International Telecommunication Union

ITU-T G.7710/Y.1701

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Amendment 1
(07/2010)

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

Data over Transport – Generic aspects – Transport network control aspects

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

Internet protocol aspects – Operation, administration and maintenance

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Common equipment management function requirements

Amendment 1: Required specification of severely errored second to align with Recommendation ITU-T Y.1563

Recommendation ITU-T G.7710/Y.1701 (2007) – Amendment 1

ITU-T G-SERIES RECOMMENDATIONS

TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

INTERNATIONAL TELEPHONE CONNECTIONS AND CIRCUITS	G.100–G.199
GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER-TRANSMISSION SYSTEMS	G.200–G.299
INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES	G.300–G.399
GENERAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON RADIO-RELAY OR SATELLITE LINKS AND INTERCONNECTION WITH METALLIC LINES	G.400–G.449
COORDINATION OF RADIOTELEPHONY AND LINE TELEPHONY	G.450–G.499
TRANSMISSION MEDIA AND OPTICAL SYSTEMS CHARACTERISTICS	G.600–G.699
DIGITAL TERMINAL EQUIPMENTS	G.700–G.799
DIGITAL NETWORKS	G.800–G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900–G.999
MULTIMEDIA QUALITY OF SERVICE AND PERFORMANCE – GENERIC AND USER-RELATED ASPECTS	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DATA OVER TRANSPORT – GENERIC ASPECTS	G.7000–G.7999
General	G.7000–G.7099
Transport network control aspects	**G.7700–G.7799**
PACKET OVER TRANSPORT ASPECTS	G.8000–G.8999
ACCESS NETWORKS	G.9000–G.9999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T G.7710/Y.1701

Common equipment management function requirements

Amendment 1

Required specification of severely errored second to align with Recommendation ITU-T Y.1563

Summary

Amendment 1 to Recommendation ITU-T G.7710/Y.1701 updates the packet layer related specification of severely errored second (SES) in Recommendation ITU-T G.7710/Y.1701 to align it with the SES definition in Recommendation ITU-T Y.1563.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.7710/Y.1701	2001-11-29	15
2.0	ITU-T G.7710/Y.1701	2007-07-29	15
2.1	ITU-T G.7710/Y.1701 (2007) Cor.1	2009-11-13	15
2.2	ITU-T G.7710/Y.1701 (2007) Amend. 1	2010-07-29	15

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

CONTENTS

			Page
1)	Scope		1
2)	References		1
3)	Clauses to be updated		1
	3.1)	Clause 4	1
	3.2)	Clause 10.1.2	1
	3.3)	Clause 10.1.3	3
	3.4)	Clause 10.1.4	4
	3.5)	Table 26 of clause 10.1.6.1	5
	3.6)	Clause 10.2	5

Recommendation ITU-T G.7710/Y.1701

Common equipment management function requirements

Amendment 1

Required specification of severely errored second to align with Recommendation ITU-T Y.1563

1) Scope

This amendment contains the update to the packet layer related specification of severely errored second (SES) in Recommendation ITU-T G.7710/Y.1701 (version 2007).

2) References

[ITU-T G.7710] Recommendation ITU-T G.7710/Y.1701 (2007), *Common equipment management function requirements*.

3) Clauses to be updated

The following text and clauses are updated as shown by the revision-marked text.

3.1) Clause 4

Add the following abbreviations to clause 4 (Abbreviations and acronyms):

BB Background Block

BBC Background Block Count

BD Block Delay

BDV Block Delay Variation

EBR Errored Block Ratio

FD Frame Delay

FDV Frame Delay Variation

FLR Frame Loss Ratio

LB Lost Block

LBC Lost Block Count

LBR Lost Block Ratio

LF Lost Frames

TBC Transmitted Block Count

TBmin Transmitted Blocks minimum

TF Transmitted Frames

3.2) Clause 10.1.2

Update clause 10.1.2 as follows:

10.1.2 Maintenance

The fault management supervision and validation processes (see clauses 7.1.1 and 7.1.2) describe an effective method to detect and analyse disturbances, and to provide an appropriate indication of the fault condition to maintenance personnel. The described processes, however, are not able to detect and report all causes leading to degraded performance. Maintenance measurements are required to detect additional error causes.

– In order to be able to do preventive maintenance, it is required to perform signal quality trend analysis. When the quality appears degraded, maintenance personnel may be instructed to replace or repair the degraded equipment before a failure is declared. Signal quality trend analysis is performed on signal quality maintenance measurements at the sink function.

  • For circuit layer: These measurements are based on transmitted block count (TBC), errored block count (EBC), block delay (BD) and calculated errored block ratio (EBR = EBC/TBC), background block count (BBC), background block errors (BBE) and block delay variation (BDV). ~~the validation of the received error detection code (EDC) for digital layers and frame count (FC) or packet count (PC) for packet layers, the calculation of the EDC violations for digital layers and FC or PC violations (i.e., frame or packet loss) and the derived calculated number of errored blocks (EB) and background block errors (BBE).~~ A block ~~in a digital layer~~ is a set of consecutive bits – including an error detection code (EDC) – associated with the connection; each bit belongs to one, and only one, block. Consecutive bits may not be contiguous in time. ~~A block in a packet layer is a frame or packet.~~ An errored block (EB) ~~in a digital layer~~ is a block with one or more EDC violations. ~~An EB in a packet layer is an indication of a lost frame or lost packet.~~ A BBE is an EB not occurring as part of a severely errored second (SES, see next dashed item). A background block (BB) is a transmitted block (TB) not occurring as part of an SES. The number of BBEs and BBs is summed over 15-minute and 24-hour intervals, over which the trend analysis is performed. The TBC is a, circuit signal type and bit rate dependent, fixed value. Summary statistics (such as minimum, average, and maximum) for BD and BDV are derived over 15-minute and 24-hour interval for continuous monitoring.

  • For packet layer: These measurements are based on transmitted block count (TBC), lost block count (LBC), block delay (BD) and the calculated lost block ratio (LBR = LBC/TBC), background block count (BBC), background block error (BBE) and block delay variation (BDV). A block is a non drop eligible frame or packet with a specific priority associated with the connection. An LB is a lost block. A BBE is a LB not occurring as part of a severely errored second (SES, see next dashed item). The number of BBEs is summed over 15-minute and 24-hour intervals, over which the trend analysis is performed. The TBC is a variable value. Summary statistics (such as minimum, average, and maximum) for BD and BDV are derived over 15-minute and 24-hour intervals for continuous monitoring.

– In order to locate the source of intermittent error conditions, e.g., short bursts of bit errors or lost frames or packets, it is required to measure these error conditions at various places in the network. These bursts cause a high ~~number of~~ EBR or LBR~~s~~, or result in the declaration of framing defects (e.g., dLOF, dLOP). Fault management is not able to alert maintenance personnel in these cases because the defects do not persist long enough to become a failure.

- Severely errored second (SES): The maintenance measurement is based on the detection of these bursts. ~~:~~ ~~a~~ An SES is declared when, during one second, the ~~number of~~ EBR~~s~~ or LBR exceeds a threshold, or when a defect is declared.

The number of SESs is summed over 15-minute and 24-hour intervals. The analysis of these reports may be an aid to locate the error source.

– In order to determine whether the performance level is normal, degraded or unacceptable, it is required to set appropriate performance limits. For example, according to [ITU-T M.2101], the degraded and unacceptable performance limits are expressed as threshold values for the number of background block errors (BBEs), the number of errored seconds (ESs) and the number of SESs, summed over 15-minute intervals and 24-hour intervals. An ES is declared when, during one second, there are one or more EBs or LBs detected, or when a defect is declared. When a threshold report (see clause 10.1.7) is generated, maintenance personnel may be driven to perform additional network performance analysis.

– In order to locate the source that causes the generation of jitter and wander, e.g., due to a wrongly selected timing reference source, it is required to measure these error conditions. Jitter and wander can be measured directly by connecting the appropriate measurement equipment to the interface port. This method, however, may require maintenance personnel being present at the measurement location. An alternative approach, for example, is to measure the positive and negative pointer justification events (PJEs). These events may be an indication of a wrongly applied timing source. The PJEs are summed over 24-hour intervals. The analysis of these reports may be an aid to locate the error source.

– In order to locate equipment that needs adjustment or retuning, e.g., to limit drift or oscillation, it is required to do gauge measurements at or near the equipment. Examples of gauge measurements are the (optical) power level, the gain and the temperature. These gauges are measured periodically. Maintenance personnel may request a snapshot, in which case the current value is made available at the workstation or craft terminal. The NE keeps a record of the highest value and the lowest value of the gauge over 15-minute and 24-hour measurement intervals. The analysis of these gauge tidemark reports may drive maintenance personnel to readjust the equipment.

It must be noted that the previous described error causes are indeed detected by the indicated maintenance measurements. The reverse, however, is not always true: not every SES indicates a burst error; an increasing number of BBEs does not necessarily indicate degraded equipment; a large amount of PJEs need not be caused by a wrong timing reference source. Therefore, care must be taken with the analysis of the performance maintenance reports.

3.3) Clause 10.1.3

Update clause 10.1.3 as follows:

10.1.3 Bringing-into-service

Bringing-into-service (BIS) tests should be long-term measurements of new equipment, using a pseudo-random generator and receiver. However, for practical reasons the measurements may be reduced to a quick measurement and the assessment completed with in-service performance monitoring available in the network element. BIS methods for paths are defined in [ITU-T M.2110].

The BIS performance objectives for equipment supporting ~~digital~~ circuit layers, e.g., SDH Paths, PDH Paths, OTN ODU paths, etc. are based on the collection of ESs, SESs and BBEs. The BIS performance objectives for equipment supporting packet layers, e.g., ETH Paths, ~~T-MPLS Paths~~ are based on the collection of ESs, SESs and BBEs or a subset of those. These measurements are evaluated in the management system and/or the NE over periods of 15 minutes, 2 hours, 1 day and

7 days. For the declaration of a SES, see the technology-specific ITU-T Recommendations, e.g., [ITU-T M.2101] defines the SDH BIS performance objectives in full detail.

The 15-minute and 24-hour registers should provide the capability to be reset to zero at the conclusion of the BIS intervals. If the history is stored as a log record, the capability to delete the log entries should be provided.

3.4) Clause 10.1.4

Update clause 10.1.4 as follows:

10.1.4 Quality of Service

Quality of service (QoS) deals with service quality criteria stated in service provider specifications or service level agreements (SLAs) between service providers, or service providers and customers. In general, SLAs are applicable when there is a relationship, e.g., between a customer and an operator, or between a lead operator and several carriers. At a minimum, the SLA contains specifications for the grade of service to be delivered. Because of service provider specifications and SLA contracts, it is important for the service provider to measure the quality level during the "bringing the connection into service" phase. Once the NE and the connection is in service, both the service provider and the service customer need in-service performance measurements to validate the specifications or SLAs.

QoS measurements are performed once the NE and connections are in-service. These measurements cannot be PRBS-based, as the payload is reserved for the client signal. The QoS measurements are used to evaluate and validate the performance objectives to be met over an evaluation period of typically 30 consecutive days (one month). For example, Table 25 lists the performance parameters used in SDH technology, defined in [ITU-T G.826], [ITU-T G.827], [ITU-T G.828] and [ITU-T G.829]. The right column specifies the measurements inside the NE.

Table 25 – QoS performance parameters and NE measurements

Performance parameters	NE measurements (see Note)
Errored second ratio (ESR) is defined as the ratio of ESs in available time to total seconds in available time during a fixed measurement interval.	The NE shall count the number of ESs during 24-hour intervals.
Severely errored second ratio (SESR) is defined as the ratio of SESs in available time to total seconds in available time during a fixed measurement interval.	The NE shall count the number of SESs during 24-hour intervals.
Background block error ratio (BBER) is defined as the ratio of BBEs in available time to total blocks in available time during a fixed measurement interval. <u>The count of total blocks excludes all blocks during SESs.</u>	The NE shall count the number of BBEs during 24-hour intervals.
Severely errored period intensity (SEPI) is defined as the number of SEP events in available time, divided by the total available time in seconds during a fixed measurement interval. Note that another name for SEP is CSES period.	The consecutive severely errored second (CSES) period is defined as a sequence of between three to nine consecutive SESs. The sequence is terminated by a second, which is not a SES. The NE shall time-stamp and log the start of the CSES event.

Table 25 – QoS performance parameters and NE measurements

Performance parameters	NE measurements (see Note)
The Availability Ratio (AR) is defined as the ratio of the total available time to the duration of the fixed measurement interval. The total available time in the 24-hour interval is calculated as the difference between the number of seconds in the 24-hour interval (i.e., 86'400) and the number of unavailable seconds.	The NE shall administer the total unavailable time in one or two methods. The first method counts the number of unavailable seconds (UAS) during 24-hour intervals. The second method logs the begin time (BUT) and end time (EUT) of unavailable periods.
The outage intensity (OI) is defined as the reciprocal of the average duration of available time during a fixed measurement interval. The outage intensity over a 30-day interval is calculated as the quotient of the number of unavailable periods in the 30-day interval and the total available time of the 30-day interval.	As for the AR, the NE shall log the BUT and EUT.
NOTE – The NE measurements outlined here are only for QoS purposes. The full list and measurement intervals are to be found in clause 10.1.6.1.	

3.5) Table 26 of clause 10.1.6.1

Add the following Note in the last row of Table 26:

NOTE 3 – The technology-specific Recommendations may require only a subset of the performance parameters listed in the table.

3.6) Clause 10.2

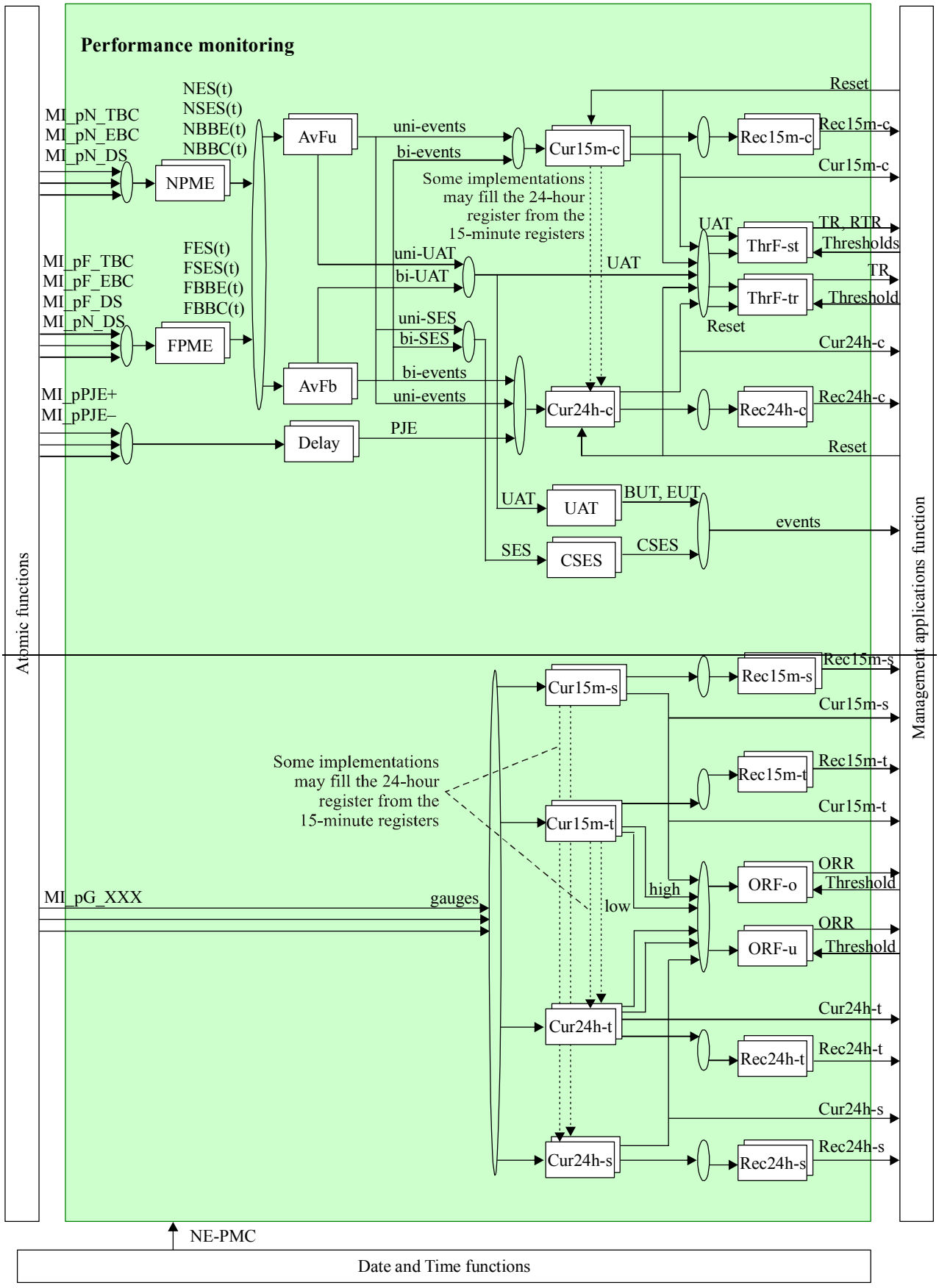
Update clause 10.2 as follows:

10.2 Performance monitoring functions

Figure 36 contains the functional model of performance monitoring inside the EMF. The white boxes are the performance monitoring functions (PMFs). Full specifications of the functions are given in subsequent clauses. The intermediate ellipses represent the interconnect options between the PMFs.

The equipment functional specification defines which (sub) set of PMFs is (to be) supported by the equipment, as well as the quantity of each PMF. For the case where the number of transport atomic functions exceeds the number of performance monitoring resources, selection may be indicated by "performance monitoring connection functions", or by alternative means. This is outside the scope of this Recommendation. For the case where such selectivity is not present or is not required, the interconnection is predefined and can be represented by explicit interconnections between PMFs and atomic functions.

Although Figure 36 allows **all** possible interconnections, it must be noted that the performance monitoring packages, defined by the technology-specific Recommendations, determine which interconnections are applicable.



G.7710-Y.1701(07)_F36

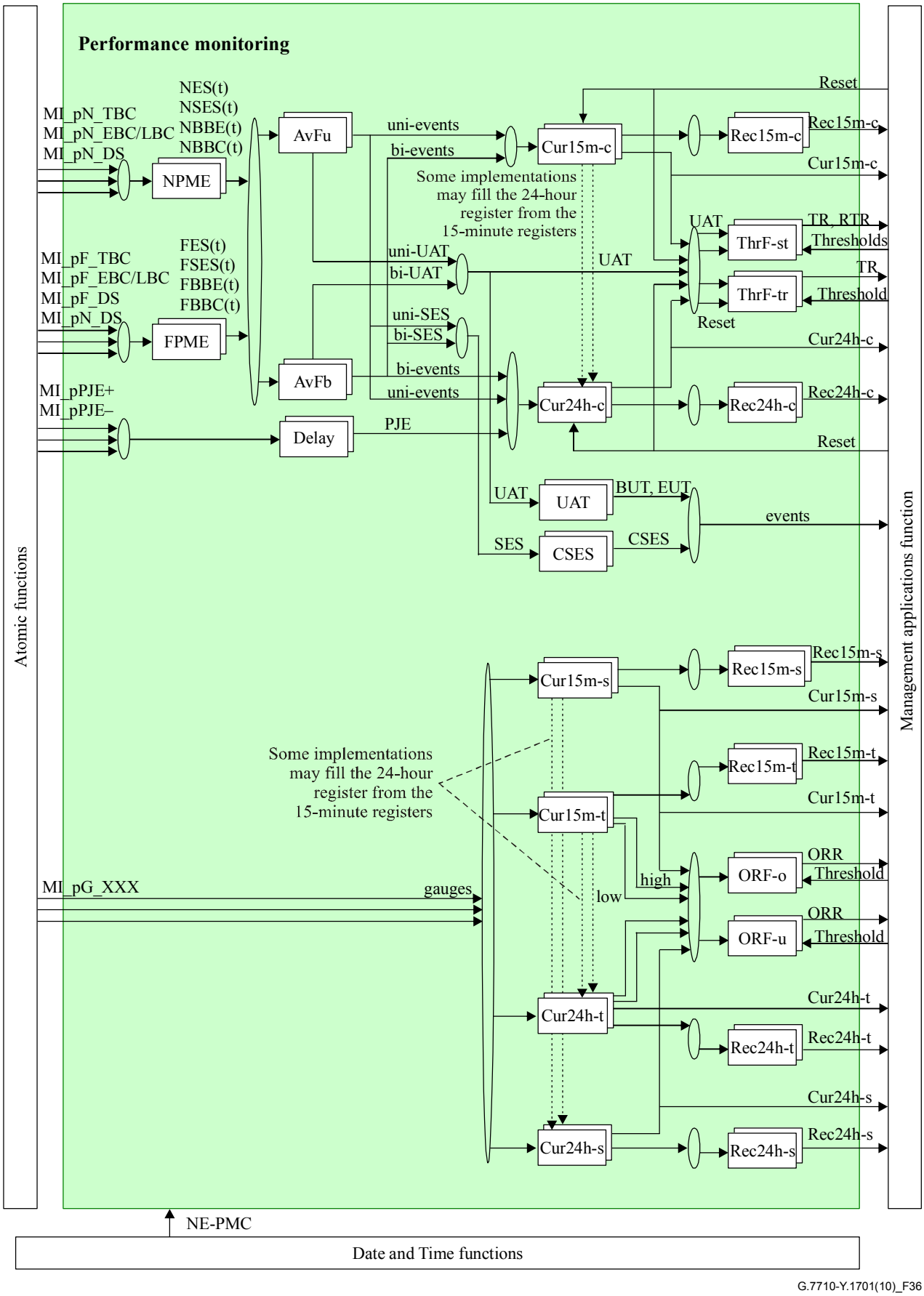


Figure 36 – Performance monitoring inside the EMF

10.2.1 Near-end performance monitoring event function – NPME

Symbol:

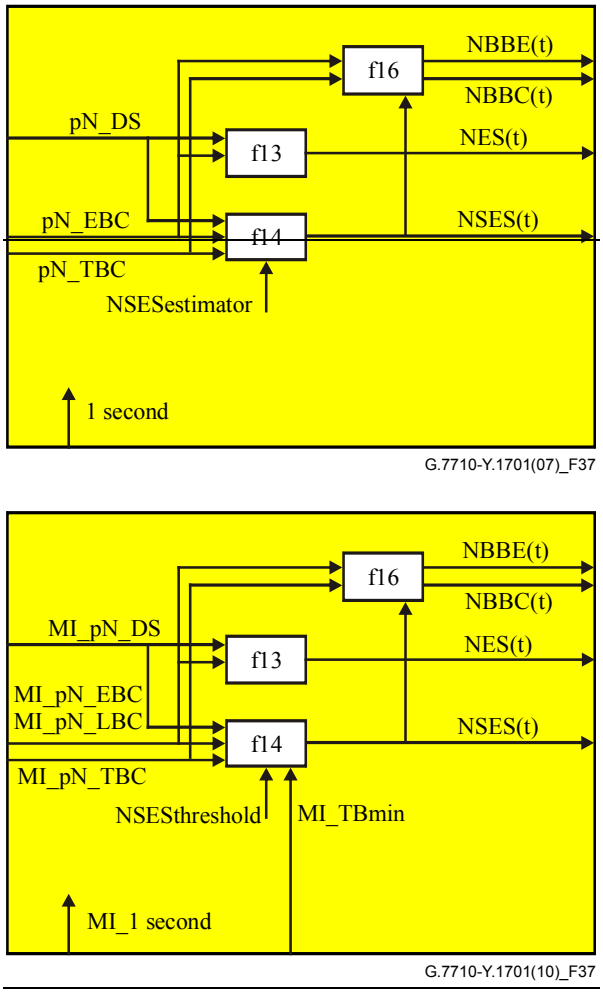


Figure 37 – NPME

Interfaces:

Table 27 – NPME input and output signals

Input(s)	Output(s)
MI_pN_DS MI_pN_EBC or MI_pN_LBC MI_pN_TBC MI_1second MI_TBmin NSES~~estimator~~threshold	NBBE(t) NBBC(t) NES(t) NSES(t)

Processes:

This function determines, on a per second basis, the number of near-end background block errors (BBE), near-end background block count, and whether an ES and/or SES occurred.

The TBC, EBC and DS performance monitoring primitive signals, received from a transport atomic function, are the inputs for the determination of the performance events BBE, BBC, ES, SES.

For the case a DS input is not connected, DS shall be assumed to be false. In the case where an EBC input is not connected, EBC shall be assumed to be "0". In the case where a TBC input is not connected, TBC shall be assumed to be "1".

Figure 37 presents the processes and their interconnections within the near-end performance monitoring event (NPME) atomic performance monitoring function.

f13: A near-end errored second (NES) performance monitoring event signal shall be generated if pN_DS is set or if pN_EBC ≥ 1; i.e.:

– NES ← (pN_DS = true) or (pN_EBC ≥ 1).

f14: A near-end severely errored second (NSES) performance monitoring event signal shall be generated if pN_DS is set or if pN_EBC ≥ ~~NSESestimator~~ NSESthreshold × pN_TBC and more than a minimum number of blocks (TBmin) were transmitted; i.e.:

– NSES ← (pN_DS = true) or ((pN_TBC ≥ TBmin) and (pN_EBC ≥ ~~NSESestimator~~ NSESthreshold × pN_TBC)).

The value of the near-end SES ~~estimator~~threshold, ~~NSESestimator~~NSESthreshold, depends on the network layer this NPME is connected to. The value of NSESthreshold is a real value between 0 and 1.

NOTE – For ~~digital~~ circuit layers (SDH, PDH, OTN) where the number of blocks within a one-second period is a fixed known value, pN_TBC is representing this fixed known value~~NSESestimator is an integer value representing this number of blocks times the SES threshold value and pN_TBC is fixed to 1~~. For packet layers (e.g., ETH~~, T-MPLS~~) where the number of blocks (i.e., frames or packets) within a one-second period is variable, pN_TBC represents the counted number of transmitted blocks within the one-second period~~NSESestimator is a real value between 0 and 1 representing the SES threshold~~.

f16: The near-end background block error (NBBE) and near-end background block count (NBBC) performance monitoring event signals shall equal pN_EBC and pN_TBC resp. if the NSES of that second is not set. Otherwise, NBBE and NBBC shall be zero.

10.2.2 Far-end performance monitoring event function – FPME

Symbol:

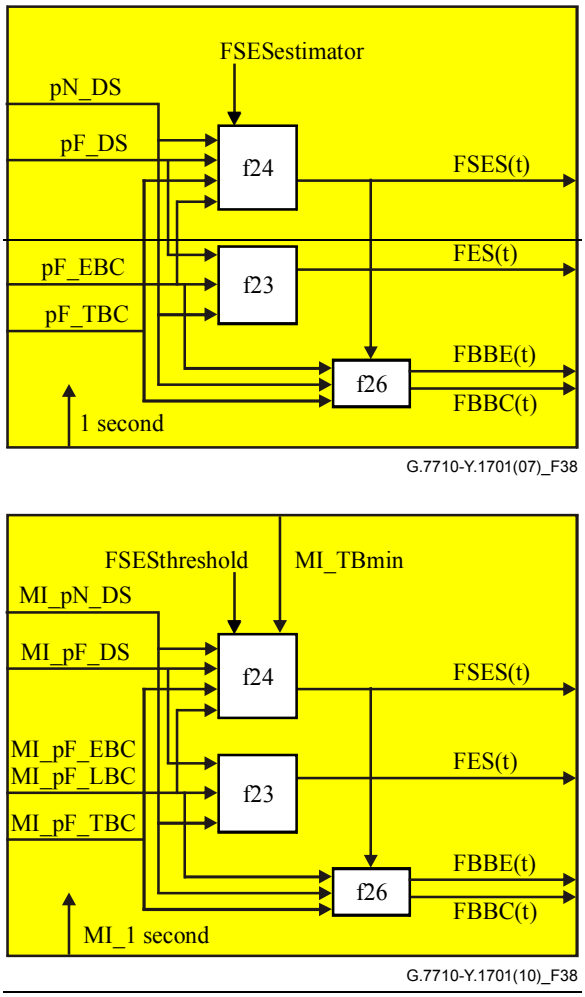


Figure 38 – FPME

Interfaces:

Table 28 – FPME input and output signals

Input(s)	Output(s)
MI_pN_DS MI_pF_DS MI_pF_EBC or MI_pF_LBC MI_pF_TBC MI_1second MI_TBmin FSES~~estimator~~threshold	FBBE(t) FBBC(t) FES(t) FSES(t)

Processes:

This function determines, on a per second basis, the number of far-end background block errors (BBE), far-end background block count, and whether an ES and/or SES occurred.

The TBC, EBC and DS performance monitoring primitive signals received from an atomic function are the inputs for the determination of the performance events BBE, BBC, ES, SES.

In the case where a DS input is not connected, DS shall be assumed to be false. For the case an EBC input is not connected, EBC shall be assumed to be "0". In the case where a TBC input is not connected, TBC shall be assumed to be "1".

Figure 38 presents the processes and their interconnections within the far-end performance monitoring event (FPME) atomic performance monitoring function. Note that "far-end" represents either those signals that are called "far-end" or those signals that are called "outgoing".

f23: A far-end errored second (FES) performance monitoring event signal shall be generated if pF_DS is set or if pF_EBC ≥ 1, and if that second is not a near-end defect second (pN_DS); i.e.:

– FES ← (pN_DS = false) and ((pF_DS = true) or (pF_EBC ≥ 1)).

f24: A far-end severely errored second (FSES) performance monitoring event signal shall be generated if pF_DS is set or if pF_EBC ≥ FSES~~estimator~~threshold × pF_TBC and more than a minimum number of blocks (TBmin) were transmitted, and that second is not a near-end defect second; i.e.:

– FSES ← (pN_DS = false) and ((pF_DS = true) or ((pN_TBC ≥ TBmin) and (pF_EBC ≥ FSES~~estimator~~threshold × p~~F~~N_TBC))).

The value of the far-end SES ~~estimator~~threshold, FSESthreshold~~estimator~~, depends on the network layer this FPME is connected to. The value of FSESthreshold is a real value between 0 and 1.

NOTE – For ~~digital~~ circuit layers (SDH, PDH, OTN) where the number of blocks within a one-second period is a fixed known value, pF_TBC is representing this fixed known value~~FSESestimator is an integer value representing this number of blocks times the SES threshold value and pN_TBC is fixed to 1~~. For packet layers (e.g., ETH~~, T-MPLS~~) where the number of blocks (i.e., frames or packets) within a one-second period is variable, pF_TBC represents the counted number of transmitted blocks within the one-second period~~FSESestimator is a real value between 0 and 1 representing the SES threshold~~.

f26: The far-end background block error (FBBE) and far-end background block count (FBBC) performance monitoring event signal shall equal pF_EBC and pF_TBC resp. if the FSES of that second is not set and if that second is not a near-end defect second. Otherwise, FBBE and FBBC shall be zero.

ITU-T Y-SERIES RECOMMENDATIONS

GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

GLOBAL INFORMATION INFRASTRUCTURE	
General	Y.100–Y.199
Services, applications and middleware	Y.200–Y.299
Network aspects	Y.300–Y.399
Interfaces and protocols	Y.400–Y.499
Numbering, addressing and naming	Y.500–Y.599
Operation, administration and maintenance	Y.600–Y.699
Security	Y.700–Y.799
Performances	Y.800–Y.899
INTERNET PROTOCOL ASPECTS	
General	Y.1000–Y.1099
Services and applications	Y.1100–Y.1199
Architecture, access, network capabilities and resource management	Y.1200–Y.1299
Transport	Y.1300–Y.1399
Interworking	Y.1400–Y.1499
Quality of service and network performance	Y.1500–Y.1599
Signalling	Y.1600–Y.1699
Operation, administration and maintenance	**Y.1700–Y.1799**
Charging	Y.1800–Y.1899
IPTV over NGN	Y.1900–Y.1999
NEXT GENERATION NETWORKS	
Frameworks and functional architecture models	Y.2000–Y.2099
Quality of Service and performance	Y.2100–Y.2199
Service aspects: Service capabilities and service architecture	Y.2200–Y.2249
Service aspects: Interoperability of services and networks in NGN	Y.2250–Y.2299
Numbering, naming and addressing	Y.2300–Y.2399
Network management	Y.2400–Y.2499
Network control architectures and protocols	Y.2500–Y.2599
Future networks	Y.2600–Y.2699
Security	Y.2700–Y.2799
Generalized mobility	Y.2800–Y.2899
Carrier grade open environment	Y.2900–Y.2999

For further details, please refer to the list of ITU-T Recommendations.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	**Transmission systems and media, digital systems and networks**
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Terminals and subjective and objective assessment methods
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
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Series Y	**Global information infrastructure, Internet protocol aspects and next-generation networks**
Series Z	Languages and general software aspects for telecommunication systems

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