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SERIES L: ENVIRONMENT AND ICTS, CLIMATE CHANGE, E-WASTE, ENERGY EFFICIENCY; CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

Optical infrastructures – Infrastructure including node elements (except cables)

Passive node elements with automated ID tag detection

Recommendation ITU-T L.207

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Recommendation ITU-T L.207

Passive node elements with automated ID tag detection

Summary

With the fast growth of fibre to the x (FTTx), rapid deployment and effective maintenance of a new passive fibre cable network [i.e., optical distribution network (ODN)] have become major challenges for telecommunications network operators. The global communications industry has been developing passive node elements with automated identifier (ID) tag detection to enable automated information collection on optical fibre connectivity for more efficient installation, operation and maintenance of optical fibre networks.

Recommendation ITU-T L.207 focuses on hardware aspects of this type of passive node element and to describe the general features, characterization and performance specifications for node elements with automated ID tag detection, including environmental conditions, functional requirements, performance requirements, and mechanical and electrical or optical interface requirements.

A product characterization checklist is included in an appendix.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T L.207	2018-03-16	15	11.1002/1000/13567

Keywords

automated ID tag detection, optical fibre connectivity, passive fibre cable network.

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Passive node elements with automated ID tag detection

1 Scope

This Recommendation addresses the general features, characterization and performance requirements for passive node elements with identifier (ID) tag detection that supports automatic information collection on fibre connectivity. This Recommendation focuses on both indoor and outside plant deployment conditions and includes:

– functional requirements;

– automated ID tag detection performance requirements;

– mechanical and electrical or optical interface requirements.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T L.200] Recommendation ITU-T L.200/L.51 (2003), *Passive node elements for fibre optic networks – General principles and definitions for characterization and performance evaluation*.

[ITU-T L.202] Recommendation ITU-T L.202/L.50 (2010), *Requirements for passive optical nodes: Optical distribution frames for central office environments.*

[ITU-T L.361] Recommendation ITU-T L.361/L.64 (2012), *ID tag requirements for infrastructure and network elements management*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the terms defined in [ITU-T L.202**]**, [ITU-T L.200], and [ITU-T L.361].

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 electrical interface: The interface used to exchange information with the management system in real time online transactions through a data network. The interface should be based on a standard network interface, such as the Ethernet.

3.2.2 management system: Network system with an architecture that encompasses functional modules for data collection, node management, fibre network and work order management. The operation support systems/business support systems (OSSs/BSSs) and other applications related to fibre infrastructure management provide various applications through a management system to a user who wants to use fibre infrastructure more efficiently.

3.2.3 fibre infrastructure management (FIM) tool: A personal digital assistant (PDA), a laptop personal computer (PC) or a smartphone with specialized software for use by a field operator or installer to access identifier (ID) tag information and communicate with the management system.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

BSS	Business Support System
E	Extreme
EI	Electrical Interface
FIM	Fibre Infrastructure Management
FTTx	Fibre To The x (curb/building/home)
IC	Indoor temperature Controlled
ID	Identification Data
IN	Indoor Non-temperature controlled
ME	Multiple Element
MS	Management System
ODN	Optical Distribution Network
OI	Optical Interface
OPGW	Optical Power Ground Wire
OS	Outdoor underground – Sub-terrain
OSS	Operation Support System
PC	Personal Computer
PDA	Personal Digital Assistant
SC	Single Circuit
SE	Single Element
SF	Single Fibre
SR	Single Ribbon
SNMP	Simple Network Management Protocol

5 Conventions

None.

6 Background

With the fast growth of FTTx, management of a new passive fibre cable network [i.e., optical distribution network (ODN)] efficiently and accurately has become a major issue and challenge for operators. The global communications industry has been developing passive node elements in which each port has the capability of automated ID tag detection when an optical fibre connector with an ID tag is inserted into a port to enable automated information collection on optical fibre connection.

This Recommendation addresses passive node elements with automated ID tag detection capability along with the environmental conditions, functional requirements, performance requirements, and mechanical and electrical or optical interface requirements.

7 Deployment (environment) conditions

In addition to the optical functionality of the node in the network, performance requirements and test severity should also reflect the environmental conditions to which a product is exposed during its lifecycle.

7.1 Installed product

The conditions for an installed product should comply with the conditions for passive optical nodes (see clause 7.1 of [ITU-T L.200]) except for the OS (i.e., outdoor underground – sub-terrain) environmental class.

7.2 Transport and storage

The conditions for transport and storage should comply with the conditions for passive optical nodes (see clause 7.2 of [ITU-T L.200]).

7.3 Installation or intervention

The conditions for installation or intervention should comply with the conditions for passive optical nodes (see clause 7.3 of [ITU-T L.200]).

8 Functional requirements

In general, passive node elements with ID tag detection should comply with the functional requirements defined in [ITU-T L.200]. In addition, they should also meet the functional requirements related to automated ID tag detection.

8.1 Base functionalities

The node elements should comply with the functional requirements defined in clause 6 of [ITU-T L.200].

8.2 Functionalities concerning automated ID tag detection

The node elements should meet the functional requirements specified in 8.2.1 to 8.2.8 concerning ID tag detection.

8.2.1 Identifying each optical connector with unique ID information about the ID tag

The ID information about each ID tag is universally unique, and is attached to identify each optical connector, including the optical connector of the pigtail and the patch cord. The ID tag should be changed or replaced without interrupting the optical signal transmission through the related optical fibre.

8.2.2 Reading and conditionally writing ID information from or to an ID tag

The purpose of automated ID tag detection is to track and verify fibre connectivity, by reading the ID information from the ID tag when the fibre connector attached with the ID tag is inserted into a related port. Additionally, it should support writing ID information to the ID tag via the ports, and the writing operation should be implemented under control to assure the accuracy of the information.

8.2.3 Port management

The automated ID tag detection for node elements is implemented by port management. When a fibre connector attached with the ID tag is inserted into a port, the port senses the change of port status to

implement automated ID tag detection. Moreover, some additional functions associated with ID tag detection should be supported to facilitate the automated ID tag detection.

a) Monitoring and indicating the port status including idle and occupied, sensing the change of port status when a fibre connector attached with ID tag is inserted into or drawn out of a port.
b) Indicating the target port into which a fibre connector is to be inserted.
c) Associated port with ID information, which is the source to verify the correct fibre connectivity.
d) Initiating reading and writing ID information when it is initiated manually or a fibre connector is inserted into a port.

8.2.4 Storage of information about the port and ID tags

The element node should support the storage of information about the port and ID tags, including the status of the port and the associations between the ports and ID tags. Then it can check whether unexpected changes of the optical fibre connectors and ports occur.

8.2.5 Alarm management

Based on the capability of automated ID tag detection, monitoring the fibre connectivity is a critical function. The node elements should support indicating unexpected events, e.g., an unexpected fibre connector is inserted into or drawn out of a port.

8.2.6 Resource data collection

In order to improve the efficiency of resource data collection, the node element should support resource data collection including the port status and ID information when it is initiated manually.

8.2.7 Visual field operation guidance

In order to improve the accuracy and efficiency of field operation, the node element should support visual field operation guidance when fibre connection is performed.

8.2.8 Communication with other systems

In order to implement automated ID tag detection and further fibre connectivity management, the node element should support the capability of communication with other systems, such as a management system (MS) or management terminals (like PDAs).

9 Automated ID tag detection performance requirements

Passive node elements with ID tag detection should meet performance requirements related to automated ID tag detection. It should be noted that the value of each requirement could be defined according to the deployment scenario selected by a service provider.

9.1 Resource information acquisition time

The resource information acquisition time is the time interval between the moment when a node element receives the resource information acquisition command to the moment when the node element returns the resource information acquisition result. The resource information acquisition command could be sent by the MS or the FIM tool.

9.2 Port state change response time

The port state change response time is the time interval between the moment of the insert or draw operation of the ID carrier and the moment of the state change of the port indicator light. When workers are conducting an insert/draw operation, they should be informed in a timely manner. Therefore, the response time of the port state change should be defined.

9.3 Alarm information reporting time

The alarm information reporting time is the time interval between the moment when an ID carrier insert or draw anomaly occurs and the moment when a node element reports the anomaly alarm. Alarm information can help network managers and workers to be aware of the faults and get them fixed in a timely manner. Therefore, the alarm information reporting time should be defined.

9.4 Port reading success rate

By using the MS or the FIM tool, the ID carrier insert or draw state of each port can be read. Port reading success rate is the ratio of the number of correct "reads" to the number of total "reads". The connectivity state obtained by the MS or the FIM tool should be accurate.

9.5 Power dissipation

Workers sometimes have to work all day outside without recharging their FIM tools. Therefore, for FIM tool power supply conservation, the power dissipation of the node element should be as low as possible under conditions that satisfy functional and performance requirements.

10 Mechanical and electrical or optical interface requirements

In order to use the online-management mode, it is recommended that a network MS interface be supported. To ensure real-time online management, it is recommended that node elements support an interface for steady power supply. Thus, all passive node element – MS interfaces should meet the following requirements.

a) The interface should be used to exchange information with the MS in real time online through a data network. The interface should be based on a standard network interface, such as the Ethernet.

b) The communication protocol of the management interface should be scalable and reliable to support numerous node elements that are managed simultaneously. The protocol should be based on a standard telecommunications equipment management protocol, such as the simple network management protocol (SNMP).

c) The steady power supply interface should have universally accepted characteristics as those of the telecommunications equipment.

d) These interfaces should not interfere with the performance and functionality of other interfaces.

e) Maintenance activity for these interfaces should not affect the performance and functionality of node elements as defined in [ITU-T L.200].

For the off-line management scenario, a passive node element – MS interface should support a field tool-management interface. This management interface should meet the following requirements.

The management interface should be used to exchange information with the FIM tool from point to point. The management interface should be based on a serial interface. It should support temporary power supply from the FIM tool for operation on the node elements when field operation is conducted. Power supply capacity should meet the following requirements for field operation.

a) It should support physical interface pull out without shut down of the node element.

b) Its reliability and durability should meet the requirements for field operation.

c) Maintenance activity for these interfaces should not affect the performance and functionality of node elements defined in [ITU-T L.200].

The optical interface (OI) should meet all the requirements for passive node elements without ID tags. Because of the heterogeneous interfaces, passive node elements with automatic ID tag detection should meet additional requirements for electrical interfaces (EIs) and the interaction between OIs

and EIs. Thus, the interface requirements for passive node elements with automatic ID tag detection are as follows.

1) OI should comply with [ITU-T L.202] and [ITU-T L.200].

2) EIs should not affect the performance of OIs and vice versa. Adding, operating, or removing EIs should not affect the performance of OIs.

3) EIs should support full functionalities of ID tags satisfying the general requirements defined in clause 6 of [ITU-T L.361]. Thus, EIs should meet the following requirements:
   - through EIs, the obtained ID and connectivity information should be sent with accuracy to an MS;
   - EIs should provide at least the level of durability of the ID tag used;
   - EIs should provide protection of the ID tag from electrical shocks.

Appendix I

Performance evaluation criteria

(This appendix does not form an integral part of this Recommendation.)

This appendix contains an example of performance criteria values. Exact performance criteria are to be determined by customer and supplier. The performance evaluation criteria should be assessed during or after the tests in Appendix II.

I.1 Mechanical performance evaluation

I.1.1 Product appearance

International Standard: [b-IEC 61300-3-1].

Conditions: Visual examination of product.

Requirement: No defects that would affect product performance.

I.2 Optical evaluation

NOTE 1 – All optical losses indicated are referenced to the initial optical signal at the start of the test.

NOTE 2 – An "incoming fibre" is defined as a part of an optical transmission circuit containing the fibre entering the product connected to a fibre leaving the product. One optical circuit can contain many "incoming fibres".

Light will sequentially flow through all the "incoming fibres".

NOTE 3 – Fibre type used for single mode: b-ITU-T G.652-matched cladding.

I.2.1 Change in insertion loss (static optical stability)

International Standard: [b-IEC 61300-3-3], Method 1.

Conditions:

Source wavelength: 1 310, 1 550 or 1 625 nm (select the highest applicable wavelength).

Insertion loss difference (ΔIL) requirements:

ΔIL ≤ 0.2 dB (1 310/1 550 nm) per incoming fibre during the test (excursion loss).

ΔIL ≤ 0.5 dB (1 625 nm) per incoming fibre during the test (excursion loss).

ΔIL ≤ 0.1 dB (1 310/1 550/1 625 nm) per incoming fibre after the test (residual loss).

If optical connectors are part of the optical path:

ΔIL ≤ 0.3 dB (1 310/1 550 nm) per incoming fibre during the test (excursion loss).

ΔIL ≤ 0.5 dB (1 625 nm) per incoming fibre during the test (excursion loss).

ΔIL ≤0.2 dB (1 310/1 550/1 625 nm) per incoming fibre after the test (residual loss).

I.2.2 Transient loss (dynamic optical stability)

International Standard: [b-IEC 61300-3-28].

Conditions:

Source wavelength: 1 310, 1 550 or 1 625 nm (select the highest applicable wavelength) unpolarized.

Detector bandwidth: (0-1 500) Hz.

Requirements:

$\Delta IL \leq 0.5$ dB (1 310/1 550 nm) during the test measured in the live circuit (transient loss).

$\Delta IL \leq 1.0$ dB (1 625 nm) during the test measured in the live circuit (transient loss).

$\Delta IL \leq 0.1$ dB (1 310/1 550/1 625 nm) after the test in the live circuit (residual loss).

If optical connectors are part of the optical path:

$\Delta IL \leq 0.5$ dB (1 310/1 550 nm) during the test measured in the live circuit (transient loss).

$\Delta IL \leq 1.0$ dB (1 625 nm) during the test measured in the live circuit (transient loss).

$\Delta IL \leq 0.2$ dB (1 310/1 550/1 625 nm) after the test in the live circuit (residual loss).

Appendix II

Performance test programme

(This appendix does not form an integral part of this Recommendation.)

II.1 Introduction

This appendix contains an example of a performance test programme. The detailed test programme and corresponding values are to be determined between customer and supplier.

NOTE 1 – All testing is at room temperature, unless otherwise stated.

NOTE 2 – Construct of optical samples according to Appendix I of [ITU-T L.200].

NOTE 3 – Temperature ranges for air-cycling are typical values for indoor non-temperature-controlled environments (IN). Adaptations to specific local conditions can be agreed between customer and supplier.

NOTE 4 – The need for static or dynamic optical stability is to be agreed between customer and supplier. The appropriate performance criteria are to be selected accordingly in the test programme of clause 6.2.1 of [ITU-T L.200].

NOTE 5 – The values mentioned for shock and vibration are not sufficient to guarantee earthquake resistance. Products to be used in risk areas may require more severe test conditions.

II.2 Mechanical and optical evaluation

II.2.1 Axial load on pigtail

International Standard: Not available.

Conditions: Load on pigtail: To be agreed between customer and supplier.

Typical values are in the range 10 to 70 N.

Test time: 10 min.

Performance criteria: Visual appearance:

(See Note 4) Static: Change of insertion loss (residual loss) on the manipulated pigtail.

Dynamic: Transient loss in the circuits adjacent to the manipulated pigtail.

II.2.2 Intervention at a node

International Standard: [b-IEC 61300-2-33].

Conditions: Execute all manipulations that normally occur for this product during an intervention after initial installation. A list of typical manipulations can be found in Appendix II of [ITU-T L.200].

Performance criteria: Static: Change of insertion loss (residual loss).

(See Note 4) Dynamic: Transient loss.

II.2.3 Vibration (see Note 5)

International Standard: [b-IEC 61300-2-1].

Conditions: Sweep range: Minimum (10-55) Hz sinusoidal at 1 octave/min.

Crossover frequency: 9 Hz.

For subunits (e.g., shelves, modules):

– amplitude below 9 Hz: 1.5 mm;

– acceleration above 9 Hz: 5 m/s^2 (<0.5*g*).

For a complete ODF (e.g., rack + subunits installed):

– amplitude below 9 Hz: 0.3 mm;

– acceleration above 9 Hz: 1 m/s^2 (<0.1*g*).

Direction: Three mutually perpendicular axes.

Duration: 10 cycles/axis.

Performance criteria: Visual appearance:

(See Note 4) Static: Change in insertion loss (residual loss).

Dynamic: Transient loss.

II.2.4 Shock (see Note 5)

International Standard: [b-IEC 61300-2-9].

Conditions: Wave form: Half sine; Duration: 11 ms; Acceleration: 150 m/s^2 (~15*g*)

Direction: Three mutually perpendicular axes.

Number of shocks: Three up and three down per axis.

Performance criteria: Visual appearance:

(See Note 4) Static: Change in insertion loss (residual loss).

Dynamic: Transient loss.

II.2.5 Temperature cycling (IN)

International Standard: [b-IEC 61300-2-22].

Conditions: Lowest/highest temperature: (–10/+60 ± 2)°C.

Humidity: uncontrolled.

Dwell time: 4 h; change of temperature: 1°C/min.

Number of cycles: Five.

Performance criteria: Visual appearance:

(See Note 4) Static/dynamic: Change in insertion loss (excursion loss).

II.2.6 Damp heat

International Standard: [b-IEC 61300-2-19].

Conditions: Temperature: (+40 ± 2)°C.

Humidity: (93 ± 3)% RH.

Duration: 96 h.

Performance criteria: Visual appearance:

(See Note 4) Static/dynamic: Change in insertion loss (excursion loss).

II.3 Electrical evaluation

Electrical continuity of the ID tag circuitry.

Appendix III

Product characterization checklist

(This appendix does not form an integral part of this Recommendation.)

This checklist facilitates the systematic characterization of the features and capabilities of a passive node element with ID tag detection.

It reflects the parameters that are described in [ITU-T L.200/L.51]. It may be useful for preparation of the products' test programme as well as product description for tenders and purchasing, specifications, comparison of different or competitive products and creation of commercial information and ordering guides.

Product name:

Application environment(s) (see clause 7.1 of [ITU-T L.200])

IC Indoor temperature controlled

IN Indoor non-temperature controlled

E Extreme (describe differences versus a basic environmental class)

Optical functionality and compatibility (see clause 6 of [ITU-T L.200])

– Optical stability level

Static

Dynamic (transient free)

– Wavelength (see clause 6.3 of [ITU-T L.200])

1 310 nm

1 550 nm

1 625 nm

Other:

– Cable construction (see clause 6.1.1 of [ITU-T L.200])

Loose buffer tube

Micro-sheath

Central core

Slotted core

Blown fibre

Break-out cable

Interfacility cable

Optical power ground wire (OPGW) cable

Other:

– Fibre type, fibre grouping, fibre coating (see clause 6.1.2 of [ITU-T L.200])

Multimode

Single-mode

Single fibre

Ribbon 4

R8

R12

R24

Other:

Primary coated (~250 μm)

Secondary coated (~900 μm)

– Passive devices (see clause 6.1.3 of [ITU-T L.200])

Splice type: Fusion

Mechanical (brand/type):

Splice protector type:

Heatshrink (min/max dimensions):

Mechanical (brand/type):

Connectors: (Specify brand/type):

Branching devices: (Describe type, split ratio, etc.):

Delivered as pre-assembled/pre-fibred modules: Yes/No

Other passive devices: (Describe):

Delivered as pre-assembled/pre-fibred modules: Yes/No

– Fibre storage and separation level (see clause 6.2.2 of [ITU-T L.200])

Circuit separation level

ME SE SR SC SF

Uncut fibre (looped fibre)

Splices

Passive optical components

Other:

ME Multiple element

SC Single circuit

SE Single element

SF Single fibre

SR Single ribbon

Additional or special requirements and features

– Storage/transport conditions (see clause 7.2 of [ITU-T L.200])

Normal: Public transport – indoor storage

Special handling/transport:

Special storage:

– Additional (conditional) requirements (see Appendix III of [ITU-T L.200])

Earthquake resistance according to:

Sealed rack (IP rating) according to:

Fire-related performance according to:

Fire retardancy according to:

Halogen-free according to:

Low smoke emission according to:

Electrical grounding and shield continuity according to:

Current surge according to:

Insulation resistance according to:

Contact resistance according to:

Rodent resistance according to:

Other: according to:

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[b-IEC 61300-2-9] IEC 61300-2-9:2017, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*.

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[b-IEC 61300-3-3] IEC 61300-3-3:2009, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*.

[b-IEC 61300-3-28] IEC 61300-3-28:2012, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-28: Examinations and measurements – Transient loss*.

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