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SERIES L: CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

Practical aspects of unbundling services by multiple operators in copper access networks

ITU-T Recommendation L.62

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Practical aspects of unbundling services by multiple operators in copper access networks

Summary

In many countries, Other Licensed Operators (OLOs) are allowed to compete with the incumbent operator. This creates an environment where a company has to install, operate and maintain its network bearing in mind that other networks exist right beside it, or even at the same location. In a number of countries, it is also determined that the operators should share some parts of the network with OLOs, in a transparent process to the users. This is called Unbundling of Network Elements or, in short, unbundling, and is a very complex task. Some new issues have to be taken into account to allow the accommodation of those operators sharing the same location to do so without problems. To guarantee an environment where operators interact but do not affect the Quality of Service provided by other operators, legal, regulatory and administrative statements must be followed by the correct technical solutions, which assure the network integrity, easy use of equipment and access to security. This Recommendation is intended to provide the guidelines to achieve these targets for the local loop in copper networks.

Source

ITU-T Recommendation L.62 was approved on 6 September 2004 by ITU-T Study Group 6 (2001-2004) under the ITU-T Recommendation A.8 procedure.

Keywords

Copper cable, ISDN, local loop, network element, shared network, unbundling, xDSL.

FOREWORD

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Introduction

Network elements can be unbundled in a number of ways which are described in this Recommendation. Co-location is also described, as it is intrinsically related to unbundling.

Crucial aspects must be foreseen, e.g., the evolution of the optical access network, which reduces the copper network, getting closer to the customer premises. It may be difficult to change the network topology maintaining services already provided by OLOs in the same network element.

It must be noted that when multiple services are provided over the same network element, each service must not affect the Quality of Service provided by other operators and shall comply with the Recommendations applicable for each service when provided alone. Also, a service must not interfere with other services in use, or which are planned to be used, in a network element.

ITU-T Recommendation L.62

Practical aspects of unbundling services by multiple operators in copper access networks

1 Scope

This Recommendation relates to the technical aspects of copper local loop unbundling which, it should be noted are subject to national regulations. Although a number of network elements can be defined, this Recommendation focuses specifically on the copper local loop because it is the most prevalent worldwide.

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 Recommendation K.58 (2003), *EMC, resistibility and safety requirements and procedures for co-located telecommunication installations*.

– ITU-T Recommendation K.59 (2003), *EMC, resistibility and safety requirements and procedures for connection to unbundled cables*.

– ITU-T Recommendation L.19 (2003), *Multi-pair copper network cable supporting shared multiple services such as POTS, ISDN and xDSL*.

3 Definitions

This Recommendation defines the following terms.

For better understanding of the terms, the main types of unbundling of the local loop are outlined in Figure 1 and described below. See abbreviations on the next item.

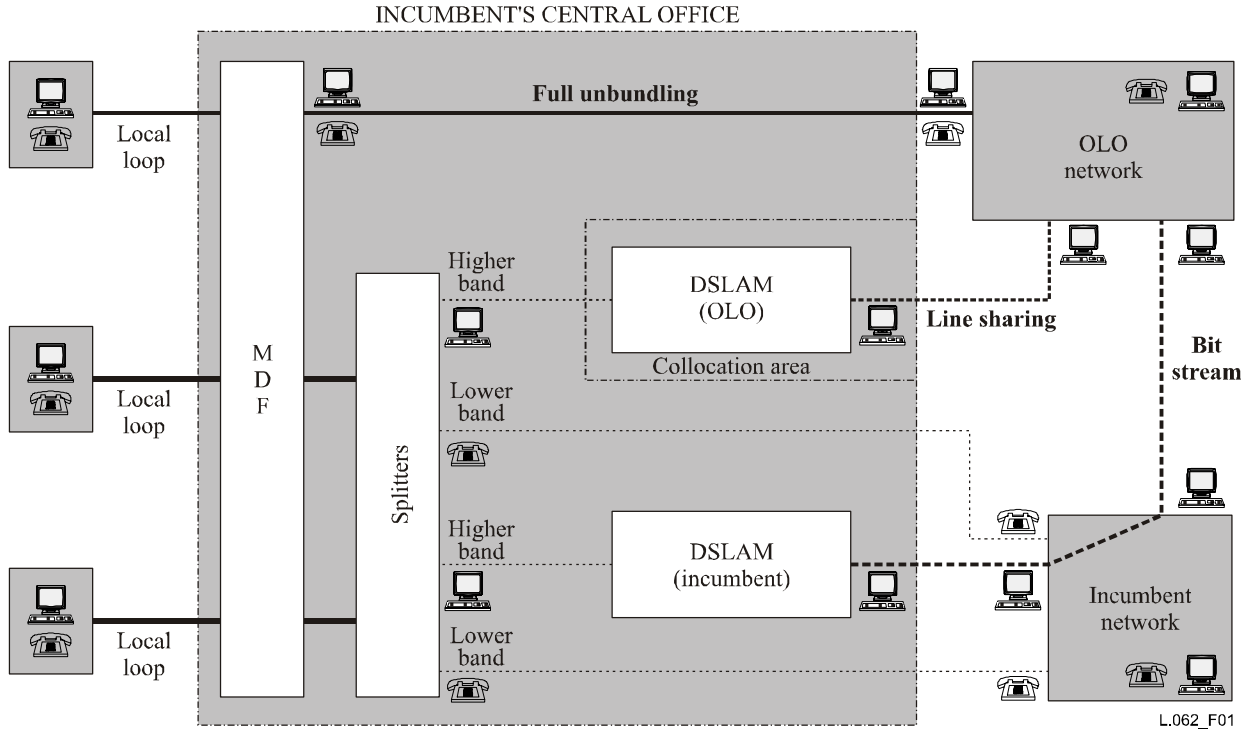


Figure 1/L.62 – Typical types of unbundled network elements

3.1 full unbundling: OLO has direct access to the twisted copper pair and can use the pair to provide any service allowed (xDSL, voice), without interfering with other services provided in the same cable, usually associated with co-location of OLO's equipment.

3.2 line sharing: Voice service (POTS, PSTN) and data transmission services (xDSL, ISDN) are provided using the same copper pair. Voice is provided in the lower frequency band and data transmission in the higher frequency band. Both operators must physically access the pair, and the OLO's equipment is usually housed in a co-location area inside the incumbent's central office building. Splitters have to be installed, both in the customer's premises and in the central office, to guide the signals suitably to the computer and to the telephone terminal, and to their correspondent networks.

3.3 bitstream: Actually, this is not unbundling, but a higher layer service, with less physical contact between the incumbent and the OLO. In this Recommendation, this term includes the wholesale services provided by the incumbent to other operators that, otherwise, would not have access to their customers. Typically, the incumbent operator installs and operates the network from the customer premises to the DSLAM, providing the OLO with a bundle of channels (usually STM-1) usually associated with a transportation service (back haul) to the nearest OLO's PoP.

3.4 co-location: An OLO may want to (or may be obliged to) rent space in the incumbent's central office to install its own equipment. Figure 1 shows a typical co-location area inside the CO, with the OLO's DSLAM installed on it. Due to an eventual lack of suitable space, there are some different kinds of co-location arrangements. When some OLOs want to (or may be obliged to) use the same room (or cabinet), there is a "shared co-location". A "virtual co-location" takes place when the DSLAM belongs to the OLO, but is installed and operated by the incumbent. Also, equipment

may be housed outside the incumbent's building (remote co-location), in another building or in containers located in parking lots, for example. Another special situation, described in 3.5, occurs when an outdoor remote DSLAM is needed.

3.5 outdoor remote DSLAM: This is the toughest situation, requiring critical technical solutions. When a network has remote concentration (or switching) elements in cabinets along the copper loops, it may be necessary to connect those elements to the OLO's network. Usually there is no space for co-location and the elements are in an aggressive environment. This connection can be a very challenging task, as the equipments of both operators may have to be able to accept external tie cables and/or have space inside to install the OLO's DSLAM. Other solutions may include connection of the incumbent's cabinet to the OLO's cabinet, compatible printed circuit cards inserted in the incumbent's remote equipment, and the transport of the signals by the incumbent to the OLO's nearest PoP. The physical access is an important issue that has to have a convenient solution, because of security matters. Special attention is needed when the insertion of signals is allowed at some point along the cable between the central office and the customer's premises. Such signals may interfere in the other services already provided on the same cable since they can be stronger than the others at the insertion point.

3.6 sub-loop: There are special circumstances, usually in long copper loops, where parts of the local loop are rented separately from each other. The individual sub-loop elements usually available are feeders, distribution and concentration elements. Problems and solutions are similar to those listed for the outdoor remote DSLAM.

4 Abbreviations

This Recommendation uses the following abbreviations:[1]

ADSL	Asymmetric Digital Subscriber Line
CO	Central Office
DSLAM	Digital Subscriber Line Access Multiplexer
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
HDF	Handover Distribution Frame
HDSL	High bit rate Digital Subscriber Line
ISDN	Integrated Services Digital Network
LLU	Local Loop Unbundling also called Unbundling of the Local Loop (ULL)
MDF	Main Distribution Frame
NE	Network Element
NTP	Network Termination Point
OLO	Other Licensed Operator
PoP	Point of Presence
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
SDSL	Symmetric Digital Subscriber Line

[1] Extracted from ITU's abbreviations database (http://www.itu.int/sancho).

SHDSL Single pair High speed Digital Subscriber Line

SSDSL Synchronized Symmetrical Digital Subscriber Line

STM Synchronous Transport Module

UADSL Universal Asymmetric Digital Subscriber Line

UNE Unbundling of Network Elements

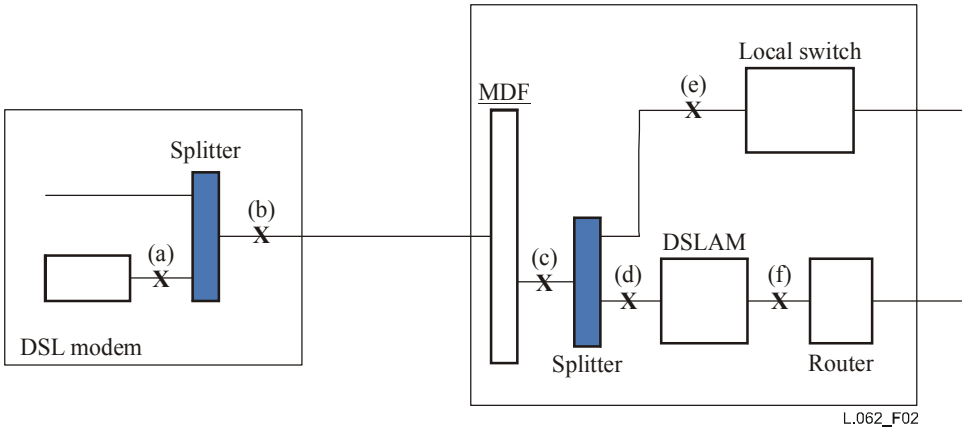
VDSL Very high-speed Digital Subscriber Line

xDSL Any of the various types of Digital Subscriber Lines

5 Topologies

The connection between incumbent and OLO equipments can be done at points that depend on the topology of the network. The following items describe some recommended configurations.

5.1 Indoor



"**X**" *indicates connection points.*
(1) Connection at MDF corresponding to (c), (e) as shown in the figure above.
(2) Splitter output correponding to (d) as shown in the figure above.
(3) Output port of DSLAM corresponding to (f) as shown in the figure above.

Figure 2/L.62 – Typical DSL network and indoor connection points

5.2 Outdoor

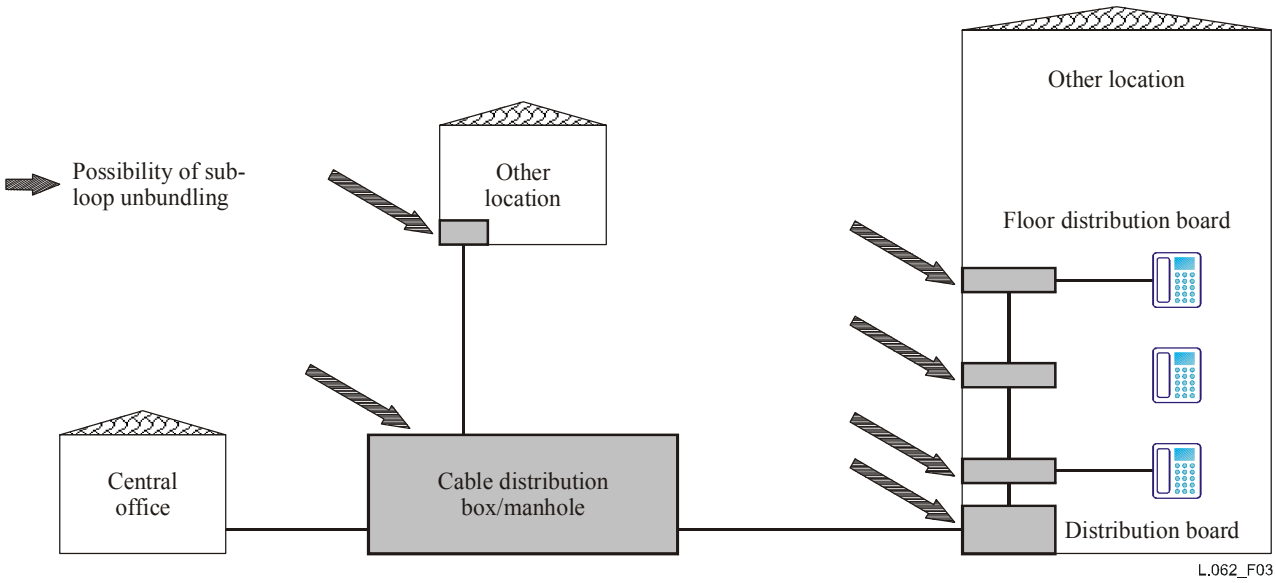


Figure 3/L.62 – Typical DSL network and outdoor connection points

6 Issues related to unbundling

Specific rules must be agreed upon with all operators that share a network element. There should be security rules related to physical access, fire safety, electrical compatibility, EMC/EMI, etc.

Information about that part of the network should be available, to avoid problems like interruptions, interferences, etc.

6.1 Interfacing operators on the MDF

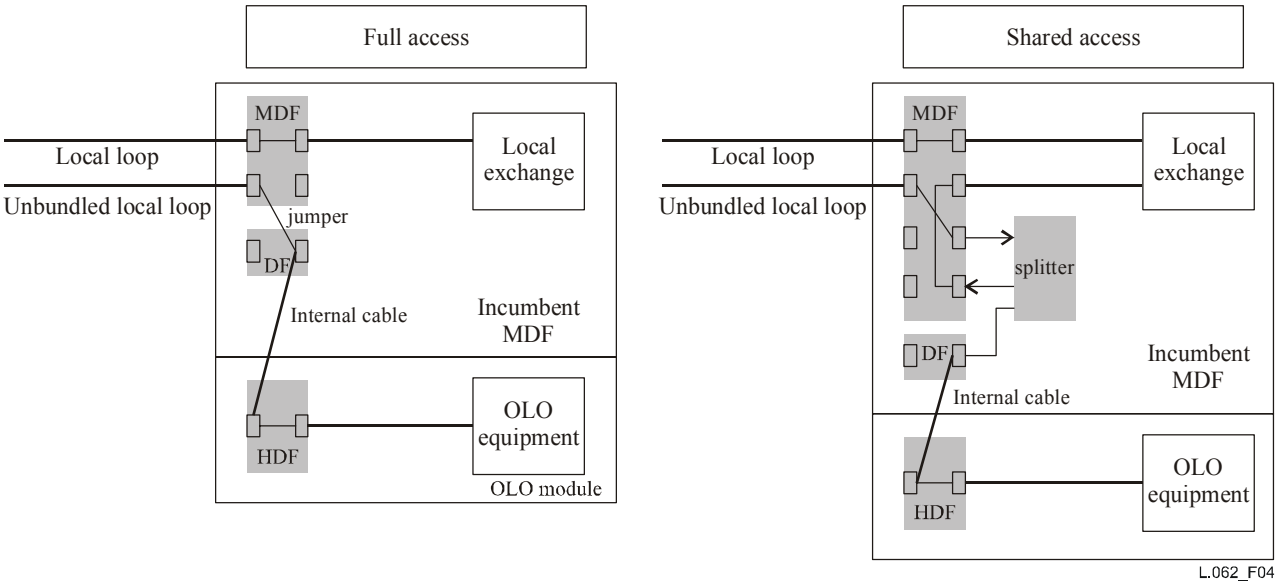


Figure 4/L.62 – Typical MDF connection points

6.2 Interfacing operators on cabinets or closures

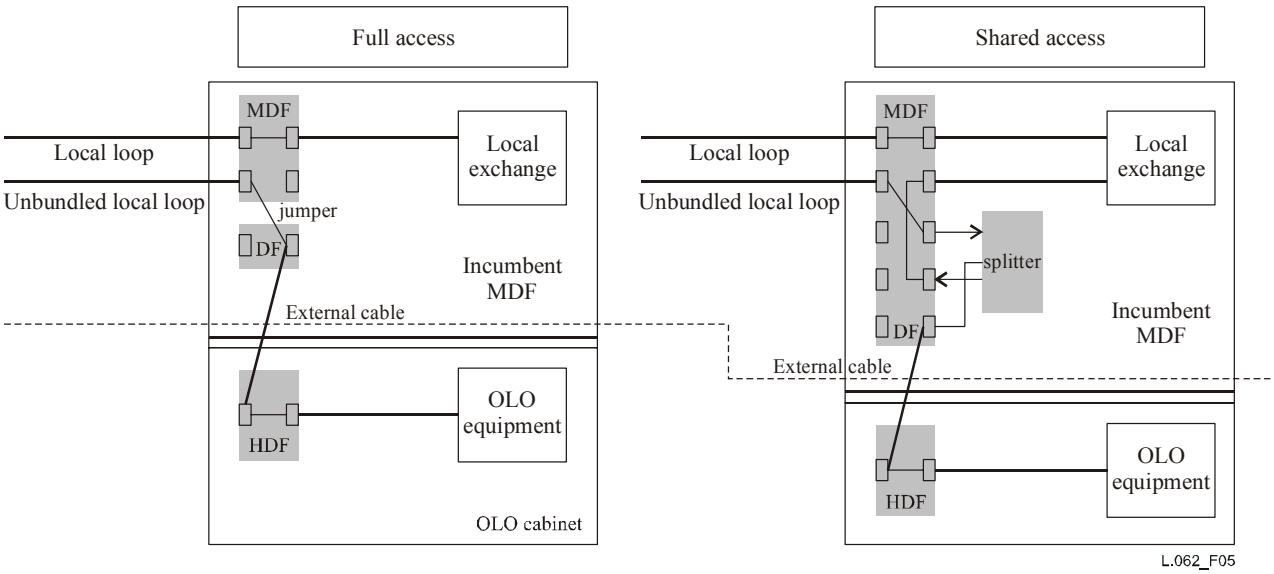


Figure 5/L.62 – Typical cabinets and closures connection points

6.3 Interfacing operators on aerial installations

This infrequent configuration needs further study.

6.4 Interfacing operators on buried installations

This infrequent configuration needs further study.

6.5 Interfacing operators in the manhole

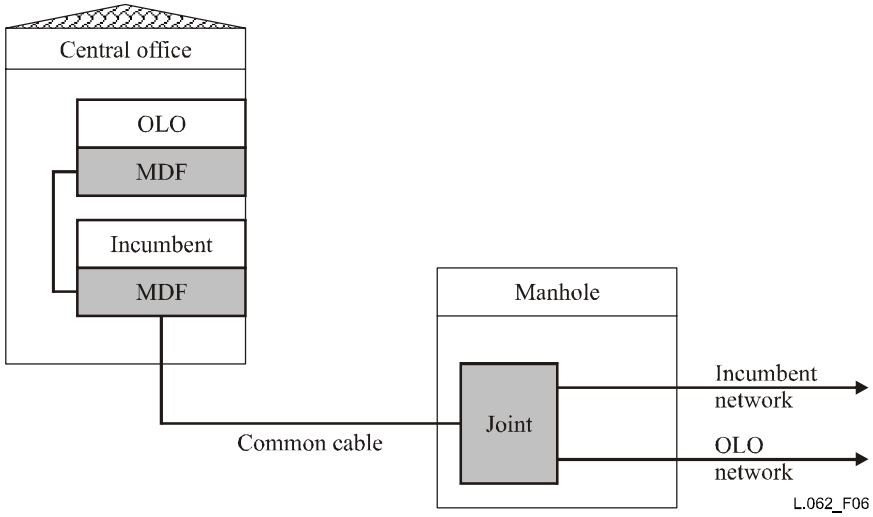


Figure 6/L.62 – Typical manhole connection points

6.6 Interfacing operators on the customer premises

This subject is for further study.

6.7 Cable frequency spectrum management plan

The occupation of the frequency spectrum must be determined before the shared services start, to avoid interferences. A spectrum management policy must be implemented and respected by all operators involved. Some services, e.g., voice, may have precedence over others.

Factors that must be taken into account include: cable characteristics related to data transmission; connector characteristics; copper pair pre-qualification and conditioning; services allowed simultaneously and their protocols; maximum number of pairs used for each service in a cable; selection of pairs as a function of different services, etc.

6.8 Installation and maintenance

The involved operators must agree upon the installation and maintenance procedures, including action flowchart; time-limits and responsibilities; network integrity assurance; implementation of new technologies and topologies; proceedings to solve conflicts, etc.

7 Issues related to co-location

Specific rules must be agreed upon with all operators that co-locate equipments. There should be security rules related to physical access, fire safety, electrical compatibility, EMC/EMI, etc.

7.1 Typical co-location inside MDF

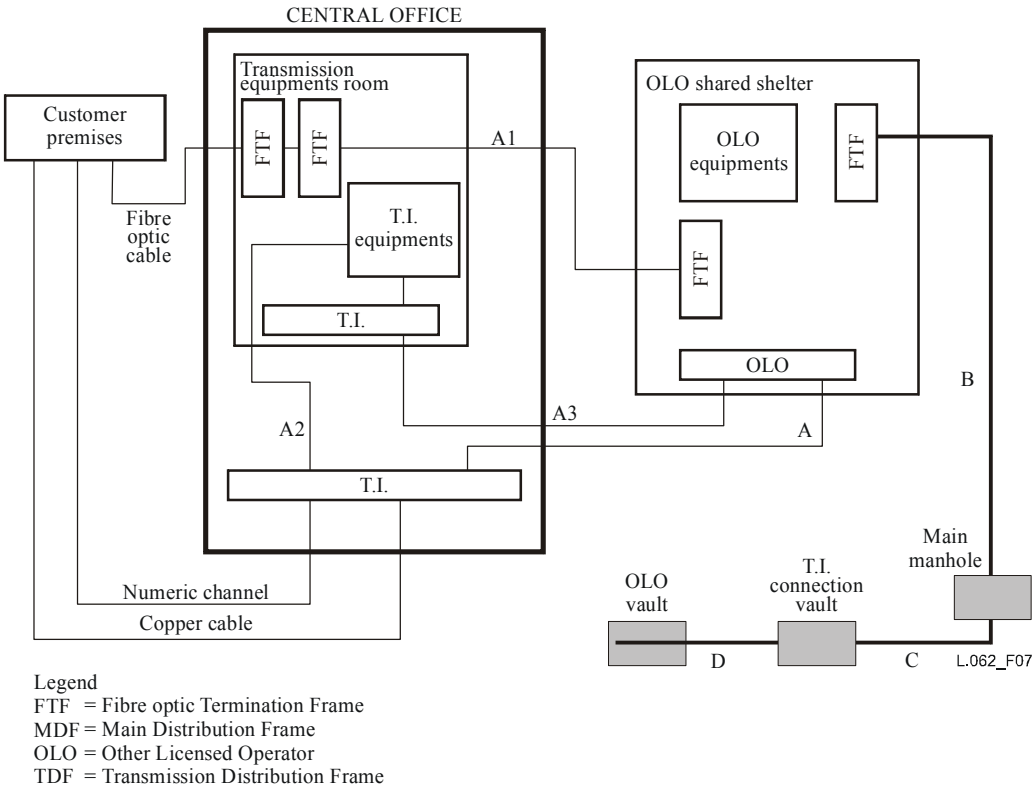
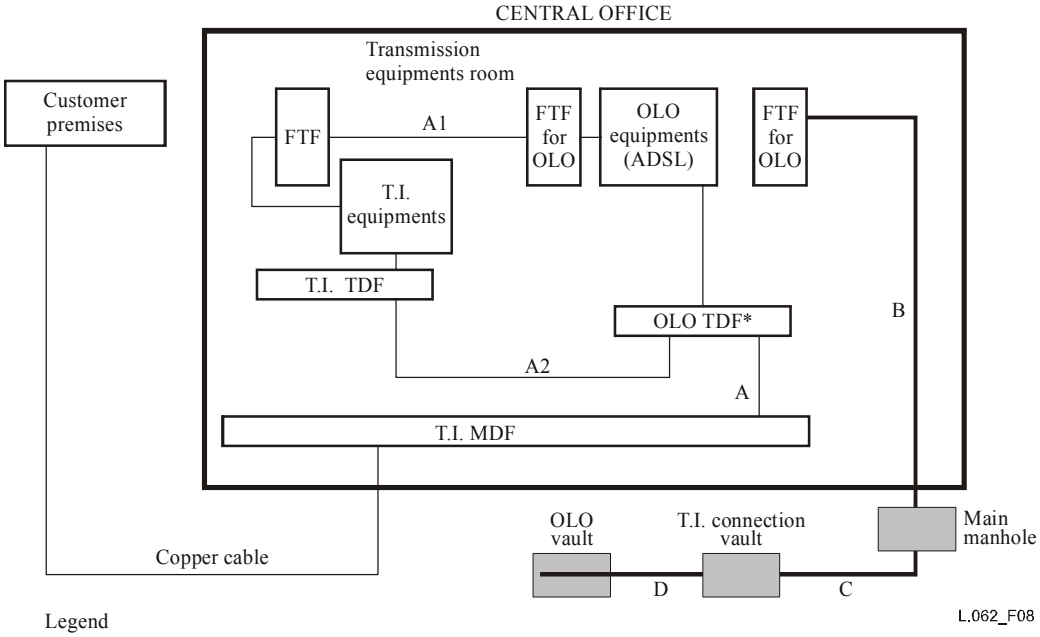


Figure 7/L.62 – Typical co-location inside MDF

7.2 Virtual co-location inside MDF

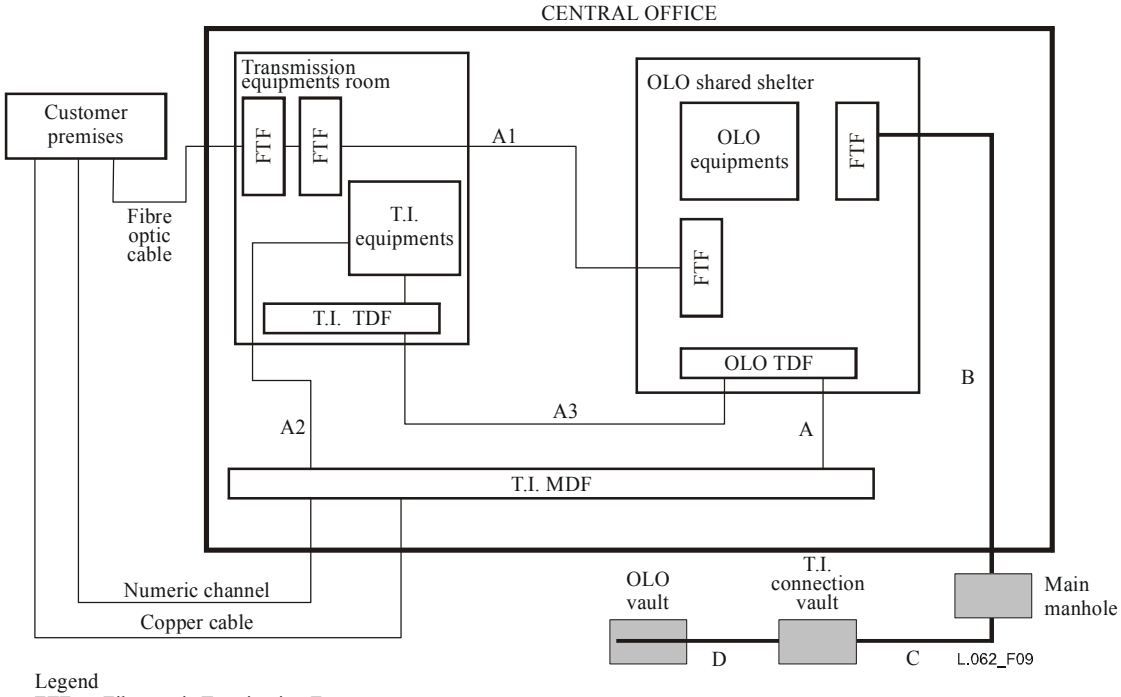


Legend
FTF = Fibre optic Termination Frame
MDF = Main Distribution Frame
OLO = Other Licensed Operator
TDF = Transmission Distribution Frame

* TDF OLO and FTF OLO, normally, coincide with the existing T.I. FTF

Figure 8/L.62 – Typical virtual co-location inside MDF

7.3 Co-location outside MDF



Legend
FTF = Fibre optic Termination Frame
MDF = Main Distribution Frame
OLO = Other Licensed Operator
TDF = Transmission Distribution Frame

Figure 9/L.62 – Typical co-location outside MDF

8 Shared sub-loops

Specific rules must be agreed upon with all operators that share sub-loops. There should be security rules related to physical access, fire safety, electrical compatibility, EMC/EMI, etc.

Special attention must be given to external tie cables and the related hardware to be used at the operators interface point, e.g., splices, connectors, etc.

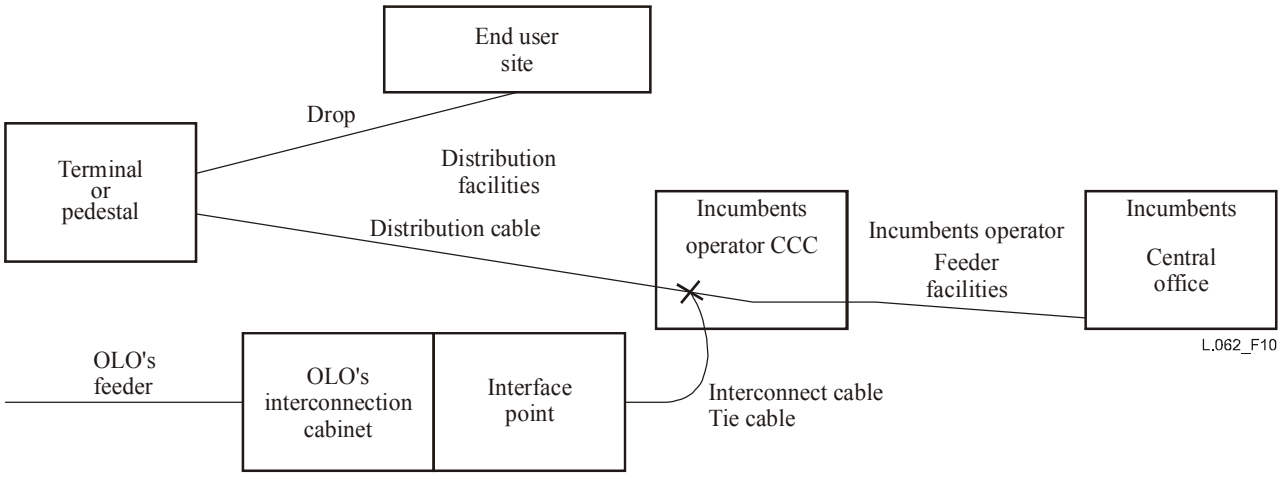


Figure 10/L.62 – Typical shared sub-loop

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