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Amendment 6

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

Digital sections and digital line system – Metallic access networks

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Single-ended line testing for digital subscriber lines (DSL)

Amendment 6

Recommendation ITU-T G.996.2 (2009) – Amendment 6

International Telecommunication Union

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Recommendation ITU-T G.996.2

Single-ended line testing for digital subscriber lines (DSL)

Amendment 6

Summary

Amendment 6 to Recommendation ITU-T G.996.2 (2009) updates Annexes A, E and F, defining the following new functionalities:

1) SELT-PMD management
2) MELT-PMD management
3) Report of negative capacitance values
4) Pair identification tone with timeout
5) Report of reliability indicator for measurements
6) Report of time stamp
7) Parallelism and polarity of far-end signature detection
8) CPE identification capacitive.

History

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* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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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In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had 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/.

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Single-ended line testing for digital subscriber lines (DSL)

Amendment 6

Modifications introduced by this amendment are shown in revision marks. Unchanged text is replaced by ellipsis (…). Some parts of unchanged text (clause numbers, etc.) may be kept to indicate the correct insertion points.

1) Clause A.3

Replace clause A.3 "Test management and communications", with the following:

A.3 Test management and communications

The CO-side SELT PMD is managed using the parameters defined in this clause. The NT-side SELT PMD management is for further study.

A.3.1 CO SELT PMD control

This parameter configures the CO SELT PMD for a particular measurement.

The parameter is of type enumeration, with the following valid values:

- disable: the CO SELT PMD is not configured for a measurement;
- enable: the CO SELT PMD is configured for a measurement.

The CO SELT PMD is by default "disable". When "disable", the line is in normal operation (e.g., in the L0 state if the line is configured with AdminStatus=up). When "enable", the AN/DPU ME shall force the line into the L3 state if necessary.

A.3.2 CO SELT PMD request

While the CO SELT PMD is "enable", this parameter is used to trigger the start of a particular measurement (either UER or QLN) or to trigger the abortion of a measurement.

The parameter is of type enumeration, with the following valid values:

- none: A measurement is not triggered.
- uer-measurement: Triggers the CO SELT PMD to start an uncalibrated echo response (UER) measurement.
- qln-measurement: Triggers the CO SELT PMD to start a quiet line noise (QLN) measurement.
- abort: Triggers the CO SELT PMD to abort any currently ongoing measurement.

A measurement is triggered when the value is configured from "none" to either "uer-measurement" or "qln-measurement". After completion of the current measurement, transition to "none" is required before a new measurement can be triggered. Transition from any measurement to "abort" shall stop the measurement. Transitions from "uer-measurement" to "qln-measurement" and vice versa are invalid. One or more measurements may be triggered while the CO SELT PMD is configured "enable", possibly with different CO SELT PMD configuration parameters. If the triggered measurement cannot be executed, then the AN/DPU ME rejects this request and the CO SELT PMD status remains "inactive".

A.3.3 CO SELT PMD status

This parameter reports the status of the measurement.

The parameter is of type enumeration, with the following valid values:

- inactive: The CO SELT PMD is inactive.
- uer-ongoing: The CO SELT PMD has a UER measurement ongoing.
- qln-ongoing: The CO SELT PMD has a QLN measurement ongoing.

Upon the CO SELT PMD request triggering a UER measurement, the CO SELT PMD status shall become "uer-ongoing" if the measurement is executed.

Upon the CO SELT PMD request triggering a QLN measurement, the CO SELT PMD status shall become "qln-ongoing" if the measurement is executed.

Upon abortion, failure or successful completion of the UER or QLN measurement, the SELT PMD status shall become "inactive" and the AN/DPU ME shall send a notification to the NMS.

A.3.4 CO SELT UER results status

This parameter reports the status of the CO SELT PMD UER measurement results.

The parameter is of type enumeration, with the following valid values:

- no-measurement-results-available: No UER measurement results are available if a UER measurement has not yet been performed or if the results have been deleted after the UER measurement.
- measurement-failed-results-invalid: UER measurement results are invalid if the most recent UER measurement failed.
- measurement-succeeded-results-valid: UER measurement results are valid if the most recent UER measurement succeeded.

A.3.5 CO SELT QLN results status

This parameter reports the status of the CO SELT PMD QLN measurement results.

The parameter is of type enumeration, with the following valid values:

- no-measurement-results-available: No QLN measurement results are available if a QLN measurement has not yet been performed or if the results have been deleted after the QLN measurement;
- measurement-failed-results-invalid: QLN measurement results are invalid if the most recent QLN measurement failed.
- measurement-succeeded-results-valid: QLN measurement results are valid if the most recent QLN measurement succeeded.

2) Clause E.1.1.2

Revise the text of clause E.1.1.2 "Measurement of the 3-element capacitance with a controlled metallic voltage" as follows:

E.1.1.2 Measurement of the 3-element capacitance with a controlled metallic voltage

E.1.1.2.1 3-element capacitance

This parameter defines a measurement, or a series of measurements, to measure the capacitance of the cable plus line equipment, if present, from an equivalent AC network located between tip, ring and GND as shown in Figure E.2.

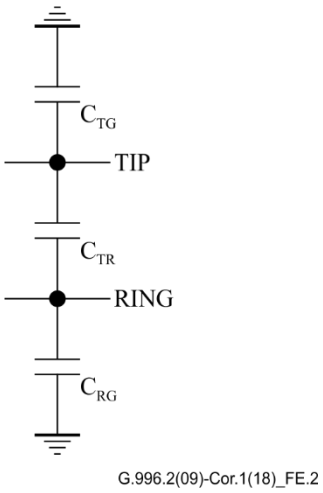

Figure E.2 – Capacitance between tip, ring and GND

If the consideration of internal components during the measurement process leads to negative values, these negative capacitance values shall be reported.

NOTE – The reporting of negative capacitance values may be used to detect hardware defects.

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3) Clause E.1.1.4

Revise the text of clause E.1.1.4, "Measurement of the loop capacitance with a high metallic voltage", as follows:

E.1.1.4 Measurement of the loop capacitance with a high metallic voltage

E.1.1.4.1 Loop capacitance

The loop capacitance $C_{TR,HV}$ is defined as the measured capacitance between tip and ring, using a high voltage to conduct current through the zener diode located in the far-end signature (see clause E.2.1.5). To this effect, the metallic voltage used by this procedure shall be higher than the maximum far-end signature conduction voltage configuration parameter (see clause E.2.1.5).

The measuring method is vendor discretionary.

If the consideration of internal components during the measurement process leads to negative values, these negative capacitance values shall be reported.

NOTE – The reporting of negative capacitance values may be used to detect hardware defects.

• • •

4) Clause E.2.1

Revise the text of clause E.2.1, "MELT-PMD configuration parameters", as follows:

E.2.1 MELT-PMD management entity configuration parameters

• • •

E.2.1.4 Pair identification tone frequency

This parameter sets up the frequency of the pair identification tone as defined in clause E.1.2.1. The range of frequencies is from 300 to 3400 Hz in granularity of 1 Hz.

The supported set of frequencies is at the vendor's discretion.

E.2.1.5 Pair identification tone timeout

This parameter specifies the duration of the pair identification tone. After timeout the pair identification tone shall be deactivated automatically, if not deactivated manually before.

E.2.1.6 Maximum far-end signature conduction voltage

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5) Clauses E.2.2.4 and E.2.2.5

Add clauses E.2.2.4 and E.2.2.5 as follows:

E.2.2 MELT-PMD management entity reporting parameters

• • •

E.2.2.4 Reliability indicator for reporting parameters

The reliability indicator provides information about the reliability for each associated reporting parameter. It can have following content:

- unreliable: The associated reporting parameter is not reliable. Possible reasons:
  - The measurement may not have been able to run, due to external conditions.
  - The result is not reliable / the accuracy may be degraded due to external conditions.
- reliable: The measurement for the associated reporting parameter resulted in a reliable value.

The reliability indicator for all reporting parameters is contained in a flag register, or equivalent.

E.2.2.5 Time stamp

The Time stamp contains the time when the results of last measurement test were stored. It is a string of ASCII characters formatted as '\d{4}-\d{2}-\d{2}T\d{2}:\d{2}:\d{2}(\.\d+)?'+ '(Z|[\+\-]\d{2}:\d{2})' (see [b-IETF RFC 6021] and [b-IETF RFC 3339]).

6) Clause E.2.3.4

Revise the text of clause E.2.3.4, "3-element capacitance with controlled metallic voltage", as follows:

E.2.3.4 3-element capacitance with controlled metallic voltage

The 3-element capacitances C_{TR}, C_{TG} and C_{RG}, shall be represented in linear format. The range of valid values is from ~~0~~ 2 µF to 5 µF with a granularity of 0.1 nF.

NOTE – The linear format is chosen for simplicity reason and does not imply any future accuracy requirements.

7) Clause E.2.3.6

Revise clause E.2.3.6, "Loop capacitance with high metallic voltage", as follows:

E.2.3.6 Loop capacitance with high metallic voltage

The loop capacitance $C_{TR,HV}$ shall be represented in linear format. The range of valid values is from ~~0~~ −2 µF to 5 µF with a granularity of 0.1 nF. The $C_{TR,HV}$ value of the loop capacitance with high metallic voltage test is the total capacitance measured. The C_{TR} value obtained from the 3-element capacitance with controlled metallic voltage test is not subtracted from the results.

NOTE – The linear format is chosen for simplicity reason and does not imply any future accuracy requirements.

8) Clause E.2.3.15

Add clause E.2.3.15 as follows:

E.2.3.15 Reliability indicator for measurement parameters

The reliability indicator provides information about the reliability for each associated measurement parameter. It can have following content:

- unreliable: The associated measurement parameter is not reliable. Possible reasons:
  - The measurement may not have been able to run, due to external conditions.
  - The result is not reliable / the accuracy may be degraded due to external conditions.
- reliable: The measurement for the associated measurement parameter resulted in a reliable value.

The reliability indicator for all measurement parameters is contained in a flag register, or equivalent.

9) Table E.12

Revise Table E.12 "Partitioning of MELT-ME-PMD parameters" as follows:

Table E.12 – Partitioning of MELT-PMD-ME parameters

Category/element	Defined in clause	η_C reference point
MELT-PMD configuration parameters		
Measurement class (MELT-MCLASS)	E.2.1.1	R/W (O)
Peak metallic voltage between tip and ring (MELT-PV)	E.2.1.2	R/W (M)
Signal frequency for active AC tests (MELT-AC-F)	E.2.1.3	R/W (O)
Pair identification tone frequency (MELT-PIT-F)	E.2.1.4	R/W (M)
Pair identification tone timeout (MELT-PIT-T)	E.2.1.5	R/W (O)
Maximum far-end signature conduction voltage (MELT-MAXFE-SCV)	E.2.1.6	R/W (M)
Minimum far-end signature conduction voltage (MELT-MINFE-SCV)	E.2.1.7	R/W (M)
MELT-PMD reporting parameters		
Test frequency for active AC measurements (MELT-TFREQ)	E.2.2.1	R (O)
Input impedance for foreign voltage measurements (MELT-IMP-V)	E.2.2.2	R (O)
Peak source voltage for the measurement of the loop complex admittance with a high metallic voltage (MELT-HCA-V)	E.2.2.3	R (O)
Reliability indicator for reporting parameters	E.2.2.4	R (O)
Time stamp	E.2.2.5	R (O)
MELT-PMD measurement parameters		

Table E.12 – Partitioning of MELT-PMD-ME parameters

Category/element	Defined in clause	η_C – reference point
4-element DC resistance with controlled metallic voltage R_{TR} (MELT-CDCR-TR)	E.2.3.1	R (M)
4-element DC resistance with controlled metallic voltage R_{RT} (MELT-CDCR-RT)	E.2.3.1	R (M)
4-element DC resistance with controlled metallic voltage R_{TG} (MELT-CDCR-TG)	E.2.3.1	R (M)
4-element DC resistance with controlled metallic voltage R_{RG} (MELT-CDCR-RG)	E.2.3.1	R (M)
DC test voltage for the measurement of the 4-element DC resistance with a controlled metallic voltage VDC_{TR} (MELT-CDCV-TR)	E.2.3.2	R (O)
DC test voltage for the measurement of the 4-element DC resistance with a controlled metallic voltage VDC_{RT} (MELT-CDCV-RT)	E.2.3.2	R (O)
DC test voltage for the measurement of the 4-element DC resistance with a controlled metallic voltage VDC_{TG} (MELT-CDCV-TG)	E.2.3.2	R (O)
DC test voltage for the measurement of the 4-element DC resistance with a controlled metallic voltage VDC_{RG} (MELT-CDCV-RG)	E.2.3.2	R (O)
Test current for the measurement of the 4-element DC resistance with a controlled metallic voltage IDC_{TR} (MELT-CDCI-TR)	E.2.3.3	R (O)
Test current for the measurement of the 4-element DC resistance with a controlled metallic voltage IDC_{RT} (MELT-CDCI-RT)	E.2.3.3	R (O)
Test current for the measurement of the 4-element DC resistance with a controlled metallic voltage IDC_{TG} (MELT-CDCI-TG)	E.2.3.3	R (O)
Test current for the measurement of the 4-element DC resistance with a controlled metallic voltage IDC_{RG} (MELT-CDCI-RG)	E.2.3.3	R (O)
3-element capacitance with controlled metallic voltage C_{TR} (MELT-CC-TR)	E.2.3.4	R (M)
3-element capacitance with controlled metallic voltage C_{TG} (MELT-CC-TG)	E.2.3.4	R (M)
3-element capacitance with controlled metallic voltage C_{RG} (MELT-CC-RG)	E.2.3.4	R (M)
Foreign DC voltage $V_{TR,DC}$ (MELT-FVDC-TR)	E.2.3.5	R (M)
Foreign DC voltage $V_{TG,DC}$ (MELT-FVDC-TG)	E.2.3.5	R (M)
Foreign DC voltage $V_{RG,DC}$ (MELT-FVDC-RG)	E.2.3.5	R (M)
Foreign AC voltage $V_{TR,AC}$ (MELT-FVAC-TR)	E.2.3.5	R (M)
Foreign AC voltage $V_{TG,AC}$ (MELT-FVAC-TG)	E.2.3.5	R (M)
Foreign AC voltage $V_{RG,AC}$ (MELT-FVAC-RG)	E.2.3.5	R (M)
Foreign AC voltage frequency $F_{TR,AC}$ (MELT-FVACF-TR)	E.2.3.5	R (M)
Foreign AC voltage frequency $F_{TG,AC}$ (MELT-FVACF-TG)	E.2.3.5	R (M)
Foreign AC voltage frequency $F_{RG,AC}$ (MELT-FVACF-RG)	E.2.3.5	R (M)
Loop capacitance with high metallic voltage $C_{TR,HV}$ (MELT-HC-TR)	E.2.3.6	R (M)
Loop resistance with high metallic voltage $R_{TR,HV}$ (MELT-HDCR-TR)	E.2.3.7	R (M)
Loop resistance with high metallic voltage $R_{RT,HV}$ (MELT-HDCR-RT)	E.2.3.7	R (M)
Test voltage for the measurement of the loop resistance with a high metallic voltage $VDCH_{TR}$ (MELT-HDCV-TR)	E.2.3.8	R (O)

Table E.12 – Partitioning of MELT-PMD-ME parameters

Category/element	Defined in clause	η_C – reference point
Test voltage for the measurement of the loop resistance with a high metallic voltage $VDCH_{RT}$ (MELT-HDCV-RT)	E.2.3.8	R (O)
3-element complex admittance with controlled metallic voltage real part G_{TR} (MELT-CAG-TR)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage imaginary part B_{TR} (MELT-CAB-TR)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage real part G_{TG} (MELT-CAG-TG)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage imaginary part B_{TG} (MELT-CAB-TG)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage real part G_{RG} (MELT-CAG-RG)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage imaginary part B_{RG} (MELT-CAB-RG)	E.2.3.9	R (O)
Loop complex admittance with high metallic voltage real part $G_{TR,HV}$ (MELT-HAG-TR)	E.2.3.10	R (O)
Loop complex admittance with high metallic voltage imaginary part $B_{TR,HV}$ (MELT-HAB-TR)	E.2.3.10	R (O)
Test voltage for the measurement of the 3-element capacitance with a controlled metallic voltage $VAC_{TR\text{-}CC}$ (MELT-ACV-CC-TR)	E.2.3.11	R (O)
Test voltage for the measurement of the 3-element capacitance with a controlled metallic voltage $VAC_{TG\text{-}CC}$ (MELT-ACV-CC-TG)	E.2.3.11	R (O)
Test voltage for the measurement of the 3-element capacitance with a controlled metallic voltage $VAC_{RG\text{-}CC}$ (MELT-ACV-CC-RG)	E.2.3.11	R (O)
Test voltage for the measurement of the loop capacitance with a high metallic voltage $VAC_{TR\text{-}HC}$ (MELT-ACV-HC-TR)	E.2.3.12	R (O)
Test voltage for the measurement of the 3-element complex admittance with a controlled metallic voltage $VAC_{TR\text{-}CA}$ (MELT-ACV-CA-TR)	E.2.3.13	R (O)
Test voltage for the measurement of the 3-element complex admittance with a controlled metallic voltage $VAC_{TG\text{-}CA}$ (MELT-ACV-CA-TG)	E.2.3.13	R (O)
Test voltage for the measurement of the 3-element complex admittance with a controlled metallic voltage $VAC_{RG\text{-}CA}$ (MELT-ACV-CA-RG)	E.2.3.13	R (O)
Test voltage for the measurement of the loop complex admittance with a high metallic voltage $VAC_{TR\text{-}HA}$ (MELT-ACV-HA-TR)	E.2.3.14	R (O)
Reliability indicator for measurement parameters	E.2.3.15	R (O)

10) Clauses E.3 and E.3.1 to E.3.4

Update clause E.3, and add clauses E.3.1 to E.3.4:

E.3 Test management

The MELT-PMD is managed using the parameters defined in this clause.

E.3.1 MELT PMD control

This parameter configures the MELT PMD for a MELT measurement or tone generation.

The parameter is of type enumeration, with the following valid values:

- disable: the MELT PMD is not configured for a measurement or pair identification tone (PIT) generation;
- enable: the MELT PMD is configured for a measurement or PIT generation.

The MELT PMD is by default "disable".

E.3.2 MELT PMD request

While the MELT PMD is configured "enable", this parameter is used to trigger the start of either a measurement or a PIT generation or to trigger the abortion of an ongoing measurement or PIT generation.

The parameter is of type enumeration, with the following valid values:

- none: A measurement or PIT generation is not triggered.
- measurement: Triggers the MELT PMD to start the test or tests specified by the measurement class (MELT-MCLASS).
- pair-identification-tone-generation: triggers the MELT PMD to start a PIT generation for the duration specified.
- abort: triggers the MELT PMD to abort any ongoing measurement or PIT generation.

A measurement or PIT generation is triggered when the value is configured from "none" to either "measurement" or "pair-identification-tone-generation". After completion of the current measurement or PIT generation, transition to "none" is required before a new measurement or PIT generation can be triggered. Transition from any measurement to "abort" shall stop the measurement or PIT generation. Transitions from "measurement" to "pair-identification-tone-generation" and vice versa are invalid. One or more measurements or PIT generations may be triggered while the MELT PMD is configured "enable", possibly with different MELT PMD configuration parameters. If the triggered measurement or PIT generation cannot be executed, then the AN/DPU ME rejects this request and the MELT PMD status remains "inactive".

E.3.3 MELT PMD status

This parameter reports the status of the measurement or PIT generation.

The parameter is of type enumeration, with the following valid values:

- inactive: The MELT PMD is inactive.
- measurement-ongoing: The measurement is ongoing.
- pit-generation-ongoing: The pair identification tone generation is ongoing.

Upon the MELT PMD request triggering a measurement, the MELT PMD status shall become "measurement-ongoing" if the measurement is executed.

Upon the MELT PMD request triggering a PIT generation, the MELT PMD status shall become "pit-generation-ongoing" if the PIT generation is executed.

Upon abortion, failure or successful completion of the measurement or PIT generation, the MELT PMD status shall become "inactive" and the AN/DPU ME shall send a notification to the NMS.

E.3.4 MELT results status

This parameter reports the status of the measurement results.

The parameter is of type enumeration, with the following valid values:

- no-measurement-results-available: No measurement results are available when no measurement has been performed yet or after measurement, the results have been deleted;
- measurement-failed-results-invalid: Measurement results are invalid after the most recent measurement failed.
- measurement-succeeded-results-valid: Measurement results are valid after the most recent measurement succeeded.

11) Clause F.1.1

Revise the text of clause F.1.1, "MELT-P derived parameters", as follows:

F.1.1 MELT-P derived parameters

• • •

F.1.1.6 Far-end signature topology identification

F.1.1.6.1 Far-end signature topology type

This parameter specifies the topology types of the detected far-end signature. The valid signature topology types are defined in Figure F.1:

- ZRC: e.g., signature for indicating a DSL-CPE
- DR: Passive test termination, e.g., for master socket

NOTE 1 – The far-end signature capacitance C_{SIG} can be estimated from the capacitance measurement at low voltage C_{TR} (see clause E.1.1.2) and the capacitance measurement at high voltage $C_{TR,HV}$ (see clause E.1.1.4), using a vendor-discretionary algorithm.

NOTE 2 – The passive termination resistance (R_{PT}) can be estimated from two consecutive measurements of resistance (R_{TR} and R_{RT}, see clause E.1.1.1) using a vendor-discretionary algorithm.

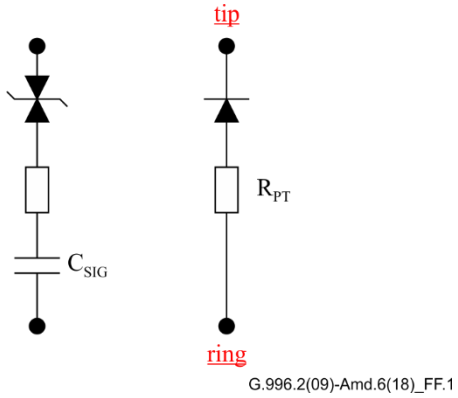

Figure F.1 – Valid signature topology types (resp. ZRC (left) and DR (right))

Valid response values are:

– no signature detected;
– unknown signature;
– signature type DR detected;
– signature type DR inverse detected;
– signature type ZRC detected;
– signature type DR + ZRC detected;
– signature type DR inverse + ZRC detected.

F.1.1.7 CPE identification capacitive

This parameter indicates if a CPE has been detected based on the termination capacitance. Valid response values are:

– no CPE detected;

– CPE detected;

CPE detected shall be reported if the measured capacitance value $C_{TR\text{-}Term}$ is ≥ MELT-SYSC-CPE. $C_{TR\text{-}Term}$ shall represent the termination capacitance only. Therefore, the line capacitance shall be subtracted from the measured C_{TR} value. For this equation to hold, the MELT-SYSC-CPE value should be derived from the nominal CPE capacitance by accounting for all tolerances in best efforts and be set to the minimum possible measurement result.

12) Clause F.2.2.7

Add clause F.2.2.7 as follows:

F.2.2 MELT-P management entity derived parameters

• • •

F.2.2.7 Reliability indicator for derived parameters

The reliability indicator provides information about the reliability for each associated derived parameter. It can have following content:

- unreliable: At least one of the PMD measurement parameters on which the associated derived parameter is based is indicated as unreliable.
- reliable: All PMD measurement parameters on which the associated derived parameter is based are indicated as reliable.

The reliability indicator for all derived parameters is contained in a flag register, or equivalent.

13) Table F.1

Revise Table F.1, "Partitioning of MELT-ME-PMD parameters", as follows:

Table F.1 – Partitioning of MELT-P-ME parameters

Category/element	Defined in clause	Q – interface
MELT-PMD configuration parameters		
Measurement class (MELT-MCLASS)	E.2.1.1	R/W (O)
Peak metallic voltage between tip and ring (MELT-PV)	E.2.1.2	R/W (M)
Signal frequency for active AC tests (MELT-AC-F)	E.2.1.3	R/W (O)
Pair identification tone frequency (MELT-PIT-F)	E.2.1.4	R/W (M)
Pair identification tone timeout (MELT-PIT-T)	E.2.1.5	R/W (O)
Maximum far-end signature conduction voltage (MELT-MAXFE-SCV)	E.2.1.6	R/W (M)
Minimum far-end signature conduction voltage (MELT-MINFE-SCV)	E.2.1.7	R/W (M)
MELT-PMD reporting parameters		
Test frequency for active AC measurements (MELT-TFREQ)	E.2.2.1	R (O)

Table F.1 – Partitioning of MELT-P-ME parameters

Category/element	Defined in clause	Q – interface
Input impedance for foreign voltage measurements (MELT-IMP-V)	E.2.2.2	R (O)
Peak test voltage for the measurement of the loop complex admittance with a high metallic voltage (MELT-HCA-V)	E.2.2.3	R (O)
Reliability indicator for reporting parameters	E.2.2.4	R (O)
Time stamp	E.2.2.5	R (O)
MELT-PMD measurement parameters		
4-element DC resistance with controlled metallic voltage R_{TR} (MELT-CDCR-TR)	E.2.3.1	R (M)
4-element DC resistance with controlled metallic voltage R_{RT} (MELT-CDCR-RT)	E.2.3.1	R (M)
4-element DC resistance with controlled metallic voltage R_{TG} (MELT-CDCR-TG)	E.2.3.1	R (M)
4-element DC resistance with controlled metallic voltage R_{RG} (MELT-CDCR-RG)	E.2.3.1	R (M)
DC test voltage for the measurement of the 4-element DC resistance with a controlled metallic voltage VDC_{TR} (MELT-CDCV-TR)	E.2.3.2	R(O)
DC test voltage for the measurement of the 4-element DC resistance with a controlled metallic voltage VDC_{RT} (MELT-CDCV-RT)	E.2.3.2	R(O)
DC test voltage for the measurement of the 4-element DC resistance with a controlled metallic voltage VDC_{TG} (MELT-CDCV-TG)	E.2.3.2	R(O)
DC test voltage for the measurement of the 4-element DC resistance with a controlled metallic voltage VDC_{RG} (MELT-CDCV-RG)	E.2.3.2	R(O)
Test current for the measurement of the 4-element DC resistance with a controlled metallic voltage IDC_{TR} (MELT-CDCI-TR)	E.2.3.3	R(O)
Test current for the measurement of the 4-element DC resistance with a controlled metallic voltage IDC_{RT} (MELT-CDCI-RT)	E.2.3.3	R(O)
Test current for the measurement of the 4-element DC resistance with a controlled metallic voltage IDC_{TG} (MELT-CDCI-TG)	E.2.3.3	R(O)
Test current for the measurement of the 4-element DC resistance with a controlled metallic voltage IDC_{RG} (MELT-CDCI-RG)	E.2.3.3	R(O)
3-element capacitance with controlled metallic voltage C_{TR} (MELT-CC-TR)	E.2.3.4	R (M)
3-element capacitance with controlled metallic voltage C_{TG} (MELT-CC-TG)	E.2.3.4	R (M)
3-element capacitance with controlled metallic voltage C_{RG} (MELT-CC-RG)	E.2.3.4	R (M)
Foreign DC voltage $V_{TR,DC}$ (MELT-FVDC-TR)	E.2.3.5	R (M)
Foreign DC voltage $V_{TG,DC}$ (MELT-FVDC-TG)	E.2.3.5	R (M)
Foreign DC voltage $V_{RG,DC}$ (MELT-FVDC-RG)	E.2.3.5	R (M)
Foreign AC voltage $V_{TR,AC}$ (MELT-FVAC-TR)	E.2.3.5	R (M)
Foreign AC voltage $V_{TG,AC}$ (MELT-FVAC-TG)	E.2.3.5	R (M)
Foreign AC voltage $V_{RG,AC}$ (MELT-FVAC-RG)	E.2.3.5	R (M)
Foreign AC voltage frequency $F_{TR,AC}$ (MELT-FVACF-TR)	E.2.3.5	R (M)
Foreign AC voltage frequency $F_{TG,AC}$ (MELT-FVACF-TG)	E.2.3.5	R (M)
Foreign AC voltage frequency $F_{RG,AC}$ (MELT-FVACF-RG)	E.2.3.5	R (M)
Loop capacitance with high metallic voltage $C_{TR,HV}$ (MELT-HC-TR)	E.2.3.6	R (M)

Table F.1 – Partitioning of MELT-P-ME parameters

Category/element	Defined in clause	Q – interface
Loop resistance with high metallic voltage $R_{TR,HV}$ (MELT-HDCR-TR)	E.2.3.7	R (M)
Loop resistance with high metallic voltage $R_{RT,HV}$ (MELT-HDCR-RT)	E.2.3.7	R (M)
Test voltage for the measurement of the loop resistance with a high metallic voltage $VDCH_{TR}$ (MELT-HDCV-TR)	E.2.3.8	R (O)
Test voltage for the measurement of the loop resistance with a high metallic voltage $VDCH_{RT}$ (MELT-HDCV-RT)	E.2.3.8	R (O)
3-element complex admittance with controlled metallic voltage real part G_{TR} (MELT-CAG-TR)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage imaginary part B_{TR} (MELT-CAB-TR)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage real part G_{TG} (MELT-CAG-TG)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage imaginary part B_{TG} (MELT-CAB-TG)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage real part G_{RG} (MELT-CAG-RG)	E.2.3.9	R (O)
3-element complex admittance with controlled metallic voltage imaginary part B_{RG} (MELT-CAB-RG)	E.2.3.9	R (O)
Loop complex admittance with high metallic voltage real part $G_{TR,HV}$ (MELT-HAG-TR)	E.2.3.10	R (O)
Loop complex admittance with high metallic voltage imaginary part $B_{TR,HV}$ (MELT-HAB-TR)	E.2.3.10	R (O)
Test voltage for the measurement of the 3-element capacitance with a controlled metallic voltage $VAC_{TR\text{-}CC}$ (MELT-ACV-CC-TR)	E.2.3.11	R (O)
Test voltage for the measurement of the 3-element capacitance with a controlled metallic voltage $VAC_{TG\text{-}CC}$ (MELT-ACV-CC-TG)	E.2.3.11	R (O)
Test voltage for the measurement of the 3-element capacitance with a controlled metallic voltage $VAC_{RG\text{-}CC}$ (MELT-ACV-CC-RG)	E.2.3.11	R (O)
Test voltage for the measurement of the loop capacitance with a high metallic voltage $VAC_{TR\text{-}HC}$ (MELT-ACV-HC-TR)	E.2.3.12	R (O)
Test voltage for the measurement of the 3-element complex admittance with a controlled metallic voltage $VAC_{TR\text{-}CA}$ (MELT-ACV-CA-TR)	E.2.3.13	R (O)
Test voltage for the measurement of the 3-element complex admittance with a controlled metallic voltage $VAC_{TG\text{-}CA}$ (MELT-ACV-CA-TG)	E.2.3.13	R (O)
Test voltage for the measurement of the 3-element complex admittance with a controlled metallic voltage $VAC_{RG\text{-}CA}$ (MELT-ACV-CA-RG)	E.2.3.13	R (O)
Test voltage for the measurement of the loop complex admittance with a high metallic voltage $VAC_{TR\text{-}HA}$ (MELT-ACV-HA-TR)	E.2.3.14	R (O)
Reliability indicator for measurement parameters	E.2.3.15	R (O)
MELT-P configuration parameters		
Loop resistance classification threshold (MELT-LRC-TH)	F.2.1.1	R/W (M)
Loop parameters per unit length (MELT-LOOP-PARAMS)	F.2.1.2	R/W (M)

Table F.1 – Partitioning of MELT-P-ME parameters

Category/element	Defined in clause	Q – interface
Hazardous DC voltage level (MELT-HDCV-L)	F.2.1.3	R/W (M)
Hazardous AC voltage level (MELT-HACV-L)	F.2.1.4	R/W (M)
Foreign EMF DC voltage level (MELT-FDCV-L)	F.2.1.5	R/W (M)
Foreign EMF AC voltage level (MELT-FACV-L)	F.2.1.6	R/W (M)
System capacitance at the CPE side (MELT-SYSC-CPE)	F.2.1.7	R/W (O)
MELT-P derived parameters		
Identification of an open wire failure (MELT-O-WIRE-type) – Open wire failure type	F.2.2.1.1	R (M)
Identification of an open wire failure (MELT-O-WIRE-DIST) – Distance to the open wire failure	F.2.2.1.2	R (O)
Identification of a short circuit failure type (MELT-S-CCT-type)	F.2.2.2.1	R (M)
Leakage identification (MELT-LEAK-ID)	F.2.2.3	R (M)
Resistive fault identification (MELT-RFAULT-ID)	F.2.2.4	R/W(M)
Foreign voltage type classification (MELT-FV-TYPE)	F.2.2.5.1	R (M)
Foreign voltage level classification (MELT-FV-LEVEL)	F.2.2.5.2	R (M)
Far-end signature topology type identification (MELT-FES-ID)	F.2.2.6.1	R (M)
CPE identification capacitive (MELT-CPE-ID)	F.2.2.7	R (O)
Derived parameters reliability indicator	F.2.2.8	R (O)

14) Bibliography

Add the following entries to the Bibliography:

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[b-IETF RFC 3339] IETF RFC 3339 (2002), *Date and time on the Internet: Timestamps*.

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