



ETSI WG TM6
(ACCESS TRANSMISSION SYSTEMS ON METALLIC CABLES)

Permanent Document

TM6(05)05 – rev 3

Living List for Spectral Management

SpM - part 1

revision of TR 101 830-1

This document is the living list of current issues connected with ETSI's spectral management report TR 101 830, part 1 (*Definitions and signal library*).

This work item is focussed on the revision of "Part 1", to add new signal descriptions such as for enhanced SDSL and ADSL2plus. A target date for "working group approval" is scheduled for the november meeting of ETSI TM6 in 2005. The issues related to the creation of "Part 2" or "Part 3", are beyond the scope of this living list.

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2. STUDY POINTS PART 1 (DEFINITIONS AND SIGNAL LIBRARY)

SP	Title	Owner	Status
1-1	Alignment of "definitions" with ETSI SpM-2 and SpM-3	Rob van den Brink (KPN/TNO)	Agreed
1-2	Refinement of references in text on "DC Power feeding"	Rob van den Brink (KPN/TNO)	Agreed
1-3	Signal description for enhanced SDSL	Bernd Heise, Infineon	Agreed
1-4	Signal description for various ADSL2plus variants	Rob van den Brink (KPN/TNO)	PA
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1-6			
1-7			
1-8			

The current agreed procedure for changing the status of living list items is in Annex A of TM6 working methods.

Part 1 study points

SP 1-1. Alignment of “definitions” with ETSI SpM-2 and SpM-3

During the creation of SpM “part 2” and “part 3”, various definitions have been enhanced or added, to enable a consistent terminology. It is desired that “part 1” adopts this list, so that all three parts contain the same list of definitions. This study point is mainly a formality, to enable formal agreements on these definitions.

Related Contributions:

- *m01p20a10, may 2005, Draft of SpM part 2 – Rapporteur*
- *TR 101 830-2 (published version of SpM-2)*

SP 1-2. Refinement of references in text on “DC power feeding”

In a liason statement, ETSI “TC Safety” has informed TM6 about a change in the standards on safety requirements. This has (minor) consequences for the references being used in clause 7 on “DC power feeding”, and in clause 8 on POTS signals. This study point is mainly a formality, to enable official agreement on these definitions, since “TC Safety” has already provided the required corrections.

Related Contributions:

- *051t06, feb 2005, Liason statement to TM6 regarding TR 101 830-1 – Chairman TC Safety*

SP 1-3. Signal description for enhanced SDSL

The SDSL standard has been extended with annex E describing enhance SDSL variants, using PSDs that are wider then common for SDSL. To facilitate loop providers with correct signal descriptions for granting these signals access to the local loop wiring, an additional description is to added to the current signal library.

Related Contributions:

- *051t27, feb 2005, Additional signals for SpM1 – Infineon*

SP 1-4. Signal description for various ADSL2plus variants

Various new ADSL variant have been defined by ITU Recommendations. To facilitate loop providers with correct signal descriptions for granting these signals access to the local loop wiring, an additional description is to added to the current signal library.

Related Contributions:

- *052t18, June 2005, Signal descriptions of various ADSL2plus variants – KPN, TNO*

Text proposals, being candidate for inclusion into the Draft .

The text fragments below have been proposed for inclusion in the draft version of SpM part 1, but are still in the "under study" status. If agreement is achieved, they will be moved into the Draft

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ADSL

- [1] ETSI TS 101 388 (v1.3.1): "Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Asymmetric Digital Subscriber Line (ADSL) - European specific requirements".
- [2] ITU-T Recommendation G.992.5 (01/2005): "Asymmetric Digital Subscriber Line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2+)".

Text portions proposed for inclusion into clause 11

11. CLUSTER 4 SIGNALS (ASYMMETRICAL BROAD BAND)

11.5. "ADSL2plus/A" signals (EC, over POTS)

This category covers signals, generated by ADSL2plus transmission equipment with spectrum overlap, i.e. for which the downstream overlaps the upstream. These signals may share the same wire pair with POTS signals.

This clause is based on ITU-T G.992.5 [2]. A signal can be classified as an "ADSL2plus/A" signal if it is compliant with all clauses below.

11.5.1. Total signal power (downstream only)

To be compliant with this signal category, the mean downstream signal power into a resistive load of 100 Ω shall not exceed a level of +20,4 dBm, measured within a frequency band from at least 4 kHz to 7 MHz.

Reference: ITU-T Recommendation G.992.5 [2], clause A.1.2.2.

11.5.2. Total signal power (upstream only)

To be compliant with this signal category, the mean upstream signal power into a resistive load of 100 Ω shall not exceed a level of +12,5 dBm, measured within a frequency band from at least 4 kHz to 7 MHz.

Reference: ITU-T Recommendation G.992.5 [2], clause A.2.2.2.

11.5.3. Peak amplitude (upstream and downstream)

To be compliant with this signal category, the nominal voltage peak of the largest signal pulse into a resistive load of 100 Ω shall not exceed a level of 19V (38 V peak-peak), measured within a frequency band from at least 100 Hz to 3 MHz. The definition and measurement method of peak amplitude is specified in clause 13.1.

NOTE: No ETSI deliverable specifies this parameter.

11.5.4. Narrow-band signal power (downstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance R , shall not exceed the limits given in table 1 at any point in the frequency range 100 Hz to 30 MHz. This table specifies the break points of these limits. Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 1 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power P of a sending signal into a load resistance R , within a *power* bandwidth B . The measurement method of the NBSP is described in clause 13.2.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: "X" and "Y". The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.4.

Reference: ITU-T Recommendation G.992.5 [2], clause A.1.2 reconstructed from PSD requirements.

Table 1: Break points of the narrow-band power limits

Centre frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	600 Ω	-77,5 dBm	100 Hz	-97,5 dBm/Hz	"X"
4 kHz	600 Ω	-77,5 dBm	100 Hz	-97,5 dBm/Hz	
4 kHz	600 Ω	-72,5 dBm	100 Hz	-92,5 dBm/Hz	
25,875 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 104 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 622 kHz	100 Ω	-6,5 dBm	10 kHz	-46,5 dBm/Hz	
2 208 kHz	100 Ω	-7,8 dBm	10 kHz	-47,8 dBm/Hz	
2 500 kHz	100 Ω	-19,4 dBm	10 kHz	-59,4 dBm/Hz	
3 001.5 kHz	100 Ω	-40 dBm	10 kHz	-80 dBm/Hz	
3 175 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
60 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	
1 104 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	
1 622 kHz	100 Ω	0 dBm	100 kHz	-50 dBm/Hz	
2 208 kHz	100 Ω	-1,3 dBm	100 kHz	-51,3 dBm/Hz	
2 500 kHz	100 Ω	-12,9 dBm	100 kHz	-62,9 dBm/Hz	
3 001.5 kHz	100 Ω	-33,5 dBm	100 kHz	-83,5 dBm/Hz	
3 175 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
3 175 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
4 545 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
7 225 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

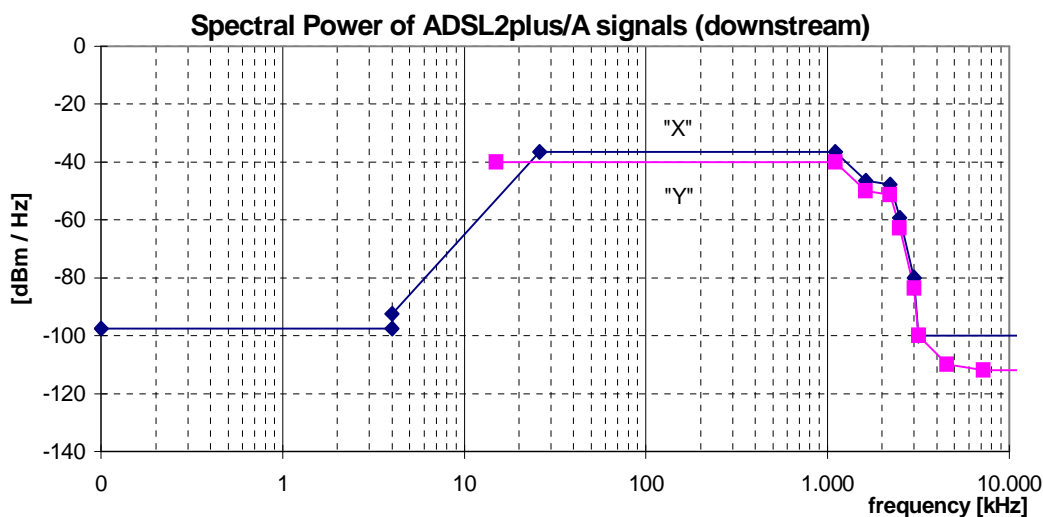


Figure 1: Spectral Power, for downstream ADSL2plus/A, as specified in table 1.

11.5.5. Narrow-band signal power (upstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance R , shall not exceed the limits given in table 2, at any point in a frequency range between 100 Hz to 30 MHz. This table specifies the break points of these limits. Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 2 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power P of a sending signal into a load resistance R , within a power bandwidth B . The measurement method of the NBSP is described in clause 13.2.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: "X" and "Y". The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.5. The ADSL1 ATU-R Mask is not valid for ADSL2plus because of a steeper slope at the edge 138 kHz.

Reference: ITU-T Recommendation G.992.5 [2], clause A.2.2 reconstructed from PSD requirements.

Table 2: Break points of the narrow-band power limits

Centre frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	600 Ω	-77,5 dBm	100 Hz	-97,5 dBm/Hz	"X"
4 kHz	600 Ω	-77,5 dBm	100 Hz	-97,5 dBm/Hz	
4 kHz	600 Ω	-72,5 dBm	100 Hz	-92,5 dBm/Hz	
25,875 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
138 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
243 kHz	100 Ω	-53,2 dBm	10 kHz	-93,2 dBm/Hz	
686 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
5 275 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
60 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	"Y"
138 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	
243 kHz	100 Ω	-46,7 dBm	100 kHz	-96,7 dBm/Hz	
686 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
1 630 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
5 275 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

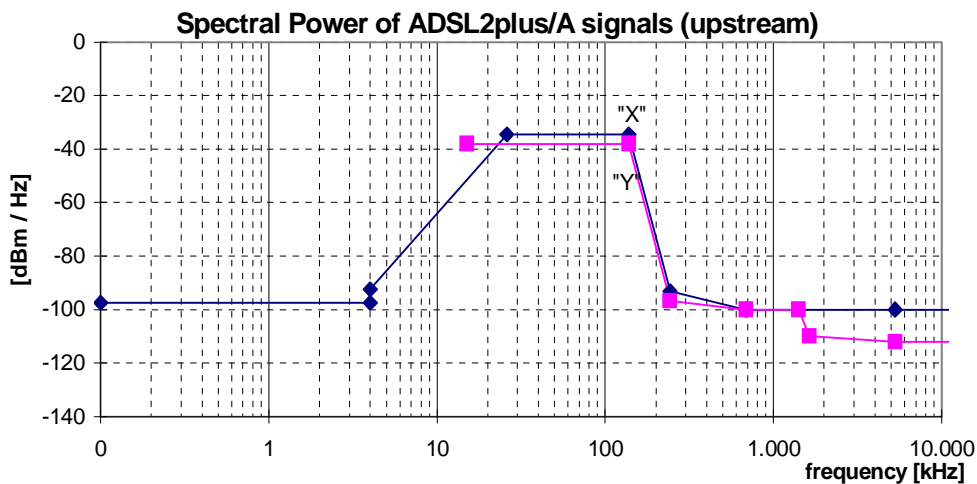


Figure 2: Spectral Power, for upstream ADSL2plus/A signals, as specified in table 2.

11.5.6. Unbalance about earth (upstream and downstream)

To be compliant with this signal category, the balance of the signal that may flow through the LT-port or NT-port shall exceed minimum requirements, under the condition that the local loop wiring and its termination is well balanced. This can be verified by a longitudinal output voltage (LOV) and a longitudinal conversion loss (LCL) measurement at the source of that signal. Clause 11.1.6 describes and refers to the concerning sections. Table 3 gives the values for the LOV limits in case of ADSL2plus while the LCL mask for ADSL2plus is given in figure 3. The LCL values of the associated break frequencies of this figure are given in table 4.

Table 3: Values for the LOV limits

	LOV	B	f_{min}	f_{max}	R_L	C_L
downstream	-46 dBV	10 kHz	5,1 kHz	3650 kHz	100 Ω	150 nF
upstream	-46 dBV	10 kHz	5,1 kHz	210 kHz	100 Ω	150 nF

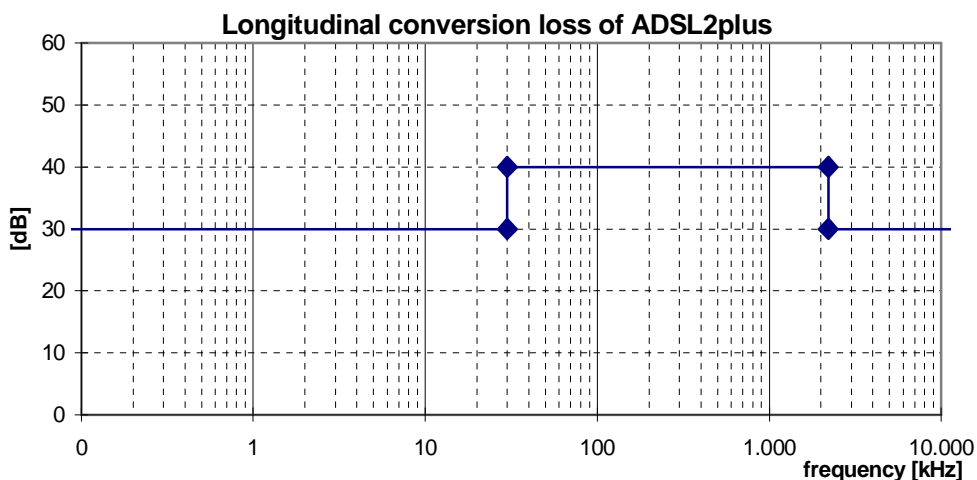


Figure 3: Minimum longitudinal conversion loss

Table 4: Frequencies and LCL values of the breakpoints of the LCL mask in figure 3.

Frequency	LCL
< 30 kHz	30 dB
30 kHz	40 dB
2 208 kHz	40 dB
2 208 kHz	30 dB
30 MHz	30 dB

11.6. "FDD.ADSL2plus/A" signals (over POTS)

This category covers signals, generated by ADSL2plus transmission equipment, which uses Frequency Division Duplexing (FDD) to separate upstream and downstream. In this mode, the usable frequency band of downstream signals is narrower and not overlapping the upstream, but adjacent to it, to minimize self-NEXT. Therefore both downstream and upstream of "FDD.ADSL2plus/A" also fulfil the requirements of "ADSL2plus/A" (EC) signals, as described in a previous clause of the present document. These signals may share the same wire pair with POTS signals.

This clause is based on ITU-T G.992.5 [2]. A signal can be classified as an "FDD.ADSLplus/A" signal if it is compliant with all clauses below.

11.6.1. Total signal power (downstream only)

To be compliant with this signal category, the mean downstream signal power into a resistive load of 100 Ω shall not exceed a level of +19,9 dBm, measured within a frequency band from at least 4 kHz to 7 MHz.

Reference: ITU-T Recommendation G.992.5 [2], clause A.1.3.2.

11.6.2. Total signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/A" (EC).

11.6.3. Peak amplitude (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/A" (EC).

11.6.4. Narrow-band signal power (downstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance R , shall not exceed the limits given in table 5, at any point in the frequency range 100 Hz to 30 MHz. This table specifies the break points of these limits. Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 4 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power P of a sending signal into a load resistance R , within a power bandwidth B . The measurement method of the NBSP is described in clause 13.2.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: "X" and "Y". The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.4.

Reference: ITU-T Recommendation G.992.5 [2], clause A.1.3 reconstructed from PSD requirements.

Table 5: Break points of the narrow-band power limits

Centre frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	600 Ω	-77,5 dBm	100 Hz	-97,5 dBm/Hz	"X"
1 kHz	600 Ω	-77,5 dBm	100 Hz	-97,5 dBm/Hz	
1 kHz	600 Ω	-67,5 dBm	1 kHz	-97,5 dBm/Hz	
4 kHz	600 Ω	-67,5 dBm	1 kHz	-97,5 dBm/Hz	
4 kHz	100 Ω	-52,5 dBm	10 kHz	-92,5 dBm/Hz	
80 kHz	100 Ω	-32,5 dBm	10 kHz	-72,5 dBm/Hz	
137,9 kHz	100 Ω	-4,2 dBm	10 kHz	-44,2 dBm/Hz	
138 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 104 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 622 kHz	100 Ω	-6,5 dBm	10 kHz	-46,5 dBm/Hz	
2 208 kHz	100 Ω	-7,8 dBm	10 kHz	-47,8 dBm/Hz	
2 500 kHz	100 Ω	-19,4 dBm	10 kHz	-59,4 dBm/Hz	
3 001,5 kHz	100 Ω	-40 dBm	10 kHz	-80 dBm/Hz	
3 175 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
170 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	"Y"
1 104 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	
1 622 kHz	100 Ω	0 dBm	100 kHz	-50 dBm/Hz	
2 208 kHz	100 Ω	-1,3 dBm	100 kHz	-51,3 dBm/Hz	
2 500 kHz	100 Ω	-12,9 dBm	100 kHz	-62,9 dBm/Hz	
3 001,5 kHz	100 Ω	-33,5 dBm	100 kHz	-83,5 dBm/Hz	
3 175 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
3 175 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
4 545 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
7225 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

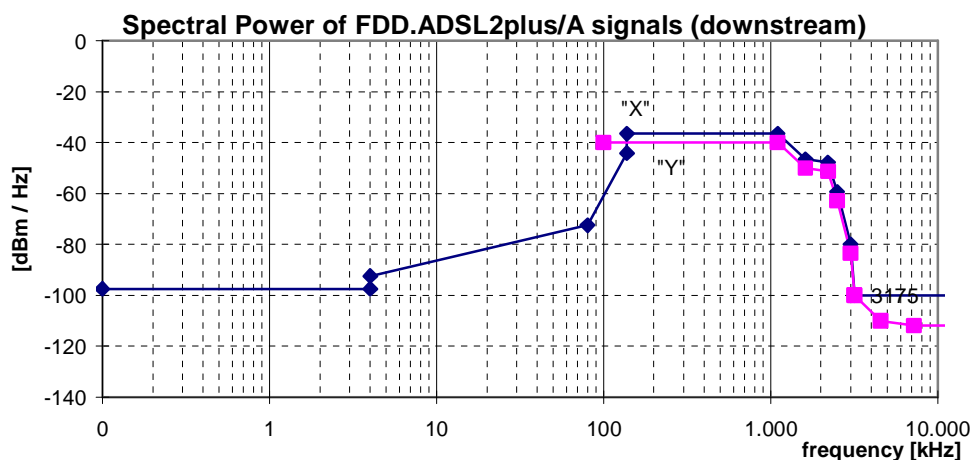


Figure 4: Spectral Power, for downstream FDD.ADSL2plus/A signals, as specified in table 5.

11.6.5. Narrow-band signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/A" (EC).

11.6.6. Unbalance about earth (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/A" (EC).

11.7. "ADSL2plus/B" signals (EC, over ISDN)

This category covers signals, generated by ADSL2plus transmission equipment with spectrum overlap, i.e. for which the downstream overlaps the upstream. These signals may share the same wire pair with ISDN signals.

This clause is based on ITU-T [2]. A signal can be classified as an "ADSL2plus/B" signal if it is compliant with all clauses below.

11.7.1. Total signal power (downstream only)

To be compliant with this signal category, the mean downstream signal power into a resistive load of 100 Ω shall not exceed a level of +19,9 dBm, measured within a frequency band from at least 4 kHz to 7 MHz.

Reference: ITU-T G.992.5 [2], clause B.1.2.2.

11.7.2. Total signal power (upstream only)

To be compliant with this signal category, the mean upstream signal power into a resistive load of 100 Ω shall not exceed a level of +13,3 dBm, measured within a frequency band from at least 4 kHz to 3 MHz.

Reference: ITU-T G.992.5 [2], clause B.2.2.2.

11.7.3. Peak amplitude (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/A" (EC).

11.7.4. Narrow-band signal power (downstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance R , shall not exceed the limits given in table 6, at any point in the frequency range 100 Hz to 30 MHz. This table specifies the break points of these limits. Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 5 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power P of a sending signal into a load resistance R , within a power bandwidth B . The measurement method of the NBSP is described in clause 13.2.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: “X” and “Y”. The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.4.

Reference: ITU-T Recommendation G.992.5 [2], clause B.1.2, reconstructed from PSD requirements.

Table 6: Break points of the narrow-band power limits

Centre Frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	100 Ω	-70 dBm	100 Hz	-90 dBm/Hz	“X”
1 kHz	100 Ω	-70 dBm	100 Hz	-90 dBm/Hz	
1 kHz	100 Ω	-60 dBm	1 kHz	-90 dBm/Hz	
4 kHz	100 Ω	-60 dBm	1 kHz	-90 dBm/Hz	
4 kHz	100 Ω	-50 dBm	10 kHz	-90 dBm/Hz	
50 kHz	100 Ω	-50 dBm	10 kHz	-90 dBm/Hz	
80 kHz	100 Ω	-41,8 dBm	10 kHz	-81,8 dBm/Hz	
120 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 104 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 622 kHz	100 Ω	-6,5 dBm	10 kHz	-46,5 dBm/Hz	
2 208 kHz	100 Ω	-7,8 dBm	10 kHz	-47,8 dBm/Hz	
2 500 kHz	100 Ω	-19,4 dBm	10 kHz	-59,4 dBm/Hz	
3 001,5 kHz	100 Ω	-40 dBm	10 kHz	-80 dBm/Hz	
3 175 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
100 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	“Y”
1 104 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	
1 622 kHz	100 Ω	0 dBm	100 kHz	-50 dBm/Hz	
2 208 kHz	100 Ω	-1,3 dBm	100 kHz	-51,3 dBm/Hz	
2 500 kHz	100 Ω	-12,9 dBm	100 kHz	-62,9 dBm/Hz	
3 001,5 kHz	100 Ω	-33,5 dBm	100 kHz	-83,5 dBm/Hz	
3 175 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
3 175 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
4 545 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
7 225 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

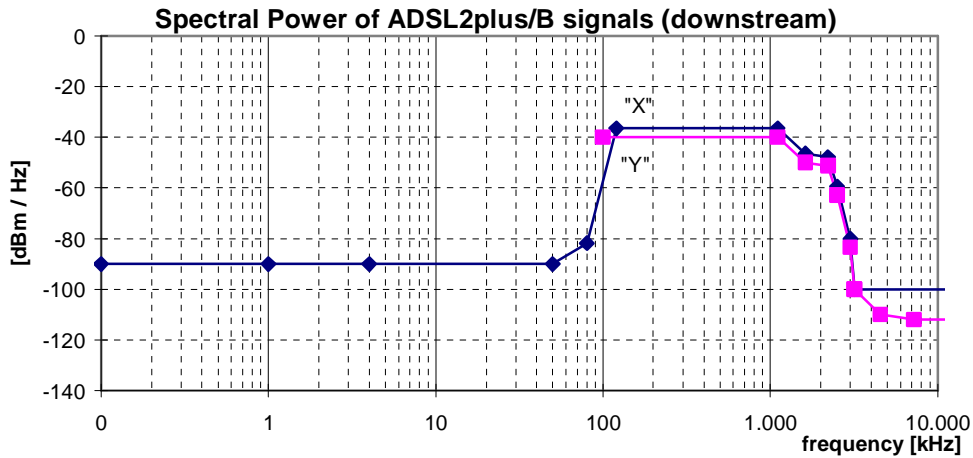


Figure 5: Spectral Power, for downstream ADSL2plus/B signals, as specified in table 6.

11.7.5. Narrow-band signal power (upstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance R , shall not exceed the limits given in table 7, at any point in the frequency range 100 Hz to 30 MHz. This table specifies the break points of these limits. Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 12 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power P of a sending signal into a load resistance R , within a power bandwidth B . The measurement method of the NBSP is described in clause 13.2.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: "X" and "Y". The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.5. The ADSL1 ATU-R Mask is not valid for ADSL2plus because of a steeper slope at the edge 276 kHz.

Reference: ITU-T Recommendation G.992.5 [2], clause B.2.2 reconstructed from PSD requirements.

Table 7: Break points of the narrow-band power limits

Centre frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	100 Ω	-70 dBm	100 Hz	-90 dBm/Hz	"X"
1 kHz	100 Ω	-70 dBm	100 Hz	-90 dBm/Hz	
1 kHz	100 Ω	-60 dBm	1 kHz	-90 dBm/Hz	
4 kHz	100 Ω	-60 dBm	1 kHz	-90 dBm/Hz	
4 kHz	100 Ω	-50 dBm	10 kHz	-90 dBm/Hz	
50 kHz	100 Ω	-50 dBm	10 kHz	-90 dBm/Hz	
80 kHz	100 Ω	-41,8 dBm	10 kHz	-81,8 dBm/Hz	
120 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
276 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
508,8 kHz	100 Ω	-58 dBm	10 kHz	-98 dBm/Hz	
686 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	"Y"
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
120 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	
276 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	
508,8 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
686 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
1 630 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
5 275 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

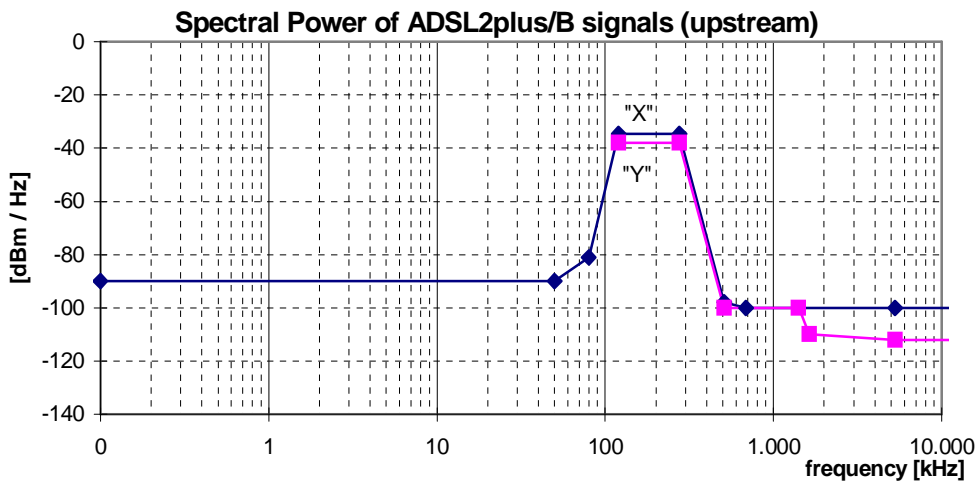


Figure 6: Spectral Power, for upstream ADSL2plus/B signals, as specified in table 7.

11.7.6. Unbalance about earth (upstream and downstream)

To be compliant with this signal category, the balance of the signal that may flow through the LT-port or NT-port shall exceed minimum requirements, under the condition that the local loop wiring and its termination is well balanced. This can be verified by a longitudinal output voltage (LOV) and a longitudinal conversion loss (LCL) measurement at the source of that signal, as specified in clause 13.3. The minimum LOV and LCL requirements hold for what can be observed at the ports of the Local Loop Wiring, when the Local Loop Wiring is replaced by an artificial impedance network described in clause 13.3. Table 8 gives the values for the LOV limits in case of ADSL2plus while the LCL mask for ADSL2plus is given in figure 7. The LCL values of the associated break frequencies of this figure are given in table 9.

Table 8: Values for the LOV limits.

	LOV	B	f_{min}	f_{max}	R_L	C_L
downstream	-46 dBV	10 kHz	5,1 kHz	3650 kHz	100 Ω	150 nF
upstream	-46 dBV	10 kHz	5,1 kHz	415 kHz	100 Ω	150 nF

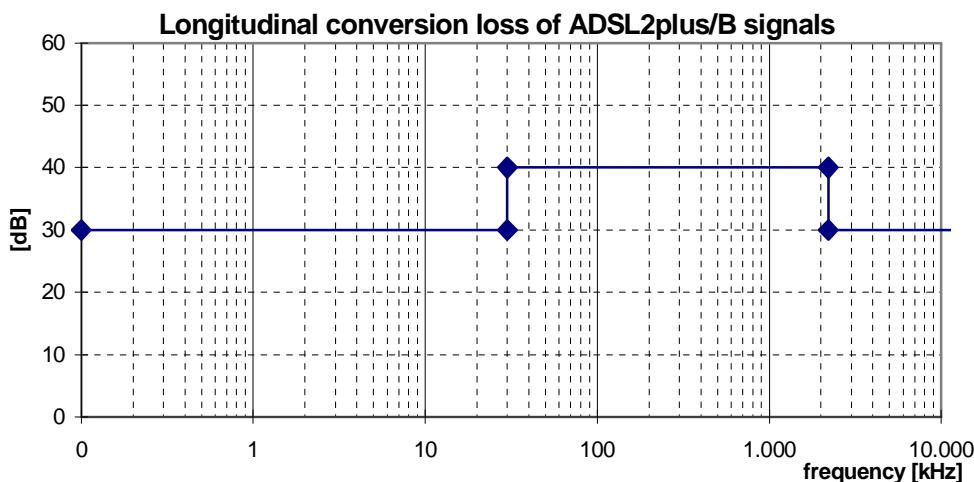


Figure 7: Minimum longitudinal conversion loss.

Table 9: Frequencies and LCL values of the breakpoints of the LCL-mask in figure 7.

Frequency	LCL
< 30 kHz	30 dB
30 kHz	40 dB
2 208 kHz	40 dB
2 208 kHz	30 dB
30 MHz	30 dB

11.8. "FDD.ADSL2plus/B" signals (over ISDN)

This category covers signals, generated by ADSL2plus transmission equipment which uses Frequency Division Duplexing (FDD) to separate upstream and downstream. In this mode, the usable frequency band of downstream signals is narrower to limit the overlap with the upstream to four DMT tones. This is to minimize self-NEXT. Therefore both downstream and upstream of "FDD.ADSL2plus/B" also fulfil the requirements of "ADSL2plus/B" (EC) signals, as described in a previous clause of the present document.

These signals may share the same wire pair with ISDN signals.

This clause is based on ITU-T G.992.5 [2]. A signal can be classified as an "FDD.ADSL2plus/B" signal if it is compliant with all clauses below.

11.8.1. Total signal power (downstream only)

To be compliant with this signal category, the mean downstream signal power into a resistive load of 100 Ω shall not exceed a level of +19,3 dBm, measured within a frequency band from at least 4 kHz to 7 MHz.

If measurements of the upstream power indicates that downstream power back-off is necessary, as described for the downstream PSD, then the maximum total transmit power shall be reduced accordingly.

Reference: ITU-T G.992.5 [2], clause B.1.3.2.

11.8.2. Total signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/B" (EC).

11.8.3. Peak amplitude (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/B" (EC).

11.8.4. Narrow-band signal power (downstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance R , shall not exceed the limits given in table 10, at any point in the frequency range 100 Hz to 30 MHz. This table specifies the break points of these limits. Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 8 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power P of a sending signal into a load resistance R , within a power bandwidth B . The measurement method of the NBSP is described in clause 13.2.

Reference: ITU-T Recommendation G.992.5 [2], clause B.1.3, reconstructed from PSD requirements.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: "X" and "Y". The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.4.

Table 10: Break points of the narrow-band power limits

Centre Frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	100 Ω	-70 dBm	100 Hz	-90 dBm/Hz	"X"
1 kHz	100 Ω	-70 dBm	100 Hz	-90 dBm/Hz	
1 kHz	100 Ω	-60 dBm	1 kHz	-90 dBm/Hz	
4 kHz	100 Ω	-60 dBm	1 kHz	-90 dBm/Hz	
4 kHz	100 Ω	-50 dBm	10 kHz	-90 dBm/Hz	
93,1 kHz	100 Ω	-50 dBm	10 kHz	-90 dBm/Hz	
209 kHz	100 Ω	-22 dBm	10 kHz	-62 dBm/Hz	
253,9 kHz	100 Ω	-8,5 dBm	10 kHz	-48,5 dBm/Hz	
254 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 104 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 622 kHz	100 Ω	-6,5 dBm	10 kHz	-46,5 dBm/Hz	
2 208 kHz	100 Ω	-7,6 dBm	10 kHz	-47,8 dBm/Hz	
2 500 kHz	100 Ω	-19,4 dBm	10 kHz	-59,4 dBm/Hz	
3 001,5 kHz	100 Ω	-40 dBm	10 kHz	-80 dBm/Hz	
3 175 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
276 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	"Y"
1 104 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	
1 622 kHz	100 Ω	0 dBm	100 kHz	-50 dBm/Hz	
2 208 kHz	100 Ω	-1,3 dBm	100 kHz	-51,3 dBm/Hz	
2 500 kHz	100 Ω	-12,9 dBm	100 kHz	-62,9 dBm/Hz	
3 001,5 kHz	100 Ω	-33,5 dBm	100 kHz	-83,5 dBm/Hz	
3 175 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
3 175 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
3 750 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
4 545 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
7 225 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

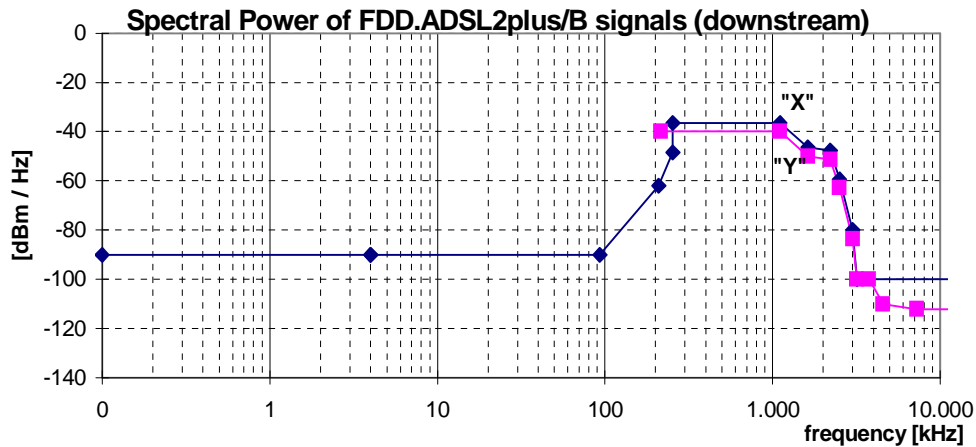


Figure 8: Spectral Power, for downstream FDD.ADSL2plus/B signals, specified in table 10.

11.8.5. Narrow-band signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/B" (EC).

11.8.6. Unbalance about earth (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/B" (EC).

11.9. "ADSL2plus/I" signals (EC, All digital mode)

This category covers signals, generated by ADSL2plus transmission equipment with spectrum overlap, i.e. for which the downstream overlaps the upstream. These signals do not share the same wire pair with POTS or ISDN signals.

This clause is based on ITU-T G.992.5 [2]. A signal can be classified as an "ADSL2plus/I" signal if it is compliant with all clauses below.

11.9.1. Total signal power (downstream only)

To be compliant with this signal category, the mean downstream signal power into a resistive load of 100 Ω shall not exceed a level of +20,4 dBm, measured within a frequency band from at least 4 kHz to 7 MHz.

Reference: ITU- T Recommendation G.992.5 [2], clause I.1.2.2.

11.9.2. Total signal power (upstream only)

To be compliant with this signal category, the mean upstream signal power into a resistive load of 100 Ω shall not exceed a level of +13,3 dBm, measured within a frequency band from at least 4 kHz to 7 MHz.

Reference: ITU-T Recommendation G.992.5 [2], clause I.2.2.2.

11.9.3. Peak amplitude (upstream and downstream)

To be compliant with this signal category, the nominal voltage peak of the largest signal pulse into a resistive load of 100 Ω shall not exceed a level of 19V (38 V peak-peak), measured within a frequency band from at least 100 Hz to 1 MHz. The definition and measurement method of peak amplitude is specified in clause 13.1..

NOTE: No ETSI deliverable does specify this parameter.

11.9.4. Narrow-band signal power (downstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance **R**, shall not exceed the limits given in table 11, at any point in the frequency range 100 Hz to 30 MHz. This table specifies the break points of these limits. Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 9 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power **P** of a sending signal into a load resistance **R**, within a *power* bandwidth **B**. The measurement method of the NBSP is described in clause 13.2.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: “X” and “Y”. The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.4.

Reference: ITU-T Recommendation G.992.5 [2], clause I.1.2 reconstructed from PSD requirements.

Table 11: Break points of the narrow-band power limits

Centre frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	600 Ω	-28,5 dBm	100 Hz	-48,5 dBm/Hz	“X”
1,5 kHz	600 Ω	-28,5 dBm	100 Hz	-48,5 dBm/Hz	
3 kHz	600 Ω	-16,5 dBm	100 Hz	-36,5 dBm/Hz	
25,875 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 104 kHz	100 Ω	+3,5 dBm	10 kHz	-36,5 dBm/Hz	
1 622 kHz	100 Ω	-6,5 dBm	10 kHz	-46,5 dBm/Hz	
2 208 kHz	100 Ω	-7,8 dBm	10 kHz	-47,8 dBm/Hz	
2 500 kHz	100 Ω	-19,4 dBm	10 kHz	-59,4 dBm/Hz	
3 001.5 kHz	100 Ω	-40 dBm	10 kHz	-80 dBm/Hz	
3 175 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
25 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	“Y”
1 104 kHz	100 Ω	+10 dBm	100 kHz	-40 dBm/Hz	
1 622 kHz	100 Ω	0 dBm	100 kHz	-50 dBm/Hz	
2 208 kHz	100 Ω	-1,3 dBm	100 kHz	-51,3 dBm/Hz	
2 500 kHz	100 Ω	-12,9 dBm	100 kHz	-62,9 dBm/Hz	
3 001.5 kHz	100 Ω	-33,5 dBm	100 kHz	-83,5 dBm/Hz	
3 175 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
3 175 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
3 750 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
4 545 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
7 225 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

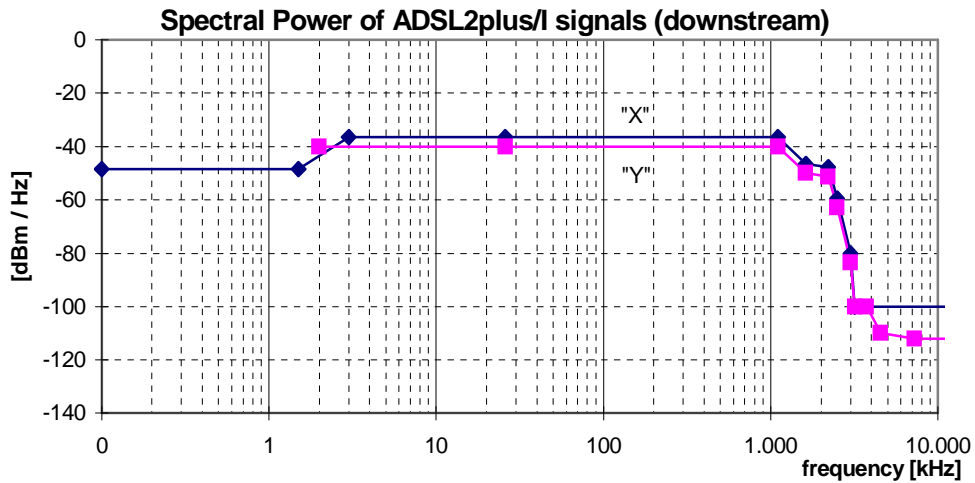


Figure 9: Spectral Power, for downstream ADSL2plus/l signals, as specified in table 11.

11.9.5. Narrow-band signal power (upstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance R , shall not exceed the limits given in table 12, at any point in the frequency range 100 Hz to 30 MHz. This table specifies the break points of these limits. Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 10 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power P of a sending signal into a load resistance R , within a *power* bandwidth B . The measurement method of the NBSP is described in clause 13.2.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: "X" and "Y". The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.5.

Reference: ITU-T Recommendation G.992.5 [2], clause I.2.2 reconstructed from PSD requirements.

Table 12: Break points of the narrow-band power limits

Centre frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	600 Ω	-26,5 dBm	100 Hz	-46,5 dBm/Hz	"X"
1,5 kHz	600 Ω	-26,5 dBm	100 Hz	-46,5 dBm/Hz	
3 kHz	600 Ω	-14,5 dBm	100 Hz	-34,5 dBm/Hz	
10 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
138 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
243 kHz	100 Ω	-53,2 dBm	10 kHz	-93,2 dBm/Hz	
686 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
5 275 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
25 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	"Y"
138 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	
243 kHz	100 Ω	-46,7 dBm	100 kHz	-96,7 dBm/Hz	
686 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
1 630 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
5 275 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

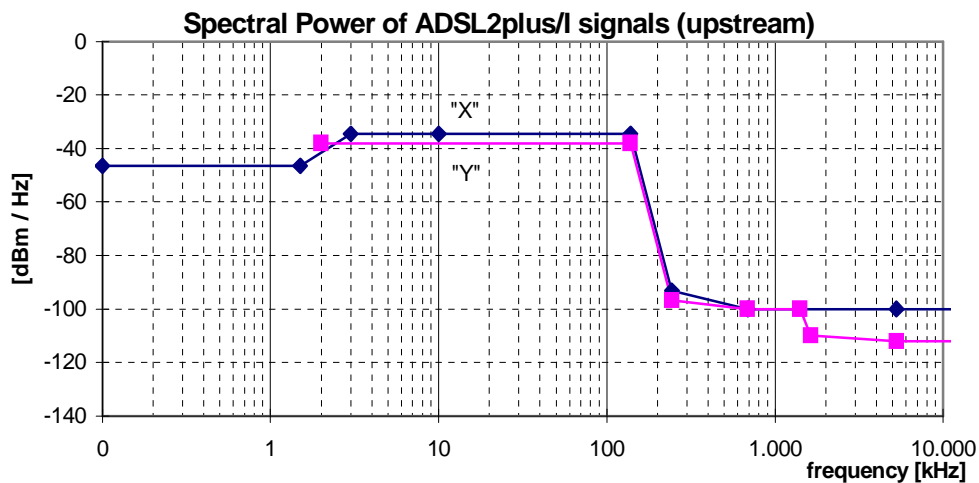


Figure 10: Spectral Power, for upstream ADSL2plus/I signals, as specified in table 12.

11.9.6. Unbalance about earth (upstream and downstream)

The description of this signal characteristic equals that of "FDD.ADSL2plus/A" (EC).

11.10. "FDD.ADSL2plus/I" signals (All digital mode)

This category covers signals, generated by ADSL2plus transmission equipment, which uses Frequency Division Duplexing (FDD) to separate upstream and downstream. In this mode, the usable frequency band of downstream signals is narrower and not overlapping the upstream, but adjacent to it, to minimize self-NEXT. Therefore both downstream and upstream of "FDD.ADSL2plus/I" also fulfil the requirements of "ADSL2plus/I" (EC) signals, as described in a previous clause of the present document. These signals do not share the same wire pair with POTS or ISDN signals.

This clause is based on ITU-T G992.5 [2]. A signal can be classified as an "FDD.ADSL2plus/I" signal if it is compliant with all clauses below.

11.10.1. Total signal power (downstream only)

The description of this signal characteristic equals that of "FDD.ADSL2plus/A" (EC).

Reference: ITU-T Recommendation G.992.5 [2], clause I.1.3.2.

11.10.2. Total signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/I" (EC).

11.10.3. Peak amplitude (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/I" (EC).

11.10.4. Narrow-band signal power (downstream only)

The description of this signal characteristic equals that of "FDD.ADSL2plus/A".

Reference: ITU-T Recommendation G.992.5 [2], clause I.1.3.

NOTE: There is one modification on the PSD mask, namely: For $0 < f < 4\text{kHz}$, the PSD shall be below $-97,5\text{kHz}$ (no extra limitation of max power in 0-4kHz band)

11.10.5. Narrow-band signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/I" (EC).

11.10.6. Unbalance about earth (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/A" (EC).

11.11. "ADSL2plus/J" signals (EC, all digital mode)

This category, "ADSL2plus/J", covers signals, generated by ADSL2plus transmission equipment with spectrum overlap, i.e. for which the downstream overlaps the upstream and with extended upstream. These signals do not share the same wire pair with POTS or ISDN signals.

This clause is based on ITU-T G.992.5 [2]. A signal can be classified as an "ADSL2plus/J" signal if it is compliant with all clauses below.

11.11.1. Total signal power (downstream only)

The description of this signal characteristic equals that of "ADSL2plus/I" (EC).

Reference: ITU-T Recommendation G.992.5 [2], clause J.1.2.2.

11.11.2. Total signal power (upstream only)

To be compliant with this signal category, the mean upstream signal power into a resistive load of $100\ \Omega$ shall not exceed a level of $+13,4\ \text{dBm}$, measured within a frequency band from at least $4\ \text{kHz}$ to $3\ \text{MHz}$.

Reference: ITU-T Recommendation G.992.5 [2], clause J.2.2.2.

11.11.3. Peak amplitude (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/I" (EC).

11.11.4. Narrow-band signal power (downstream only)

The description of this signal characteristic equals that of "ADSL2plus/I" (EC).

Reference: ITU-T Recommendation G.992.5 [2], clause J.1.2.

11.11.5. Narrow-band signal power (upstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance **R**, shall not exceed the limits given in table 14, at any point in the frequency range 100 Hz to 30 MHz. This table specifies the break points of these limits.

The ITU-T Recommendation G.992.5 [2], clause J.2.2 describes a family of 9 different upstream spectral mask called ADLU-32, ADLU-36,... ADLU-64. The passband is defined as the band from 3 kHz tot an upperbound frequency f1 which corresponds with the frequency spacing of the highest DMT symbol used in the passband. E.g. mask ADLU-32 defines an upstream mask with a its passband up to DMT symbol 32 corresponding with a upperbound frequency of 138 kHz. The NBSP specification in table 14 is based on the In-band Peak PSD (dBm/Hz) of ADLU-32 while the Frequency f1 (kHz), Intercept Frequency f_int (kHz) and Intercept PSD Level PSD_int (dBm/Hz) are based on ADLU-64, ITU-T G.992.5 [2], clause J.2.2, table J.3.

Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 11 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power **P** of a sending signal into a load resistance **R**, within a *power* bandwidth **B**. The measurement method of the NBSP is described in clause 13.2.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: "X" and "Y". The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.5.

Reference: ITU-T Recommendation G.992.5 [2], clause J.2.2 reconstructed from PSD requirements.

Table 13: Break points of the narrow-band power limits

Centre frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	100 Ω	-26,5 dBm	100 Hz	-46.5 dBm/Hz	"X"
1,5 kHz	100 Ω	-26,5 dBm	100 Hz	-46,5 dBm/Hz	
3 kHz	100 Ω	-14,5 dBm	100 Hz	-34,5 dBm/Hz	
10 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
276 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
493,41 kHz	100 Ω	-57,9 dBm	10 kHz	-97,9 dBm/Hz	
686 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
5275 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	"Y"
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
25 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	
276 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	
493,41 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
686 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
1 630 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
5 275 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

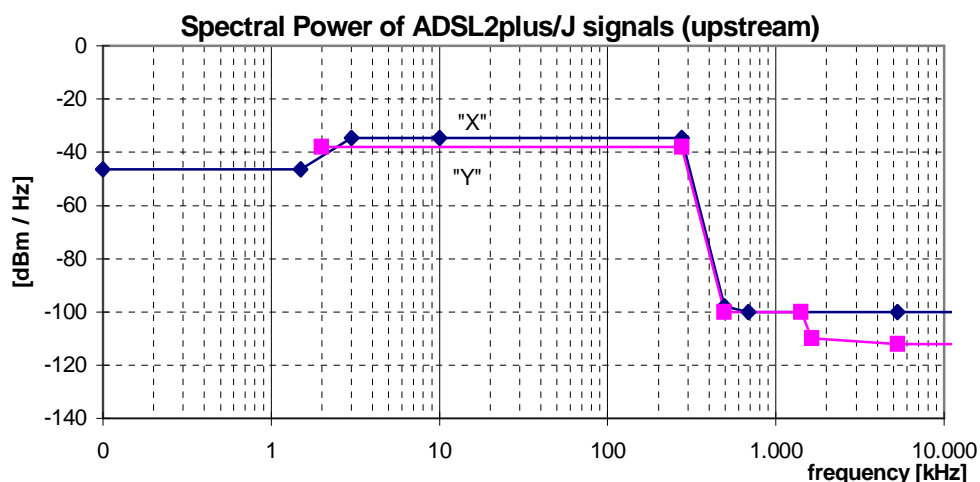


Figure 11: Spectral Power, for upstream ADSL2plus/J signals, as specified in table 13.

11.11.6. Unbalance about earth (upstream and downstream)

The description of this signal characteristic equals that of "FDD.ADSL2plus/B" (EC).

11.12. "FDD.ADSL2plus/J" signals (all digital mode)

This category covers signals, generated by ADSL2plus transmission equipment, which uses Frequency Division Duplexing (FDD) to separate upstream and downstream, and uses an extended upstream. In this mode, the usable frequency band of downstream signals is narrower and not overlapping the upstream, but adjacent to it, to minimize self-NEXT. Therefore both downstream and upstream of "FDD.ADSL2plus/J" also fulfil the requirements of "ADSL2plus/J" (EC) signals, as described in a previous clause of the present document.

These signals do not share the same wire pair with POTS or ISDN signals.

This clause is based on ITU-T G992.5 [2]. A signal can be classified as an "FDD.ADSL2plus/J" signal if it is compliant with all clauses below.

11.12.1. Total signal power (downstream only)

The description of this signal characteristic equals that of "FDD.ADSL2plus/B".

Reference: ITU-T Recommendation G.992.5 [2], clause J.1.3.2.

11.12.2. Total signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/J" (EC).

11.12.3. Peak amplitude (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/J" (EC).

11.12.4. Narrow-band signal power (downstream only)

The description of this signal characteristic equals that of "FDD.ADSL2plus/B".

Reference: ITU-T Recommendation G.992.5 [2], clause J.1.3.

11.12.5. Narrow-band signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/J".

Reference: ITU-T Recommendation G.992.5 [2], clause J.2.2.

11.12.6. Unbalance about earth (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/B" (EC).

11.13. "ADSL2plus/M" signals (EC, extended upstream)

This category covers signals, generated by ADSL2plus transmission equipment with spectrum overlap, i.e. for which the downstream overlaps the upstream, and use an extended upstream. These signals may share the same wire pair with POTS signals.

This clause is based on ITU-T G.992.5 [2]. A signal can be classified as an "ADSL2plus/M" signal if it is compliant with all clauses below.

11.13.1. Total signal power (downstream only)

The description of this signal characteristic equals that of "ADSL2plus/A" (EC).

Reference: ITU-T G.992.5 [2], clause M.1.2.2.

11.13.2. Total signal power (upstream only)

To be compliant with this signal category, the mean upstream signal power into a resistive load of $100\ \Omega$ shall not exceed a level of +12,5 dBm, measured within a frequency band from at least 4 kHz to 3 MHz.

Reference: ITU-T G.992.5 [2], clause M.2.2.2.

11.13.3. Peak amplitude (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/I" (EC).

11.13.4. Narrow-band signal power (downstream only)

The description of this signal characteristic equals that of "ADSL2plus/A" (EC).

Reference: ITU G.992.5 [2], clause M.1.2.

11.13.5. Narrow-band signal power (upstream only)

To be compliant with this signal category, the narrow-band signal power (NBSP) into a resistive load impedance R , shall not exceed the limits given in table 14, at any point in the frequency range 100 Hz to 30 MHz. This table specifies the break points of these limits.

The ITU-T Recommendation G.992.5 [2], clause M.2.2 describes a family of 9 different upstream spectral mask called EU-32, EU-36,... EU-64. The passband is defined as the band from 3 kHz to an upperbound frequency f_1 which corresponds with the frequency spacing of the highest DMT symbol used in the passband. E.g. mask EU-32 defines an upstream mask with its passband up to DMT symbol 32 corresponding with an upperbound frequency of 138 kHz. The NBSP specification in table 15 is based on the In-band Peak PSD (dBm/Hz) of EU-32 while the Frequency f_1 (kHz), Intercept Frequency f_{int} (kHz) and Intercept PSD Level PSD_{int} (dBm/Hz) are based on EU-64, ITU-T G.992.5 [2], clause M.2.2, table M.3.

Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Figure 13 illustrates the NBSP in a bandwidth-normalized way.

The NBSP is the average power P of a sending signal into a load resistance R , within a power bandwidth B . The measurement method of the NBSP is described in clause 13.2.

NOTE: The NBSP specification of this signal category has been split into two overlapping limits: "X" and "Y". The reason for this split is the same as described in the NBSP descriptions for ADSL, e.g. clause 11.1.5.

Reference: ITU-T Recommendation G.992.5 [2], clause M.2.2 reconstructed from PSD requirements.

Table 14: Break points of the narrow-band power limits.

Centre frequency f	Impedance R	Signal Level P	Power bandwidth B	Spectral Power P/B	
0,1 kHz	100 Ω	-77,5 dBm	100 Hz	-97,5 dBm/Hz	"X"
4 kHz	100 Ω	-77,5 dBm	100 Hz	-97,5 dBm/Hz	
4 kHz	100 Ω	-72,5 dBm	100 Hz	-92,5 dBm/Hz	
25,875 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
276 kHz	100 Ω	+5,5 dBm	10 kHz	-34,5 dBm/Hz	
493,41 kHz	100 Ω	-57,9 dBm	10 kHz	-97,9 dBm/Hz	
686 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
5275 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
30 000 kHz	100 Ω	-60 dBm	10 kHz	-100 dBm/Hz	
60 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	"Y"
276 kHz	100 Ω	+12 dBm	100 kHz	-38 dBm/Hz	
493,41 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
686 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-50 dBm	100 kHz	-100 dBm/Hz	
1 411 kHz	100 Ω	-40 dBm	1 MHz	-100 dBm/Hz	
1 630 kHz	100 Ω	-50 dBm	1 MHz	-110 dBm/Hz	
5 275 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	
30 000 kHz	100 Ω	-52 dBm	1 MHz	-112 dBm/Hz	

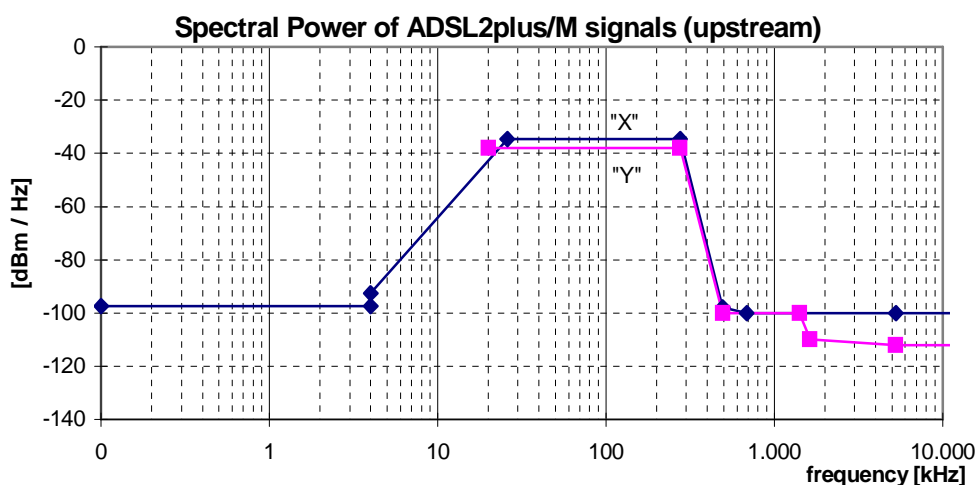


Figure 13: Spectral Power, for upstream ADSL2plus/M signals, as specified in table 14.

11.13.6. Unbalance about earth (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/B" (EC).

11.14. "FDD.ADSL2plus/M" signals

This category covers signals, generated by ADSL2plus transmission equipment, which uses Frequency Division Duplexing (FDD) to separate upstream and downstream. In this mode, the usable frequency band of downstream signals is narrower and not overlapping the upstream, but adjacent to it, to minimize self-NEXT. Therefore both downstream and upstream of "FDD.ADSL2plus/M" also fulfil the requirements of "ADSL2plus/M" (EC) signals, as described in a previous clause of the present document.

These signals may share the same wire pair with POTS signals.

This clause is based on ITU G992.5 [2]. A signal can be classified as an "FDD.ADSL2plus/M" signal if it is compliant with all clauses below.

11.14.1. Total signal power (downstream only)

The description of this signal characteristic equals that of "FDD.ADSL2plus/B".

Reference: ITU-T Recommendation G.992.5 [2], clause M.1.3.2.

11.14.2. Total signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/M" (EC).

Reference: ITU-T Recommendation G.992.5 [2], clause M.2.2.2.

11.14.3. Peak amplitude (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/M" (EC).

11.14.4. Narrow-band signal power (downstream only)

The description of this signal characteristic equals that of "FDD.ADSL2plus/B".

Reference: ITU-T Recommendation G.992.5 [2], clause M.1.3.

11.14.5. Narrow-band signal power (upstream only)

The description of this signal characteristic equals that of "ADSL2plus/M".

Reference: ITU-T Recommendation G.992.5 [2], clause M.2.2.

11.14.6. Unbalance about earth (upstream and downstream)

The description of this signal characteristic equals that of "ADSL2plus/B" (EC).

End of literal text proposals

Hidden definitions (do not delete!!):

Clause 11.1.4

Clause 11.1.5

Clause 11.1.6

Clause 13.1

Clause 13.2

Clause 13.3