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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,  
DIGITAL SYSTEMS AND NETWORKS

Packet over Transport aspects – MPLS over Transport  
aspects

SERIES Y: GLOBAL INFORMATION  
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS,  
NEXT-GENERATION NETWORKS, INTERNET OF  
THINGS AND SMART CITIES

Internet protocol aspects – Transport

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**Management aspects of the MPLS-TP network  
element**

Recommendation ITU-T G.8151/Y.1374

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# Recommendation ITU-T G.8151/Y.1374

## Management aspects of the MPLS-TP network element

### Summary

Recommendation ITU-T G.8151/Y.1374 addresses management aspects of the multi-protocol label switching (MPLS) transport profile (MPLS-TP) capable network element containing transport functions of one or more of the layer networks of the MPLS-TP network. The management of the MPLS-TP layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client. The management functions for fault management, configuration management, performance monitoring and security management are specified.

This Recommendation aligns with the MPLS-TP architecture and requirements jointly developed by IETF and ITU-T and provides the specification for managing MPLS-TP network elements (NEs) that support the operations, administration, maintenance (OAM) protocol neutral equipment functionality as defined in Recommendations ITU-T G.8121/Y.1381, G.8121.1/Y.1381.1 and G.8121.2/Y.1381.2.

### History

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### Keywords

Configuration, equipment management, fault, MPLS-TP, performance monitoring, transport resource.

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# Recommendation ITU-T G.8151/Y.1374

## Management aspects of the MPLS-TP network element

### 1 Scope

This Recommendation addresses management aspects of the multi-protocol label switching (MPLS) transport profile (MPLS-TP) capable network element containing transport functions of one or more of the layer networks of the MPLS-TP network. The management of the MPLS-TP layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client. In this version of the Recommendation, fault management, configuration management, performance management and security management are specified. Accounting management is for further study.

The generic requirements for managing transport network elements (NEs) are specified in [ITU-T G.7710] and the requirements for the management of equipment used in networks supporting an MPLS-TP are specified in [b-IETF RFC 5951]. This Recommendation specifies the requirements for managing the following MPLS-TP specific equipment functional blocks, which are defined in [ITU-T G.8121]:

- MPLS-TP layer connection function;
- MPLS-TP layer trail termination functions;
- MPLS-TP server to MPLS-TP client adaptation functions;
- MPLS-TP server to Ethernet client adaptation functions;
- synchronous digital hierarchy (SDH) server to MPLS-TP client adaptation functions;
- plesiochronous digital hierarchy (PDH) server to MPLS-TP client adaptation functions;
- optical transport network (OTN) sever to MPLS-TP client adaptation functions;
- Ethernet MAC layer (ETH) sever to MPLS-TP client adaptation functions.

The management of the adaptation of other clients and servers with respect to MPLS-TP is for further study.

This Recommendation also describes the management network organizational model for communication between an element management layer (EML) operations system and the MPLS-TP equipment management function within an MPLS-TP network element.

The architecture described in this Recommendation for the management of MPLS-TP transport networks is based on the following considerations:

- the management view of network element functional elements should be uniform whether those elements form part of an inter-domain interface or part of an intra-domain interface. Those properties necessary to form such a uniform management view are to be included in this Recommendation;
- MPLS-TP layer network entities (MTLNEs) refer to trail termination, adaptation and connection functions as described in [ITU-T G.8110.1];
- a network element may only contain MPLS-TP layer network entities;
- a network element may contain both MTLNEs and client layer network entities (CLNEs);
- client layer entities are managed as part of their own logical domain (e.g., Ethernet management network);
- CLNE and MTLNE may or may not share a common message communication function (MCF) and management application function (MAF) depending on the application;

- CLNE and MTLNE may or may not share the same agent;
- server layer network entities (SLNEs) and MTLNEs may or may not share the same agent.

This Recommendation provides a representation of the MPLS-TP technology using the methodologies that have been used for other transport technologies (e.g., SDH, OTN and Ethernet).

## 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 G.707] Recommendation ITU-T G.707/Y.1322 (2007), *Network node interface for the synchronous digital hierarchy (SDH)*.
- [ITU-T G.709] Recommendation ITU-T G.709/Y.1331 (2016), *Interfaces for the optical transport network*.
- [ITU-T G.805] Recommendation ITU-T G.805 (2000), *Generic functional architecture of transport networks*.
- [ITU-T G.806] Recommendation ITU-T G.806 (2012), *Characteristics of transport equipment – Description methodology and generic functionality*.
- [ITU-T G.7041] Recommendation ITU-T G.7041/Y.1303 (2016), *Generic framing procedure (GFP)*.
- [ITU-T G.7044] Recommendation ITU-T G.7044/Y.1347 (2011), *Hitless adjustment of ODUflex (GFP)*.
- [ITU-T G.7710] Recommendation ITU-T G.7710/Y.1701 (2012), *Common equipment management function requirements*.
- [ITU-T G.7712] Recommendation ITU-T G.7712/Y.1703 (2010), *Architecture and specification of data communication network*,
- [ITU-T G.8051] Recommendation ITU-T G.8051/Y.1345 (2017), *Management aspects of the Ethernet Transport (ET) capable network element*.
- [ITU-T G.8110.1] Recommendation ITU-T G.8110.1/Y.1370.1 (2011), *Architecture of MPLS Transport Profile (MPLS-TP) layer network*.
- [ITU-T G.8113.1] Recommendation ITU-T G.8113.1/Y.1372.1 (2016), *Operations, administration and maintenance mechanism for MPLS-TP in packet transport networks*.
- [ITU-T G.8113.2] Recommendation ITU-T G.8113.2/Y.1372.2 (2016), *Operations, administration and maintenance mechanisms for MPLS-TP networks using the tools defined for MPLS*.
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- [ITU-T M.20] Recommendation ITU-T M.20 (1992), *Maintenance philosophy for telecommunication networks.*
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- [ITU-T X.700] Recommendation ITU-T X.700 (1992), *Management framework for Open Systems Interconnection (OSI) For CCITT Applications.*
- [ITU-T X.701] Recommendation ITU-T X.701 (1997), *Information technology – Open Systems Interconnection – Systems management overview.*
- [ITU-T X.733] Recommendation ITU-T X.733 (1992), *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function.*
- [ITU-T X.735] Recommendation ITU-T X.735 (1992), *Information technology – Open Systems Interconnection – Systems management: Log control function.*
- [ITU-T Y.1563] Recommendation ITU-T Y.1563 (2009), *Ethernet frame transfer and availability performance.*

### 3 Definitions

#### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- 3.1.1 agent:** [ITU-T X.701]
- 3.1.2 alarm reporting:** [ITU-T M.3100]
- 3.1.3 alarm reporting control (ARC):** [ITU-T M.3100]
- 3.1.4 atomic function (AF):** [ITU-T G.806]
- 3.1.5 data communication network (DCN):** [ITU-T G.7712]
- 3.1.6 local craft terminal:** [ITU-T G.7710]
- 3.1.7 managed entity:** [ITU-T M.3100]
- 3.1.8 managed object (MO):** [ITU-T X.700]
- 3.1.9 managed object class (MOC):** [ITU-T X.701]
- 3.1.10 management application function (MAF):** [ITU-T G.7710]
- 3.1.11 management interface:** [ITU-T M.3100]
- 3.1.12 management point (MP):** [ITU-T G.806]
- 3.1.13 manager:** [ITU-T X.701]
- 3.1.14 message communication function (MCF):** [ITU-T M.3013]
- 3.1.15 network element (NE):** [ITU-T M.3010]

- 3.1.16 **network element function (NEF):** [ITU-T M.3010]
- 3.1.17 **operations system:** [ITU-T M.3010]
- 3.1.18 **operations system function:** [ITU-T M.3100]
- 3.1.19 **persistence interval:** [ITU-T M.3100]
- 3.1.20 **Q-interface:** [ITU-T M.3010]
- 3.1.21 **qualified problem:** [ITU-T M.3100]
- 3.1.22 **timed interval:** [ITU-T M.3100]
- 3.1.23 **workstation function (WF):** [ITU-T M.3010]

## 3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

**3.2.1 MPLS-TP management network (MT.MN):** An MPLS-TP management network is a subset of a telecommunication management network (TMN) that is responsible for managing the parts of a network element that contain MPLS-TP layer network entities. A MT.MN may be subdivided into a set of MPLS-TP management subnetworks.

**3.2.2 MPLS-TP management subnetwork (MT.MSN):** An MPLS-TP management subnetwork (MT.MSN) consists of a set of separate embedded control channels (ECCs) and associated intra-site data communication links which are interconnected to form a data communication network (DCN) within any given MPLS-TP transport topology. For MPLS-TP, the physical channel supporting the ECC is the MPLS-TP management communication channel (MCC) as defined in [ITU-T G.7712]. A MT.MSN represents a MPLS-TP specific local communication network (LCN) portion of a network operator's overall DCN or telecommunication management network (TMN).

**3.2.3 MPLS-TP network element (MT.NE):** The part of a network element that contains entities from one or more MPLS-TP layer networks. A MT.NE may therefore be a standalone physical entity or a subset of a network element. It supports at least network element functions (NEFs) and may also support an operations system function (OSF). It contains managed objects (MOs), a message communication function (MCF) and a management application function (MAF). The functions of a MT.NE may be contained within a network element (NE) that also supports other layer networks. These layer network entities are considered to be managed separately from MPLS-TP entities. As such they are not part of the MPLS-TP management network (MT.MN) or MPLS-TP management subnetwork (MT.MSN).

## 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

|      |                             |
|------|-----------------------------|
| 1SL  | One-Way Synthetic Loss      |
| AcSL | Accepted Signal Label       |
| AF   | Atomic Function             |
| AIS  | Alarm Indication Signal     |
| ALM  | ALarM reporting             |
| ARC  | Alarm Reporting Control     |
| CC   | Continuity Check            |
| CLNE | Client Layer Network Entity |
| CoS  | Class of Service            |

|       |  |
|-------|--|
| CP    | Connection Point   |
| CSF   | Client Signal Fail   |
| CTP   | Connection Termination Point   |
| CtrlP | Control Plane  |
| DCN   | Data Communication Network   |
| DEG   | Degraded   |
| DLM   | Direct Loss Measurement  |
| DM    | Delay Measurement  |
| ECC   | Embedded Communication Channel   |
| E-LSP | Explicitly TC-encoded-PSC LSP  |
| EMF   | Equipment Management Function  |
| EML   | Element Management Layer   |
| EMS   | Element Management System  |
| ETH   | Ethernet MAC layer   |
| FCAPS | Fault management, Configuration management, Account management, Performance management and Security management |
| FLR   | Frame Loss Ratio   |
| GNE   | Gateway Network Element  |
| ILM   | Inferred Loss Measurement  |
| IP    | Internet Protocol  |
| LAN   | Local Area Network   |
| LCK   | Locked   |
| LCN   | Local Communication Network  |
| LCT   | Local Craft Terminal   |
| LM    | Loss Measurement   |
| L-LSP | Label-only-inferred PSC LSP  |
| LSP   | Label Switched Path  |
| MAC   | Media Access Control   |
| MAF   | Management Application Function  |
| MCC   | Management Communication Channel   |
| MCF   | Message Communication Function   |
| MD    | Mediation Device   |
| MEP   | Maintenance entity group End Point   |
| MF    | Mediation Function   |
| MgmtP | Management Plane   |
| MI    | Management Information   |
| MIB   | Management Information Base  |

|         |  |
|---------|--|
| MIP     | Maintenance entity group Intermediate Point                                  |
| MN      | Management Network   |
| MO      | Managed Object   |
| MOC     | Managed Object Class   |
| MP      | Management Point   |
| MPLS    | Multi-Protocol Label Switching   |
| MPLS-TP | MPLS Transport Profile   |
| MSN     | Management SubNetwork  |
| MSRP    | MPLS-TP Shared Ring Protection   |
| MT.C    | MPLS-TP Channel layer (Note – Equivalent to MPLS-TP transport service layer) |
| MTLNE   | MPLS-TP Layer Network Entity   |
| MTM-n   | MPLS-TP Transport Module layer n   |
| MT.MN   | MPLS-TP MN   |
| MT.MSN  | MPLS-TP MSN  |
| MT.NE   | MPLS-TP NE   |
| MT.P    | MPLS-TP Path layer   |
| MT.S    | MPLS-TP Section layer  |
| NALM    | No ALaRm reporting   |
| NALM-CD | No ALaRm reporting, Count Down   |
| NALM-NR | No ALaRm reporting, Not Ready  |
| NALM-QI | No ALaRm reporting, Qualified Inhibit  |
| NALM-TI | No ALaRm reporting, Timed Inhibit  |
| NE      | Network Element  |
| NEF     | Network Element Function   |
| NEL     | Network Element Layer  |
| OAM     | Operations, Administration and Maintenance                                   |
| OAMP    | Operations, Administration, Maintenance and Provisioning                     |
| OS      | Operations System  |
| OSF     | Operations System Function   |
| OSI     | Open Systems Interconnection   |
| OTN     | Optical Transport Network  |
| PDH     | Plesiochronous Digital Hierarchy   |
| PHB     | Per Hop Behaviour  |
| PMC     | Performance Monitoring Clock   |
| PSC     | PHB Scheduling Class   |
| PW      | Pseudowire   |
| QoS     | Quality of Service   |

|      |                                      |
|------|--------------------------------------|
| RTC  | Real Time Clock                      |
| RTR  | Reset Threshold Report               |
| SCC  | Signalling Communication Channel     |
| SDH  | Synchronous Digital Hierarchy        |
| SES  | Severely Errored Seconds             |
| SLNE | Server Layer Network Entity          |
| TCM  | Tandem Connection Monitoring         |
| TLV  | Type Length Value                    |
| TMN  | Telecommunication Management Network |
| TR   | Threshold Report                     |
| TTL  | Time-To-Live                         |
| TTP  | Trail Termination Point              |
| WAN  | Wide Area Network                    |
| WS   | WorkStation                          |
| WTR  | Wait To Restore                      |

## 5 Conventions

In this Recommendation, MT.MN stands for MPLS-TP management network, MT.MSN for MPLS-TP management subnetwork, MT.NE for MPLS-TP NE, MT.C for MPLS-TP channel layer, MT.P for MPLS-TP path layer and MT.S for MPLS-TP section layer.

## 6 MPLS-TP management architecture

See clause 6 of [ITU-T G.7710] for the generic architecture for managing transport equipment. MPLS-TP specific management architecture is described below.

### 6.1 MPLS-TP network management architecture

The transport layer network architecture of MPLS-TP is described in [ITU-T G.8110.1]. The management of the MPLS-TP layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client.

#### 6.1.1 Relationship between TMN, MT.MN and MT.MSN

The MPLS-TP management network (MT.MN) may be partitioned into MPLS-TP management subnetworks (MT.MSNs). The inter-relationship between a management network, its subnetworks and a telecommunication management network (TMN) as generically described in clause 6 of [ITU-T G.7710] is applicable to MPLS-TP.

#### 6.1.2 Access to the MT.MSN

See clause 6.1.2 of [ITU-T G.7710] for the generic requirements.

#### 6.1.3 MT.MSN requirements

See clause 6.1.3 of [ITU-T G.7710] for the generic requirements.

In addition all MT.NEs must support message communication functions (MCFs). The MCF of an MT.NE initiates/terminates (in the sense of the lower protocol layers), forwards, or otherwise processes management messages over management communication channels (MCCs), or over other DCN interfaces. In addition:

- all MT.NEs are required to terminate the MT.S-MCCs. In OSI terms, this means that each NE must be able to perform the functions of an end system;
- MT.NEs may also be required to forward management messages between ports according to routing control information held in the MT.NE. In OSI terms, this means that some MT.NEs may be required to perform the functions of an intermediate system;
- in addition to supporting interfaces for the MT.S-MCC, a MT.NE may also be required to support other DCN interfaces, which may include MT.P-MCCs, or MT.C-MCCs or an Ethernet DCN interface.

The use of the MT.P-MCCs and MT.C-MCCs for management communications is within the scope of this Recommendation.

#### 6.1.4 MT.MSN data communication network

Refer to clause 6.1.4 of [ITU-T G.7710] for the generic requirements.

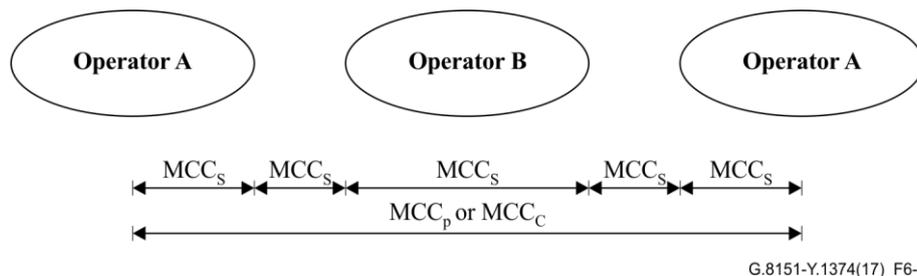
##### 6.1.4.1 Management communication channel

The MT.MN supports three MCCs:

- 1) MT.S-MCC ( $MCC_S$ );
- 2) MT.P-MCC ( $MCC_P$ );
- 3) MT.C-MCC ( $MCC_C$ ).

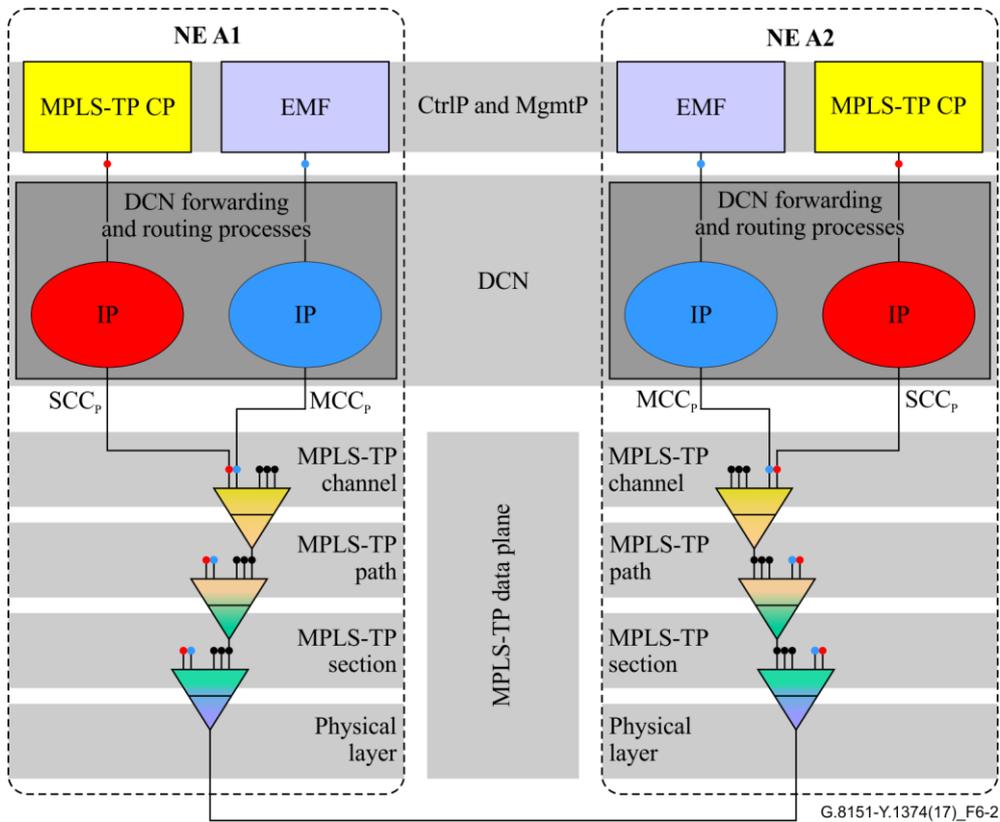
The general MT.S-, MT.P- and MT.C-MCCs are described in [ITU-T G.7712].

Figure 6-1 illustrates a network scenario consisting of two operators. Operator B provides an MT.P Service to Operator A (i.e., Operator B transports the MT.P signal that begins and ends Operator A's domain). According to [ITU-T G.8110.1], the  $MCC_P$  and the  $MCC_C$  signals passed transparently through Operator B's network.

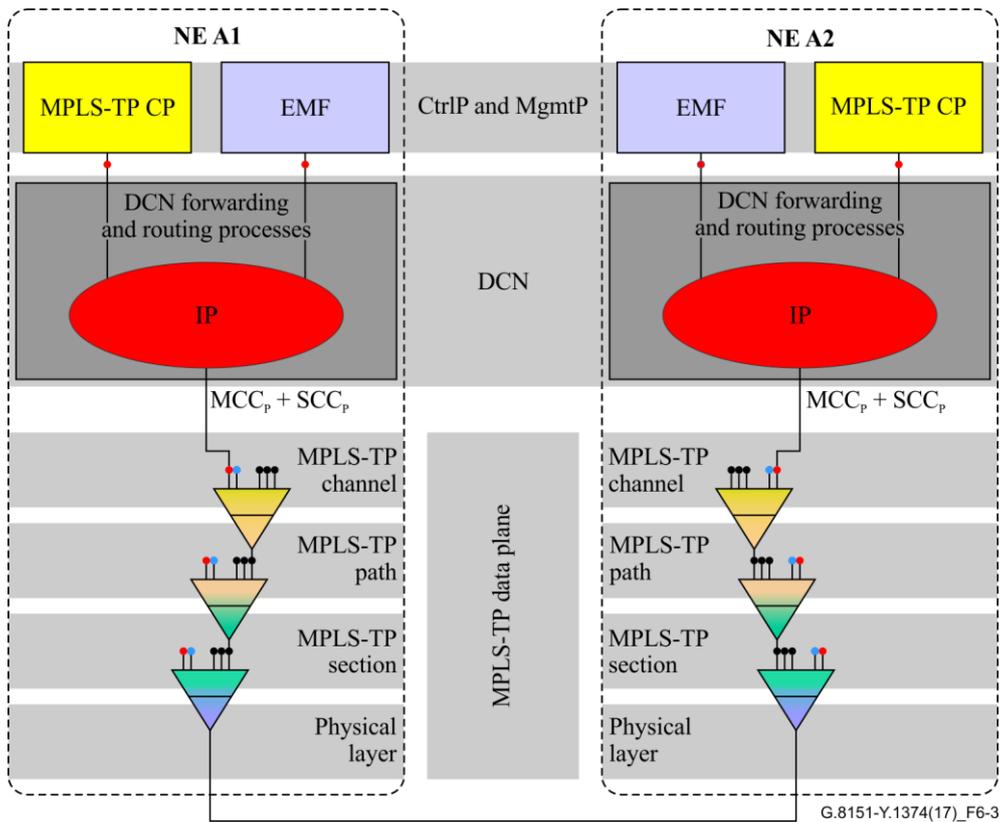


**Figure 6-1 – MCC scenarios**

The physical layer is terminated in every network element and its related adaptation function provides the MT.S signals as well as the  $MCC_S$ . Hence, the  $MCC_S$  cannot cross administrative domains. In Figure 6-1, Figure 6-2 and Figure 6-3 illustrate scenarios where the  $MCC_P$  and  $MCC_C$  are transported transparently through Operator B's domain (the Operator B network elements are not shown in Figure 6-2 and Figure 6-3). In these scenarios, it is possible that Operator B may use the  $MCC_S$  within its own domain for the management of its domain.



**Figure 6-2 – MCC<sub>p</sub> scenario example 1**



**Figure 6-3 – MCC<sub>p</sub> scenario example 2**

#### **6.1.4.2 MCC physical characteristics**

The MT.S-, MT.C- and MT.P-MCCs are logical elements within the MPLS-TP transport module layer n (MTM-n). The MCC provides general management communications between two MPLS-TP network elements with access to the MT.S, MT.P and MT.C characteristic information respectively. The MT.S-, MT.P-, or MT.C-MCC is provided by the MPLS-TP operations, administration and maintenance (OAM) function at section, path, or channel layer as described in [ITU-T G.7712] or by any other embedded communication channel (ECC) of the MPLS-TP transport network.

The MT.S management communication channel (MCC<sub>S</sub>) shall operate as a single message channel between MT.S termination points. The bit rate of the MCC<sub>S</sub> shall be configurable.

The MT.P management communication channel (MCC<sub>P</sub>) shall operate as a single message channel between any network elements that terminate the MT.P layer. The MCC<sub>P</sub> is transported transparently through MT.NEs that only terminates the MT.S layer and forwards the MT.P signal. The bit rate of the MCC<sub>P</sub> shall be configurable.

The MT.C management communication channel (MCC<sub>C</sub>) shall operate as a single message channel between any network elements that terminate the MT.C layer. The MCC<sub>C</sub> is transported transparently through MT.NEs that only terminates the MT.S layer or the MT.S and MT.P layers and forwards the MT.C signal. The bit rate of the MCC<sub>C</sub> shall be configurable.

#### **6.1.4.3 MCC data link layer protocol**

The MCC data link protocols for management applications are under study for [ITU-T G.7712].

#### **6.1.5 Management of DCN**

See clause 6.1.5 of [ITU-T G.7710] for the generic requirements.

#### **6.1.6 Remote log-in**

See clause 6.1.6 of [ITU-T G.7710] for the generic requirements.

#### **6.1.7 Relationship between technology domains**

See clause 6.1.7 of [ITU-T G.7710] for the generic requirements.

### **6.2 MPLS-TP equipment management architecture**

This clause provides an overview of the minimum functions that are required to support inter-vendor/network communications and single-ended maintenance of MT.NEs within a management subnetwork (MSN), or between communicating peer MT.NEs across a network interface. Single-ended maintenance is the ability to access remotely located MT.NEs to perform maintenance functions (see clause 10.1 of [ITU-T G.7710]).

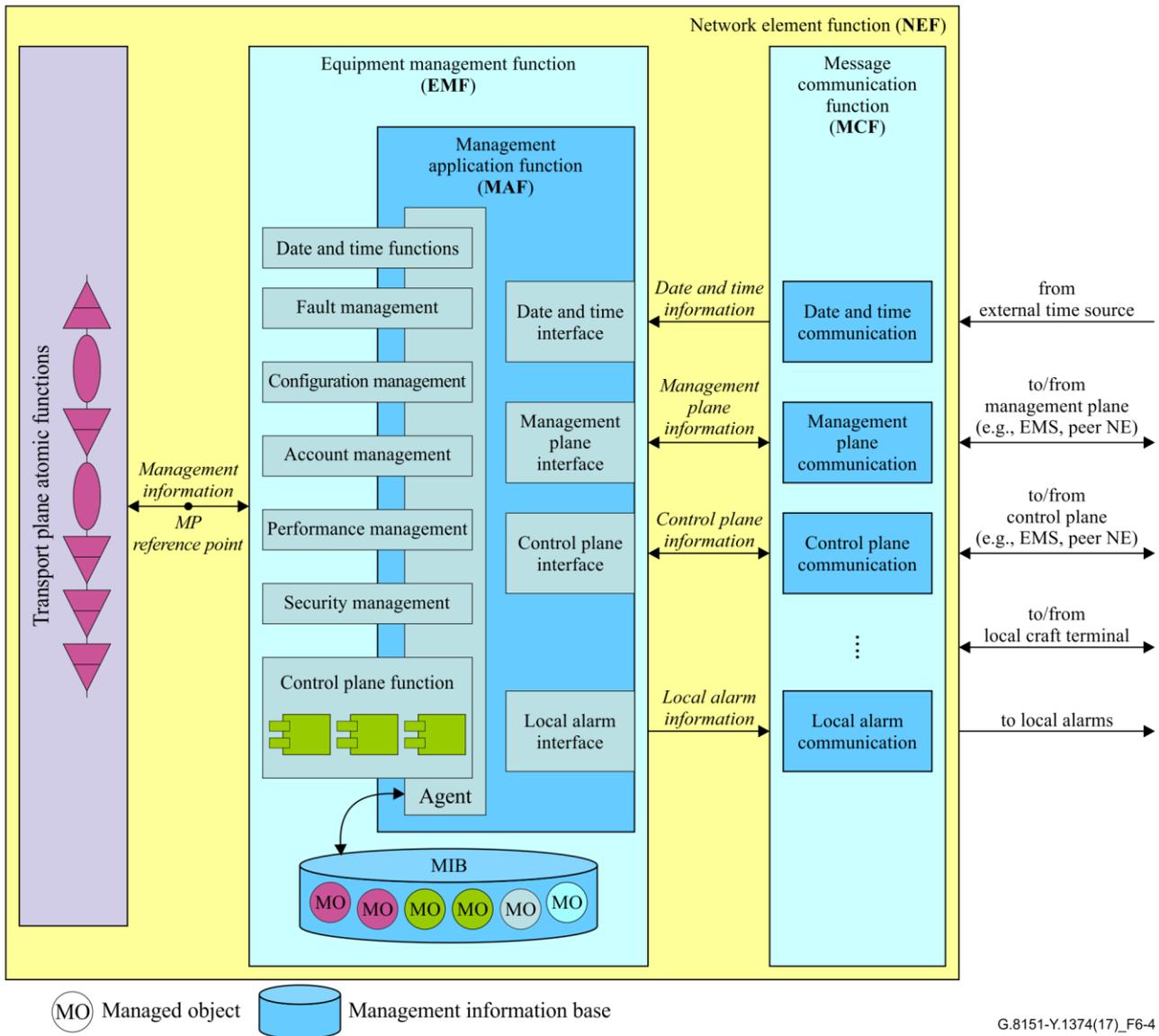
The management functions have been categorized according to the classifications given in [ITU-T X.700].

Detailed specifications of the management functions, in terms of managed objects classes, attributes and message specification are for further study.

The MPLS-TP equipment management function (EMF) (see Figure 6-4) provides the means through which the MPLS-TP network element function (NEF) is managed by an internal or external manager. If a network element (NE) contains an internal manager, this manager will be part of the MPLS-TP EMF.

The MPLS-TP EMF interacts with the other atomic functions (AFs) (refer to [ITU-T G.8121]) by exchanging information across the management point (MP) reference points. See [ITU-T G.806] and [ITU-T G.8121] for more information on atomic functions and on MPs. The MPLS-TP EMF contains a number of functions that provide a data reduction mechanism on the information received across

the MP reference points. The outputs of these functions are available to the agent via the network element resources and management application functions (MAF) which represent this information as managed objects.



**Figure 6.4 – MPLS-TP equipment management function**

Network element resources provide event processing and storage. The MAF processes the information provided to and by the NE resources. The agent converts this information to management messages and responds to management messages from the manager by performing the appropriate operations on the managed objects.

This information to and from the agent is passed to the message communication function (MCF).

### 6.3 Information flows over management points

The information flows described in this clause are functional. The existence of these information flows in the equipment will depend on the functionality provided by the MPLS-TP NE and the options selected.

The information flow over the MP reference points that arises from anomalies and defects detected in the atomic functions is described in specific details for each atomic function in [ITU-T G.8121].

The information flow over the MP reference points that arises from provisioning and reporting data is described in specific details for each atomic function in [ITU-T G.8121]. The information listed under the Input columns in the tables in clauses 9, 10 and 11 of [ITU-T G.8121], [ITU-T G.8121.1] and [ITU-T G.8121.2] refers to the provisioning data that is passed from the MPLS-TP EMF to the atomic functions. The information listed under the Output column of those tables refers to the reports passed to the MPLS-TP EMF from the atomic functions.

## **7 Fault (maintenance) management**

Fault management is a set of functions which enables the detection, isolation and correction of abnormal operation of the telecommunication network and its environment. It provides facilities for the performance of the maintenance phases from [ITU-T M.20]. The quality assurance measurements for fault management include component measurements for reliability, availability and survivability.

### **7.1 Fault management applications**

See [ITU-T G.7710] for a description of the basic fault management applications.

#### **7.1.1 Supervision**

The supervision process describes the way in which the actual occurrence of a disturbance or fault is analysed with the purpose of providing an appropriate indication of performance and/or detected fault condition to maintenance personnel. The supervision philosophy is based on the concepts underlying the functional model of [ITU-T G.805], [ITU-T G.8110.1] and the alarm reporting function of [ITU-T X.733].

The five basic supervision categories are related to: transmission, quality of service, processing, equipment and environment. These supervision processes are able to declare fault causes, which need further validation before the appropriate alarm is reported. See [ITU-T G.7710] for additional discussion of these categories.

The MT.NE shall indicate to the OS when a termination point is no longer able to supervise the signal (e.g., implementing equipment has a fault or loss of power).

##### **7.1.1.1 Transmission supervision**

See clause 7.1.1.1 of [ITU-T G.7710] for a description of transmission supervision.

For MT.NE, the defects that must be monitored for the purpose of transmission supervision are defined in clause 6.1 of [ITU-T G.8121].

The atomic function associated failure conditions are listed in clause 7.2.1.

##### **7.1.1.2 Quality of service supervision**

See [ITU-T G.7710] for a description of quality of service supervision.

##### **7.1.1.3 Processing supervision**

See [ITU-T G.7710] for a description of processing supervision.

##### **7.1.1.4 Hardware supervision**

See [ITU-T G.7710] for a description of equipment supervision.

##### **7.1.1.5 Environment supervision**

See [ITU-T G.7710] for a description of environmental supervision.

#### **7.1.2 Validation**

See [ITU-T G.7710] for a description of fault cause validation.

### **7.1.3 Alarm handling**

#### **7.1.3.1 Severity assignment**

See [ITU-T G.7710] for a description of severity categories.

#### **7.1.3.2 Alarm reporting control**

Alarm reporting control (ARC) provides an automatic in-service provisioning capability.

The following ARC states may be specified for a managed entity:

|         |   |
|---------|---|
| ALM     | Alarm reporting; alarm reporting is turned on.  |
| NALM    | No alarm reporting; alarm reporting is turned off.  |
| NALM-CD | No alarm reporting, count down; this is a substate of NALM-QI and performs the persistence timing countdown function when the managed entity is qualified problem free. |
| NALM-NR | No alarm reporting, not ready; this is a substate of NALM-QI and performs a wait function until the managed entity is qualified problem free.                           |
| NALM-QI | No alarm reporting, qualified Inhibit; alarm reporting is turned off until the managed entity is qualified problem free for a specified persistence interval.           |
| NALM-TI | No alarm reporting, timed inhibit; alarm reporting is turned off for a specified timed interval.  |

Alarm reporting may be turned off (using NALM, NALM-TI, or NALM-QI) on a per-managed entity basis to allow sufficient time for customer testing and other maintenance activities in an "alarm free" state. Once a managed entity is ready, alarm reporting is automatically turned on (to ALM). The managed entity may be automatically turned on either by using NALM-TI or NALM-QI and allowing the resource to transition out automatically, or by invoking first the NALM state from an element management system (EMS) and when maintenance activity is done, invoking the ALM state. This later automation is carried out by the EMS. For further details relating to ARC, see [ITU-T M.3100].

#### **7.1.3.3 Reportable failures**

See [ITU-T G.7710] for a description of reportable failures.

#### **7.1.3.4 Alarm reporting**

Alarm surveillance is concerned with the detection and reporting of relevant events and conditions which occur in the network. In a network, events and conditions detected within the equipment and incoming signals should be reportable. In addition, a number of events external to the equipment should also be reportable. Alarms are indications that are automatically generated by an NE as a result of the declaration of a failure. The OS shall have the ability to define which events and conditions generate autonomous reports and which shall be reported on request.

The following alarm-related functions shall be supported:

- 1) autonomous reporting of alarms;
- 2) request for reporting of all alarms;
- 3) reporting of all alarms;
- 4) allow or inhibit of autonomous alarm reporting;
- 5) reporting on request status of allow or inhibit alarm reporting;
- 6) reporting of protection switch events.

### 7.1.3.4.1 Local reporting

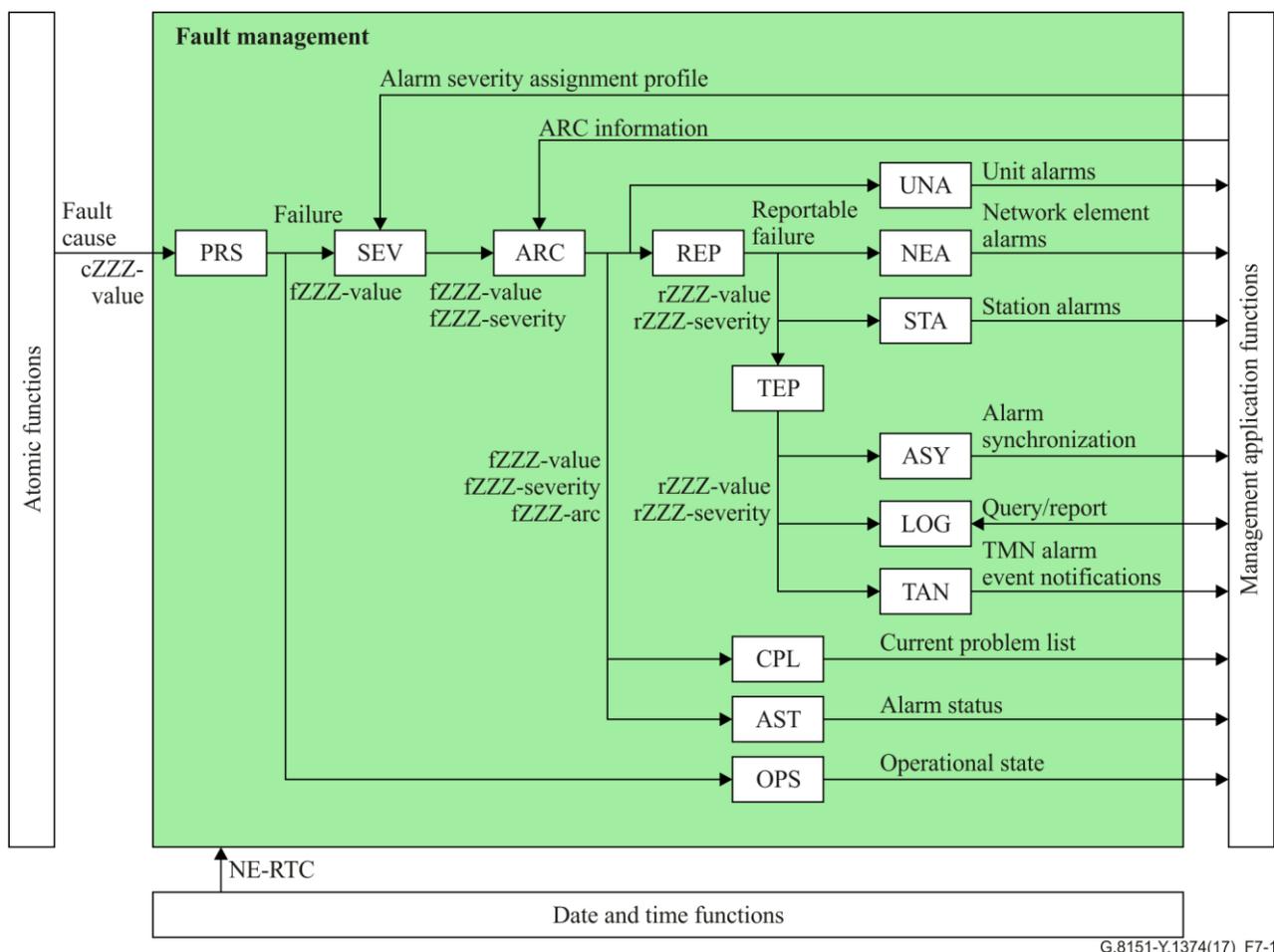
See [ITU-T G.7710] for a description of local reporting.

### 7.1.3.4.2 TMN reporting

See [ITU-T G.7710] for a description of TMN reporting.

## 7.2 Fault management functions

Figure 7-1 contains the functional model of fault management inside the MPLS-TP EMF. This model is consistent with the alarm flow functional model, specified in [ITU-T M.3100]. It does not address configuration aspects relating to fault management, the full ARC functional model, nor does it define where all possible event report parameters get assigned. Figure 7-1 is intended only to illustrate which well-known functions are impacted by the ARC, and which are not, and to provide a generalized alarm flow view.



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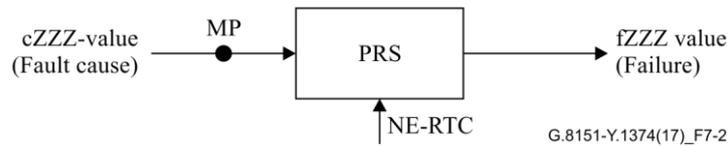
**Figure 7-1 – Fault management within the MPLS-TP NEF**

### 7.2.1 Fault cause persistency function – PRS

The defect correlations provide a data reduction mechanism on the fault and performance monitoring primitives' information presented at the MP reference points.

The equipment management function within the network element performs a persistency check on the fault causes (that are reported across the MP reference points) before it declares a fault cause a failure. In addition to the transmission failures, hardware failures with signal transfer interruption are also reported at the input of the fault cause function for further processing. See Figure 7-2.

## Symbol



**Figure 7-2 – Fault cause persistency function**

For MT.NE that supports the following functions specified in [ITU-T G.8121], the EMF PRS process shall support the persistency check for the fault causes listed in Table 7-1.

## Inputs and outputs

**Table 7-1 – Inputs/outputs for the fault cause persistency function**

| Atomic function<br>([ITU-T G.8121]) | Input  | Output   |
|-------------------------------------|--|--|
| MT_C                                | cFOP-PMb<br>cFOP-PMc<br>cFOP-CM<br>cFOP-NR<br>cFOP-TO                | fFOP-PMb<br>fFOP-PMc<br>fFOP-CM<br>fFOP-NR<br>fFOP-TO                |
| MTp_C                               | cFOP-PMb<br>cFOP-PMc<br>cFOP-CM<br>cFOP-NR<br>cFOP-TO                | fFOP-PMb<br>fFOP-PMc<br>fFOP-CM<br>fFOP-NR<br>fFOP-TO                |
| MT_TT_Sk                            | cSSF<br>cLCK<br>cLOC<br>cMMG<br>cUNM<br>cUNP<br>cUNC<br>cDEG<br>cRDI | fSSF<br>fLCK<br>fLOC<br>fMMG<br>fUNM<br>fUNP<br>fUNC<br>fDEG<br>fRDI |
| MT/ETH_A_Sk                         | cCSF   | fCSF   |
| Sn/MT_A_Sk                          | cPLM<br>cLFD<br>cEXM<br>cUPM   | fPLM<br>fLFD<br>fEXM<br>fUPM   |
| Sn-X-L/MT_A_Sk                      | cPLM<br>cLFD<br>cEXM<br>cUPM   | fPLM<br>fLFD<br>fEXM<br>fUPM   |
| Sm/MT_A_Sk                          | cPLM<br>cLFD<br>cEXM<br>cUPM   | fPLM<br>fLFD<br>fEXM<br>fUPM   |

**Table 7-1 – Inputs/outputs for the fault cause persistency function**

| <b>Atomic function</b><br>([ITU-T G.8121]) | <b>Input</b>                 | <b>Output</b>                |
|--|------------------------------|------------------------------|
| Sm-X-L/MT_A_Sk                             | cPLM<br>cLFD<br>cEXM<br>cUPM | fPLM<br>fLFD<br>fEXM<br>fUPM |
| Pq/MT_A_Sk                                 | cPLM<br>cLFD<br>cEXM<br>cUPM | fPLM<br>fLFD<br>fEXM<br>fUPM |
| Pq-X-L/MT_A_Sk                             | cPLM<br>cLFD<br>cEXM<br>cUPM | fPLM<br>fLFD<br>fEXM<br>fUPM |
| ODUKP/MT_A_Sk                              | cPLM<br>cLFD<br>cEXM<br>cUPM | fPLM<br>fLFD<br>fEXM<br>fUPM |
| ODUKP-h/MT_A_Sk                            | cPLM<br>cLFD<br>cEXM<br>cUPM | fPLM<br>fLFD<br>fEXM<br>fUPM |

See [ITU-T G.7710] for the mapping of failure (fXXX) to the generic probable cause to be used in alarm reporting.

### **Process**

The equipment management function within the network element performs a persistency check on the fault causes before it declares a fault cause a failure.

A transmission failure (fXXX) shall be declared if the fault cause persists continuously for  $2.5 \pm 0.5$  s. The failure shall be cleared if the fault cause is absent continuously for  $10 \pm 0.5$  s.

The specific set of failures associated with each atomic function is listed in Table 7-1.

The failure declaration and clearing shall be time stamped. The time-stamp shall indicate the time at which the fault cause is activated at the input of the fault cause persistency (i.e., defect-to-failure integration) function and the time at which the fault cause is deactivated at the input of the fault cause persistency function.

### **7.2.2 Severity assignment function – SEV**

See [ITU-T G.7710] for a description of the severity assignment function.

### **7.2.3 Alarm reporting control function – ARC**

The ARC function allows a management system to control the alarm reporting on a managed entity basis as defined in [ITU-T M.3100].

The alarms that can be controlled with this function are defined for each atomic function in [ITU-T G.8121].

The following ARC states may be specified for a managed entity:

|         |   |
|---------|---|
| ALM     | Alarm reporting; alarm reporting is turned on.  |
| NALM    | No alarm reporting; alarm reporting is turned off.  |
| NALM-CD | No alarm reporting, count down; this is a substate of NALM-QI and performs the persistence timing countdown function when the managed entity is qualified problem free. |
| NALM-NR | No alarm reporting, not ready; this is a substate of NALM-QI and performs a wait function until the managed entity is qualified problem free.                           |
| NALM-QI | No alarm reporting, qualified inhibit; alarm reporting is turned off until the managed entity is qualified problem free for a specified persistence interval.           |
| NALM-TI | No alarm reporting, timed inhibit; alarm reporting is turned off for a specified timed interval.  |

The ALM state is required for all managed entities that can detect alarms.

In addition, at least one of the states: NALM, NALM-TI, or NALM-QI must be supported.

If NALM-QI is supported, then NALM-NR is required and NALM-CD is optional.

For MT.NE that supports the following functions specified in [ITU-T G.8121], the EMF ARC process shall support the ARC function for the failures listed in Table 7-2.

**Table 7-2 – ARC specifications for MPLS-TP**

| Atomic function | Qualified problems   | QoS reporting     | Default state value |
|-----------------|--|-------------------|---------------------|
| MT_C            | fFOP-PMb<br>fFOP-PMc<br>fFOP-CM<br>fFOP-NR<br>fFOP-TO                | For further study | ALM                 |
| MTp_C           | fFOP-PMb<br>fFOP-PMc<br>fFOP-CM<br>fFOP-NR<br>fFOP-TO                | For further study | ALM                 |
| MT_TT_Sk        | fSSF<br>fLCK<br>fLOC<br>fMMG<br>fUNM<br>fUNP<br>fUNC<br>fDEG<br>fRDI | For further study | ALM                 |
| MT/ETH_A_Sk     | fCSF   | For further study | ALM                 |
| Sn/MT_A_Sk      | fPLM<br>fLFD<br>fEXM<br>fUPM   | For further study | ALM                 |

**Table 7-2 – ARC specifications for MPLS-TP**

| <b>Atomic function</b> | <b>Qualified problems</b>    | <b>QoS reporting</b> | <b>Default state value</b> |
|------------------------|------------------------------|----------------------|----------------------------|
| Sn-X-L/MT_A_Sk         | fPLM<br>fLFD<br>fEXM<br>fUPM | For further study    | ALM                        |
| Sm/MT_A_Sk             | fPLM<br>fLFD<br>fEXM<br>fUPM | For further study    | ALM                        |
| Sm-X-L/MT_A_Sk         | fPLM<br>fLFD<br>fEXM<br>fUPM | For further study    | ALM                        |
| Pq/MT_A_Sk             | fPLM<br>fLFD<br>fEXM<br>fUPM | For further study    | ALM                        |
| Pq-X-L/MT_A_Sk         | fPLM<br>fLFD<br>fEXM<br>fUPM | For further study    | ALM                        |
| ODUkP/MT_A_Sk          | fPLM<br>fLFD<br>fEXM<br>fUPM | For further study    | ALM                        |
| ODUkP-h/MT_A_Sk        | fPLM<br>fLFD<br>fEXM<br>fUPM | For further study    | ALM                        |

**7.2.4 Reportable failure function – REP**

See [ITU-T G.7710] for a description of the reportable failure function.

**7.2.5 Unit alarms function – UNA**

See [ITU-T G.7710] for a description of the unit alarms function.

**7.2.6 Network element alarms function – NEA**

See [ITU-T G.7710] for a description of the network element alarms function.

**7.2.7 Station alarms function – STA**

See [ITU-T G.7710] for a description of the station alarms function.

**7.2.8 TMN event pre-processing function – TEP**

See [ITU-T G.7710] for a description of the TMN event pre-processing function.

### 7.2.9 Alarm synchronization function – ASY

See [ITU-T G.7710] for a description of the alarm synchronization function.

### 7.2.10 Logging function – LOG

Alarm history management is concerned with the recording of alarms. Historical data shall be stored in registers in the NE. Each register contains all the parameters of an alarm message.

Registers shall be readable on-demand or periodically. The OS can define the operating mode of the registers as wrapping or stop when full. The OS may also flush the registers or stop recording at any time.

NOTE – Wrapping is the deletion of the earliest record to allow a new record when a register is full. Flushing is the removal of all records in the register. See [ITU-T X.735] for additional details.

See [ITU-T G.7710] for a description of the logging function.

### 7.2.11 TMN alarm event notification function – TAN

See [ITU-T G.7710] for a description of the TMN alarm event notification function.

### 7.2.12 Current problem list function – CPL

See [ITU-T G.7710] for a description of the current problem list function.

### 7.2.13 Alarm status function – AST

See [ITU-T G.7710] for a description of the alarm status function.

### 7.2.14 Operational state function – OPS

See [ITU-T G.7710] for a description of the operational state function.

For MT.NE that supports the following functions specified in [ITU-T G.8121], the EMF OPS process shall support the failures listed in Table 7-3, which lists the failures that could influence the operational state of the related objects.

**Table 7-3 – Operational state function input and output signals for MPLS-TP**

| Atomic function | Failure input (fZZZ-value)                            | Operational state output (enabled/disabled)         |
|-----------------|---|---|
| MT_C            | fFOP-PMb<br>fFOP-PMc<br>fFOP-CM<br>fFOP-NR<br>fFOP-TO | Enabled<br>Enabled<br>Enabled<br>Enabled<br>Enabled |
| MTp_C           | fFOP-PMb<br>fFOP-PMc<br>fFOP-CM<br>fFOP-NR<br>fFOP-TO | Enabled<br>Enabled<br>Enabled<br>Enabled<br>Enabled |

**Table 7-3 – Operational state function input and output signals for MPLS-TP**

| <b>Atomic function</b> | <b>Failure input (fZZZ-value)</b>                                    | <b>Operational state output (enabled/disabled)</b>  |
|------------------------|--|---|
| MT_TT_Sk               | fSSF<br>fLCK<br>fLOC<br>fMMG<br>fUNM<br>fUNP<br>fUNC<br>fDEG<br>fRDI | Enabled<br>Enabled<br>Enabled<br>Enabled<br>Enabled<br>Enabled<br>Enabled<br>Enabled<br>Enabled |
| Sn/MT_A_Sk             | fPLM<br>fLFD<br>fEXM<br>fUPM   | Enabled<br>Enabled<br>Enabled<br>Enabled  |
| Sn-X-L/MT_A_Sk         | fPLM<br>fLFD<br>fEXM<br>fUPM   | Enabled<br>Enabled<br>Enabled<br>Enabled  |
| Sm/MT_A_Sk             | fPLM<br>fLFD<br>fEXM<br>fUPM   | Enabled<br>Enabled<br>Enabled<br>Enabled  |
| Sm-X-L/MT_A_Sk         | fPLM<br>fLFD<br>fEXM<br>fUPM   | Enabled<br>Enabled<br>Enabled<br>Enabled  |
| Pq/MT_A_Sk             | fPLM<br>fLFD<br>fEXM<br>fUPM   | Enabled<br>Enabled<br>Enabled<br>Enabled  |
| Pq-X-L/MT_A_Sk         | fPLM<br>fLFD<br>fEXM<br>fUPM   | Enabled<br>Enabled<br>Enabled<br>Enabled  |
| ODUkP/MT_A_Sk          | fPLM<br>fLFD<br>fEXM<br>fUPM   | Enabled<br>Enabled<br>Enabled<br>Enabled  |
| ODUkP-h/MT_A_Sk        | fPLM<br>fLFD<br>fEXM<br>fUPM   | Enabled<br>Enabled<br>Enabled<br>Enabled  |

### 7.2.15 External events

For further study.

## 8 Configuration management

See [ITU-T G.7710] for the generic requirements for configuration management. MPLS-TP detailed specifications, if needed, are explicitly described.

### 8.1 Hardware

See [ITU-T G.7710] for a description of hardware management.

### 8.2 Software

See [ITU-T G.7710] for a description of software management.

### 8.3 Protection switching

See [ITU-T G.7710] for a description of the generic management requirements for protection switching. The MPLS-TP specific management requirements will be provided after the protection switching process is defined in [ITU-T G.8121].

### 8.4 Trail termination

See [ITU-T G.7710] for a description of trail termination management.

This function allows a user to provision and monitor the operation of the MPLS-TP Trail Termination process.

The management information (MI) signals listed in the table(s) of this clause are communicated between the EMF and the MPLS-TP trail termination process across the MP within the MT.NE.

For MT.NE that supports the MT\_TT function specified in [ITU-T G.8121], the EMF shall support the following management functions for the MI listed in Table 8-1:

- provisioning the trail termination management information;
- retrieving the trail termination management information;
- notifying the changes of the trail termination management information;
- receiving the monitored trail termination management information.

**Table 8-1 – Provisioning and reporting for termination functions**

| MI signal                | Value range                              | Default value |
|--------------------------|--|---------------|
| MT_TT_So Provisioning    |  |               |
| MT_TT_SO_MI_GAL_ENABLE   | True, false                              | (Note 3)      |
| MT_TT_So_MI_TTLVALUE     | 0 to 255                                 | 255           |
| MT_TT_So_MI_MEG_ID       | String; values are OAM protocol-specific | (Note 1)      |
| MT_TT_So_MI_MEP_ID       | String; values are OAM protocol-specific | (Note 1)      |
| MT_TT_So_MI_CC_OAM_Tool  | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]    | N/A           |
| MT_TT_So_MI_RDI_OAM_Tool | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]    | N/A           |

**Table 8-1 – Provisioning and reporting for termination functions**

| MI signal  | Value range   | Default value |
|--|---|---------------|
| MT_TT_So_MI_CC_Enable                              | True, false   | False         |
| MT_TT_So_MI_CVp_Enable                             | True, false<br>The combination of<br>MT_TT_So_MI_CC_Enable=<br>false and<br>MT_TT_So_MI_CVp_Enable<br>=true is not allowed. | False         |
| MT_TT_So_MI_CC_CoS                                 | 0, 1, 2, 3, 4, 5, 6, 7  | 7             |
| MT_TT_So_MI_CC_Period                              | 3.33 ms, 10 ms, 100 ms, 1 s,<br>10 s, 1 min, 10 min   | 100 ms        |
| MT_TT_So_MI_1LMp_Enable                            | True, false   | False         |
| MT_TT_So_MI_LMp_OAM_Tool[1... M <sub>LMp</sub> ]   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A           |
| MT_TT_So_MI_LMp_Enable[1... M <sub>LMp</sub> ]     | True, false   | False         |
| MT_TT_So_MI_LMp_Period[1... M <sub>LMp</sub> ]     | 100 ms, 1 s, 10 s   | 100 ms        |
| MT_TT_So_MI_LMp_CoS[1... M <sub>LMp</sub> ]        | 0, 1, 2, 3, 4, 5, 6, 7  | –             |
| MT_TT_So_MI_DMp_OAM_Tool[1... M <sub>DMp</sub> ]   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A           |
| MT_TT_So_MI_DMp_Enable[1... M <sub>DMp</sub> ]     | True, false   | False         |
| MT_TT_So_MI_DMp_Period[1... M <sub>DMp</sub> ]     | 100 ms, 1 s, 10 s   | 100 ms        |
| MT_TT_So_MI_DMp_Test_ID[1... M <sub>DMp</sub> ]    | (Note 2)  | –             |
| MT_TT_So_MI_DMp_CoS[1... M <sub>DMp</sub> ]        | 0, 1, 2, 3, 4, 5, 6, 7  | –             |
| MT_TT_So_MI_DMp_Length[1... M <sub>DMp</sub> ]     | Non-negative integer<br>representing number of bytes<br>for the length of the padding<br>type length value (TLV).           | 0             |
| MT_TT_So_MI_1DMp_OAM_Tool[1... M <sub>1DMp</sub> ] | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A           |
| MT_TT_So_MI_1DMp_Enable[1... M <sub>1DMp</sub> ]   | True, false   | False         |
| MT_TT_So_MI_1DMp_Period[1... M <sub>1DMp</sub> ]   | 100 ms, 1 s, 10 s   | 100 ms        |
| MT_TT_So_MI_1DMp_Test_ID[1... M <sub>1DMp</sub> ]  | (Note 2)  | –             |
| MT_TT_So_MI_1DMp_CoS[1... M <sub>1DMp</sub> ]      | 0, 1, 2, 3, 4, 5, 6, 7  | –             |
| MT_TT_So_MI_1DMp_Length[1... M <sub>1DMp</sub> ]   | Non-negative integer<br>representing number of bytes<br>for the length of the padding<br>TLV.                               | 0             |
| MT_TT_So_MI_SLP_OAM_Tool[1... M <sub>SLp</sub> ]   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A           |
| MT_TT_So_MI_SLP_Enable[1... M <sub>SLp</sub> ]     | True, false   | False         |
| MT_TT_So_MI_SLP_Period[1... M <sub>SLp</sub> ]     | 100 ms, 1 s, 10 s   | 100 ms        |
| MT_TT_So_MI_SLP_Test_ID[1... M <sub>SLp</sub> ]    | (Note 2)  | –             |
| MT_TT_So_MI_SLP_CoS[1... M <sub>SLp</sub> ]        | 0, 1, 2, 3, 4, 5, 6, 7  | –             |

**Table 8-1 – Provisioning and reporting for termination functions**

| MI signal   | Value range   | Default value |
|---|---|---------------|
| MT_TT_So_MI_SLP_Length[1... M <sub>SLP</sub> ]    | Non-negative integer representing number of bytes for the length of the padding TLV.                          | 0             |
| MT_TT_So_MI_1SLP_OAM_Tool[1...M <sub>1SLP</sub> ] | [ITU-T G.8113.1], [ITU-T G.8113.2]  | N/A           |
| MT_TT_So_MI_1SLP_Enable[1...M <sub>1SLP</sub> ]   | True, false   | False         |
| MT_TT_So_MI_1SLP_Period[1...M <sub>1SLP</sub> ]   | 100 ms, 1 s, 10 s   | 100 ms        |
| MT_TT_So_MI_1SLP_CoS[1...M <sub>1SLP</sub> ]      | 0, 1, 2, 3, 4, 5, 6, 7  | –             |
| MT_TT_So_MI_1SLP_Test_ID[1...M <sub>1SLP</sub> ]  | (Note 2)  | –             |
| MT_TT_So_MI_1SLP_Length[1...M <sub>1SLP</sub> ]   | Non-negative integer representing number of bytes for the length of the padding TLV.                          | 0             |
| <b>MT_TT_Sk Provisioning</b>                      |   |               |
| MT_TT_Sk_MI_GAL_Enable                            | True, false   | (Note 3)      |
| MT_TT_Sk_MI_MEG_ID                                | String; values are OAM protocol-specific  | (Note 2)      |
| MT_TT_Sk_MI_PeerMEP_ID                            | String; values are OAM protocol-specific  | Empty list    |
| MT_TT_Sk_MI_CC_OAM_Tool                           | [ITU-T G.8113.1], [ITU-T G.8113.2]  | N/A           |
| MT_TT_Sk_MI_RDI_OAM_Tool                          | [ITU-T G.8113.1], [ITU-T G.8113.2]  | N/A           |
| MT_TT_Sk_MI_CC_Enable                             | True, false   | False         |
| MT_TT_Sk_MI_CVp_Enable                            | True, false<br>The combination of MT_TT_Sk_MI_CC_Enable=false and MT_TT_Sk_MI_CVp_Enable=true is not allowed. | False         |
| MT_TT_Sk_MI_CC_Period                             | 3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min  | 100 ms        |
| MT_TT_Sk_MI_CC_CoS                                | 0, 1, 2, 3, 4, 5, 6, 7  | 7             |
| MT_TT_Sk_MI_ILMp_Enable                           | True, false   | False         |
| MT_TT_Sk_MI_Get_SvdCC                             | Last received continuity check (CC) frame(s) that caused defect   | –             |

**Table 8-1 – Provisioning and reporting for termination functions**

| MI signal  | Value range  | Default value     |
|--|--|-------------------|
| MT_TT_Sk_MI_LMp_OAM_Tool[1... M <sub>LMp</sub> ]   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]                | N/A               |
| MT_TT_Sk_MI_LMp_Enable[1... M <sub>LMp</sub> ]   | True, false  | False             |
| MT_TT_Sk_MI_LMp_CoS[1... M <sub>LMp</sub> ]  | 0, 1, 2, 3, 4, 5, 6, 7                               | –                 |
| MT_TT_Sk_MI_LM_DEGM  | 2-10; See Table 7-1 of<br>[ITU-T G.806]              | 10                |
| MT_TT_Sk_MI_LM_M   | 2-10   | 10                |
| MT_TT_Sk_MI_LM_DEGTHR  | 0% to 100%; See Table 7-1<br>of [ITU-T G.806]        | 30%               |
| MT_TT_Sk_MI_LM_TFMIN   | For further study                                    | For further study |
| MT_TT_Sk_MI_1second  | –  | –                 |
| MT_TT_Sk_MI_DMp_OAM_Tool[1... M <sub>DMp</sub> ]   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]                | N/A               |
| MT_TT_Sk_MI_DMp_Enable[1... M <sub>DMp</sub> ]   | True, false  | False             |
| MT_TT_Sk_MI_DMp_CoS[1... M <sub>DMp</sub> ]  | 0, 1, 2, 3, 4, 5, 6, 7                               | –                 |
| MT_TT_Sk_MI_1DMp_OAM_Tool[1... M <sub>1DMp</sub> ]   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]                | N/A               |
| MT_TT_Sk_MI_1DMp_Enable[1...M <sub>1DMp</sub> ]  | True, false  | False             |
| MT_TT_Sk_MI_1DMp_Test_ID[1...M <sub>1DMp</sub> ]   | (Note 2)   | –                 |
| MT_TT_Sk_MI_SLP_OAM_Tool[1... M <sub>SLp</sub> ]   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]                | N/A               |
| MT_TT_Sk_MI_SLP_Enable[1... M <sub>SLp</sub> ]   | True, false  | False             |
| MT_TT_Sk_MI_SLP_CoS[1... M <sub>SLp</sub> ]  | 0, 1, 2, 3, 4, 5, 6, 7                               | –                 |
| MT_TT_Sk_MI_1SLp_OAM_Tool  | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]                | N/A               |
| MT_TT_Sk_MI_1SLp_Enable[1... M <sub>1SLp</sub> ]   | True, false  | False             |
| MT_TT_Sk_MI_1SLp_Test_ID[1... M <sub>1SLp</sub> ]  | (Note 2)   | –                 |
| MT_TT_Sk_MI_AIS_OAM_Tool   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]                | N/A               |
| MT_TT_Sk_MI_LCK_OAM_Tool   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]                | N/A               |
| <b>MT_TT_Sk Reporting</b>  |  |                   |
| MT_TT_Sk_MI_SvdCC  | Last received CC packet(s)<br>that causes the defect | –                 |
| <p>NOTE 1 – A value must be provided at provisioning.</p> <p>NOTE 2 – The Test ID field is optional when this proactive measurement tool is used.</p> <p>NOTE 3 – MI_GAL_Enable must be set to true on label switched paths (LSPs) and sections, and to false on pseudowires (PWs). Setting it to true for PWs is for further study.</p> |  |                   |

### 8.4.1 Trail termination – ITU-T G.8121.1 specific

For MT.NE that supports the MT\_TT function specified in [ITU-T G.8121.1], there is no additional MI to be managed beyond those listed in Table 8-1.

NOTE – In [ITU-T G.8121.1], MI\_LMC\_Enable and MI\_LML\_Enable are used to mean MI\_ILMp\_Enable and MI\_LMp\_Enable as described in [ITU-T G.8121].

### 8.4.2 Trail termination – ITU-T G.8121.2 specific

For MT.NE that supports the MT\_TT function specified in [ITU-T G.8121.2], the EMF shall in addition support the management of the MIs listed in Table 8-1.1:

**Table 8-1.1 – Provisioning and reporting for termination functions**

| MI signal                                    | Value range  | Default value |
|--|--|---------------|
| MT_TT_So Provisioning                        |  |               |
| MT_TT_So_MI_CCCV_Mode[]                      | Coord, Src, Sink   | Coord         |
| MT_TT_So_MI_Local_Discr[]                    | 32-bit value   | 0             |
| MT_TT_So Reporting                           |  |               |
| MT_TT_So_MI_DMp_PeriodChanged[1...MDMp]      | True, false  | False         |
| MT_TT_So_MI_LMp_PeriodChanged[1...MLMp]      | True, false  | False         |
| MT_TT_Sk Provisioning                        |  |               |
| MT_TT_Sk_MI_CCCV_Mode[]                      | Coord, Src, Sink   | Coord         |
| MT_TT_Sk_MI_Remote_Discr[]                   | 32-bit value   | 0             |
| MT_TT_Sk_MI_PeerMEPID[]                      |  |               |
| MT_TT_Sk_MI_DMp_CopyPad[1...MDMp]            | 0,128  | 0             |
| MT_TT_Sk_MI_LMp_LMType[1...MLMp]             | Inferred loss measurement (ILM), direct loss measurement (DLM) |               |
| MT_TT_Sk_MI_LMp_CountBytes[1...MLMp]         | True, false  | True          |
| MT_TT_Sk_MI_PM_ClearError                    | –  | –             |
| MT_TT_Sk_MI_PM_Responder_Enable              | True, false  | True          |
| MT_TT_Sk Reporting                           |  |               |
| MT_TT_Sk_MI_DMp_ReportError(Error)[1...MDMp] | True, false  | False         |
| MT_TT_Sk_MI_LMp_ReportError(Error)[1...MLMp] | True, false  | False         |

## 8.5 Adaptation

See clause 8.5 of [ITU-T G.7710] for a description of adaptation management.

An access point that has multiple adaptation functions connected to it, thereby allowing different clients to be transported via the server signal, requires a mechanism for the selection of the active client.

This function allows a user to provision and monitor the operation of the MPLS-TP adaptation processes.

The MI signals listed in the following table are communicated between the EMF and the adaptation processes across the management point within the MPLS-TP NE.

For MT.NE that supports the adaptation functions specified in [ITU-T G.8121], the EMF shall support the following management functions for the MI listed in Table 8-2:

- provisioning the flow forwarding management information;
- retrieving the flow forwarding management information;
- notifying the changes of the flow forwarding management information.

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal                            | Value range  | Default value     |
|--------------------------------------|--|-------------------|
| MT/MT_A_So Provisioning              |  |                   |
| MT/MT_A_So_MI_Admin_State            | Locked (LCK), Normal   | Normal            |
| MT/MT_A_So_MI_Label [1...M]          | 16 to (2**20)-1  | (Note 2)          |
| MT/MT_A_So_MI_LSPTYPE[1...M]         | Explicitly TC-encoded-PSC LSP (E-LSP), label-only-inferred PSC LSP (L-LSP) | (Note 1)          |
| MT/MT_A_So_MI_CoS[1...M]             | (Note 1)   | (Note 1)          |
| MT/MT_A_So_MI_PHB2EXPMapping[1...M]  | (Note 1)   | (Note 1)          |
| MT/MT_A_So_MI_QoSEncodingMode[1...M] | A, B (Note 5)  | (Note 2)          |
| MT/MT_A_So_MI_Mode                   | Mode 1, Mode 2   | Mode 1            |
| MT/MT_A_So_MI_LCK_OAM_Tool[1...M]    | [ITU-T G.8113.1], [ITU-T G.8113.2]   | N/A               |
| MT/MT_A_So_MI_LCK_Period[1...M]      | 1 s, 1 min   | 1 s               |
| MT/MT_A_So_MI_LCK_CoS[1...M]         | 0 to 7   | 7                 |
| MT/MT_A_So_MI_APS_OAM_Tool[1...M]    | For further study  | For further study |
| MT/MT_A_So_MI_APS_CoS[1...M]         | 0 to 7   | 7                 |
| MT/MT_A_So_MI_GAL_Enable[1...M]      | True, false  | (Note 4)          |
| MT/MT_A_Sk Provisioning              |  |                   |
| MT/MT_A_Sk_MI_Admin_State            | LCK, Normal  | Normal            |
| MT/MT_A_Sk_MI_Label [1...M]          | 16 to (2**20)-1  | (Note 2)          |
| MT/MT_A_Sk_MI_LSPTYPE[1...M]         | E-LSP, L-LSP   | (Note 1)          |
| MT/MT_A_Sk_MI_CoS[1...M]             | (Note 1)   | (Note 1)          |
| MT/MT_A_Sk_MI_TC2PHBMapping[1...M]   | (Note 1)   | (Note 1)          |
| MT/MT_A_Sk_MI_QoSDecodingMode[1...M] | A, B (Note 5)  | (Note 2)          |
| MT/MT_A_Sk_MI_Mode                   | Mode 1, Mode 2   | Mode 1            |
| MT/MT_A_Sk_MI_AIS_OAM_Tool[1...M]    | [ITU-T G.8113.1], [ITU-T G.8113.2]   | N/A               |
| MT/MT_A_Sk_MI_AIS_Period[1...M]      | 1 s, 1 min   | 1 s               |
| MT/MT_A_Sk_MI_AIS_CoS[1...M]         | 0 to 7   | 7                 |
| MT/MT_A_Sk_MI_LCK_OAM_Tool[1...M]    | [ITU-T G.8113.1], [ITU-T G.8113.2]   | N/A               |
| MT/MT_A_Sk_MI_LCK_Period[1...M]      | 1 s, 1 min   | 1 s               |
| MT/MT_A_Sk_MI_LCK_CoS[1...M]         | 0 to 7   | 7                 |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal   | Value range   | Default value     |
|---|---|-------------------|
| MT/MT_A_Sk_MI_APS_OAM_Tool[1...M]   | For further study   | For further study |
| MT/MT_A_Sk_MI_GAL_Enable [1...M]  | True, false   | (Note 4)          |
| <b>MT/MSRP_A_So Provisioning</b>  |   |                   |
| MT/MSRP_A_So_MI_GAL_Enable  | True, false   | True              |
| MT/MSRP_A_So_MI_APS_CoS   | 0...7   |                   |
| MT/MSRP_A_So_MI_APS_OAM_Tool  | MSRP (See [ITU-T G.8121])   | N/A               |
| <b>MT/MSRP_A_Sk Provisioning</b>  |   |                   |
| MT/MSRP_A_Sk_MI_GAL_Enable  | True, false   | True              |
| MT/MSRP_A_Sk_MI_APS_OAM_Tool  | MSRP (See [ITU-T G.8121])   | N/A               |
| <b>MSRP/MT_A_Sk Provisioning</b>  |   |                   |
| MSRP/MT_MI_DestNode_ID[1...m]   | For further study   | For further study |
| <b>MTDi/MT_A_Sk Provisioning</b>  |   |                   |
| MTDi/MT_A_Sk_MI_DS_MP_Type<br>NOTE – This MI should be properly configured by the EMF on the basis of the MPLS-TP connection configuration within the node but not exposed to the operator as a configuration parameter in the NE/EMS management interface. See clause 9.4.2.2.2 of [ITU-T G.8121] and its Appendix I for examples of configuration of this MI. | Maintenance entity group end point (MEP), Maintenance entity group intermediate Point (MIP) | –                 |
| <b>MT/ETH_A_So Provisioning</b>   |   |                   |
| MT/ETH_A_So_MI_Admin_State  | LCK, Normal   | Normal            |
| MT/ETH_A_So_MI_FCSEnable  | True, false   | True              |
| MT/ETH_A_So_MI_CWEnable   | True, false   | True              |
| MT/ETH_A_So_MI_SQUse  | True, false   | False             |
| MT/ETH_A_So_MI_PRI2CoSMapping   | (Note 1)  | (Note 1)          |
| MT/ETH_A_So_MI_MEP_MAC* (Note 3)  | 6-byte unicast MAC address  | –                 |
| MT/ETH_A_So_MI_Client_MEL* (Note 3)   | 0 to 7  | 7                 |
| MT/ETH_A_So_MI_LCK_Period* (Note 3)   | 1 s, 1 min  | 1 s               |
| MT/ETH_A_So_MI_LCK_Pri* (Note 3)  | 0 to 7  | 7                 |
| MT/ETH_A_So_MI_MEL* (Note 3)  | 0 to 7  | 7                 |
| MT/ETH_A_Sk_MI_GAL_Enable   | True, false   | (Note 4)          |
| MT/ETH_A_Sk_MI_CSF_OAM_Tool   | [ITU-T G.8113.1], [ITU-T G.8113.2]  | N/A               |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal                            | Value range                           | Default value |
|--------------------------------------|---------------------------------------|---------------|
| MT/ETH_A_So_MI_CSF_Period            | (Note 1)                              | (Note 1)      |
| MT/ETH_A_So_MI_CSF_CoS               | 0 to 7                                | 7             |
| MT/ETH_A_So_MI_CSF_Enable            | True, false                           | False         |
| MT/ETH_A_So_MI_CSFrdifdiEnable       | True, false                           | False         |
| MT/ETH_A_Sk Provisioning             |                                       |               |
| MT/ETH_A_Sk_MI_FCSEnable             | True, false                           | True          |
| MT/ETH_A_Sk_MI_CWEnable              | True, false                           | False         |
| MT/ETH_A_Sk_MI_SQUse                 | True, false                           | False         |
| MT/ETH_A_Sk_MI_GAL_Enable            | True, false                           | (Note 4)      |
| MT/ETH_A_Sk_MI_CoS2PRIMapping        | (Note 1)                              | (Note 1)      |
| MT/ETH_A_Sk_MI_MEL* (Note 3)         | 0 to 7                                | 7             |
| MT/ETH_A_Sk_MI_Admin_State           | LCK, Normal                           | Normal        |
| MT/ETH_A_Sk_MI_LCK_Period * (Note 3) | 1 s, 1 min                            | 1 s           |
| MT/ETH_A_Sk_MI_LCK_Pri * (Note 3)    | 0 to 7                                | 7             |
| MT/ETH_A_Sk_MI_Client_MEL * (Note 3) | 0 to 7                                | 7             |
| MT/ETH_A_Sk_MI_MEP_MAC * (Note 3)    | 6-byte unicast MAC address            | –             |
| MT/ETH_A_Sk_MI_AIS_Pri * (Note 3)    | 0 to 7                                | 7             |
| MT/ETH_A_Sk_MI_AIS_Period * (Note 3) | 1 s, 1 min                            | 1 s           |
| MT/ETH_A_Sk_MI_GAL_Enable            | True, false                           | (Note 4)      |
| MT/ETH_A_Sk_MI_CSF_OAM_Tool          | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| MT/ETH_A_Sk_MI_CSF_Reported          | True, false                           | False         |
| MT/ETH_A_Sk_MI_CSFrdifdiEnable       | True, false                           | False         |
| MT/SCC_A_So Provisioning             |                                       |               |
| MT/SCC_A_So_MI_Active                | True, false                           | True          |
| MT/SCC_A_So_MI_ECC_CoS               | 0 to 7                                | 7             |
| MT/SCC_A_So_MI_GAL_Enable            | True, false                           | (Note 4)      |
| MT/SCC_A_Sk Provisioning             |                                       |               |
| MT/SCC_A_Sk_MI_Active                | True, false                           | True          |
| MT/SCC_A_Sk_GAL_Enable               | True, false                           | (Note 4)      |
| MT/MCC_A_So Provisioning             |                                       |               |
| MT/MCC_A_So_MI_Active                | True, false                           | True          |
| MT/MCC_A_So_MI_ECC_CoS               | 0 to 7                                | 7             |
| MT/MCC_A_So_MI_GAL_enable            | True, false                           | (Note 4)      |
| MT/MCC_A_Sk Provisioning             |                                       |               |
| MT/MCC_A_Sk_MI_Active                | True, false                           | True          |
| MT/MCC_A_Sk_MI_GAL_Enable            | True, false                           | (Note 4)      |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal   | Value range                           | Default value |
|---|---------------------------------------|---------------|
| Sn/MT_A_So Provisioning   |                                       |               |
| Sn/MT_A_So_MI_SCCType   | 0 to 255                              | 32            |
| Sn/MT_A_So_MI_Label[1...M]                                      | 16 to (2**20)-1                       | (Note 2)      |
| Sn/MT_A_So_MI_LSPTType[1...M]                                   | E-LSP, L-LSP                          | –             |
| Sn/MT_A_So_MI_CoS[1...M]  | 0 to 7                                | –             |
| Sn/MT_A_So_PHB2TCMapping[1...M]                                 | (Note 1)                              | –             |
| Sn/MT_A_So_MI_QoSEncodingMode[1...M]                            | A, B (Note 5)                         | –             |
| Sn/MT_A_So_MI_Mode[1...M]                                       | Mode 1, Mode 2                        | Mode 1        |
| Sn/MT_A_Sk Provisioning   |                                       |               |
| Sn/MT_A_Sk_MI_SCCType   | 0 to 255                              | 32            |
| Sn/MT_A_Sk_MI_Label[1...M]                                      | 16 to (2**20)-1                       | (Note 2)      |
| Sn/MT_A_Sk_MI_LSPTType[1...M]                                   | E-LSP, L-LSP                          | (Note 1)      |
| Sn/MT_A_Sk_MI_CoS[1...M]  | (Note 1)                              | (Note 1)      |
| Sn/MT_A_Sk_MI_TC2PHBMapping[1...M]                              | (Note 1)                              | (Note 1)      |
| Sn/MT_A_Sk_MI_QoSDecodingMode[1...M]                            | A, B (Note 5)                         | (Note 1)      |
| Sn/MT_A_Sk_MI_Mode[1...M]                                       | Mode 1, Mode 2                        | Mode 1        |
| Sn/MT_A_Sk_MI_LCK_Period[1...M]                                 | 1 s, 1 min                            | 1 s           |
| Sn/MT_A_Sk_MI_LCK_CoS[1...M]                                    | 0 to 7                                | –             |
| Sn/MT_A_Sk_MI_LCK_OAM_Tool [1...M]                              | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Sn/MT_A_Sk_MI_Admin_State                                       | LCK, Normal                           | Normal        |
| Sn/MT_A_Sk_MI_AIS_Period[1...M]                                 | 1 s, 1 min                            | 1 s           |
| Sn/MT_A_Sk_MI_AIS_CoS[1...M]                                    | 0 to 7                                | –             |
| Sn/MT_A_Sk_MI_AIS_OAM_Tool[1...M]                               | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Sn/MT_A_Sk_MI_GAL_enable[1...M]                                 | True, false                           | (Note 4)      |
| Sn/MT_A_Sk Reporting  |                                       |               |
| Sn/MT_A_Sk_MI_AcSL<br>(see Table 9-11 of [ITU-T G.707])         | 0 to 255                              | –             |
| Sn/MT_A_Sk_MI_AcEXI<br>(see Table 6-2 of [ITU-T G.7041])        | 0 to 15                               | –             |
| Sn/MT_A_Sk_MI_LastValidUPI<br>(see Table 6-3 of [ITU-T G.7041]) | 0 to 255                              | –             |
| Sn-X-L/MT_A_So Provisioning                                     |                                       |               |
| Sn-X-L/MT_A_So_MI_SCCType<br>(See Table 6-3 of [ITU-T G.7041])  | 0 to 255                              | 32            |
| Sn-X-L/MT_A_So_MI_Label[1...M]                                  | 16 to (2**20)-1                       | (Note 2)      |
| Sn-X-L/MT_A_So_MI_LSPTType[1...M]                               | E-LSP, L-LSP                          | –             |
| Sn-X-L/MT_A_So_MI_CoS[1...M]                                    | 0 to 7                                | (Note 1)      |
| Sn-X-L/MT_A_So_PHB2TCMapping[1...M]                             | (Note 1)                              | (Note 1)      |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal   | Value range                           | Default value |
|---|---------------------------------------|---------------|
| Sn-X-L/MT_A_So_MI_QoSEncodingMode[1...M]                            | A, B (Note 5)                         | (Note 1)      |
| Sn-X-L/MT_A_So_MI_Mode[1...M]                                       | Mode 1, Mode 2                        | Mode 1        |
| Sn-X-L/MT_A_Sk Provisioning   |                                       |               |
| Sn-X-L/MT_A_Sk_MI_SCCType<br>(See Table 6-3 of [ITU-T G.7041])      | 0 to 255                              | 32            |
| Sn-X-L/MT_A_Sk_MI_Label[1...M]                                      | 16 to (2**20)-1                       | (Note 2)      |
| Sn-X-L/MT_A_Sk_MI_LSPTType[1...M]                                   | E-LSP, L-LSP                          | –             |
| Sn-X-L/MT_A_Sk_MI_CoS[1...M]  | 0 to 7                                | (Note 1)      |
| Sn-X-L/MT_A_Sk_MI_TC2PHBMapping[1...M]                              | (Note 1)                              | (Note 1)      |
| Sn-X-L/MT_A_Sk_MI_QoSDecodingMode[1...M]                            | A, B (Note 5)                         | (Note 1)      |
| Sn-X-L/MT_A_Sk_MI_Mode[1...M]                                       | Mode 1, Mode 2                        | Mode 1        |
| Sn-X-L/MT_A_Sk_MI_LCK_Period[1...M]                                 | 1 s, 1 min                            | 1 s           |
| Sn-X-L/MT_A_Sk_MI_LCK_CoS[1...M]                                    | 0 to 7                                | –             |
| Sn-X-L/MT_A_Sk_MI_LCK_OAM_Tool [1...M]                              | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Sn-X-L/MT_A_Sk_MI_Admin_State                                       | LCK, Normal                           | Normal        |
| Sn-X-L/MT_A_Sk_MI_AIS_Period[1...M]                                 | 1 s, 1 min                            | 1 s           |
| Sn-X-L/MT_A_Sk_MI_AIS_CoS[1...M]                                    | 0 to 7                                | –             |
| Sn-X-L/MT_A_Sk_MI_AIS_OAM_Tool [1...M]                              | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Sn-X-L /MT_A_Sk_MI_GAL_Enable [1...M]                               | True, false                           | (Note 4)      |
| Sn-X-L/MT_A_Sk Reporting  |                                       |               |
| Sn-X-L/MT_A_Sk_MI_AcSL<br>(see Table 9-11 of [ITU-T G.707])         | 0 to 255                              | –             |
| Sn-X-L/MT_A_Sk_MI_AcEXI<br>(see Table 6-2 of [ITU-T G.7041])        | 0 to 15                               | –             |
| Sn-X-L/MT_A_Sk_MI_LastValidUPI<br>(See Table 6-3 of [ITU-T G.7041]) | 0 to 255                              | –             |
| Sm/MT_A_So Provisioning   |                                       |               |
| Sm/MT_A_So_MI_SCCType   | 0 to 255                              | 32            |
| Sm/MT_A_So_MI_Label[1...M]  | 16 to (2**20)-1                       | (Note 2)      |
| Sm/MT_A_So_MI_LSPTType[1...M]                                       | E-LSP, L-LSP                          | –             |
| Sm/MT_A_So_MI_CoS[1...M]  | 0 to 7                                | –             |
| Sm/MT_A_So_PHB2TCMapping[1...M]                                     | (Note 1)                              | (Note 1)      |
| Sm/MT_A_So_MI_QoSEncodingMode[1...M]                                | A, B (Note 5)                         | (Note 1)      |
| Sm/MT_A_So_MI_Mode[1...M]   | Mode 1, Mode 2                        | Mode 1        |
| Sm/MT_A_Sk Provisioning   |                                       |               |
| Sm/MT_A_Sk_MI_SCCType   | 0 to 255                              | 32            |
| Sm/MT_A_Sk_MI_Label[1...M]  | 16 to (2**20)-1                       | (Note 2)      |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal  | Value range                           | Default value |
|--|---------------------------------------|---------------|
| Sm/MT_A_Sk_MI_LSPType[1...M]   | E-LSP, L-LSP                          | –             |
| Sm/MT_A_Sk_MI_CoS[1...M]   | 0 to 7                                | –             |
| Sm/MT_A_Sk_MI_TC2PHBMapping[1...M]                                     | (Note 1)                              | (Note 1)      |
| Sm/MT_A_Sk_MI_QoSDecodingMode[1...M]                                   | A, B (Note 5)                         | (Note 1)      |
| Sm/MT_A_Sk_MI_Mode[1...M]  | Mode 1, Mode 2                        | Mode 1        |
| Sm/MT_A_Sk_MI_LCK_Period[1...M]  | 1 s, 1 min                            | 1 s           |
| Sm/MT_A_Sk_MI_LCK_CoS[1...M]   | 0 to 7                                | –             |
| Sm/MT_A_Sk_MI_LCK_OAM_Tool [1...M]                                     | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Sm/MT_A_Sk_MI_Admin_State  | LCK, Normal                           | Normal        |
| Sm/MT_A_Sk_MI_AIS_Period[1...M]  | 1 s, 1 min                            | 1 s           |
| Sm/MT_A_Sk_MI_AIS_CoS[1...M]   | 0 to 7                                | –             |
| Sm/MT_A_Sk_MI_AIS_OAM_Tool[1...M]                                      | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Sm/MT_A_Sk_MI_GAL_Enable[1...M]  | True, false                           | (Note 4)      |
| <b>Sm/MT_A_Sk Reporting</b>  |                                       |               |
| Sm/MT_A_Sk_MI_AcSL<br>(See Table 9-12 and Table 9-13 of [ITU-T G.707]) | 0 to 255                              | –             |
| Sm/MT_A_Sk_MI_AcEXI<br>(See Table 6-2 of [ITU-T G.7041])               | 0 to 15                               | –             |
| Sm/MT_A_Sk_MI_LastValidUPI<br>(See Table 6-3 of [ITU-T G.7041])        | 0 to 255                              | –             |
| <b>Sm-X-L/MT_A_So Provisioning</b>                                     |                                       |               |
| Sm-X-L/MT_A_So_MI_SCCType  | 0 to 255                              | 32            |
| Sm-X-L/MT_A_So_MI_Label[1...M]   | 16 to (2**20)-1                       | (Note 2)      |
| Sm-X-L/MT_A_So_MI_LSPType[1...M]                                       | E-LSP, L-LSP                          | –             |
| Sm-X-L/MT_A_So_MI_CoS[1...M]   | 0 to 7                                | –             |
| Sm-X-L/MT_A_So_PHB2TCMapping[1...M]                                    | (Note 1)                              | (Note 1)      |
| Sm-X-L/MT_A_So_MI_QoSEncodingMode[1...M]                               | A, B (Note 5)                         | (Note 1)      |
| Sm-X-L/MT_A_So_MI_Mode[1...M]  | Mode 1, Mode 2                        | Mode 1        |
| <b>Sm-X-L/MT_A_Sk Provisioning</b>                                     |                                       |               |
| Sm-X-L/MT_A_Sk_MI_SCCType  | 0 to 255                              | 32            |
| Sm-X-L/MT_A_Sk_MI_Label[1...M]   | 16 to (2**20)-1                       | (Note 2)      |
| Sm-X-L/MT_A_Sk_MI_LSPType[1...M]                                       | E-LSP, L-LSP                          | –             |
| Sm-X-L/MT_A_Sk_MI_CoS[1...M]   | 0 to 7                                | –             |
| Sm-X-L/MT_A_Sk_MI_TC2PHBMapping[1...M]                                 | (Note 1)                              | (Note 1)      |
| Sm-X-L/MT_A_Sk_MI_QoSDecodingMode[1...M]                               | A, B (Note 5)                         | (Note 1)      |
| Sm-X-L/MT_A_Sk_MI_Mode[1...M]  | Mode 1, Mode 2                        | Mode 1        |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal                              | Value range                           | Default value |
|--|---------------------------------------|---------------|
| Sm-X-L/MT_A_Sk_MI_LCK_Period[1...M]    | 1 s, 1 min                            | 1 s           |
| Sm-X-L/MT_A_Sk_MI_LCK_CoS[1...M]       | 0 to 7                                | –             |
| Sm-X-L/MT_A_Sk_MI_LCK_OAM_Tool [1...M] | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Sm-X-L/MT_A_Sk_MI_Admin_State          | LCK, Normal                           | Normal        |
| Sm-X-L/MT_A_Sk_MI_AIS_Period[1...M]    | 1 s, 1 min                            | 1 s           |
| Sn-X-L/MT_A_Sk_MI_AIS_CoS[1...M]       | 0 to 7                                | –             |
| Sm-X-L/MT_A_Sk_MI_AIS_OAM_Tool [1...M] | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Sm-X-L/MT_A_Sk_MI_GAL_Enable[1...M]    | True, false                           | (Note 4)      |
| <b>Sm-X-L/MT_A_Sk Reporting</b>        |                                       |               |
| Sm-X-L/MT_A_Sk_MI_AcSL                 | 0 to 255                              | –             |
| Sm-X-L/MT_A_Sk_MI_AcEXI                | 0 to 15                               | –             |
| Sm-X-L/MT_A_Sk_MI_LastValidUPI         | 0 to 255                              | –             |
| <b>Pq/MT_A_So Provisioning</b>         |                                       |               |
| Pq/MT_A_So_MI_SCCType                  | 0 to 255                              | 32            |
| Pq/MT_A_So_MI_Label[1...M]             | 16 to (2**20)-1                       | (Note 2)      |
| Pq/MT_A_So_MI_LSPTType[1...M]          | E-LSP, L-LSP                          | –             |
| Pq/MT_A_So_MI_CoS[1...M]               | 0 to 7                                | –             |
| Pq/MT_A_So_PHB2TCMapping[1...M]        | (Note 1)                              | (Note 1)      |
| Pq/MT_A_So_MI_QoSEncodingMode[1...M]   | A, B (Note 5)                         | (Note 1)      |
| Pq/MT_A_So_MI_Mode[1...M]              | Mode 1, Mode 2                        | Mode 1        |
| <b>Pq/MT_A_Sk Provisioning</b>         |                                       |               |
| Pq/MT_A_Sk_MI_SCCType                  | 0 to 255                              | 32            |
| Pq/MT_A_Sk_MI_Label[1...M]             | 16 to (2**20)-1                       | (Note 2)      |
| Pq/MT_A_Sk_MI_LSPTType[1...M]          | E-LSP, L-LSP                          | –             |
| Pq/MT_A_Sk_MI_CoS[1...M]               | 0 to 7                                | –             |
| Pq/MT_A_Sk_MI_TC2PHBMapping[1...M]     | (Note 1)                              | (Note 1)      |
| Pq/MT_A_Sk_MI_QoSDecodingMode[1...M]   | A, B (Note 5)                         | (Note 1)      |
| Pq/MT_A_Sk_MI_Mode[1...M]              | Mode 1, Mode 2                        | Mode 1        |
| Pq/MT_A_Sk_MI_LCK_Period[1...M]        | 1 s, 1 min                            | 1 s           |
| Pq/MT_A_Sk_MI_LCK_CoS[1...M]           | 0 to 7                                | –             |
| Pq/MT_A_Sk_MI_LCK_Tool[1...M]          | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Pq/MT_A_Sk_MI_Admin_State              | LCK, Normal                           | Normal        |
| Pq/MT_A_Sk_MI_AIS_Period[1...M]        | 1 s, 1 min                            | 1 s           |
| Pq/MT_A_Sk_MI_AIS_CoS[1...M]           | 0 to 7                                | –             |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal   | Value range                           | Default value |
|---|---------------------------------------|---------------|
| Pq/MT_A_Sk_MI_AIS_Tool[1...M]                                   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Pq/MT_A_Sk_MI_GAL_Enable [1...M]                                | True, false                           | (Note 4)      |
| Pq/MT_A_Sk Reporting  |                                       |               |
| Pq/MT_A_Sk_MI_AcSL<br>(See clause 2.1.2 of [ITU-T G.832])       | 0 to 7                                | –             |
| Pq/MT_A_Sk_MI_AcEXI<br>(See Table 6-2 of [ITU-T G.7041])        | 0 to 15                               | –             |
| Pq/MT_A_Sk_MI_LastValidUPI<br>(See Table 6-3 of [ITU-T G.7041]) | 0 to 255                              | –             |
| Pq-X-L/MT_A_So Provisioning                                     |                                       |               |
| Pq-X-L/MT_A_So_MI_SCCType                                       | 0 to 255                              | 32            |
| Pq-X-L/MT_A_So_MI_Label[1...M]                                  | 16 to (2**20)-1                       | (Note 2)      |
| Pq-X-L/MT_A_So_MI_LSPTType[1...M]                               | E-LSP, L-LSP                          | –             |
| Pq-X-L/MT_A_So_MI_CoS[1...M]                                    | 0 to 7                                | –             |
| Pq-X-L/MT_A_So_PHB2TCMapping[1...M]                             | (Note 1)                              | (Note 1)      |
| Pq-X-L/MT_A_So_MI_QoSEncodingMode[1...M]                        | A, B (Note 5)                         | (Note 1)      |
| Pq-X-L /MT_A_So_MI_Mode[1...M]                                  | Mode 1, Mode 2                        | Mode 1        |
| Pq-X-L/MT_A_Sk Provisioning                                     |                                       |               |
| Pq-X-L/MT_A_Sk_MI_SCCType                                       | 0 to 255                              | 32            |
| Pq-X-L/MT_A_Sk_MI_Label[1...M]                                  | 16 to (2**20)-1                       | (Note 2)      |
| Pq-X-L/MT_A_Sk_MI_LSPTType[1...M]                               | E-LSP, L-LSP                          | –             |
| Pq-X-L/MT_A_Sk_MI_CoS[1...M]                                    | 0 to 7                                | –             |
| Pq-X-L/MT_A_Sk_MI_TC2PHBMapping[1...M]                          | (Note 1)                              | (Note 1)      |
| Pq-X-L/MT_A_Sk_MI_QoSDecodingMode[1...M]                        | A, B (Note 5)                         | (Note 1)      |
| Pq-X-L/MT_A_Sk_MI_Mode[1...M]                                   | Mode 1, Mode 2                        | Mode 1        |
| Pq-X-L/MT_A_Sk_MI_LCK_Period[1...M]                             | 1 s, 1 min                            | 1 s           |
| Pq-X-L/MT_A_Sk_MI_LCK_CoS[1...M]                                | 0 to 7                                | –             |
| Pq-X-L/MT_A_Sk_MI_LCK_Tool[1...M]                               | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Pq-X-L/MT_A_Sk_MI_Admin_State                                   | LCK, Normal                           | Normal        |
| Pq-X-L/MT_A_Sk_MI_AIS_Period[1...M]                             | 1 s, 1 min                            | 1 s           |
| Pq-X-L/MT_A_Sk_MI_AIS_CoS[1...M]                                | 0 to 7                                | –             |
| Pq-X-L/MT_A_Sk_MI_AIS_Tool[1...M]                               | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| Pq-X-L//MT_A_Sk_MI_GAL_Enable[1...M]                            | True, false                           | (Note 4)      |
| Pq-X-L/MT_A_Sk Reporting  |                                       |               |
| Pq-X-L/MT_A_Sk_MI_AcSL  | 0 to 7                                | –             |
| Pq-X-L/MT_A_Sk_MI_AcEXI   | 0 to 15                               | –             |
| Pq-X-L/MT_A_Sk_MI_LastValidUPI                                  | 0 to 255                              | –             |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal  | Value range                           | Default value |
|--|---------------------------------------|---------------|
| ODUKP/MT_A_So Provisioning   |                                       |               |
| ODUKP/MT_A_So_MI_Active  | True, false                           | False         |
| ODUKP/MT_A_So_MI_SCCType   | 0 to 255                              | 32            |
| ODUKP/MT_A_So_MI_Label[1...M]                                      | 16 to (2**20)-1                       | (Note 2)      |
| ODUKP/MT_A_So_MI_LSPTType[1...M]                                   | E-LSP, L-LSP                          | –             |
| ODUKP/MT_A_So_MI_CoS[1...M]  | 0 to 7                                | –             |
| ODUKP/MT_A_So_PHB2TCMapping[1...M]                                 | (Note 1)                              | (Note 1)      |
| ODUKP/MT_A_So_MI_QoSEncodingMode[1...M]                            | A, B (Note 5)                         | (Note 1)      |
| ODUKP/MT_A_So_MI_Mode[1...M]                                       | Mode 1, Mode 2                        | Mode 1        |
| ODUKP/MT_A_Sk Provisioning   |                                       |               |
| ODUKP/MT_A_Sk_MI_Active  | True, false                           | False         |
| ODUKP/MT_A_Sk_MI_SCCType   | 0 to 255                              | 32            |
| ODUKP/MT_A_Sk_MI_Label[1...M]                                      | 16 to (2**20)-1                       | (Note 2)      |
| ODUKP/MT_A_Sk_MI_LSPTType[1...M]                                   | E-LSP, L-LSP                          | –             |
| ODUKP/MT_A_Sk_MI_CoS[1...M]  | 0 to 7                                | –             |
| ODUKP/MT_A_Sk_MI_TC2PHBMapping[1...M]                              | (Note 1)                              | (Note 1)      |
| ODUKP/MT_A_Sk_MI_QoSDecodingMode[1...M]                            | A, B (Note 5)                         | (Note 1)      |
| ODUKP/MT_A_So_MI_Mode[1...M]                                       | Mode 1, Mode 2                        | Mode 1        |
| ODUKP/MT_A_Sk_MI_LCK_Period[1...M]                                 | 1 s, 1 min                            | 1 s           |
| ODUKP/MT_A_Sk_MI_LCK_CoS[1...M]                                    | 0 to 7                                | –             |
| ODUKP/MT_A_Sk_MI_LCK_Tool[1...M]                                   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| ODUKP/MT_A_Sk_MI_Admin_State                                       | LCK, Normal                           | Normal        |
| ODUKP/MT_A_Sk_MI_AIS_Period[1...M]                                 | 1 s, 1 min                            | 1 s           |
| ODUKP/MT_A_Sk_MI_AIS_CoS[1...M]                                    | 0 to 7                                | –             |
| ODUKP/MT_A_Sk_MI_AIS_Tool[1...M]                                   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2] | N/A           |
| ODUKP/MT_A_Sk_MI_GAL_Enable[1...M]                                 | True, false                           | (Note 4)      |
| ODUKP/MT_A_Sk Reporting  |                                       |               |
| ODUKP/MT_A_Sk_MI_AcPT<br>(See Table 15-8 of [ITU-T G.709])         | 0 to 255                              | –             |
| ODUKP/MT_A_Sk_MI_AcEXI<br>(See Table 6-2 of [ITU-T G.7041])        | 0 to 15                               | –             |
| ODUKP/MT_A_Sk_MI_LastValidUPI<br>(See Table 6-3 of [ITU-T G.7041]) | 0 to 255                              | –             |
| ODUKP-h/MT_A_So provisioning                                       |                                       |               |
| ODUKP-h/MT_A_So_MI_Active  | True, false                           | False         |
| ODUKP-h/MT_A_So_MI_SCCType   | 0 to 255                              | 32            |
| ODUKP-h/MT_A_So_MI_Label[1...M]                                    | 16 to (2**20)-1                       | (Note 2)      |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal                                  | Value range                        | Default value |
|--|------------------------------------|---------------|
| ODUKP-h/MT_A_So_MI_LSPTType[1...M]         | E-LSP, L-LSP                       | –             |
| ODUKP-h/MT_A_So_MI_CoS[1...M]              | 0 to 7                             | –             |
| ODUKP-h/MT_A_So_PHB2TCMapping[1...M]       | (Note 1)                           | –             |
| ODUKP-h/MT_A_So_MI_QoSEncodingMode[1...M]  | A, B (Note 5)                      | –             |
| ODUKP-h/MT_A_So_MI_Mode[1...M]             | Mode 1, Mode 2                     | Mode 1        |
| ODUKP-h/MT_A_So_MI_GAL_Enable[1...M]       | True, False                        | (Note 4)      |
| ODUKP-h/MT_A_So_MI_INCREASE                | True, false                        | False         |
| ODUKP-h/MT_A_So_MI_DECREASE                | True, false                        | False         |
| ODUKP-h/MT_A_So_MI_TSNUM                   | According to [ITU-T G.7044]        | N/A           |
| ODUKP-h/MT_A_So_MI_ODUflexRate             | FlexCBR, FlexGFP                   | N/A           |
| ODUKP-h/MT_A_So reporting                  |                                    |               |
| ODUKP-h/MT_A_So_MI_ADJSTATE                | According to [ITU-T G.7044]        | N/A           |
| ODUKP-h/MT_A_Sk provisioning               |                                    |               |
| ODUKP-h/MT_A_Sk_MI_Active                  | True, false                        | False         |
| ODUKP-h /MT_A_Sk_MI_SCCType                | True, false                        | False         |
| ODUKP-h /MT_A_Sk_MI_Label[1...M]           | 0 to 255                           | 32            |
| ODUKP-h /MT_A_Sk_MI_LSPTType[1...M]        | 16 to (2**20)-1                    | (Note 2)      |
| ODUKP-h /MT_A_Sk_MI_CoS[1...M]             | E-LSP, L-LSP                       | –             |
| ODUKP-h /MT_A_Sk_MI_TC2PHBMapping[1...M]   | 0 to 7                             | –             |
| ODUKP-h /MT_A_Sk_MI_QoSDecodingMode[1...M] | (Note 1)                           | –             |
| ODUKP/MT_A_Sk_MI_Mode[1...M]               | A, B (Note 5)                      | –             |
| ODUKP-h /MT_A_Sk_MI_LCK_Period[1...M]      | 1 s, 1 min                         | 1 s           |
| ODUKP-h /MT_A_Sk_MI_LCK_CoS[1...M]         | 0 to 7                             | 7             |
| ODUKP-h /MT_A_Sk_MI_LCK_Tool[1...M]        | [ITU-T G.8113.1], [ITU-T G.8113.2] | N/A           |
| ODUKP-h /MT_A_Sk_MI_Admin_State            | LCK, Normal                        | Normal        |
| ODUKP-h /MT_A_Sk_MI_AIS_Period[1...M]      | 1 s, 1 min                         | 1 s           |
| ODUKP-h /MT_A_Sk_MI_AIS_CoS[1...M]         | 0 to 7                             | 7             |
| ODUKP-h /MT_A_Sk_MI_AIS_Tool[1...M]        | [ITU-T G.8113.1], [ITU-T G.8113.2] | N/A           |
| ODUKP-h /MT_A_Sk_MI_GAL_Enable[1...M]      | True, false                        | (Note 4)      |
| ODUKP-h/MT_A_Sk_MI_INCREASE                | True, false                        | False         |
| ODUKP-h/MT_A_Sk_MI_DECREASE                | True, false                        | False         |
| ODUKP-h/MT_A_Sk reporting                  |                                    |               |
| ODUKP-h/MT_A_Sk_MI_AcPT                    | According to [ITU-T G.709]         | N/A           |

**Table 8-2 – Provisioning and reporting for adaptation functions**

| MI signal  | Value range                        | Default value |
|--|------------------------------------|---------------|
| ODUKP-h/MT_A_Sk_MI_AcEXI   | According to [ITU-T G.709]         | N/A           |
| ODUKP-h/MT_A_Sk_MI_LastValidUPI  | According to [ITU-T G.709]         | N/A           |
| <b>ETH/MT_A_So Provisioning</b>  |                                    |               |
| ETH/MT_A_So_MI_Label[1...M]  | 16 to (2**20)-1                    | (Note 2)      |
| ETH/MT_A_So_MI_LSPTType[1...M]   | E-LSP, L-LSP                       | (Note 1)      |
| ETH/MT_A_So_MI_CoS[1...M]  | (Note 1)                           | (Note 1)      |
| ETH/MT_A_So_PHB2TCMapping[1...M]   | (Note 1)                           | (Note 1)      |
| ETH/MT_A_So_MI_QoSEncodingMode[1...M]  | A, B (Note 5)                      | (Note 2)      |
| ETH/MT_A_So_MI_Mode[1...M]   | Mode 1, Mode 2                     | Mode 1        |
| ETH/MT_A_So_MI_Etype   |                                    |               |
| <b>ETH/MT_A_Sk Provisioning</b>  |                                    |               |
| ETH/MT_A_Sk_MI_Label[1...M]  | 16 to (2**20)-1                    | (Note 2)      |
| ETH/MT_A_Sk_MI_LSPTType[1...M]   | E-LSP, L-LSP                       | –             |
| ETH/MT_A_Sk_MI_CoS[1...M]  | 0 to 7                             | –             |
| ETH/MT_A_Sk_MI_TC2PHBMapping[1...M]  | (Note 1)                           | (Note 1)      |
| ETH/MT_A_Sk_MI_QoSDecodingMode[1...M]  | A, B (Note 5)                      | (Note 1)      |
| ETH/MT_A_Sk_MI_Mode[1...M]   | Mode 1, Mode 2                     | Mode 1        |
| ETH/MT_A_Sk_MI_LCK_Enable[1...M]   | True, false                        | True          |
| ETH/MT_A_Sk_MI_LCK_Period[1...M]   | 1 s, 1 min                         | 1 s           |
| ETH/MT_A_Sk_MI_LCK_CoS[1...M]  | 0 to 7                             | 7             |
| ETH/MT_A_Sk_MI_LCK_OAM_Tool[1...M]   | [ITU-T G.8113.1], [ITU-T G.8113.2] | N/A           |
| ETH/MT_A_Sk_MI_Admin_State   | LCK, Normal                        | Normal        |
| ETH/MT_A_Sk_MI_AIS_Enable[1...M]   | True, false                        | True          |
| ETH/MT_A_Sk_MI_AIS_Period[1...M]   | 1 s, 1 min                         | 1 s           |
| ETH/MT_A_Sk_MI_AIS_CoS[1...M]  | 0 to 7                             | 7             |
| ETH/MT_A_Sk_MI_AIS_OAM_Tool[1...M]   | [ITU-T G.8113.1], [ITU-T G.8113.2] | N/A           |
| <p>NOTE 1 – According to [ITU-T G.8121].</p> <p>NOTE 2 – A value must be provided at provisioning.</p> <p>NOTE 3 – Indicates ETH OAM related.</p> <p>NOTE 4 – MI_GAL_Enable must be set to true on LSPs and sections and to false on PWs. Setting it to true for PWs is for further study.</p> <p>NOTE 5 – See clause 8.2.1 of [ITU-T G.8121] for the semantic of A and B.</p> |                                    |               |

### 8.5.1 Adaptation – ITU-T G.8121.1 specific

For MT.NE that supports the adaptation functions specified in [ITU-T G.8121.1], the EMF shall in addition support the management of the MIs listed in Table 8-2.1.

**Table 8-2.1 – Provisioning and reporting for adaptation functions**

| MI signal                   | Value range | Default value |
|-----------------------------|-------------|---------------|
| MT/ETH_A_So Provisioning    |             |               |
| MT/ETH_A_So_MI_CSFdciEnable | True, false | False         |

### 8.5.2 Adaptation – ITU-T G.8121.2 specific

For MT.NE that supports the adaptation functions specified in [ITU-T G.8121.2], the EMF shall in addition support the management of the MIs listed in Table 8-2.2.

**Table 8-2.2 – Provisioning and reporting for adaptation functions**

| MI signal                       | Value range | Default value |
|---------------------------------|-------------|---------------|
| MT/MT_A_Sk Provisioning         |             |               |
| MT/MT_A_Sk_MI_Local_Defect      | True, false | False         |
| Sn/MT_A_Sk Provisioning         |             |               |
| Sn/MT_A_Sk_MI_Local_Defect      | True, false | False         |
| Sn-X-L/MT_A_Sk Provisioning     |             |               |
| Sn-X-L/MT_A_Sk_MI_Local_Defect  | True, false | False         |
| Sm/MT_A_Sk Provisioning         |             |               |
| Sm/MT_A_Sk_MI_Local_Defect      | True, false | False         |
| Sm-X-L/MT_A_Sk Provisioning     |             |               |
| Sm-X-L/MT_A_Sk_MI_Local_Defect  | True, false | False         |
| Pq/MT_A_Sk Provisioning         |             |               |
| Pq/MT_A_Sk_MI_Local_Defect      | True, false | False         |
| Pq-X-L/MT_A_Sk Provisioning     |             |               |
| Pq-X-L/MT_A_Sk_MI_Local_Defect  | True, false | False         |
| ODUKP/MT_A_Sk Provisioning      |             |               |
| ODUKP/MT_A_Sk_MI_Local_Defect   | True, false | False         |
| ODUKP-h/MT_A_Sk provisioning    |             |               |
| ODUKP-h/MT_A_Sk_MI_Local_Defect | True, false | False         |
| ETH/MT_A_Sk Provisioning        |             |               |
| ETH/MT_A_Sk_MI_Local_Defect     | True, false | False         |

## 8.6 Diagnostic

This clause provides the requirements for the management of the MT diagnostic trail termination functions (MTDe\_TT)

For MT.NE that supports the MTDe\_TT function specified in [ITU-T G.8121], the EMF shall support the following management functions for the MIs listed in Table 8-3:

- provisioning the trail termination management information;

- retrieving the trail termination management information;
- notifying the changes of the trail termination management information;
- receiving the monitored trail termination management information.

**Table 8-3 – Provisioning and reporting for diagnostic trail termination function**

| MI signal  | Value range   | Default value   |
|--|---|---|
| MTDe_TT_So Provisioning  |   |   |
| MTDe_TT_So_MI_GAL_Enable   | True, false   | (Note 3)  |
| MTDe_TT_So_MI_TTLVALUE   | 0 to 255  | 255   |
| MTDe_TT_So_MI_CV_OAM_Tool  | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_So_MI_CV_Series ()   | See Tables 8-3.1 and 8-3.2 for the respective parameters and values   | See Tables 8-3.1 and 8-3.2 for the respective parameters and values |
| MTDe_TT_So_MI_1TH_OAM_Tool   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_So_MI_1TH_Start(CoS, Pattern, Length, Period)<br>NOTE – Pattern is ITU-T G.8121.1 specific | Class of service (CoS): 0 to 7<br>Length: 0 to L<br>The value of L depends on implementation, e.g., may be 2 <sup>32</sup> .<br>Patterns, Period: for further study | Default value of Length: 0  |
| MTDe_TT_So_MI_1TH_Terminate  | –   | –   |
| MTDe_TT_So_MI_LMo_OAM_Tool   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_So_MI_LMo_Start(CoS,Period) [1...M <sub>LMo</sub> ]  | CoS: 0 to 7<br>Period: 100 ms, 1 s, 10 s  |   |
| MTDe_TT_So_MI_LMo_Intermediate_Request [1...M <sub>LMo</sub> ]                                     | –   | –   |
| MTDe_TT_So_MI_LMo_Terminate[1...M <sub>LMo</sub> ]   | –   | –   |
| MTDe_TT_So_MI_DMo_OAM_Tool   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_So_MI_DMo_Start(CoS,Test_ID, Length,Period)[1...M <sub>DMo</sub> ]                         | CoS: 0 to 7<br>Test_ID: (Note 2)<br>Length: 0 to L. The value of L depends on implementation, e.g., may be 2 <sup>32</sup> .<br>Period: 1 s, 10 s, 1 min            | Default value of Length: 0<br>Default value of Period: 1 min        |
| MTDe_TT_So_MI_DMo_Terminate[1...M <sub>DMo</sub> ]   | –   | –   |
| MTDe_TT_So_MI_1DMo_OAM_Tool  | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_So_MI_1DMo_Start(CoS,Test_ID, Length,Period)[1...M <sub>1DMo</sub> ]                       | CoS: 0 to 7<br>Test_ID: (Note 2)<br>Length: 0 to L. The value of L depends on implementation, e.g., may be 2 <sup>32</sup> .<br>Period: 100 ms, 1 s, 10 s           | Default value of Length: 0  |
| MTDe_TT_So_MI_DMo_Intermediate_Reques t[1...M <sub>LMo</sub> ]                                     | –   | –   |
| MTDe_TT_So_MI_1DMo_Terminate [1...M <sub>1DMo</sub> ]  | –   | –   |

**Table 8-3 – Provisioning and reporting for diagnostic trail termination function**

| MI signal   | Value range   | Default value   |
|---|---|---|
| MTDe_TT_So_MI_SLo_OAM_Tool  | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_So_MI_SLo_Start(CoS,Test_ID, Length,Period)[1...M <sub>SLo</sub> ]  | CoS: 0 to 7<br>Test_ID: (Note 2)<br>Length: 0 to L. The value of L depends on implementation, e.g., may be 2 <sup>32</sup> .<br>Period: 0.1 ms, 0.5 ms, 1 ms, 3.3 ms, 10 ms, 100 ms | Default value of Length: 0<br>Default value of Period: 10 ms        |
| MTDe_TT_So_MI_SLo_Intermediate_Request [1...M <sub>LMo</sub> ]  | –   | –   |
| MTDe_TT_So_MI_SLo_Terminate[1...M <sub>SLo</sub> ]  | –   | –   |
| MTDe_TT_So_MI_Admin_State   | LCK, Normal   | Normal  |
| MTDe_TT_So_MI_Lock_Instruct_Enable  | True, false   | True  |
| MTDe_TT_So_MI_DP_Loopback_Enable  | True, false   | False   |
| MTDe_TT_So Reporting  |   |   |
| MTDe_TT_So_MI_CV_Series_Result()  | See Tables 8-3.1 and 8-3.2 for the respective parameters and values   | See Tables 8-3.1 and 8-3.2 for the respective parameters and values |
| MTDe_TT_So_MI_1TH_Result(Sent)  | –   | –   |
| MTDe_TT_So_MI_LMo_Result(N_TF,N_LF,F_TF,F_LF)[1...M <sub>LMo</sub> ]  | –   | –   |
| MTDe_TT_So_MI_DMo_Result(count, B_FD[],F_FD[],N_FD[])[1...M <sub>DMo</sub> ]  | –   | –   |
| MTDe_TT_So_MI_SLo_Result(N_TF,N_LF, F_TF,F_LF)[1...M <sub>SLo</sub> ]   | –   | –   |
| MTDe_TT_Sk Provisioning   |   |   |
| MTDe_TT_Sk_MI_GAL_Enable  | True, false   | (Note 3)  |
| MTDe_TT_Sk_MI_CV_OAM_Tool   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_Sk_MI_1TH_OAM_Tool  | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_Sk_MI_1TH_Start(Pattern, Length, Period)<br><br>NOTE – Pattern, length and period are ITU-T G.8121.1 specific | For further study   |   |
| MTDe_TT_Sk_MI_1TH_Terminate   | –   | –   |
| MTDe_TT_Sk_MI_LMo_OAM_Tool  | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_Sk_MI_DMo_OAM_Tool  | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_Sk_MI_1DMo_OAM_Tool   | [ITU-T G.8113.1],<br>[ITU-T G.8113.2]   | N/A   |
| MTDe_TT_Sk_MI_1DMo_Start(Cos, Test_ID)[1...M <sub>1DMo</sub> ]  | (Note 2)  | –   |

**Table 8-3 – Provisioning and reporting for diagnostic trail termination function**

| MI signal   | Value range                              | Default value |
|---|--|---------------|
| MTDe_TT_Sk_MI_1DMo_Terminate [1...M <sub>1DMo</sub> ]   | –  | –             |
| MTDe_TT_Sk_MI_SLo_OAM_Tool  | [ITU-T G.8113.1], [ITU-T G.8113.2]       | N/A           |
| MTDe_TT_Sk_MI_DP_Loopback_Enable  | True, false                              | False         |
| MTDe_TT_Sk Reporting  |  |               |
| MTDe_TT_Sk_MI_1TH_Result(REC,CRC,BER,OO)  | –  | –             |
| MTDe_TT_Sk_MI_1DMo_Intermediate_Request[1...M <sub>1DMo</sub> ]   | –  | –             |
| MTDe_TT_Sk_MI_1DMo_Result(count,N_FD[])[1...M <sub>1DMo</sub> ]   | –  | –             |
| MTDe_TT_Sk_MI_Admin_State_Request   | Trigger to LCK, Trigger to Normal        | –             |
| MTDi_TT_So Provisioning   |  |               |
| MTDi_TT_So_MI_GAL_Enable  | True, false                              | (Note 3)      |
| MTDi_TT_So_MI_TTLVALUE  | 0 to 255                                 | 255           |
| MTDi_TT_So_MI_MIP_ID  | String; values are OAM protocol-specific | (Note 1)      |
| MTDi_TT_So_MI_CV_OAM_Tool   | [ITU-T G.8113.1], [ITU-T G.8113.2]       | N/A           |
| MTDi_TT_So_MI_DP_Loopback_Enable  | True, false                              | False         |
| MTDi_TT_Sk Provisioning   |  |               |
| MTDi_TT_Sk_MI_GAL_Enable  | True, false                              | (Note 3)      |
| MTDi_TT_Sk_MI_MIP_ID  | String; values are OAM protocol-specific | (Note 1)      |
| MTDi_TT_Sk_MI_CV_OAM_Tool   | [ITU-T G.8113.1], [ITU-T G.8113.2]       | N/A           |
| MTDi_TT_Sk_MI_DP_Loopback_Enable  | True, false                              | False         |
| NOTE 1 – A value must be provided at provisioning.  |  |               |
| NOTE 2 – The Test ID field is optional when this proactive measurement tool is used.  |  |               |
| NOTE 3 – MI_GAL_Enable must be set to true on LSPs and sections and to false on PWs. Setting it to true for PWs is for further study. |  |               |

### 8.6.1 Diagnostic – ITU-T G.8121.1 specific

For MT.NE that supports the MTDe\_TT function specified in [ITU-T G.8121.1], the EMF shall in addition support the management of the MIs listed in Table 8-3.1:

**Table 8-3.1 – Provisioning and reporting for termination functions**

| MI signal   | Value range  | Default value  |
|---|--|--|
| MTDe_TT_So Provisioning                               |  |  |
| MTDe_TT_So_MI_CV_Series(CoS, N, Length, Period)       | Time-to-live (TTL): 0 to 255<br>CoS: 0 to 7<br>N: 1 to n. The value of n depends on implementation, e.g., may be 2 <sup>32</sup> .<br>Length: 0 to L. The value of L depends on implementation, e.g., may be 2 <sup>32</sup> .<br>Period: 5 to 10 s. | Default value of N: 3<br><br>Default value of length: 0<br><br>Default value of period: 5 s. |
| MTDe_TT_So_MI_CV_Test(CoS, Pattern, Length, Period)   | See [ITU-T G.8121.1]   |  |
| MTDe_TT_So Reporting                                  |  |  |
| MTDe_TT_So_MI_CV_Test_Result(Sent, REC, REC, ERR, OO) | See [ITU-T G.8121.1]   |  |
| MTDe_TT_So_MI_CV_Series_Result(REC, ERR, OO)          | For further study  |  |
| MTDe_TT_Sk Provisioning                               |  |  |
| MTDe_TT_Sk_MI_MEP_ID                                  | See [ITU-T G.8121.1]   |  |

### 8.6.2 Diagnostic – ITU-T G.8121.2 specific

For MT.NE that supports the MT\_TT function specified in [ITU-T G.8121.2], the EMF shall in addition support the management of the MIs listed in Table 8-3.2:

**Table 8-3.2 – Provisioning and reporting for termination functions**

| MI signal  | Value range   | Default value  |
|--|---|--|
| MTDe_TT_So Provisioning  |   |  |
| MTDe_TT_So_MI_Target_FEC   | See [ITU-T G.8121.2]  | –  |
| MTDe_TT_So_MI_CV_Series (Session_ID, Counter, Period, CoS, Size, ValidateFEC, ValidateReverse, TargetFECStack) | CoS: 0 to 7<br>To be defined for other parameters   | 8.10 CoS: 7<br>8.10 To be defined for other parameters |
| MTDe_TT_So_MI_CV_Trace(Session_ID, CoS, ValidateFEC, ValidateReverse, TargetFECStack)                          | CoS: 0 to 7<br>To be defined for other parameters   | CoS: 7<br>To be defined for other parameters           |
| MTDe_TT_So_MI_FEC_Checking   | True, false   | True   |
| MTDe_TT_So_MI_DMo_Start(CoS, Test_ID, Length, Period, CopyPad)[1...M <sub>DMo</sub> ]<br>(Note)                | CoS: 0 to 7<br>Length: 0 to L.<br>The value of L depends on implementation, e.g., may be 2 <sup>32</sup> .<br>Period: 1 s, 10 s, 1 min<br>CopyPad: True, false<br>Test_ID: non-negative integer |  |

**Table 8-3.2 – Provisioning and reporting for termination functions**

| MI signal  | Value range  | Default value |
|--|--|---------------|
| MTDe_TT_So_MI_LMo_Start(CoS, Test_ID, Period, LMType, CountBytes)[1...MLMo]<br>(Note)            | CoS: 0 to 7<br>Period: 1 s, 10 s, 1 min<br>LMType: ILM, DLM<br>CountBytes: True, false<br>Test_ID: non-negative integer  |               |
| MTDe_TT_So_MI_LMDMo_Start(CoS, Test_ID, Length, Period, LMType, CountBytes, CopyPad)[1...MLMDMo] | CoS: 0 to 7<br>Length: 0 to L.<br>Period: 1 s, 10 s, 1 min<br>LMType: ILM, DLM<br>CountBytes: True, false<br>CopyPad: True, false<br>Test_ID: non-negative integer |               |
| MTDe_TT_So_MI_LMDMo_Terminate [1...MLMDMo]   | –  |               |
| MTDe_TT_So_MI_LI_Period  | 1, 255   | 1             |
| MTDe_TT_So_MI_LI_MEPID   | 0 to 255   | 255           |
| MTDe_TT_So_MI_LI_CoS   | 0, 1, 2, 3, 4, 5, 6, 7   | 7             |
| MTDe_TT_So Reporting   |  |               |
| MTDe_TT_So_MI_CV_Series_Result(Session_ID, Rev, CoS, OOO, FWErr, BWErr)                          | To be defined  | –             |
| MTDe_TT_So_MI_CV_Trace_Result (Session_ID, Result)   | To be defined  | –             |
| MTDe_TT_So_MI_CV_BWErr(Session_ID, Seq, RC, SubRC, ErrTLV)                                       | To be defined  | –             |
| MTDe_TT_So_MI_CV_BWErr(Session_ID, Seq, RC, SubRC, ErrTLV)                                       | To be defined  | –             |
| MTDe_TT_So_MI_DMo_ReportError(Error) [1...MDMo]  | True, false  |               |
| MTDe_TT_So_MI_DMo_PeriodChanged [1...MDMo]   | True, false  |               |
| MTDe_TT_So_MI_LMo_ReportError(Error) [1...MLMo]  | True, false  |               |
| MTDe_TT_So_MI_LMo_PeriodChanged [1...MLMo]   | True, false  |               |
| MTDe_TT_Sk Provisioning  |  |               |
| MTDe_TT_Sk_MI_PM_Responder_Enable  | True, false  | False         |
| MTDe_TT_Sk_MI_FEC_Checking   | True, false  | True          |
| MTDe_TT_Sk Reporting   |  |               |
| MTDi_TT_So Provisioning  |  |               |
| MTDi_TT_So_MI_Target_FEC   | See [ITU-T G.8121.2]   | –             |
| MTDi_TT_So_MI_Ifnun  | See [ITU-T G.8121.2]   | –             |

**Table 8-3.2 – Provisioning and reporting for termination functions**

| MI signal  | Value range          | Default value |
|--|----------------------|---------------|
| MTDi_TT_So_MI_MTU  | See [ITU-T G.8121.2] | –             |
| MTDi_TT_Sk Provisioning  |                      |               |
| MTDi_TT_Sk_MI_FEC_Checking   | See [ITU-T G.8121.2] | –             |
| NOTE – These MI signals are defined in MTDe_TT_So in [ITU-T G.8121] and [ITU-T G.8121.2] does not use these MI signals as defined in Table 8-3 in this Recommendation. |                      |               |

## 8.7 Connection

See clause 8.6 of [ITU-T G.7710] for a description of connection management.

This function allows a user to provision the operation of a MPLS-TP connection process.

The MI signals, listed in this clause, are communicated from the EMF to the connection process through the management point.

For MT.NE that supports the MT\_C and MTp\_C functions specified in [ITU-T G.8121], the EMF shall support the following management functions for the MIs listed in Table 8-4:

- provisioning the trail termination management information;
- retrieving the trail termination management information;
- notifying the changes of the trail termination management information.

**Table 8-4 – Provisioning and reporting for connection functions**

| MI signal                                   | Value range  | Default value |
|---|--|---------------|
| MT_C Provisioning (per matrix connection)   |  |               |
| MT_C_MI_ConnectionType                      | Protected, unprotected   | Unprotected   |
| MT_C_MI_Return_CP_ID                        | NULL (for unidirectional), or the connection point (CP) identifier (for bidirectional) | –             |
| MT_C_MI_ConnectionPortIds                   | Set of CP identifiers  | –             |
| MT_C Provisioning                           |  |               |
| MT_C_MI_MatrixControl                       | Connect, disconnect  | N/A           |
| MT_C Provisioning (per protection process)  |  |               |
| MT_C_MI_PS_WorkingPortId                    | (Note)   | (Note)        |
| MT_C_MI_PS_ProtectionPortId                 | (Note)   | (Note)        |
| MT_C_MI_PS_ProfType                         | (Note)   | (Note)        |
| MT_C_MI_PS_OperType                         | (Note)   | (Note)        |
| MT_C_MI_PS_HoTime                           | (Note)   | (Note)        |
| MT_C_MI_PS_WTR                              | (Note)   | (Note)        |
| MT_C_MI_PS_ExtCMD                           | (Note)   | (Note)        |
| MT_C_MI_PS_SD_Protection                    | Disabled, enabled  | Disabled      |
| MTp_C Provisioning (per protection process) |  |               |
| MT_C_MI_PS_WorkingPortId                    | (Note)   | (Note)        |

**Table 8-4 – Provisioning and reporting for connection functions**

| MI signal   | Value range       | Default value |
|---|-------------------|---------------|
| MT_C_MI_PS_ProtectionPortId                       | (Note)            | (Note)        |
| MT_C_MI_PS_ProfType                               | (Note)            | (Note)        |
| MT_C_MI_PS_OperType                               | (Note)            | (Note)        |
| MT_C_MI_PS_HoTime                                 | (Note)            | (Note)        |
| MT_C_MI_PS_WTR                                    | (Note)            | (Note)        |
| MT_C_MI_PS_ExtCMD                                 | (Note)            | (Note)        |
| MT_C_MI_PS_SD_Protection                          | Disabled, enabled | Disabled      |
| MSRP_C Provisioning (per ring protection process) |                   |               |
| MI_MSRRP_EastPort                                 | (Note)            | (Note)        |
| MI_MSRRP_WestPort                                 | (Note)            | (Note)        |
| MI_MSRRP_ProfType                                 | (Note)            | (Note)        |
| MI_MSRRP_HoTime                                   | (Note)            | (Note)        |
| MI_MSRRP_WTR                                      | (Note)            | (Note)        |
| MI_MSRRP_ExtCMD                                   | (Note)            | (Note)        |
| NOTE – According to [ITU-T G.8121].               |                   |               |

### 8.7.1 Connection – ITU-T G.8121.1 specific

For MT.NE that supports the MT\_C functions specified in [ITU-T G.8121.1], there is no additional MI to be managed beyond those listed in Table 8-4.

### 8.7.2 Connection – ITU-T G.8121.2 specific

For MT.NE that supports the MT\_C functions specified in [ITU-T G.8121.2], there is no additional MI to be managed beyond those listed in Table 8-2.

## 8.8 Degraded (DEG) thresholds

For further study.

## 8.9 XXX\_Reported

See clause 8.8 of [ITU-T G.7710] for a description of XXX\_Reported management.

## 8.10 Alarm severity

See clause 8.9 of [ITU-T G.7710] for a description of alarm severity.

## 8.11 Alarm reporting control

See clause 8.10 of [ITU-T G.7710] for a description of alarm report control.

## 8.12 PM thresholds

For further study.

## 8.13 TCM activation

For further study.

## **8.14 Date and time**

The date and time functions within the MPLS-TP EMF comprise the local real time clock (RTC) function and the performance monitoring clock (PMC) function. The message communication function within the MPLS-TP NEF shall be capable of setting the local RTC function.

The date and time values are incremented by a free-running local clock, or by an external timing source. The fault management, configuration management, account management, performance management and security management (FCAPS) functions need date and time information, e.g., to time stamp event reports. They obtain this information from the date and time function.

### **8.14.1 Date and time applications**

Clause 8.13.1 of [ITU-T G.7710] identifies three date and time applications. These are:

- 1) time-stamping;
- 2) performance monitoring clock signals;
- 3) activity scheduling.

The MPLS-TP NEF functional requirements for these applications are specified in the following clauses.

#### **8.14.1.1 Time-stamping**

See clause 8.13.1.1 of [ITU-T G.7710] for a description of the time-stamping application.

#### **8.14.1.2 Performance monitoring clock signals**

See clause 8.13.1.2 of [ITU-T G.7710] for a description of the PMC signals.

#### **8.14.1.3 Activity scheduling**

See clause 8.13.1.3 of [ITU-T G.7710] for a description of the activity scheduling.

### **8.14.2 Date and time functions**

There are three date and time functions defined. The local RTC function is required for time stamping and activity scheduling. The local RTC alignment function is required for aligning the clock with an external time reference. The PMC function, in addition to RTC, is typical for digital counter measurements.

#### **8.14.2.1 Local RTC function**

The local RTC function is specified in clause 8.13.2.1 of [ITU-T G.7710].

#### **8.14.2.2 Local RTC alignment function with external time reference**

The local RTC alignment function with external time reference is specified in clause 8.13.2.2 of [ITU-T G.7710].

#### **8.14.2.3 Performance monitoring clock function**

The performance monitoring clock function is specified in clause 8.13.2.3 of [ITU-T G.7710].

## **9 Accounting management**

For further study.

## **10 Performance management**

See clause 10 of [ITU-T G.7710] for the generic requirements for performance management. MPLS-TP specific management requirements are described below.

## 10.1 Performance management applications

See clause 10.1 of [ITU-T G.7710] for the generic description for performance management applications.

## 10.2 Performance monitoring functions

See clause 10.2 of [ITU-T G.7710] for generic requirements of performance monitoring functions.

The following are MPLS-TP specific performance management requirements:

- 1) PM measurements are managed at trail termination points (TTPs) and connection termination points (CTPs) (i.e., MEPs/MIPs are created and deleted).
- 2) One MEP has to be created per TTP if that has to be supervised.
- 3) Two types of measurement jobs have to be supported (proactive, on-demand).
- 4) Proactive measurement jobs are managed at MEPs (establish, disable, enable, terminate).
- 5) On-demand measurement jobs are managed at MEPs (establish, modify, abort).
- 6) On-demand measurements can be done using four different OAM PDU generation mechanisms: single instance, repetitive instance, single series and repetitive series. To describe these mechanisms, the following terms are used:
  - OAM PDU generation type:  
generation pattern of the on-demand OAM message.  
valid types are: single instance, repetitive instance, single series and repetitive series.
  - Message period (x)  
frequency of the OAM message generation within a series.  
note that a value of zero (i.e.,  $x = 0$ ) means that only one OAM message per measurement interval is generated.
  - Measurement interval (y)  
defines discrete non-overlapping periods of time during which measurements are performed (i.e., OAM messages are generated) and reports are gathered at the end of the measurement intervals.  
note that a value of zero means a degenerated measurement interval with a single OAM message and the report is sent as immediately as possible.
  - Repetition period (z)  
defines the time between the start of two measurement intervals;  
this IS applicable for the repetitive instance type and MAY be applicable for the repetitive series type.  
note that a value of zero means not applicable (N/A). This is for the cases of single instance, single series, or repetitive series without extra gap in between the measurement intervals (i.e., also as known as continuous series).
  - Start time  
defines the start of the on-demand session.
  - Stop time  
defines the stop of the on-demand session.
  - Session duration  
stop time – start time.  
note that session duration is not a configuration parameter. That is, it is not needed in the configuration.

The four on-demand measurements are illustrative in Figure 10-1 of [ITU-T G.8051].

Note that in the repetitive series case, if the repetition period  $z = y + x$ , or the value is not provisioned, then there is no extra gap between the end of the measurement interval and the start of the new measurement interval. This pattern is also known as the continuous series cases. The repetition period ( $z$ ) is needed if there is extra gap between the measurement intervals.

- 7) It shall be possible to configure the following on-demand measurement parameters (including the default values):
  - a) OAM PDU generation type; default = repetitive instance;
  - b) Start time; default = current time;
  - c) Stop time; default = current time + 1 hour;
  - d) OAM message period; default = 0;
  - e) Measurement interval; default = 0;
  - e) Repetition period; default = 0.
- 8) Parallel measurement jobs, one per priority, can be established.
- 9) Performance data is stored in registers associated to the measurement job.
- 10) On-demand measurement jobs are automatically terminated after (last) report is sent.
- 11) Threshold profiles are managed at the managed element (create, modify, delete)
- 12) It shall be possible to retrieve the following configuration information:
  - a) All existing MEPs/MIPs within a TP (TTP or CTP);
  - b) All existing measurement jobs within a MEP;
  - c) All existing threshold profiles within a network element;
  - d) All threshold settings within a proactive PM measurement job.
- 13) It shall be possible to retrieve all proactive PM measurement current and history performance data within a MEP.
- 14) It shall be possible to request intermediate reports on an on-demand PM measurement job of "single series" and "repetitive series" types.
- 15) It shall be possible to request an autonomous continuous reporting of performance data from all proactive PM measurement jobs within a MEP (i.e., automatic "push" of the measured PM data).
- 16) On-demand loss measurement can be measured by directly counting the data traffic or can be inferred by counting the synthetic traffic. If on-demand loss measurement is supported, for each measurement interval, the MPLS-TP NE should:
  - Receive from the transport plane the measurements (i.e., N\_TF, N\_LF, F\_TF, F\_LF) at the end of each measurement interval.

According to the definition of near-end and far-end frame loss in clause 8.1 of [ITU-T G.8013], for a MEP, N\_TF and N\_LF refer to the transmitted and lost ingress frames while F\_TF and F\_LF refer to the transmitted and lost egress frames.

Note that one-way synthetic loss (1SL) can provide only near-end measurement (i.e., N\_TF, N\_LF).
  - Store the measurements (TN\_TF, TN\_LF, TF\_TF, TF\_LF) and calculate the frame loss ratios (FLRs) ( $TN\_FLR = TN\_LF / TN\_TF$ ,  $TF\_FLR = TF\_LF / TF\_TF$ ). The measurements and FLRs shall be reported to the management system.
  - At the instruction of the management system, the NE shall be able to request from the transport plane the intermediate (i.e., before the end of the Measurement Interval)

measurements, calculate the intermediate FLRs, and report the intermediate results (TN\_TF, TN\_LF, TN\_FLR, TF\_TF, TF\_LF, TF\_FLR) to the management system.

NOTE – An on-demand loss measurement (LM) or delay measurement (DM) session could be a single series of OAM messages or a single instance of OAM message. A single instance OAM could be considered as a special case of a single series OAM.

- 17) Proactive loss measurement can be measured by directly counting the data traffic or can be inferred by counting the synthetic traffic. If proactive loss measurement is supported, for each loss measurement session the MPLS-TP NE should:
- Receive from the transport plane the measurements (i.e., pN\_TF, pN\_LF, pF\_TF, pF\_LF) for each OAM period.  
Note that 1SL can support only near-end measurement (i.e., N\_TF, N\_LF).
  - Calculate the FLRs ( $N\_FLR = pN\_LF / pN\_TF$ ,  $F\_FLR = pF\_LF / pF\_TF$ ) for each OAM period; store the temporal minimum, average and maximum statistics (mN\_FLR, aN\_FLR, xN\_FLR, mF\_FLR, aF\_FLR, xF\_FLR) in the current 15-minute and 24-hour registers. The stored statistics shall be available for retrieval by the management system.
  - The FLR measurements of a monitored entity measured during severely errored seconds (SES) shall be included in the computation of its FLR statistics, unless the SES is part of the unavailable time period.  
NOTE – This is in line with the definition made in Note 1 of clause 1 in [ITU-T Y.1563].
  - At the maturity of the current 15-minute and 24-hour periods, the statistics in the current registers shall move to the history registers and then reset the current registers to zeros. See detailed requirements in [ITU-T G.7710].
- 18) If on-demand 1-way DM is supported, for each on-demand 1-way DM measurement interval, the MPLS-TP NE should:
- Receive from the transport plane the array of near-end measurements (count, N\_FD[]) at the end of each measurement interval.
  - Store the measurements, compute the corresponding array of N\_FD V[] and report the near-end measurements (count, N\_FD[], N\_FD V[]) to the management system.
  - At the instruction of the management system, the NE shall be able to request from the transport plane the intermediate measurements, calculate the intermediate N\_FD V[], and report the intermediate results (count, N\_FD[], N\_FD V[]) to the management system.
- 19) If proactive 1-way DM is supported, for each proactive 1-way DM session the MPLS-TP NE should:
- Receive from the transport plane the near-end measurements (pN\_FD, pN\_FD V) for each OAM period.
  - Store the temporal minimum, average and maximum (N\_FD, N\_FD V) in the current 15-minute and 24-hour registers. The stored statistics shall be available for retrieval by the management system.
  - At the maturity of the current 15-minute and 24-hour periods, the statistics in the current registers shall move to the history registers and then reset the current registers to zeros. See detailed requirements in [ITU-T G.7710].
- 20) If on-demand 2-way DM is supported, for each on-demand 2-way DM measurement interval, the MPLS-TP NE should:
- Receive from the transport plane the array of near-end, far-end and bidirectional measurements (count, N\_FD[], F\_FD[], B\_FD[]) at the end of each measurement interval.

- Store the measurements, compute the corresponding array of FDV[], and report the near-end, far-end, and bidirectional (2-way) measurements (count, N\_FD[], F\_FD[], B\_FD[]; N\_FDV[], F\_FDV[], B\_FDV[]) to the management system.
  - At the instruction of the management system, the NE shall be able to request from the transport plane the intermediate measurements, calculate the intermediate FDV[], and report the intermediate results (count, N\_FD[], F\_FD[], B\_FD[]; N\_FDV[], F\_FDV[], B\_FDV[]) to the management system.
- 21) If proactive 2-way DM is supported, for each proactive 2-way DM session the MPLS-TP NE should:
- Receive from the transport plane the near-end, far-end and bidirectional measurements (N\_FD, F\_FD, B\_FD; N\_FDV, F\_FDV, B\_FD) for each OAM period.
  - Store the temporal minimum, average and maximum for each type of the measurements (N\_FD, F\_FD, B\_FD; N\_FDV, F\_FDV, B\_FD) for the current 15-minute and 24-hour registers. The stored statistics shall be available for retrieval by the management system.
  - At the maturity of the current 15-minute and 24-hour periods, the statistics in the current registers shall move to the history registers and then reset current registers to zeros. See detailed requirements in [ITU-T G.7710].
- 22) The MPLS-TP NE should support the ability to configure for the start and stop at the respondent-end MEP of a single-ended measurement session.

MPLS-TP NE shall provide the following PM management information (see Table 10-1).

**Table 10-1 – PM management information**

| PM management information  | ITU-T G.8121 function |
|--|-----------------------|
| MT_TT_Sk_MI_pN_LF<br>MT_TT_Sk_MI_pN_TF<br>MT_TT_Sk_MI_pF_LF<br>MT_TT_Sk_MI_pF_TF<br>MT_TT_Sk_MI_pF_DS<br>MT_TT_Sk_MI_pN_DS<br>MT_TT_Sk_MI_pB_FD<br>MT_TT_Sk_MI_pB_FD<br>MT_TT_Sk_MI_pN_FD<br>MT_TT_Sk_MI_pN_FD<br>MT_TT_Sk_MI_pF_FD<br>MT_TT_Sk_MI_pF_FD | MT_TT_Sk              |
| MT/ETH_A_Sk_MI_pFCSErrors  | MT/ETH_A_Sk           |

The EMF shall support the following functions:

- notifying of the PM management information.

## 11 Security management

See [ITU-T G.7710] for a description of security management.

## Bibliography

- [b-IETF RFC 5951] IETF RFC 5951 (2010), *Network Management Requirements for MPLS-based Transport Networks*.

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