TTC
DSL ad hoc spectral management sub working group

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TITLE: Spectral mask for VDSL from CO including compliance to JJ100 class B

ABSTRACT

We will suggest spectral mask for VDSL from CO, and present JJ 100 spectrum adaptability analysis. We will show both masks are compliant to class B. We further suggest that if needed A++ will be added under the same umbrella as VDSL, i.e. have the same spectral and power limitation.

1 Introduction

We suggest approving VDSL from CO for accommodation on all lines in class B based on the next spectral templates presented in tables 1,2 and figures 1,2. The templates are based on ANSI where the low frequencies from 25-138KHz are used for upstream. Following ANSI we suggest two templates M1 and M2. The templates where checked according to JJ100 requirements and found compatible for accommodation in the same quad as any other protected service. Results are presented in tables 3,4.

We further suggest that if needed A++ will be added under the same umbrella as VDSL. As both are solutions to next generation high bandwidth application and thus should be compatible and must not mutually disturb. Since A++ is a new service, there seems to be no justification to install it in a way that will hurt VDSL installed from CO. It has been shown in [3] that when A++ provides the same service as VDSL, the former generates more spectral pollution than the latter. It has also been shown in [4] that in real life scenarios A++ additional power does not increase its reach vs. VDSL.

2 Templates

Following templates are based on ANSI, using the lower 25KHz-138KHz frequencies for upstream. In the frequency range 307..402KHz the template was reduced from –90dBm/Hz to –93.5dBm/Hz to solve spectral adaptability issue at 5Km. The result is similar to JJ100 definitions of .G.992.1 upstream, as the –90dBm/Hz there is peak value (as opposed to template which states nominal power).

Upstream templates M1 and M2, in both cases *total power is limited* to 14.5dBm:

Frequency (kHz)	PSD (dBm/Hz)	
	M1	M2
0 < f < 4	-101	
4< f < 25	-101 + 23.83*log2(f/4)	
25 < f < 138	-38	
138 < f < 307	-38 – 48.11*log2(f/138)	
307 < f < 482	-93.5 – 9.99*log2(f/307)	

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482 < f < 3575	-100 -1.73*log2(f/482)	
3575 < f < 3750	-105 + 363*log2(f/3575)	
3750 < f < 5200	-60	-53
5200 < f < 5375	-80 – 565*log2(f/5200)	
5375 < f < 8325	-107	
8325 < f < 8500	-107 + 900*log2(f/8325)	
8500 < f < 12000	-60	-54
12000 < f < 12175	-80 – 1293*log2(f/12000)	
12175 < f < 30000	-107 – 2.31*log2(f/12175)	

Table 1: Upstream Templates

Downstream templates M1 and M2, in both cases *total power is limited* to 14.5dBm:

Frequency (kHz)	PSD (dBm/Hz)	
	M1	M2
0 < f < 4	-101	
4< f < 138	-93.5	
138 < f < 1104	-40	
1104 < f < 1622	-40 – 36*log2(f/1104)	-40 – 18*log2(f/1104)
1622 < f < 3750	-60	-50 -2.89*log2(f/1622)
3750 < f < 3925	-80 - 380*log2(f/3750)	
3925 < f < 5025	-105	
5025 < f < 5200	-105 + 506*log2(f/5025)	
5200 < f < 8500	-60	-55
8500 < f < 8675	-80 - 918*log2(f/8500)	
8675 < f < 12000	-107	
12000 < f < 30000	-107 – 2.27*log2(f/12000)	

Table 2: Dowmstream Templates

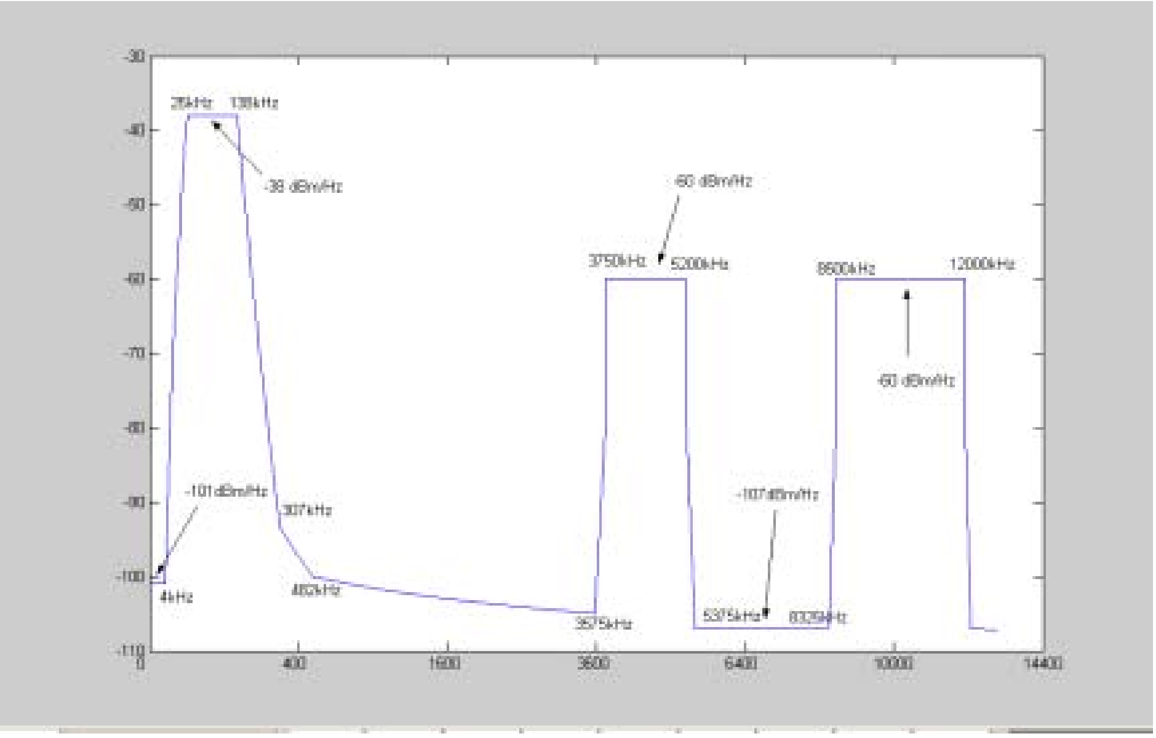

Figure 1: M1 Upstream Template

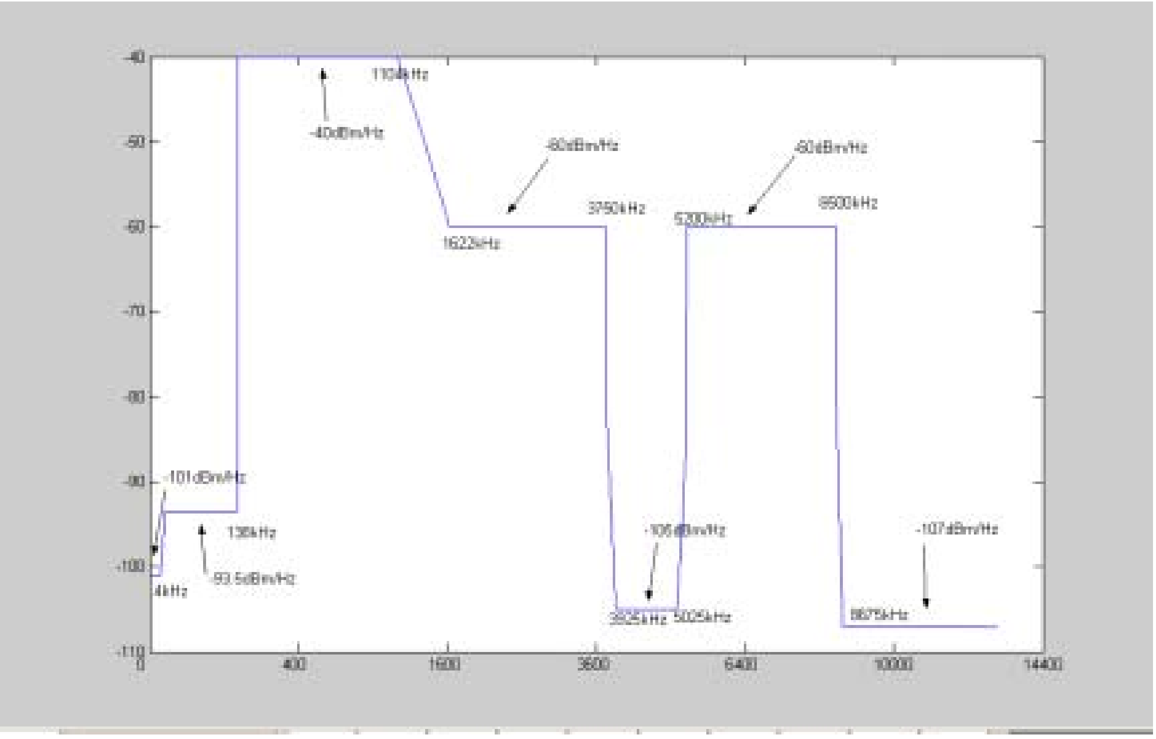

Figure 2: M1 Downstream Template

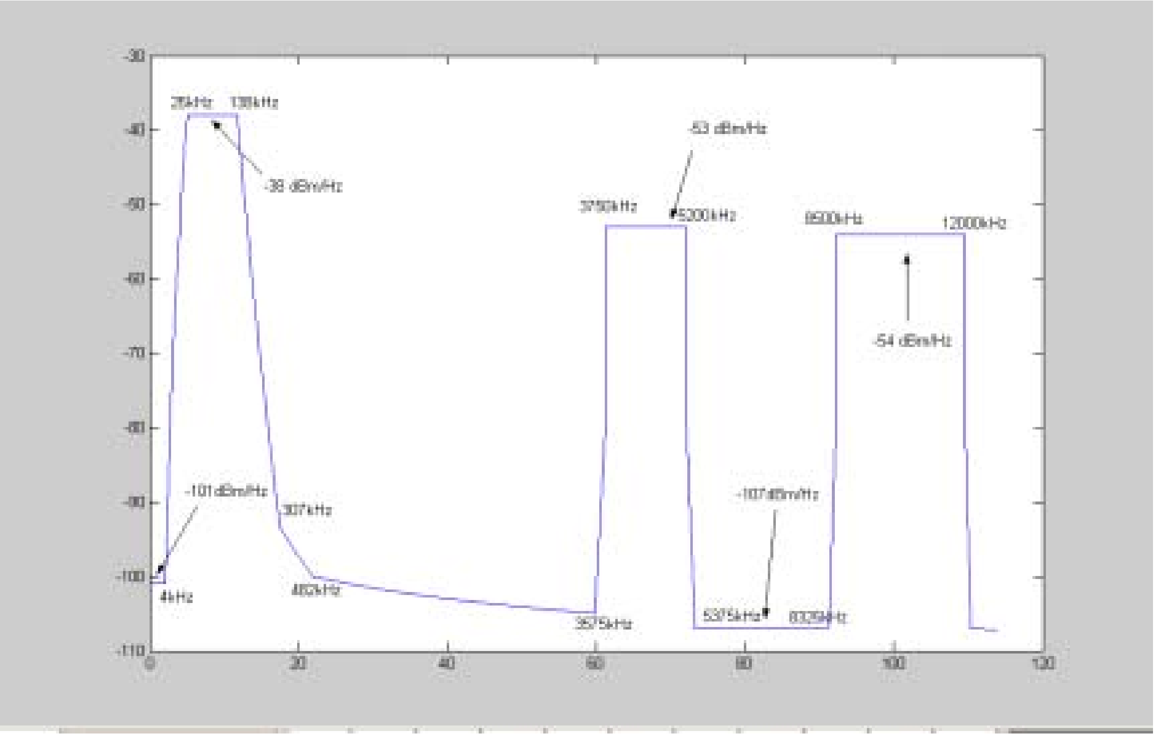

Figure 1: M2 Upstream Template

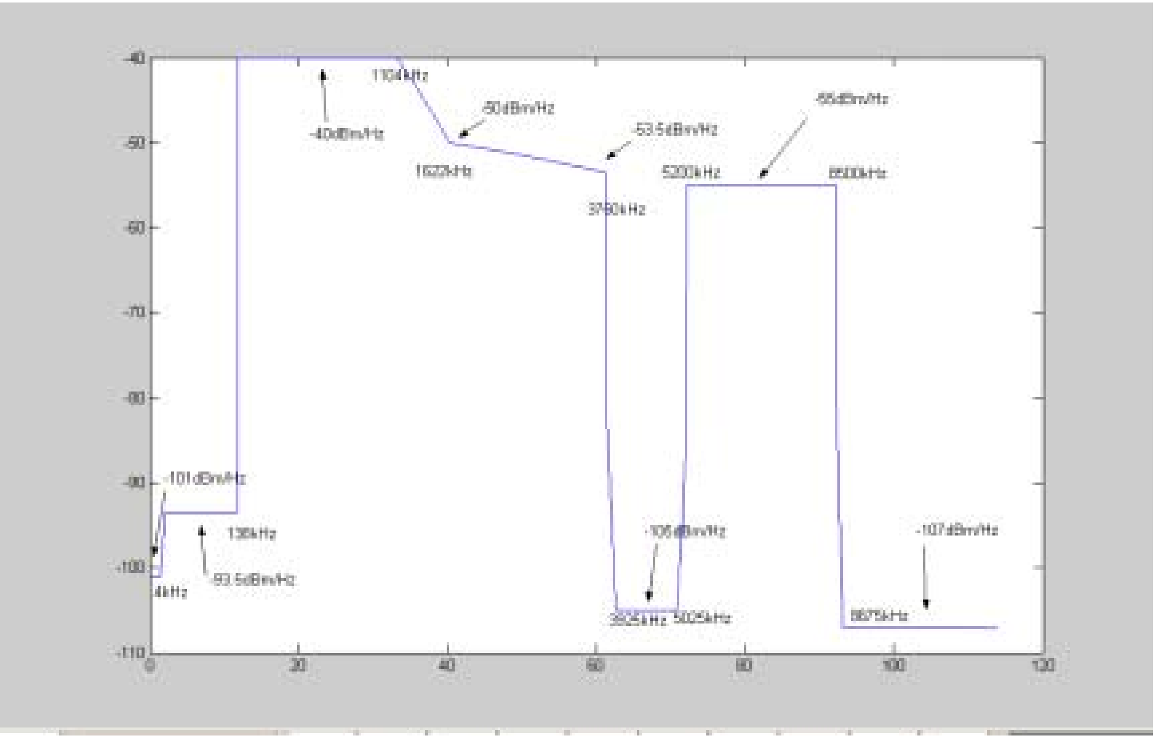

Figure 2: M2 Downstream Template

3 Spectrum adaptability of VDSL M1 and M2 masks

Spectrum adaptability was analyzed according to JJ100 instructions. The loops used are 0.4mm polyethylene based on G.996.1 model. The cross talk model used is based on NTT measurements and has been certified by the Soumusho [1] and cited by Globespan Virata [2]. The case used is 5 distributers , 1 intra quad and 4 inter quad.

Spectrum adaptability results for template M1

Dist	TCM-ISDN		G.992.1 Annex A (FDM)		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
							DBM		FBM		DBM		FBM	
	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US
0.5	144	144	7104	832	3008	832	7104	832	2624	288	3008	832	1088	288
0.75	144	144	7008	832	3008	832	7008	832	2592	288	3008	832	1088	288
1	144	144	6880	832	3008	832	6880	832	2528	288	3008	832	1088	288
1.25	144	144	6784	832	3008	832	6784	832	2496	288	3008	832	1088	288
1.5	144	144	6624	832	2976	832	6624	832	2432	288	2976	832	1088	288
1.75	144	144	6496	832	2976	832	6496	832	2400	288	2976	832	1088	288
2	144	144	6368	832	2976	832	6368	832	2336	288	2976	832	1088	288
2.25	144	144	6208	832	2944	832	6208	832	2304	288	2944	832	1088	288
2.5	144	144	5952	832	2912	832	5952	832	2208	288	2912	832	1056	288
2.75	144	144	5504	832	2880	832	5504	832	2048	288	2880	832	1056	288
3	144	144	4896	832	2848	832	4896	832	1792	288	2848	832	1024	288
3.25	144	144	4032	832	2720	832	4032	832	1472	288	2720	832	992	288
3.5	144	0	3296	832	2592	832	3296	832	1216	288	2592	832	960	288
3.75	0	0	2656	832	2400	832	2656	832	960	288	2400	832	864	288
4	0	0	2080	832	2112	832	2080	832	768	288	2112	832	768	288
4.25	0	0	1568	832	1728	832	1568	832	576	288	1728	832	640	288
4.5	0	0	1120	832	1344	832	1120	832	416	288	1344	832	480	288
4.75	0	0	768	832	960	832	768	832	256	288	960	832	352	288
5	0	0	448	832	608	832	448	832	160	288	608	832	224	288

Table 3: M1 adaptability results

Spectrum adaptability results for template M2

Dist	TCM-ISDN		G.992.1 Annex A (FDM)		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
							DBM		FBM		DBM		FBM	
	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US
0.5	144	144	7104	832	3008	832	7104	832	2624	288	3008	832	1088	288
0.75	144	144	7008	832	3008	832	7008	832	2592	288	3008	832	1088	288
1	144	144	6880	832	3008	832	6880	832	2528	288	3008	832	1088	288
1.3	144	144	6784	832	3008	832	6784	832	2496	288	3008	832	1088	288
1.5	144	144	6624	832	2976	832	6624	832	2432	288	2976	832	1088	288
1.8	144	144	6496	832	2976	832	6496	832	2400	288	2976	832	1088	288
2	144	144	6368	832	2976	832	6368	832	2336	288	2976	832	1088	288
2.3	144	144	6208	832	2944	832	6208	832	2304	288	2944	832	1088	288
2.5	144	144	5952	832	2912	832	5952	832	2208	288	2912	832	1056	288
2.8	144	144	5504	832	2880	832	5504	832	2048	288	2880	832	1056	288
3	144	144	4896	832	2848	832	4896	832	1792	288	2848	832	1024	288
3.3	144	144	4032	832	2720	832	4032	832	1472	288	2720	832	992	288
3.5	144	0	3296	832	2592	832	3296	832	1216	288	2592	832	960	288
3.8	0	0	2656	832	2400	832	2656	832	960	288	2400	832	864	288
4	0	0	2080	832	2112	832	2080	832	768	288	2112	832	768	288
4.3	0	0	1568	832	1728	832	1568	832	576	288	1728	832	640	288
4.5	0	0	1120	832	1344	832	1120	832	416	288	1344	832	480	288
4.8	0	0	768	832	960	832	768	832	256	288	960	832	352	288
5	0	0	448	832	608	832	448	832	160	288	608	832	224	288

Table 4: M2 adaptability results

4 Conclusion

We suggest approving VDSL masks M1 and M2, with maximum allowed power of 14.5dBm, for deployment from CO. We further suggest, that if ADSL++ needs to be approved, it should be limited to the same masks, and power constraint.

References

[1] Soumusho Report, “Spectral Compatibility in Japan”, April 2003.

[2] “Annex I Downstream High Bit Loading (HBL) and Regular Bit Loading (RBL).”, Source: GlobespanVirata, Inc, Tokyo, Japan 1-2 July 2003.

[3] “ADSL: Spectral friendliness: ADSL++ compared to VDSL”, Source: ST Microelectronics, Document SKS-02-STM-01, 5-6 August 2003.

[4] “Does VDSL from the CO make sense?”, Source: ST Microelectronics,Document SMS-03-STM-01, 7 August 2003.