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Amendment 1

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

Digital sections and digital line system – Metallic access
networks

Physical layer management for G.fast transceivers

Amendment 1

Recommendation ITU-T G.997.2 (2015) –
Amendment 1

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Recommendation ITU-T G.997.2

Physical layer management for G.fast transceivers

Amendment 1

Summary

Recommendation ITU-T G.997.2 specifies the physical layer management for fast access to subscriber terminals (G.fast) transmission systems. It specifies managed objects for configuration, fault, status, inventory and performance management.

Amendment 1 includes:

- New managed objects to support the test parameters of Amendment 1 to Recommendation ITU-T G.9701 (2014).
- New managed objects to support the low power modes of Amendment 1 to Recommendation ITU-T G.9701 (2014).
- Correction to the valid range of DELAYMAXds/us.
- Clarification regarding the generation of near-end failure.
- Fixes to several editorial typographical errors.

History

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FOREWORD

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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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Recommendation ITU-T G.997.2

Physical layer management for G.fast transceivers

Amendment 1

Editorial note: This is a complete-text publication. Modifications introduced by this amendment are shown in revision marks relative to Recommendation ITU-T G.997.2 (2015) plus its Cor.1 (2016).

1 Scope

This Recommendation specifies the physical layer management for fast access to subscriber terminals (G.fast) transmission systems.

It specifies managed objects for configuration, fault, status, inventory and performance management. The list of managed objects applies at the distribution point unit-Northbound (DPU-NB) interface, relating to the "DPU-MIB" nomenclature used in [ITU-T G.9701]. The managed objects are defined to provide, at least, all the information necessary for translation into a YANG data model [b-IETF RFC 6020], although this does not exclude translation to other formats such as an abstract syntax notation one (ASN.1) (ITU-T X.680 series) management information base (MIB) description used in connection with the simple network management protocol (SNMP) [b-IETF RFC 1157]. The definition of the YANG data model for G.fast-managed objects is outside the scope of this Recommendation.

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.994.1] Recommendation ITU-T G.994.1 (2012), *Handshake procedures for digital subscriber line transceivers*.
- [ITU-T G.9700] Recommendation ITU-T G.9700 (2014), *Fast access to subscriber terminals (G.fast) – Power spectral density specification*.
- [ITU-T G.9701] Recommendation ITU-T G.9701 (2014), *Fast access to subscriber terminals (G.fast) – Physical layer specification*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 managed resource [b-ITU-T M.3010]: The abstraction of those aspects of a telecommunication resource (logical or physical) required for telecommunications management.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 AdminStatus: (Based on clause 12.1.1.7 of [ITU-T G.9701]) The AdminStatus represents the configured, desired state of the interface. The AdminStatus "up" is equivalent with the interface "enabled=true", where the desired link state is L0, L2.1N, L2.1B, or L2.2. The AdminStatus "down" is equivalent with the interface "enabled=false", where the desired link state is L3.

NOTE – The relation between the AdminStatus ("up" or "down") and the interface (enabled="true" or "false") is defined in the IETF YANG Data Model for Interface Management [b-IETF RFC 7223].

3.2.12 anomaly: A discrepancy between the actual and desired characteristics of an item.

The desired characteristic may be expressed in the form of a specification.

An anomaly may or may not affect the ability of an item to perform a required function.

3.2.23 defect: A limited interruption in the ability of an item to perform a required function. It may or may not lead to maintenance action depending on the results of additional analysis.

Successive anomalies causing a decrease in the ability of an item to perform a required function are considered a defect.

3.2.34 empty array: An array whose number of elements is zero.

3.2.45 failure: A termination of the ability of an item to perform a required function.

NOTE – After failure, the item has a fault. Analysis of successive anomalies or defects affecting the same item can lead to the item being considered as "failed".

3.2.56 managed object: The management view of a managed resource.

3.2.67 DPU-NB interface: The interface between the persistent management agent and the management entity of the distribution point unit.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ASN.1	Abstract Syntax Notation one
CV	Code Violation
CV-C	Code Violation – Channel
DPU	Distribution Point Unit
DPU-NB	DPU Northbound
DRA	Dynamic Resource Allocation
ES	Errored Second
FAST	Fast Access to Subscriber Terminals
FE	Far-End
FRA	Fast Rate Adaptation
FTTdp	Fibre To The distribution point
FTTx	Fibre To The x
FTU	FAST Transceiver Unit
FTU-O	FAST Transceiver Unit – Central office end (i.e., network operator end of the loop)
FTU-R	FAST Transceiver Unit – Remote side (i.e., subscriber end of the loop)

GDR	Gamma Data Rate
G.fast	fast access to subscriber terminals
LOM	Loss of Margin
LOM-FE	Far-End Loss of Margin
LOR	Loss of RMC
LOR-FE	Far-End Loss of RMC
LORS	LOR Second
LOS	Loss of Signal
LOS-FE	Far-End Loss of Signal
LOSS	LOS Second
LPR	Loss of Power
LPR-FE	Far-End Loss of Power
MIB	Management Information Base
MDU	Multi-Dwelling Unit
ME	Management Entity
NDR	Net Data Rate
NDRds	downstream Net Data Rate
NDRus	upstream Net Data Rate
NE	Network Element
NMS	Network Management System
NT	Network Termination
OLR	On-Line Reconfiguration
OSS	Operations Support Systems
PM	Performance Monitoring
PMA	Persistent Management Agent
PMD	Physical Media Dependent
PMS-TC	Physical Media Specific – Transmission Convergence
PSD	Power Spectral Density
REIN	Repetitive Electrical Impulse Noise
RMC	Robust Management Channel
RPA	RMC Parameter Adjustment
SES	Severely Errored Second
SNMP	Simple Network Management Protocol
SNR	Signal-to-Noise Ratio
SRA	Seamless Rate Adaptation
TDD	Time Division Multiplexing
TPS-TC	Transport Protocol Specific – Transmission Convergence



TR	Threshold Report
UAS	UnAvailable Second
U-O	Loop interface – Central office end
U-R	Loop interface – Remote side (i.e., subscriber end of the loop)

5 Management architecture

The management of an access node (AN) or a distribution point unit (DPU) is performed by the network management system (NMS), passing management information over the Q reference point to each AN's management entity (ME) (see Figure 5-1a) or through a persistent management gent (PMA) to the each DPU's ME (see Figure 5-1b). The NMS may also monitor each G.fast transceiver unit – remote side (FTU-R) via the related network termination's (NT's) ME and G reference point. The connection between the ME functions at the AN or DPU and at the NT is established over management channels provided by the G.fast transceiver unit – central office ends (FTU-Os) and FTU-Rs via the copper pairs.

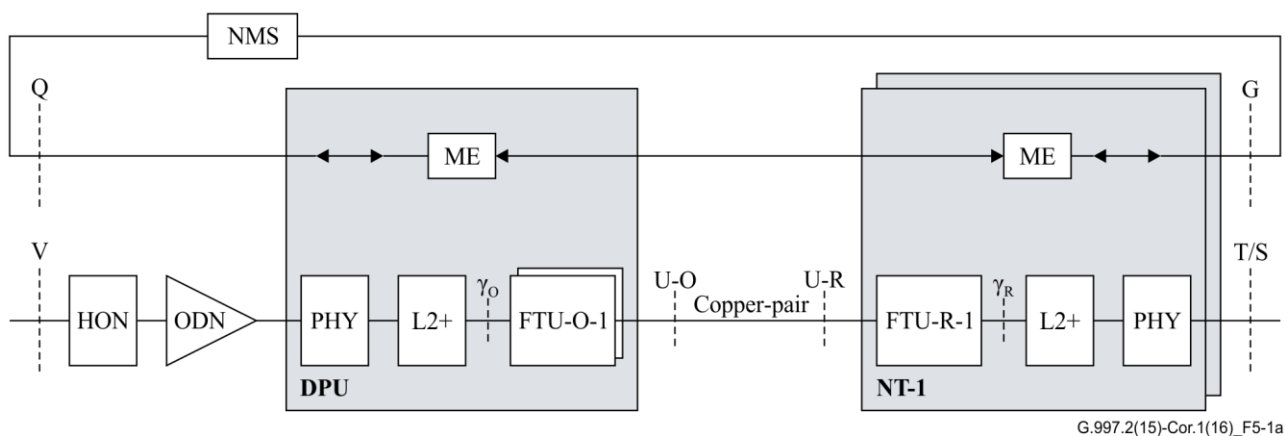


**Figure 5-1a – Reference model of traditional AN deployment
(shown for line 1 in all N lines ($N \geq 1$) connected to an AN)**

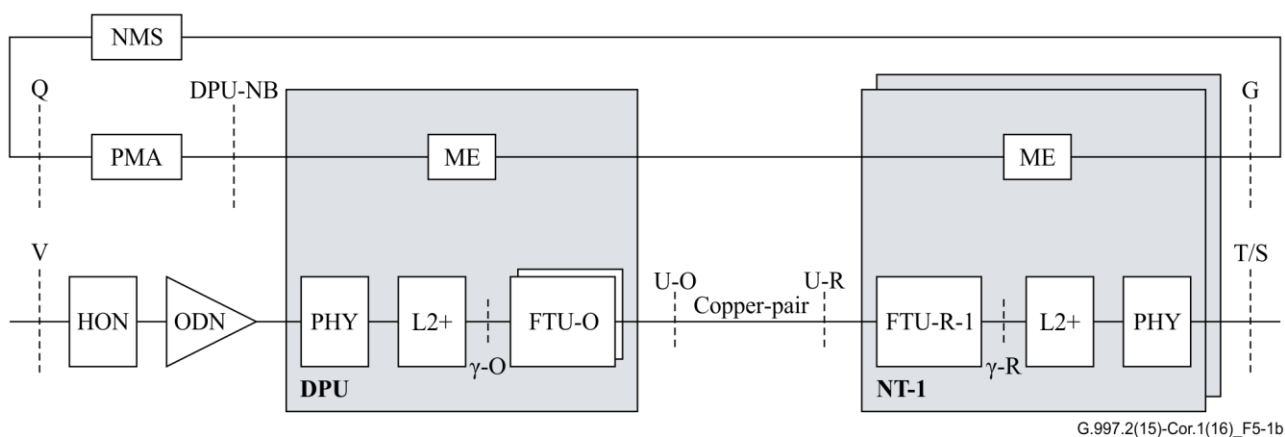


**Figure 5-1b – Reference model of FTTdp deployment with PMA and DPU
(shown for line 1 in all N lines ($N \geq 1$) connected to a DPU)**

Appendix I contains additional information regarding the Broadband Forum considerations on the fibre to the distribution point (FTTdp) deployment scenario (see also [b-BBF TR-301]).

The fundamental purpose of the PMA (see Appendix I) is to allow the operations support systems (OSS)/NMS to perform all operations on a given DPU whether or not that DPU is actually powered. This includes the following PMA functionality:

- firmware download and management;
- initial provisioning;
- configuration, including rate control;
- test and diagnostics;
- statistics gathering;
- event reporting;
- performance monitoring (PM) history beyond current and previous interval counters;
- management protocol translation between Q interface and the DPU-Northbound interface (DPU-NB interface).

Some of these operations have limited capabilities when the DPU is without power. For example, statistics gathering is limited to the history present in the PMA, since the current information is not available from the DPU.

The OSS/NMS also still needs to be able to ascertain the true power state of the DPU as a whole, and of each given line, for example for diagnostics purposes. It can choose to take into account the power state of a DPU for various processes, e.g., a new firmware download, but does not have to.

While distribution points are at locations where local power is typically not available, DPUs may also be deployed at locations where local powering or forward powering is available (e.g., in multi-dwelling unit (MDU) basements or in fibre to the x (FTTx) cabinets). In this case, a PMA could still exist as a separate entity to the DPU (if the DPU could still be unpowered at times).

[ITU-T G.9701] defines the interfaces between the FTU-O (which is part of the AN or DPU) and the FTU-R (which is part of the NT). This Recommendation specifies the physical layer management for fast access to subscriber terminals (G.fast) transmission systems as seen by the NMS (if the FTU-O is in an AN, see Figure 5-1a) and as seen by the PMA (if the FTU-O is in a DPU, see Figure 5-1b).

Clause 7 and 8 specifies managed objects for configuration, fault, test, diagnostics, status, and inventory management, and for performance monitoring. The list of managed objects applies at the DPU-NB interface shown in Figure 5-1b, relating to the "DPU-MIB" naming as used in [ITU-T G.9701]. The managed objects are defined to provide at least all the information necessary for translation into a YANG data model [b-IETF RFC 6020], although this does not exclude translation to other formats such as an ASN.1 (X.680 series) MIB description used in connection with SNMP [b-IETF RFC 1157].

The definitions of the managed objects defined in clause 7 provide the following information:

- description;
- type;
- unit;
- valid values;
- default value (for configuration objects only);
- reference.

The list of managed objects defined in clauses 7 and 8 also applies at the Q reference point shown in Figure 5-1a.

6 Network management protocol

This Recommendation makes no presumption about which management protocol is used between the NMS and the AN (see Figure 5-1a) or between the PMA and the DPU (see Figure 5-1b) for transport of the G.fast-managed objects.

7 Managed objects

The list of managed objects contains six types of information:

- 1) configuration objects;
- 2) fault monitoring – failures (alarm indications);
- 3) fault monitoring – threshold crossing (alert messages);
- 4) performance monitoring objects (counters);
- 5) test, diagnostic and status objects;
- 6) inventory objects.

Figure 7-1 shows the in-service performance monitoring process. The primitives are specified in [ITU-T G.9701].

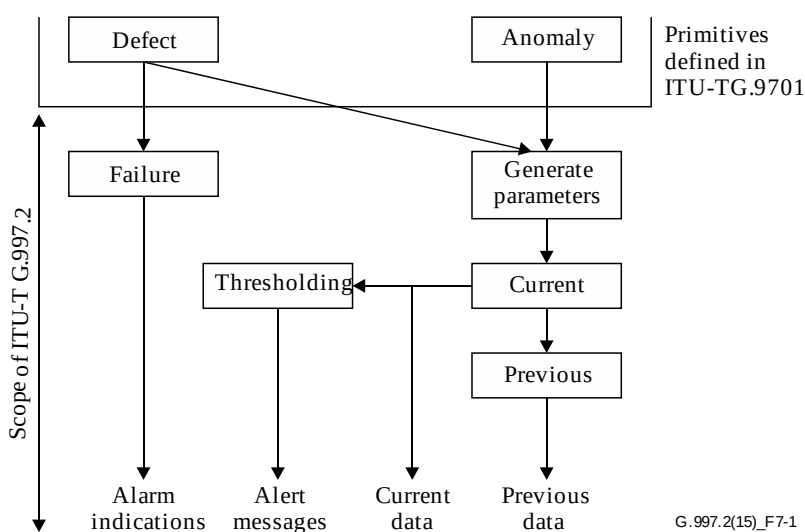


Figure 7-1 – In-service performance monitoring process

As [ITU-T G.9701] supports a DPU with up to 128 lines, provisioning every managed object for every G.fast port on the DPU may become burdensome. Therefore, the DPU configuration management (as defined in the Broadband Forum) defines G.fast configuration profiles, as well as a mechanism to associate these profiles to the individual ports. The definition of G.fast configuration profiles is outside the scope of this Recommendation. The allocation of the individual G.fast-managed objects (as defined in this Recommendation) to G.fast configuration profiles is addressed within the scope of the Broadband Forum.

NOTE – The "configuration profiles" are not the "Profiles" discussed in clause 6 of [ITU-T G.9701]. This clause uses the term "profile" for simplifying the configuration of [ITU-T G.9701] ports on a DPU in the field. Clause 6 of [ITU-T G.9701] is a discussion of a technique for defining the native capabilities (e.g., the particular subset of [ITU-T G.9701]) supported by a particular G.fast transceiver.

At the DPU-NB interface, a line is configured through the following information:

- line configuration objects (see Table 7-1) for the line;
- channel configuration objects (see Table 7-2) for the downstream channel;

- channel configuration objects (see Table 7-2) for the upstream channel;
- data path configuration objects (see Table 7-3) for the downstream data path;
- data path configuration objects (see Table 7-3) for the upstream data path.

Line configuration objects relate to the physical media dependent (PMD) sublayer and the robust management channel (RMC). Channel configuration objects relate to the bearer channel-related aspects of the physical media specific – transmission convergence (PMS-TC) sublayer. Data path configuration objects relate to the transport protocol specific – transmission convergence (TPS-TC) sublayer.

At the DPU-NB interface, a line is monitored through the following information:

- line failures (see Table 7-4);
- channel failures (see Table 7-5);
- data path failures (see Table 7-6);
- line performance monitoring objects (see Table 7-7);
- channel performance monitoring objects (see Table 7-8) for the downstream channel;
- channel performance monitoring objects (see Table 7-8) for the upstream channel;
- data path performance monitoring objects (see Table 7-9) for the downstream data path;
- data path performance monitoring objects (see Table 7-9) for the upstream data path;
- line test, diagnostics and status objects (see Table 7-10);
- channel test, diagnostics and status objects (see Table 7-11) for the downstream channel;
- channel test, diagnostics and status objects (see Table 7-11) for the upstream channel;
- data path test, diagnostic and status objects (see Table 7-12) for the downstream channel;
- data path test, diagnostic and status objects (see Table 7-12) for the upstream channel;
- inventory objects (see Table 7-13).

As [ITU-T G.9701] supports a DPU with up to 128 lines, maintaining the performance monitoring and the test, diagnostic and status information for every line may become burdensome. Although access to all mandatory managed objects shall be supported at all times for all ports on the DPU at the DPU-NB interface towards the PMA (see Figure 5-1), the objects may not be maintained within the management entity of the DPU simultaneously for all lines at all times. Although reasonable performance shall be provided at the DPU-NB interface for access to the managed objects of any line, this Recommendation does not define specific performance requirements at this interface.

When the update request flag for a test parameters-parameter group (see clause 7.1.9) is set (its value is changed from 0 to 1), the near-end parameters of the associated test parameters groups shall be updated in the DPU-MIB within 10 seconds the update time period specified in Table 7-0. The update request flag for the near-end associated test parameters group is defined in the DPU-MIB and is independent of any autonomous update process in the system. The parameter update request flag shall be reset (its value changed back to 0) by the DPU after the request parameter update is complete. The reset shall be within a period that is shorter than 3 minutes- the reset time period specified in Table 7-0 to allow reception of another update request. The 3-minute reset time period starts since the last time the update request flag was set (externally or by an autonomous process in the system). This applies only to the elements maintained in the DPU.

Test parameters and status parameters shall be updated in L0, L2.1N, L2.1B and L2.2 link states, unless explicitly stated differently in [ITU-T G.9701]. The GDRds/us and ATTGDRds/us shall be updated only in L0 state.

Table 7-0 – Test parameter groups

<u>Test parameter group (Note)</u>	<u>Update time period</u>	<u>Reset time period</u>
<u>NE test parameter group 1 (NE-G1)</u>	<u>10 seconds</u>	<u>3 minutes</u>
<u>FE test parameter group 1 (FE-G1)</u>	<u>15 seconds</u>	<u>3 minutes</u>
<u>NE test parameter group 2 (NE-G2)</u>	<u>3 minutes</u>	<u>10 minutes</u>
<u>FE test parameter group 2 (FE-G2)</u>	<u>3 minutes</u>	<u>10 minutes</u>
<u>NOTE – The test parameters contained in each test parameter group are defined in Table 7-10 and Table 7-11.</u>		

Tables 7-1 to 7-11 indicate the status of each managed object over the DPU-NB interface:

- R: Read only
- W: Write only
- R/W: Read and write
- (M): Mandatory
- (O): Optional

Entries in Tables 7-1 to 7-11 labelled with names containing the separator "/" represent multiple objects whose names are obtained by considering all combinations of the elements isolated with the separator. For example, the entry labelled with the name A/B_C/D_E/F represents eight objects with names A_C_E, A_C_F, A_D_E, A_D_F, B_C_E, B_C_F, B_D_E, B_D_F. Also, the entry labelled with the name Ads/us represents two objects with names Ads and Aus. Near-end (-NE) objects apply to the FTU-O, while far-end (-FE) objects apply to the FTU-R.

Table 7-1 – Line configuration objects

Category/object	Defined in clause:	DPU-NB interface
Profiles		
[ITU-T G.9701] profiles enabling (PROFILES)	7.1.0.1	R/W (M)
Time division ~~Multiplexing~~ Duplexing (TDD)		
Symbol periods per TDD frame (MF)	7.1.1.1	R/W (M)
Symbol periods per TDD frame dedicated for downstream transmission (Mds)	7.1.1.2	R/W (M)
Cyclic extension (CE)	7.1.1.3	R/W (M)
Power and spectrum usage		
MAXATPds	7.1.2.1	R/W (M)
MAXATPus	7.1.2.2	R/W (M)
CARMASKds	7.1.2.3	R/W (M)
CARMASKus	7.1.2.4	R/W (M)
MIBPSDMASKds	7.1.2.5	R/W (M)
MIBPSDMASKus	7.1.2.6	R/W (M)
RFIBANDS	7.1.2.7	R/W (M)
IARBANDS	7.1.2.8	R/W (M)
UPBOPSDA	7.1.2.9	R/W (M)
UPBOPSDB	7.1.2.10	R/W (M)

Table 7-1 – Line configuration objects

Category/object	Defined in clause:	DPU-NB interface
UPBOKL	7.1.2.11	R/W (M)
UPBOKLF	7.1.2.12	R/W (M)
UPBOKLREF	7.1.2.13	R/W (M)
Noise margins		
TARSNRMds	7.1.3.1	R/W (M)
TARSNRMus	7.1.3.2	R/W (M)
MAXSNRMus	7.1.3.3	R/W (M)
MINSNRMds	7.1.3.4	R/W (M)
MINSNRMus	7.1.3.5	R/W (M)
Seamless rate adaptation (SRA)		
SRA-USNRMds	7.1.4.1	R/W (M)
SRA-UTIMEds	7.1.4.2	R/W (M)
SRA-USNRMus	7.1.4.3	R/W (M)
SRA-UTIMEus	7.1.4.4	R/W (M)
SRA-DSNRMds	7.1.4.5	R/W (M)
SRA-DTIMEds	7.1.4.6	R/W (M)
SRA-DSNRMus	7.1.4.7	R/W (M)
SRA-DTIMEus	7.1.4.8	R/W (M)
Fast rate adaptation (FRA)		
FRA-TIMEds	7.1.5.1	R/W (M)
FRA-TIMEus	7.1.5.2	R/W (M)
FRA-NTONESds	7.1.5.3	R/W (M)
FRA-NTONESus	7.1.5.4	R/W (M)
FRA-RTXUCds	7.1.5.5	R/W (M)
FRA-RTXUCus	7.1.5.6	R/W (M)
FRA-VENDISCds	7.1.5.7	R/W (M)
FRA-VENDISCus	7.1.5.8	R/W (M)
Robust management channel (RMC)		
TARSNRM-RMCds	7.1.6.1	R/W (M)
TARSNRM-RMCus	7.1.6.2	R/W (M)
MINSNRM-RMCds	7.1.6.3	R/W (M)
MINSNRM-RMCus	7.1.6.4	R/W (M)
MAXBL-RMCds	7.1.6.5	R/W (M)
MAXBL-RMCus	7.1.6.6	R/W (M)
Vectoring		
FEXT cancellation enabling/disabling downstream (FEXT_TO_CANCEL_ENABLEds)	7.1.7.1	R/W (M)

Table 7-1 – Line configuration objects

Category/object	Defined in clause:	DPU-NB interface
FEXT cancellation enabling/disabling upstream (FEXT_TO_CANCEL_ENABLE _{Eus})	7.1.7.2	R/W (M)
<i>Re-initializationFast-retrain policy</i>		
LOS-PERSISTENCY _{ds}	7.1.8.1	R/W (M)
LOS-PERSISTENCY _{us}	7.1.8.2	R/W (M)
LOM-PERSISTENCY _{ds}	7.1.8.3	R/W (M)
LOM-PERSISTENCY _{us}	7.1.8.4	R/W (M)
LOR-PERSISTENCY _{ds}	7.1.8.5	R/W (M)
LOR-PERSISTENCY _{us}	7.1.8.6	R/W (M)
REINIT_TIME_THRESHOLD _{ds}	7.1.8.7	R/W (M)
REINIT_TIME_THRESHOLD _{us}	7.1.8.8	R/W (M)
LOW_ETR_THRESHOLD _{ds}	7.1.8.9	R/W (M)
LOW_ETR_THRESHOLD _{us}	7.1.8.10	R/W (M)
<i>Update test parameters request</i>		
UPDATE-NE-TEST	7.1.9.1	R/W (M)
UPDATE-FE-TEST	7.1.9.2	R/W (M)
<i>Low power modes</i>		
<u>L2-TARSNRM_{ds/us}</u>	<u>7.1.10.1</u>	<u>R/W (M)</u>
<u>L2.1-MAXSNRM_{ds/us}</u>	<u>7.1.10.2</u>	<u>R/W (M)</u>
<u>L2.1-MAXPSDR</u>	<u>7.1.10.3</u>	<u>R/W (M)</u>
<u>L2.1-SRA-USNRM_{ds}</u>	<u>7.1.10.4</u>	<u>R/W (M)</u>
<u>L2.1-SRA-USNRM_{us}</u>	<u>7.1.10.5</u>	<u>R/W (M)</u>
<u>L2.1-SRA-DSNRM_{ds}</u>	<u>7.1.10.6</u>	<u>R/W (M)</u>
<u>L2.1-SRA-DSNRM_{us}</u>	<u>7.1.10.7</u>	<u>R/W (M)</u>

Table 7-2 – Channel configuration objects

Category/object	Defined in clause:	DPU-NB interface
<i>Data rate (downstream/upstream)</i>		
Maximum net data rate (NDR) (MAXNDR _{ds/us})	7.2.1.1	R/W (M)
Minimum expected throughput (MINETR _{ds/us})	7.2.1.2	R/W (M)
Maximum gamma data rate (GDR) (MAXGDR _{ds/us})	7.2.1.3	R/W (M)
Minimum gamma data rate (MINGDR _{ds/us})	7.2.1.4	R/W (M)
<i>Retransmission (downstream/upstream)</i>		
DELAYMAX _{ds/us}	7.2.2.1	R/W (M)
INPMIN_SHINE _{ds/us}	7.2.2.2	R/W (M)

Table 7-2 – Channel configuration objects

Category/object	Defined in clause:	DPU-NB interface
SHINERATIOds/us	7.2.2.3	R/W (M)
INPMIN_REINds/us	7.2.2.4	R/W (M)
IAT_REINds/us	7.2.2.5	R/W (M)
RNRATIOds/us	7.2.2.6	R/W (M)
RTX_TESTMODEds/us	7.2.2.7	R/W (M)
Low power modes		
<u>L2.1-MAXNDRds/us</u>	<u>7.2.3.1</u>	<u>R/W (M)</u>
<u>L2.2-MAXNDR</u>	<u>7.2.3.2</u>	<u>R/W (M)</u>
<u>L2.1-MINETRds/us</u>	<u>7.2.3.3</u>	<u>R/W (M)</u>
<u>L2.2-MINETR</u>	<u>7.2.3.4</u>	<u>R/W (M)</u>
<u>L2.1-MINETR-EXITds/us</u>	<u>7.2.3.5</u>	<u>R/W (M)</u>

Table 7-3 – Data path configuration objects

Category/object	Defined in clause:	DPU-NB interface
TPS_TESTMODE	7.3.1	R/W (M)
DRA_TESTMODE	7.3.2	R/W (M)

Table 7-4 – Line failures

Category/object	Defined in clause:	DPU-NB interface
<i>Near-end (FTU-O) failures</i>		
Loss of signal (LOS)	7.4.1.1	R (M)
Loss of margin (LOM)	7.4.1.2	R (M)
Loss of RMC (LOR)	7.4.1.3	R (M)
Loss of power (LPR)	7.4.1.4	R (M)
<i>Far-end (FTU-R) failures</i>		
Far-end loss of signal (LOS-FE) failure	7.4.2.1	R (M)
Far-end loss of margin (LOM-FE) failure	7.4.2.2	R (M)
Far-end loss of RMC (LOR-FE) failure	7.4.2.3	R (M)
Far-end loss of power (LPR-FE) failure	7.4.2.4	R (M)
<i>Initialization failures</i>		
Line init (LINIT) failure	7.4.3.1	R (M)

Table 7-5 – Channel failures

Category/object	Defined in clause:	DPU-NB interface
<i>Near-end (FTU-O) failures</i>		
<i>Far-end (FTU-R) failures</i>		

Table 7-6 – Data path failures

Category/object	Defined in clause:	DPU-NB interface
<i>Near-end (FTU-O) failures</i>		
<i>Far-end (FTU-R) failures</i>		

Table 7-7 – Line performance monitoring objects

Category/object	Defined in clause:	DPU-NB interface
<i>Near-end (FTU-O)/Far-end (FTU-R) performance monitoring counters (current/previous 15 min/24 h interval)</i>		
Measured time (CURR/PREV_NE/FE_15/24_L_TIME)	7.7.1	R (M)
Invalid data flag (PREV_NE/FE_15/24_L_INVALID)	7.7.2	R (M)
Time Stamp (PREV_NE/FE_15/24_L_STAMP)	7.7.3	R (M)
LOS failure counter (CURR/PREV_NE/FE_15/24_LOS)	7.7.4	R (M)
LOM failure counter (CURR/PREV_NE/FE_15/24_LOM)	7.7.5	R (M)
LOR failure counter (CURR/PREV_NE/FE_15/24_LOR)	7.7.6	R (M)
LPR failure counter (CURR/PREV_NE/FE_15/24_LPR)	7.7.7	R (M)
ES counter (CURR/PREV_NE/FE_15/24_ES)	7.7.8	R (M)
Severely errored second (SES) counter (CURR/PREV_NE/FE_15/24_SES)	7.7.9	R (M)
LOSS counter (CURR/PREV_NE/FE_15/24_LOSS)	7.7.10	R (M)
LOR second (LORS) counter (CURR/PREV_NE/FE_15/24_LORS)	7.7.11	R (M)

Table 7-7 – Line performance monitoring objects

Category/object	Defined in clause:	DPU-NB interface
Unavailable second (UAS) counter (CURR/PREV_NE/FE_15/24_UAS)	7.7.12	R (M)
Initialization performance monitoring counters (current/previous 15 min/24 h interval)		
Full inits counter (CURR/PREV_15/24_FULL_INITS)	7.7.13	R (M)
Failed full inits counter (CURR/PREV_15/24_FAILEDFULL_INITS)	7.7.14	R (M)
Fast inits counter (CURR/PREV_15/24_FAST_INITS)	7.7.15	R (M)
Failed Fast inits counter (CURR/PREV_15/24_FAILEDFAST_INITS)	7.7.16	R (M)
Short interruption performance monitoring counters (current/previous 15 min/24 h interval)		
LPR_INTRPT counter (CURR/PREV_15/24_LPR_INTRPT)	7.7.17	R (M)
HRI_INTRPT counter (CURR/PREV_15/24_HRI_INTRPT)	7.7.18	R (M)
SPONT_INTRPT counter (CURR/PREV_15/24_SPONT_INTRPT)	7.7.19	R (M)
Near-end (FTU-O)/far-end (FTU-R) initiated OLR/FRA performance monitoring counters (current and previous 15 min/24 h interval)		
Successful bitswap counter (CURR/PREV_NE/FE_15/24_BSW)	7.7.20	R (M)
Successful autonomous SRA counter (CURR/PREV_NE/FE_15/24_SRA)	7.7.21	R (M)
Successful FRA counter (CURR/PREV_NE/FE_15/24_FRA)	7.7.22	R (M)
Successful RPA counter (CURR/PREV_NE/FE_15/24_RPA)	7.7.23	R (M)
Near-end (FTU-O) initiated TIGA performance monitoring counters (current and previous 15 min/24 h interval)		
Successful TIGA counter (CURR/PREV_15/24_TIGA)	7.7.24	R (M)

Table 7-8 – Channel performance monitoring objects

Category/object	Defined in clause:	DPU-NB interface
<i>Near-end (FTU-O)/far-end (FTU-R) performance monitoring counters (current/previous 15 min/24 h interval)</i>		
Measured Time (CURR/PREV_NE/FE_15/24_C_TIME)	7.8.1	R (M)
Invalid Data Flag (PREV_NE/FE_15/24_C_INVALID)	7.8.2	R (M)
Time Stamp (PREV_NE/FE_15/24_C_STAMP)	7.8.3	R (M)
CV counter (CURR/PREV_NE/FE_15/24_CV)	7.8.4	R (M)
RTXUC counter (CURR/PREV_NE/FE_15/24_RTXUC)	7.8.5	R (M)
RTXTX counter (CURR/PREV_NE/FE_15/24_RTXTX)	7.8.6	R (M)
NOTE – The Measured Time, Invalid Data Flag and Time Stamp objects may have the same values as the respective line performance monitoring objects.		

Table 7-9 – Data path performance monitoring objects

Category/object	Defined in clause:	DPU-NB interface

Table 7-10 – Line test, diagnostic and status objects

Category/Object	Defined in clause:	<u>Test parameter group</u>	DPU-NB Interface
<i>Profile</i>			
G.9701 profile (PROFILE)	7.10.1.1	<u>Not applicable</u>	R (M)
<i>Initialization</i>			
Initialization success/failure cause (INITSFCAUSE)	7.10.2.1	<u>Not applicable</u>	R (M)
Initialization last transmitted downstream signal (INITLASTSSIGNALds)	7.10.2.2	<u>Not applicable</u>	R (M)
Initialization last received upstream signal (INITLASTSIGNALus)	7.10.2.3	<u>Not applicable</u>	R (M)
<i>Signal-to-noise ratio margin</i>			
SNRMds	7.10.3.1 ~~3~~	<u>Not applicable</u>	R (M)
SNRMus	7.10.3.2	<u>Not applicable</u>	R (M)
<i>Upstream power back-off</i>			
UPBOKLE	7.10.4.1	<u>Not applicable</u>	R (M)
UPBOKLE-R	7.10.4.2	<u>Not applicable</u>	R (M)
<i>Actual aggregate transmit power</i>			
ACTATPds	7.10.5.1	<u>FE-G1</u>	R (M)
ACTATPus	7.10.5.2	<u>NE-G1</u>	R (M)

Table 7-10 – Line test, diagnostic and status objects

Category/Object	Defined in clause:	Test parameter group	DPU–NB Interface
Actual transmit power spectrum density per sub-carrier			
ACTPSDpsds	7.10.6.1	FE-G1	R (M)
ACTPSDpsus	7.10.6.2	NE-G1	R (M)
Channel characteristics per sub-carrier			
~~For further study~~	~~7.10.7~~		
HLOGMTds	7.10.1.1	NE-G2	R(M)
HLOGGds	7.10.7.2	NE-G2	R(M)
HLOGpsds	7.10.7.3	NE-G2	R(M)
Signal-to-noise ratio per sub-carrier			
SNRMTds	7.10.8.1	FE-G1	R (M)
SNRGds	7.10.8.2	FE-G1	R (M)
SNRpsds	7.10.8.3	FE-G1	R (M)
SNRMTus	7.10.8.4	NE-G1	R (M)
SNRGus	7.10.8.5	NE-G1	R (M)
SNRpsus	7.10.8.6	NE-G1	R (M)
<u>Quiet line noise per sub-carrier</u>			
QLNMTds	7.10.9.1	FE-G2	R (M)
QLNGds	7.10.9.2	FE-G2	R (M)
QLNpsds	7.10.9.3	FE-G2	R (M)
QLNMTus	7.10.9.4	NE-G2	R (M)
QLNGus	7.10.9.5	NE-G2	R (M)
QLNpsus	7.10.9.6	NE-G2	R (M)
<u>Active line noise per sub-carrier</u>			
ALNMT	7.10.10.1	FE-G2	R (M)
ALNG	7.10.10.2	FE-G2	R (M)
ALNps	7.10.10.3	FE-G2	R (M)
<u>Low power modes</u>			
L2.1-SNRMds	7.10.16.1	Not applicable	R(M)
L2.1-SNRMus	7.10.16.2	Not applicable	R(M)
L2.2-SNRMds	7.10.16.3	Not applicable	R(M)
L2.2-SNRMus	7.10.16.4	Not applicable	R(M)
L2-SNRM-RMCds	7.10.16.5	Not applicable	R(M)
L2-SNRM-RMCus	7.10.16.6	Not applicable	R(M)
Bit allocation per sub-carrier on data symbols			
BITSpds	7.10.11.1	Not applicable	R (M)
BITSpus	7.10.11.2	Not applicable	R (M)
RMC			
SNRM-RMCds	7.10.12.1	Not applicable	R (M)
SNRM-RMCus	7.10.12.2	Not applicable	R (M)
BITS-RMCpsds	7.10.12.3	Not applicable	R (M)

Table 7-10 – Line test, diagnostic and status objects

Category/Object	Defined in clause:	<u>Test parameter group</u>	DPU–NB Interface
BITS-RMCpsus	7.10.12.4	<u>Not applicable</u>	R (M)
<i>Test parameter time stamps</i>			
STAMP–TEST–NE– <u>G1</u>	7.10.13.1	<u>Not applicable</u>	R (M)
STAMP–TEST–FE– <u>G1</u>	7.10.13.2	<u>Not applicable</u>	R (M)
<u>STAMP–TEST–NE–G2</u>	<u>7.10.13.3</u>	<u>Not applicable</u>	<u>R (M)</u>
<u>STAMP–TEST–FE–G2</u>	<u>7.10.13.4</u>	<u>Not applicable</u>	<u>R (M)</u>
<i>OLR time stamps</i>			
STAMP–BSWds	7.10.14.1	<u>Not applicable</u>	R (M)
STAMP–BSWus	7.10.14.2	<u>Not applicable</u>	R (M)
STAMP–SRAds	7.10.14.3	<u>Not applicable</u>	R (M)
STAMP–SRAus	7.10.14.4	<u>Not applicable</u>	R (M)
STAMP–FRAds	7.10.14.5	<u>Not applicable</u>	R (M)
STAMP–FRAus	7.10.14.6	<u>Not applicable</u>	R (M)
STAMP–RPA ds	7.10.14.7	<u>Not applicable</u>	R (M)
STAMP–RPAus	7.10.14.8	<u>Not applicable</u>	R (M)
STAMP–TIGA	7.10.14.9	<u>Not applicable</u>	R (M)
<i><u>Signal attenuation</u></i>			
<u>SATNds</u>	<u>7.10.15.1</u>	<u>FE–G1</u>	<u>R (M)</u>
<u>SATNus</u>	<u>7.10.15.2</u>	<u>NE–G1</u>	<u>R (M)</u>

Table 7-11 – Channel test, diagnostic and status objects

Category/Object	Defined in clause:	Test parameter group	DPU–NB Interface
Actual data rates(downstream/upstream)			
Net Data Rate (NDRds/us)	7.11.1.1	Not applicable	R (M)
Expected Throughput (ETRsds/us)	7.11.1.2	Not applicable	R (M)
Gamma Data Rate (GDRds/us)	7.11.1.3	Not applicable	R (M)
Attainable data rates (downstream/upstream)			
Attainable net Data rate (ATTNDRds/us)	7.11.2.1	Not applicable	R (M)
Attainable Expected Throughput (ATTETRsds/us)	7.11.2.2	Not applicable	R (M)
Attainable Gamma Data Rate (ATTGDRds/us)	7.11.2.3	Not applicable	R (M)
Actual impulse noise protection (downstream/upstream)			
ACTINPsds/us	7.11.3.1	Not applicable	R (M)
ACTINP_REINds/us	7.11.3.2	Not applicable	R (M)
Actual framer setting (downstream/upstream)			
DTU–NFECds/us	7.11.4.1	Not applicable	R (M)
DTU–RFECds/us	7.11.4.2	Not applicable	R (M)
DTU–Qds/us	7.11.4.3	Not applicable	R (M)
Test parameters per time interval (downstream/upstream)			
Error–free bits current 15 minutes (EFB–C15Mds/us)	7.11.5.1	Not applicable	R (M)
Error–free bits previous 15 minutes (EFB–P15Mds/us)	7.11.5.2	Not applicable	R (M)
Error–free bits current 24 hours (EFB–C24Hds/us)	7.11.5.3	Not applicable	R (M)
Error–free bits previous 24 hours (EFB–P24Hds/us)	7.11.5.4	Not applicable	R (M)
MINEFTR current15 minutes (MINEFTR_C15Mds/us)	7.11.5.5	Not applicable	R (M)
MINEFTR previous15 minutes (MINEFTR_P15Mds/us)	7.11.5.6	Not applicable	R (M)
MINEFTR current 24 hours(MINEFTR_C24Hds/us)	7.11.5.7	Not applicable	R (M)
MINEFTR previous 24 hours (MINEFTR_P24Hds/us)	7.11.5.8	Not applicable	R (M)
Low power modes (downstream/upstream)			
L2.1-NDRds/us	7.11.6.1	Not applicable	R(M)
L2.2-NDRds/us	7.11.6.2	Not applicable	R(M)
L2.1-ETRsds/us	7.11.6.3	Not applicable	R(M)
L2.2-ETRsds/us	7.11.6.4	Not applicable	R(M)

Table 7-12 – Data path test, diagnostic and status objects

Category/object	Defined in clause:	DPU-NB interface

Table 7-13 – Inventory objects

Category/object	Defined in clause:	DPU-NB interface
<i>FTU related inventory</i>		
FTU-O ITU-T G.994.1 vendor ID (FTUO_GHS_VENDOR)	7.13.1.1	R (M)
FTU-R ITU-T G.994.1 vendor ID (FTUR_GHS_VENDOR)	7.13.1.2	R (M)
FTU-O version number (FTUO_VERSION)	7.13.1.3	R (M)
FTU-R version number (FTUR_VERSION)	7.13.1.4	R (M)
FTU-O self-test result (FTUO-SELFTEST)	7.13.1.5	R (M)
FTU-R self-test result (FTUR-SELFTEST)	7.13.1.6	R (M)
<i>System related inventory</i>		
DPU system vendor ID (DPU_SYSTEM_VENDOR)	7.13.2.1	R (M)
NT system vendor ID (NT_SYSTEM_VENDOR)	7.13.2.2	R (M)
DPU serial number (DPU_SYSTEM_SERIALNR)	7.13.2.3	R (M)
NT serial number (NT_SYSTEM_SERIALNR)	7.13.2.4	R (M)

Table 7-14 – Link state objects

<u>Category/Object</u>	<u>Defined in clause:</u>	<u>DPU-NB</u>
<u>Link State Test Configuration</u>		
<u>Link State Force (LS-FORCED)</u>	<u>7.14.1.1</u>	<u>R/W (M)</u>
<u>Link State Enabling (LS-ENABLE)</u>	<u>7.14.1.2</u>	<u>R/W (M)</u>
<u>Link state reporting</u>		
<u>Link State (LINK-STATE)</u>	<u>7.14.2.1</u>	<u>R (M)</u>
<u>Link State at update of near-end test parameter group 1 (LINK-STATE-TEST-NE-G1)</u>	<u>7.14.2.2</u>	<u>R (M)</u>
<u>Link State at update of far-end test parameter group 1 (LINK-STATE-TEST-FE-G1)</u>	<u>7.14.2.3</u>	<u>R (M)</u>