International Telecommunication Union

ITU-T

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G.992.3

Amendment 5

(10/2012)

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Digital sections and digital line system – Access networks

Asymmetric digital subscriber line transceivers 2 (ADSL2)

Amendment 5: Accuracy of test parameters

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Recommendation ITU-T G.992.3

Asymmetric digital subscriber line transceivers 2 (ADSL2)

Amendment 5

Accuracy of test parameters

Summary

Amendment 5 to Recommendation ITU-T G.992.3 (2009) covers the following functionality (it also applies to Recommendation ITU-T G.992.5 by reference):

- accuracy of test parameters (adding more functionality).

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.992.3	2002-07-29	15
1.1	ITU-T G.992.3 (2002) Amd. 1	2003-05-22	15
1.2	ITU-T G.992.3 (2002) Cor. 1	2003-12-14	15
1.3	ITU-T G.992.3 (2002) Cor. 2	2004-02-22	15
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2.3	ITU-T G.992.3 (2005) Amd. 3	2006-12-14	15
2.4	ITU-T G.992.3 (2005) Amd. 4	2007-07-29	15
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3.0	ITU-T G.992.3	2009-04-22	15
3.1	ITU-T G.992.3 (2009) Cor. 1	2009-11-13	15
3.2	ITU-T G.992.3 (2009) Amd. 1	2010-03-01	15
3.3	ITU-T G.992.3 (2009) Amd. 2	2010-07-29	15
3.4	ITU-T G.992.3 (2009) Amd. 3	2010-11-29	15
3.5	ITU-T G.992.3 (2009) Cor. 2	2011-06-22	15
3.6	ITU-T G.992.3 (2009) Amd. 4	2011-10-29	15
3.7	ITU-T G.992.3 (2009) Amd. 5	2012-10-29	15

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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.

NOTE

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/.

Recommendation ITU-T G.992.3

Asymmetric digital subscriber line transceivers 2 (ADSL2)

Amendment 5

Accuracy of test parameters

1) Change to clause 8.12.3.5

Add the following paragraph to the beginning of clause 8.12.3.5.

8.12.3.5 Signal attenuation (*SATN*)

This clause provides the requirements and definitions on signal attenuation (SATN). These definitions and requirements apply to both the downstream signal attenuation SATNds and upstream signal attenuation SATNus.

The signal attenuation (*SATN*) is defined as the difference in dB between the power received at the near end and that transmitted from the far end.

…

2) Changes to clauses 8.12.5.1.1 and 8.12.5.1.2

Introduce the changes shown below to clauses 8.12.5.1.1 and 8.12.5.1.2.

8.12.5.1.1 Channel attenuation in logarithmic format (HLOGps)

…

For each subcarrier where the HLOGps_ds accuracy requirement applies, and where HLOGps_reference_ds is above –90 dB, the absolute error (between the HLOGps_ds and the HLOGps_reference_ds) shall be equal to or smaller than 3.0 dB.

~~Requirements for the mean absolute error of HLOGps_ds reported values are for further study.~~

Accuracy requirements related to the difference over adjacent subcarriers of the absolute error (between the HLOGps_ds and the HLOGps_reference_ds) are for further study.

The HLOGps_ds accuracy requirements shall apply to HLOGps_ds measured in either initialization or in diagnostic mode.

For each subcarrier where the HLOGps_us accuracy requirement applies (based on its subcarrier index and SNRps_us value only, and not considering restrictions related to its Z_{loop} value), and where HLOGps_reference_us is above –90 dB, an HLOGps_us value different from the special value defined in clause 8.12.3.1 shall be reported.

For each subcarrier where the HLOGps_us accuracy requirement applies, and where HLOGps_reference_us is above –90 dB, the absolute error (between the HLOGps_us and the HLOGps_reference_us) shall be equal to or smaller than 3.0 dB.

~~Requirements for the mean absolute error of HLOGps_us reported values are for further study.~~

Accuracy requirements related to the difference over adjacent subcarriers of the absolute error (between the HLOGps_us and the HLOGps_reference_us) are for further study.

The HLOGps_us accuracy requirements shall apply to HLOGps_us measured in either initialization or in diagnostic mode.

8.12.5.1.2 Channel attenuation in complex format (HLINps)

~~The HLINps reference value and HLINps accuracy requirements are for further study.~~

The accuracy requirements for the magnitude of HLINps are the same as those for HLOGps in clause 8.12.5.1.1. There is no accuracy requirement for the phase of HLINps.

3) Changes to clauses 8.12.5.4 and 8.12.5.5

Introduce the changes shown below to clauses 8.12.5.4 and 8.12.5.5.

8.12.5.4 Loop attenuation (*LATN*)

~~For further study.~~

The downstream loop attenuation (LATNds) reference value shall be defined as follows:

$$\text{LATN\_reference\_ds} = -10 \times \log_{10}\left(\frac{\sum_{k=n1}^{n2} \left|\text{H\_reference\_ds}(k)\right|^2}{NSC\_D}\right)$$

where *NSC_D* is the number of subcarriers in the downstream band = $n2-n1+1$ where $n1$ and $n2$ are the indices of the first and the last subcarriers of this band, respectively; and H_reference_ds is defined as follows:

$$|\text{H\_reference\_ds}(k)|^2 = 10^{\text{HLOGps\_reference\_ds}(k)/10} = 10^{(\text{PSDps\_UR2}(k) - (REFPSDds + log\_tss_i(k))/10}$$

where PSDps_UR2(*i*) is the downstream PSD measured at the U-R2 reference point, after initialization of the line up to a C-REVERB state, in which state the ATU-C is frozen and the ATU-R subsequently replaced by an $R_N = 100\ \Omega$.

The upstream loop attenuation (LATNus) reference value shall be defined as follows:

$$\text{LATN\_reference\_us} = -10 \times \log_{10}\left(\frac{\sum_{k=n3}^{n4} \left|\text{H\_reference\_us}(k)\right|^2}{NSC\_U}\right)$$

where *NSC_U* is the number of subcarriers in the upstream band = $n4-n3+1$ where $n3$ and $n4$ are the indices of the first and the last subcarriers of this band, respectively; and H_reference_us is defined as:

$$|\text{H\_reference\_us}(k)|^2 = 10^{\text{HLOGps\_reference\_us}(k)/10} = 10^{(\text{PSDps\_UC2}(k) - (REFPSDus + log\_tss_i(k))/10}$$

where PSDps_UC2(*i*) is the upstream PSD measured at the U-C2 reference point, after initialization of the line up to an R-REVERB state, in which state the ATU-R is frozen and the ATU-C subsequently replaced by an $R_N = 100\ \Omega$.

If one or more H_reference values could not be measured because they are out of the PSD mask passband (as relevant to the chosen application option – see annexes) (see clause 8.12.3.1), then the *LATN_reference* shall be calculated as an average of H_reference values over a number of subcarriers that is less than *NSC_D* or *NSC_U*:

$$\text{LATN\_reference\_ds} = -10 \times \log_{10}\left(\frac{\sum_{k \in \{valid\_H\_reference\}} \left|\text{H\_reference\_ds}(k)\right|^2}{NSC\_D'}\right)$$

where *NSC_D′* is the number of valid downstream H_reference values.

$$\text{LATN\_reference\_us} = -10 \times \log_{10}\left(\frac{\sum_{k \in \{valid\_H\_reference\}} \left|\text{H\_reference\_us}(k)\right|^2}{NSC\_U'}\right)$$

where *NSC_U′* is the number of valid upstream H_reference values.

The absolute error between LATN_ds and LATN_reference_ds shall be equal to or smaller than 3 dB. The absolute error between LATN_us and LATN_reference_us shall be equal to or smaller than 3 dB. The accuracy requirements shall apply to its measurement either during initialization or in the loop diagnostics mode.

8.12.5.5 Signal attenuation (*SATN*)

~~For further study.~~

The reference value for the downstream signal attenuation SATNds shall be defined as:

SATN_reference_ds = TXpower_dBm_reference_ds – RXpower_dBm_reference_ds

The TXpower_dBm_reference_ds is:

TXpower_dBm_reference_ds = NOMATPds – PCBds

where REFPSD[*i*] is the value of REFPSDds for subcarrier *i* in dBm/Hz, g_i is the fine tune gain defined in clause 8.6.4, and Δf is the subcarrier spacing in Hz.

The RXpower_dBm_reference_ds is:

$$\text{RXpower\_dBm\_reference\_ds} = 10 \times \log_{10}\left(\sum_{i \in \text{MEDLEYds}} \left(10^{\frac{\text{PSDps\_UR2(i)}}{10}} \times g_i^2\right)\right)$$

where PSDps_UR2(*i*) is the downstream PSD measured at the U-R2 reference point, after initialization of the line up to a C-REVERB state, in which state the ATU-C is frozen and the ATU-R subsequently replaced by an $R_N = 100\ \Omega$.

The reference value for the upstream signal attenuation SATNus shall be defined as:

SATN_reference_us = TXpower_dBm_reference_us – RXpower_dBm_reference_us

The TXpower_dBm_reference_us is:

TXpower_dBm_reference_us = NOMATPus – PCBus

where REFPSD[*i*] is the value of REFPSDus for subcarrier *i* in dBm/Hz, g_i is the fine tune gain defined in clause 8.6.4, and Δf is the subcarrier spacing in Hz.

The RXpower_dBm_reference_us is:

$$\text{RXpower\_dBm\_reference\_us} = 10 \times \log_{10}\left(\sum_{i \in \text{MEDLEYus}} \left(10^{\frac{\text{PSDps\_UC2(i)}}{10}} \times g_i^2\right)\right)$$

where PSDps_UC2(*i*) is the upstream PSD measured at the U-C2 reference point, after initialization of the line up to an R-REVERB state, in which state the ATU-R is frozen and the ATU-C subsequently replaced by an R_N = 100 Ω.

NOTE – The feature to freeze an ATU in a REVERB state exists solely to allow a test bed to be constructed for the purpose of measuring the HLOGps reference value. It applies only to specific transceivers serving as the "transmit transceiver" of the test environment, and is not a requirement for compliance to this Recommendation.

The absolute error between SATNds and SATN_reference_ds shall be equal to or smaller than 3 dB. The absolute error between SATNus and SATN_reference_us shall be equal to or smaller than 3 dB.

The accuracy requirements for SATNds and SATNus shall apply to their measurement either during initialization, diagnostic mode, and showtime.

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