the customer's 50Hz AC mains supply. The power consumption of the BT NTE will be no more than 15 Watts.

### **4.3 LES 2 Service - AUI Option**

The LES 2 NTE is powered by the customer data apparatus via the AUI interface connection pins 6 & 13, and as detailed in clauses 7.5.2.5 & 7.5.2.6 of ISO/IEC 8802.3 (IEEE 802.3). The power consumption of the BT NTE is no more than 7.2 Watts (450mA at 16 Volts).

### **4.4 LES 2 Service - RJ45 Option**

The LES 2 NTE is powered by the customer's 50Hz AC mains supply.

A suitable mains cord is supplied which will connect to a conventional 13amp socket, for each power unit. The power consumption of a single BT NTE and power unit is no more than 7.3 watts. Where a multiple installation arrangement is required then the total power consumption of up to 12 NTEs and the twin power units is 92.4 Watts.

### **4.5 LES 10 and 10LR Service**

The BT NTE is locally powered by the customer's 50Hz AC mains supply, in the form of provided standard 13 Amp power socket(s). These should be in close proximity to the NTE installation location. Connection between BT equipment and the power socket will be made using a standard

IEC320 power lead fitted with standard 13A plugs. The NTE itself has dual power supply units internally, but depending of equipment either one or two mains supply socket are provided.

For most installations:

This will require one mains connection for each single service card NTE provided, and the consumption of the BT NTE and power unit chassis in this unmanaged service arrangement will be no more than 50 Watts per NTE.

For larger installations (at BT discretion):

At BT’s discretion, where a large number of systems of one type are being deployed, a 16-slot or 10 port NTE chassis version may be deployed. This will require two mains connections for each multiple port/slot chassis provided. The consumption, with a maximum number of interfaces, will be no more than 200 Watts per chassis.

## 5 Further Information

For enquiries concerning connection availability between particular sites and for further “sales and marketing” information on the LES 1, 2, 10 & 10LR services please contact either:

- Your Company’s BT account manager,
- For customers who do not have an account manager, please contact, BT sales on 0800 800152 for product and service information, sales and rental enquiries,
- Or the Data Connect Helpdesk, for which contact details, are given at <http://www.btplc.com/sinet/>

## 6 References

Ref:	Standard / Requirement:	Title / Description:	Date:
[1]	ISO/IEC 8802-3	ISO/IEC edition of ANSI/IEEE 802.3 CSMA/CD Ethernet Standard. (Clauses within the ISO document correspond to clauses within IEEE 802.3 document)	-
[2]	IEEE 802.1d	IEEE Recommendations for Bridging: Learning and Forwarding	-
[3]	IEEE 802.3x	IEEE Recommendations for Local and Metropolitan Area Networks: Specification for 802.3 Full Duplex	1997
[4]	IEEE 802.1q	IEEE Recommendations for Virtual LANs	1998
[5]	BS 6701: Part 1	Protective Earthing	1986
[6]	BS 6623: Part 3	15 pin D-type Connector	1986
[7]	ECMA – 97	Local Area Networks – Safety Requirements	-

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

## 7 Abbreviations

<b>ANSI</b>	American National Standards Institute
<b>AUI</b>	Attachment Unit Interface
<b>BS</b>	British Standards
<b>CPE</b>	Customer Premises Equipment
<b>CSMA/CD</b>	Carrier Sense Multiple Access with Collision Detection {Ethernet}
<b>ECMA</b>	European Computer Manufacturers Association
<b>IEC</b>	International Electrotechnical Commission
<b>IEEE</b>	Institute of Electrical and Electronics Engineers {USA}
<b>IPR</b>	Intellectual Property Rights
<b>ISO</b>	International Standards Organisation
<b>ITU-T</b>	International Telecommunications Union – Telecoms Sector {formerly CCITT}
<b>LAN</b>	Local Area Network
<b>LES</b>	LAN Extension Service
<b>LLF</b>	Link Loss Forwarding
<b>MAC</b>	Media Access Control ( & Hardware Device Address)
<b>NTE</b>	Network Terminating Equipment
<b>NTP</b>	Network Terminating Point
<b>PLS</b>	Physical Signalling
<b>SIN</b>	Suppliers' Information Note
<b>SQE</b>	Signal Quality Error

## 8 History

<b>Issue:</b>	<b>Date:</b>	<b>Notes:</b>
Issue 1	July 1987	
Issue 2	February 1989	General revision following the change of service name from LanLink 1a & 1b to LAN Extension Services 1 & 2.
Issue 3	August 1990	Removal of type approval requirements to coincide with the introduction of the approval scheme (see clause 7.2).
Issue 4.0	September 2001	Addition of LES 10, and LES 2 10-BaseT / RJ45 Service options. General review, update and revision of document including International Standards for technical references, and approval information. Adoption of NTE description for NTTA.
Issue 4.1	June 2002	Modification to LES 2 range limit to 4.5km, RJ45 Variant details for Full-Duplex and VLAN packet support. Corrections to LES 1 & 2 NTE power consumption figures.
Issue 4.2	November 2002	Modification and clarification of Radial and Route distances for LES 2 in Table 1. Clarification of power input figures for the LES 2 & LES 10 power supplies. Addition of note to RJ45 pin out diagram to align with LES 2 NTEs operation. Editorial changes.
Issue 4.3	April 2003	Terminal approval requirements clause removed. LLF feature enabled as default for LES 10, and 16 Slot chassis option for larger installations.
Issue 4.4	May 2004	Information added that LES 1 is unavailable for new supply. LES 10 maximum frame size increased to 6000 bytes. Editorial changes.
Issue 4.5	November 2004	LES 10LR service variant added. Information added that LES 2 is unavailable for new supply. LES 10 maximum frame size corrected back to be 1548 bytes. LES 10 power requirements updated.
Issue 5.0	September 2006	Withdrawal notification added for LES 1.

<b>Issue:</b>	<b>Date:</b>	<b>Notes:</b>
Issue 5.1	May 2009	Updated planned withdrawal date for LES 1. Noted that LES 10 & LES 10R services are now delivered using Openreach Wholesale End to End Extension Services 10 & 10R (WEES 10 & WEES 10R), as described in SIN 433 and SIN 432 respectively. Also minor editorial amendments.
Issue 5.2	August 2014	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>

- Annex A Follows -

## **Annex A. - Customer Apparatus Design Advice for LES 1 & LES 2 AUI Interface Services**

The AUI Electrical Characteristics and Function are given in clauses 7.4 & 7.5 of ISO/IEC 8802.3 (IEEE 802.3).

Earlier versions of SIN 118 gave the following advice, which is included here for historical information purposes only. Customer Apparatus that meets this advice should continue to operate satisfactorily with the LES 1 & LES 2 service, for the relevant parameters, although this advice has now been superseded by reference to international standards.

“Customer apparatus should be designed to meet the following electrical conditions:

**Generator.** Interchange circuits providing a generator function should have the following characteristics, irrespective of the load condition applied to any other generator circuits of the apparatus:

The output voltage between the shield and each generator circuit should neither exceed +16.0 Volts nor go below 0 Volts.

The differential output voltage open circuit should not exceed 13 Volts.

The output current between the shield and each generator output should not exceed 150mA when measured into a short circuit.

**Load.** Interchange circuits providing a load function should have the following characteristics:

The input current into any load input should not exceed 3mA when an input voltage of +16.0 Volts is being applied.

The open circuit voltage of a load input should not exceed +16 Volts.

**Voltage Plus.**

For LES 1, the interchange circuit providing the Voltage Plus on the NTE will provide up to +15.75 Volts with respect to the Voltage Common Interchange circuit. The current drain by the customer equipment on this interchange circuit should not exceed 2 Amps measured at +15.75 Volts.

For LES 2, the interchange circuit-providing the Voltage Plus function should provide a fixed voltage level power source with a minimum current capability of 500mA at no less than +11.28 Volts, and no greater than +15.75 Volts under normal current drain conditions. Under all other conditions the Voltage Plus interchange circuit should not supply a voltage less than 0 Volts nor greater than +15.75 Volts under any load condition.

**Voltage Common.** The interchange circuit providing the Voltage Common function should be connected within the apparatus to all the shield connections of the generator and load interchange circuits.

**General.** Connector pins, (with the exception of the shield pins), should not be commoned.

The connection arrangement should not be capable of making electrical contact with other apparatus or Protective Earths.”

Annex B Follows –

## **Annex B. - Customer Apparatus Installation Advice for LES 1 & LES 2 AUI Interface Services**

ISO/IEC 8802-3 (IEEE 802.3)<sup>[1]</sup> requires that the shell of cable connectors may be connected to Protective Ground (Earth). If the apparatus is to be connected to the Protective Earth then it is recommended that the Protective Earth shall be installed in customer premises in accordance with BS 6701:Part 1:1986 paragraph 6.10<sup>[5]</sup>.

In addition to any relevant safety requirements it is also recommended that the LAN to which the customer apparatus is connected complies with ECMA-97 (Local Area Networks - Safety Requirements)<sup>[7]</sup>.

The cable used to connect the customer apparatus to the BT Network Terminating Equipment (NTE) should be equivalent to that described in clause 7 of ISO/IEC 8802-3 (IEEE 802.3)<sup>[1]</sup>.

-END-