TITLE   **Additional note for generic DMT model, on bit loading**

PROJECTS   Spectral Management, part 2.

SOURCE: Rapporteur, TNO Telecom

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STATUS   Proposal, for Decision

ABSTRACT   The text for the generic DMT model should have an additional note for preventing the bit loading algorithm to enable forbidden adjustments of tone levels. Some combinations of adjustments are forbidden because they cause the aggregate power of all these tones to exceed the maximum allowed transmit power. This contribution provides dedicated text

This contribution is the result of some private communications with Tomas Nordström (FTW) on how to improve the current note in the draft on preventing forbidden bit loading combinations. The text itself should provide a clear description, that is consistent with the rest of SpM-2 document. Therefore a simple reference to "the standards" will not be adequate for the job.
This contribution proposes some text.

5.2.4 Generic DMT detection model
<SEE CURRENT DRAFT>

Bit-loading algorithm
<SEE CURRENT DRAFT>

<OLD NOTE, TO BE REPLACED>
Note that when calculating the bit-loading, the used total power needs to be reduced by the amount of power spent on the cyclic extension.

<PROPOSED NEW TEXT>
Note that when gain-adjusted bit-loading (GABL) is used, the aggregate transmit power should never exceed the maximum aggregate transmit power P_{max} allowed for transmitting. That maximum power for the bit-loaded tones $P_{max,tones}$ is lower than P_{max} because some of the power is used for the cyclic extension. The maximum power for the bit-loaded tones is different for each modem model, and calculated by:

$$P_{max,tones} = h_{tones} \times P_{max} = N_{FFT} / (N_{FFT}+N_{CE}) \times P_{max},$$

In this expression is N_{FFT} the IFFT/FFT block size, and N_{CE} the number of samples used for the cyclic extention. The cyclic extension comprises both cyclic prefix and cyclic suffix.

6.4 Receiver performance model for "ADSL over POTS" (EC)

<PROPOSED TEXT TO BE ADDED TO 6.4.2>
Restrictions for alternative bit loading algorithms
Note that when gain-adjusted bit-loading (GABL, see clause 5.2.4) is used, in stead of fractional bitloading (FBL), the aggregate transmit power of the tones being used shall not exceeded the maximum allowed values specified in [ETSI-ADSL, clause 4.3]. These maximum values are to be evaluated as:

$$P_{max,dBm} = P_{0,dBm} + 10 \times \log_{10}(N_c)$$

$$P_{max,tones,dBm} = P_{0,dBm} + 10 \times \log_{10}\left(\frac{N_{FFT}}{N_{FFT}+N_{CE}} \times N_c\right)$$

	up	**down**
Tone range	[7:31]	[7:255]
N_c	25	249
N_{FFT}	512	512
N_{CE}	32	32
$P_{0,dBm}$	-1.65 dBm	-3.65 dBm
$P_{max,dBm}$	≈12.34 dBm	≈20.31 dBm
$P_{max,tones,dBm}$	≈12.07 dBm	≈20.05 dBm

6.5 Receiver performance model for "ADSL.FDD over POTS"

<PROPOSED TEXT TO BE ADDED TO 6.5.2>
Restrictions for alternative bit loading algorithms
Note that when gain-adjusted bit-loading (GABL, see clause 5.2.4) is used, in stead of fractional bitloading (FBL), the aggregate transmit power of the tones being used shall not exceeded the maximum allowed values specified in [ETSI-ADSL, clause 4.3]. These maximum values are to be evaluated as:

$$P_{max,dBm} = P_{0,dBm} + 10 \times \log_{10}(N_c)$$

$$P_{max,tones,dBm} = P_{0,dBm} + 10 \times \log_{10}\left(\frac{N_{FFT}}{N_{FFT}+N_{CE}} \times N_c\right)$$

	up	**down**
Tone range	[7:30]	[38:255]
N_c	24	218
N_{FFT}	512	512
N_{CE}	32	32
$P_{0,dBm}$	-1.65 dBm	-3.65 dBm
$P_{max,dBm}$	≈12.15 dBm	≈19.73 dBm
$P_{max,tones,dBm}$	≈11.89 dBm	≈19.47 dBm

6.6 Receiver performance model for "ADSL over ISDN" (EC)

<PROPOSED TEXT TO BE ADDED TO 6.6.2>
Restrictions for alternative bit loading algorithms
Note that when gain-adjusted bit-loading (GABL, see clause 5.2.4) is used, in stead of fractional bitloading (FBL), the aggregate transmit power of the tones being used shall not exceeded the maximum allowed values specified in [ETSI-ADSL, clause 4.3]. These maximum values are to be evaluated as:

$$P_{max,dBm} = P_{0,dBm} + 10 \times \log_{10}(N_c)$$

$$P_{max,tones,dBm} = P_{0,dBm} + 10 \times \log_{10}\left(\frac{N_{FFT}}{N_{FFT}+N_{CE}} \times N_c\right)$$

	up	**down**
Tone range	[33:63]	[33:255]
N_c	31	223
N_{FFT}	512	512
N_{CE}	32	32
$P_{0,dBm}$	-1.65 dBm	-3.65 dBm
$P_{max,dBm}$	≈13.26 dBm	≈13.00 dBm
$P_{max,tones,dBm}$	≈19.83 dBm	≈19.57 dBm

6.7 Receiver performance model for "ADSL.FDD over ISDN"

<PROPOSED TEXT TO BE ADDED TO 6.7.2>
Restrictions for alternative bit loading algorithms
Note that when gain-adjusted bit-loading (GABL, see clause 5.2.4) is used, in stead of fractional bitloading (FBL), the aggregate transmit power of the tones being used shall not exceeded the maximum allowed values specified in [ETSI-ADSL, clause 4.3]. These maximum values are to be evaluated as:

$$P_{max,dBm} = P_{0,dBm} + 10 \times \log_{10}(N_c)$$

$$P_{max,tones,dBm} = P_{0,dBm} + 10 \times \log_{10}\left(\frac{N_{FFT}}{N_{FFT}+N_{CE}} \times N_c\right)$$

	up	**down**
Tone range	[33:56]	[64:255]
N_c	24	192
N_{FFT}	512	512
N_{CE}	32	32
$P_{0,dBm}$	-1.65 dBm	-3.65 dBm
$P_{max,dBm}$	≈12.15 dBm	≈11.89 dBm
$P_{max,tones,dBm}$	≈19.18 dBm	≈18.92 dBm