International Telecommunication Union

# ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

# G.992.5

**Amendment 2**

(06/2006)

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

Digital sections and digital line system – Access networks

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## Asymmetric Digital Subscriber Line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2plus)

**Amendment 2**

ITU-T Recommendation G.992.5 (2005) – Amendment 2

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 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 |
| General | G.900–G.909 |
| Parameters for optical fibre cable systems | G.910–G.919 |
| Digital sections at hierarchical bit rates based on a bit rate of 2048 kbit/s | G.920–G.929 |
| Digital line transmission systems on cable at non-hierarchical bit rates | G.930–G.939 |
| Digital line systems provided by FDM transmission bearers | G.940–G.949 |
| Digital line systems | G.950–G.959 |
| Digital section and digital transmission systems for customer access to ISDN | G.960–G.969 |
| Optical fibre submarine cable systems | G.970–G.979 |
| Optical line systems for local and access networks | G.980–G.989 |
| **Access networks** | **G.990–G.999** |
| 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 |
| ETHERNET 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.*

# ITU-T Recommendation G.992.5

## Asymmetric Digital Subscriber Line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2plus)

## Amendment 2

**Summary**

This amendment enables the Downstream Power Back-Off functionality defined in ITU-T Rec. G.997.1 for use with ADSL2plus transceivers.

**Source**

Amendment 2 to ITU-T Recommendation G.992.5 (2005) was approved on 6 June 2006 by ITU-T Study Group 15 (2005-2008) under the ITU-T Recommendation A.8 procedure.

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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, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

**CONTENTS**


**Page**

1) Clause 8.5.1 – Definition of control parameters ..... 1

# ITU-T Recommendation G.992.5

## Asymmetric Digital Subscriber Line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2plus)

## Amendment 2

### 1) Clause 8.5.1 – Definition of control parameters

*Change paragraphs 3 and 4 as indicated with revision marks:*

The downstream PSD mask in the CO-MIB (exchanged between NMS and Access Node over the Q reference point, see Figure 5-1/G.997.1) shall be specified through the Downstream Power Back-Off-Shaped (DPBOSHAPED, see 7.3.1.2.13/G.997.1) or through a set of breakpoints (PSDMASKds, see 7.3.1.2.9/G.997.1).

- When specified through a set of breakpoints, the Access Node shall pass these breakpoints (PSDMASKds) to the ATU-C over the gamma reference point.
- When specified through the DPBO (i.e., DPBOESEL > 0, see 7.3.1.2.13/G.997.1), the Access Node shall pass the set of breakpoints of the Modified Downstream PSD Mask (see 7.3.1.2.13/G.997.1) to the ATU-C over the gamma reference point.

At the Q and gamma reference points, each breakpoint shall consist of a subcarrier index $t$ and a MIB PSD mask level (expressed in dBm/Hz) at that subcarrier. The set of breakpoints can then be represented as [($t_1$, $PSD_1$), ($t_2$, $PSD_2$), … , ($t_N$, $PSD_N$)]. ~~In the CO-MIB, t~~The subcarrier index shall be coded as an unsigned integer in the range from $roundup(f\_pb\_start/\Delta f)$ to $rounddown(f\_pb\_stop/\Delta f)$, where $f\_pb\_start$ and $f\_pb\_stop$ are the lower and higher edge, of the passband respectively and $\Delta f$ is the subcarrier spacing defined in 8.8.1. The passband is defined in Annexes A, B or I, as relevant to the selected application option. The PSD mask level shall be coded as an unsigned integer representing the ~~MIB~~ PSD mask levels 0 dBm/Hz (coded as 0) to –127.5 dBm/Hz (coded as 255), in steps of 0.5 dBm/Hz, with valid range 0 to –95 dBm/Hz. The maximum number of breakpoints is 32. The corresponding MIB PSD mask for each frequency $f$ shall be defined as follows:

– $f\_lm\_start$ = frequency at which the flat extension below $f_1$ intersects the Limit mask (0 Hz if no intersect).

– $f\_lm\_stop$ = frequency at which the flat extension above $f_N$ intersects the Limit mask.

– At frequencies below $f_1$ and at frequencies above $f_N$, the MIB PSD mask shall be obtained as follows:

$$MIB\ PSD\ mask\left(f\right)=\begin{cases} Limit\ mask\left(f\right) & f < f\_lm\_start \\ PSD_1 & f\_lm\_start \le f \le f_1 \\ & \\ PSD_N & f_N < f \le f\_lm\_stop \\ Limit\ mask\left(f\right) & f > f\_lm\_stop \end{cases}$$

NOTE 1 – In defining the set of breakpoints of the Modified Downstream PSD Mask (see 7.3.1.2.13/G.997.1), the Access Node may take into account whether the transceiver supports windowing or not (see 8.8.4).

NOTE 2 – The actual transmit PSD (at the U-C reference point), while conforming to the MIB PSD mask (received through a set of breakpoints over the gamma reference point), may significantly undershoot the MIB PSD mask in some frequency regions if the MIB PSD mask shape requires faster roll-off than is supported by the available windowing capability. Appendix IV defines the PSD template to be used in capacity calculations with in-band transmit spectrum shaping, except where the transceiver supports windowing and windowing is enabled, in which case the shape of the windowing should be taken into account.

In case the downstream PSD mask in the CO-MIB is expressed as a set of breakpoints (exchanged between NMS and AN over the Q reference point, see 7.3.1.2.9/G.997.1), ~~T~~the set of breakpoints ~~specified in the CO-MIB~~ shall comply to the following restrictions, and the corresponding MIB PSD mask for each frequency *f* shall be defined as following:

1) *General*

– $t_n < t_{n+1}$ for $n = 1$ to $N - 1$.

– $f_n = t_n \times \Delta f$.

2) *Low-frequency end and high-frequency end of MIB PSD mask (f)*

– $t_1 = roundup(f\_pb\_start/\Delta f)$ or $(73 \le t_1 \le 271)$.

– $t_N = rounddown(f\_pb\_stop/\Delta f)$.

~~– *f_lm_start* = frequency at which the flat extension below $f_1$ intersects the Limit mask (0 Hz if no intersect).~~

~~– *f_lm_stop* = frequency at which the flat extension above $f_N$ intersects the Limit mask.~~

~~– At frequencies below $f_1$ and at frequencies above $f_N$, the MIB PSD mask shall be obtained as follows:~~

$$MIB\ PSD\ mask\ (f) = \begin{cases} Limit\ mask\ (f) & f < f\_lm\_start \\ PSD_1 & f\_lm\_start \le f \le f_1 \\ \\ PSD_N & f_N < f \le f\_lm\_stop \\ Limit\ mask\ (f) & f > f\_lm\_stop \end{cases}$$

3) *MIB PSD stopband in lower frequency part*

if $(73 \le t_1 \le 271)$ then:

– $PSD_1 = -95$ dBm/Hz.

– Set of valid $t_2$ values is every 10th tone starting from tone 100 up until tone 280.

– The value $t_1$ shall be:

$$t_1 = rounddown\left(t_2 - \left(\frac{PSD_2 - PSD_1}{2.2\ \text{dB/tone}}\right)\right)$$

– At frequencies between $f_1$ and $f_2$, the MIB PSD mask is obtained by interpolation in dB on a logarithmic frequency scale as follows:

$$MIB\ PSD\ mask\ (f) = \left\{ PSD_1 + (PSD_2 - PSD_1) \times \frac{\log\left((f/\Delta f)/t_1\right)}{\log(t_2/t_1)} \quad f_1 < f \le f_2 \right.$$

4) *MIB PSD inband shaping*

if $t_1 = roundup(f\_pb\_start/\Delta f)$ then for $n = 1$ to $N - 1$:

if $(73 \le t_1 \le 271)$ then for $n = 2$ to $N - 1$:

– The inband slope shall comply to:

$$\left| \frac{PSD_{n+1} - PSD_n}{t_{n+1} - t_n} \right| \le 0.75\,\text{dB/tone}$$

– MAX ($PSD_n$) – MIN ($PSD_n$) ≤ 20 dB.

– MAX PSD of the Limit mask –20 dB ≤ MAX ($PSD_n$) ≤ MAX PSD of the Limit mask.

– The MIB PSD mask is obtained by interpolation in dB on a linear frequency scale as follows:

$$MIB\ PSD\ mask\,(f) = \left\{ PSD_n + (PSD_{n+1} - PSD_n) \times \frac{(f/\Delta f) - t_n}{t_{n+1} - t_n} \qquad f_n < f \le f_{n+1} \right.$$

NOTE 3 – If the first breakpoint has subcarrier index $73 \le t_1 \le 271$, then a stopband is created in the lower frequency part of the passband, with spectrum shaping applied to the remainder of the passband. If $t_1 = roundup(f\_pb\_start/\Delta f)$, then only spectrum shaping is applied over the whole passband.

5) *RFI band specification*

– A RFI band is specified in the CO-MIB PSD mask through a set of 4 breakpoints ($t(i + 1)$, $PSD(i + 1)$) to ($t(i + 4)$, $PSD(i + 4)$), as shown in Figure 8.5.1-1. In addition, the CO-MIB also contains an explicit indication that the pair ($t(i + 2)$, $t(i + 3)$) represents an RFI band (see ITU-T Rec. G.997.1).

– The restrictions on the breakpoints specifying an RFI band are:

$$\frac{PSD_{i+1} - PSD_{i+2}}{t_{i+1} - t_{i+2}} \le 1.5\,\text{dB/tone}$$

$$PSD_{i+2} \ge PSD\_Limitmask(f_{i+2}) - 33.5\,\text{dB}$$

$$PSD_{i+2} = PSD_{i+3}$$

$$PSD_{i+3} \ge PSD\_Limitmask(f_{i+3}) - 33.5\,\text{dB}$$

$$\frac{PSD_{i+4} - PSD_{i+3}}{t_{i+4} - t_{i+3}} \le 1.5\,\text{dB/tone}$$

– In the RFI band, the MIB PSD mask is given by the following equations:

$$MIB\ PSD\ mask(f) = \begin{cases} PSD_{i+1} & f_{i+1} \le f \le f_{i+2} \\ PSD_{i+2} = PSD_{i+3} & f_{i+2} \le f \le f_{i+3} \\ PSD_{i+4} & f_{i+3} \le f \le f_{i+4} \end{cases}$$

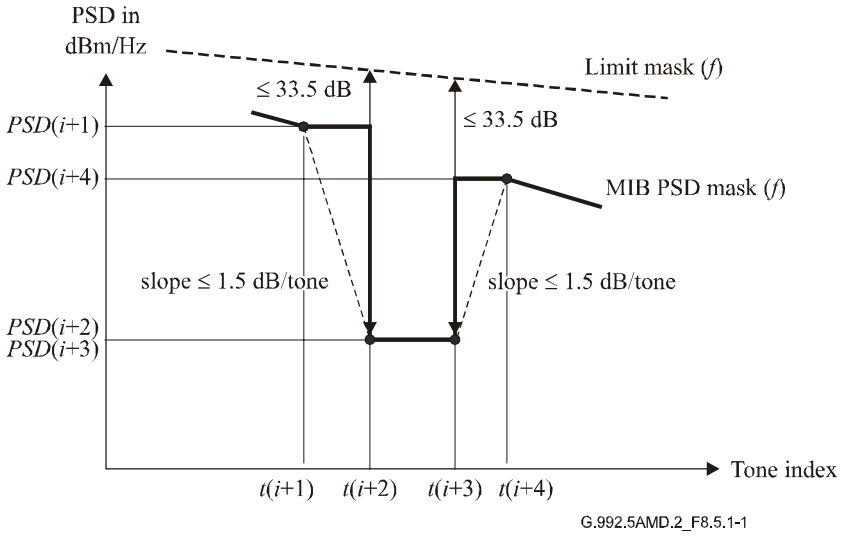


**Figure 8.5.1-1/G.992.5 – Restrictions on breakpoints and MIB PSD mask (*f*)**

## 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 | Telephone transmission quality, telephone installations, local line networks |
| Series Q | Switching and signalling |
| Series R | Telegraph transmission |
| Series S | Telegraph services terminal equipment |
| Series T | Terminals for telematic services |
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| Series V | Data communication over the telephone network |
| Series X | Data networks, open system communications and security |
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