
TTC DSL	Nov. 21, 2003	SMS-05-CTLM-01
SM SWG		

Source: Centillium Communications, eAccess Ltd.

Title: Update of extended upstream proposal

Contact: Les Brown
Centillium Communications
Tel: +1 (905) 826-4248
Cell: +1 (416) 985-9891
Email: les@centillium.com

Contact: Keishi Fujita
eAccess Ltd.
Tel: +81-3-5777-8476
Fax: +81-3-5425-2701
Email: keishi@eaccess.net

Abstract

This contribution updates the PSDs proposed for extended upstream for G.992.3/5 Annex C. This contribution was also submitted to the DSL Spec SWG (SKS-04-CTLM-02-EU-R1).

1. Introduction

Extended upstream for Annex C has been proposed in contribution SKS-02-20.

The upstream PSDs proposed in SKS-02-20 are similar to the PSDs defined in G.992.3 Annex J, which has recently been renamed Annex M. The only difference is that the upper edge slope of the PSD is modified from 48 dB/octave to 72 dB/octave. The PSD is kept flat within the used band. As the bandwidth expands, the PSD level is reduced to keep the total power the same. In G.992.3 Annex M, the upper bound of the upstream is extended from bin 32 to 36, 40, 44, ...64.

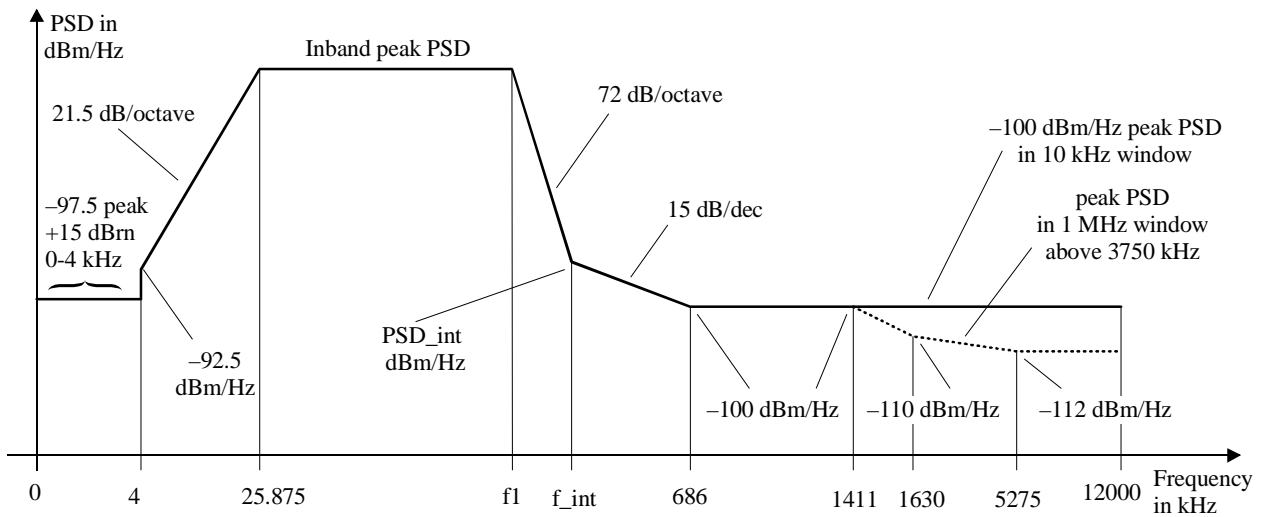
In the October 2003 SG15 meeting, ITU-T agreed to add Annex M to G.992.5. G.992.5 Annex M also define extended upstream to bin 36, 40, 44,...64. Besides the upper edge slope, G.992.5 Annex M defines a tighter upper stop band than G.992.3 Annex M. The stop band PSD is -100 dBm/Hz beyond 686 kHz, compared with -90 dBm/Hz in G.992.3 Annex M. The PSDs in SKS-02-20 are based on G.992.3 Annex M (-90 dbm/Hz in the upper stop band). In this contribution, we align the Annex C extend upstream PSD with G.992.5 Annex M.

The spectrum compatibility of the PSD proposals in SKS-02-20 was studied and submitted in SMS-03-13R1. After submission, crosscheck was conducted with other companies. As a result of the crosscheck, some calculations were adjusted. To meet the spectrum management requirement, the proposed PSD levels for the NEXT bitmap have been adjusted slightly.

This contribution updates the PSDs proposed in SKS-02-20, and the new spectrum compatibility calculation results are given.

2. Annex C Extended Upstream PSD's

Figure 1 is the extended upstream PSD mask copied from G.992.5 Annex M. The parameters for the family of PSDs in Table 1 are proposed for the FEXT bitmap, and those in Table 2 are proposed for the NEXT bitmap.



Frequency (kHz)	PSD level (dBm/Hz)	Measurement BW
0	-97.5	100 Hz
4	-97.5	100 Hz
4	-92.5	100 Hz
10	interpolated	10 kHz
25.875	Inband_peak_PSD	10 kHz
f1	Inband_peak_PSD	10 kHz
f_int	PSD_int	10 kHz
686	-100	10 kHz
5275	-100	10 kHz
12000	-100	10 kHz

Figure 1: G.992.5 Annex M upstream PSD mask

Table 1: Parameters for Annex C extended upstream in FEXT bitmap

Upstream Mask-Number	Designator	Template Nominal PSD P_0 (dBm/Hz)	Template Maximum Aggregate Transmit Power (dBm)	Inband Peak PSD (dBm/Hz)	Frequency $f1$ (kHz)	Intercept Frequency f_{int} (kHz)	Intercept PSD Level PSD_{int} (dBm/Hz)
1	EU-32	-38.0	12.5	-34.5	138.00	242.92	-93.2
2	EU-36	-38.5	12.5	-35.0	155.25	274.03	-94.0
3	EU-40	-39.0	12.5	-35.5	172.50	305.06	-94.7
4	EU-44	-39.4	12.5	-35.9	189.75	336.33	-95.4
5	EU-48	-39.8	12.5	-36.3	207.00	367.54	-95.9
6	EU-52	-40.1	12.5	-36.6	224.25	399.07	-96.5
7	EU-56	-40.4	12.5	-36.9	241.50	430.58	-97.0
8	EU-60	-40.7	12.5	-37.2	258.75	462.04	-97.4
9	EU-64	-41.0	12.5	-37.5	276.00	493.45	-97.9

Table 2: Parameters for Annex C extended upstream in NEXT bitmap

Upstream Mask-Number	Designator	Template Nominal PSD P_0 (dBm/Hz)	Template Maximum Aggregate Transmit Power (dBm)	Inband Peak PSD (dBm/Hz)	Frequency f_I (kHz)	Intercept Frequency f_{int} (kHz)	Intercept PSD Level PSD_{int} (dBm/Hz)
1	EU-32	-38	12.5	-34.5	138.00	242.92	-93.2
2	EU-36	-38.7	12.5	-35.2	155.25	273.47	-94.0
3	EU-40	-39.9	12.5	-36.4	172.50	302.26	-94.7
4	EU-44	-40.7	12.5	-37.2	189.75	331.87	-95.3
5	EU-48	-41.4	12.5	-37.9	207.00	361.55	-95.8
6	EU-52	-41.8	12.5	-38.3	224.25	392.16	-96.4
7	EU-56	-42.1	12.5	-38.6	241.50	423.12	-96.9
8	EU-60	-42.3	12.5	-38.8	258.75	454.51	-97.3
9	EU-64	-42.3	12.5	-38.8	276.00	486.91	-97.8

3. Spectral Compatibility of the Annex C Extended Upstream

The spectral compatibility of the Annex C extended upstream is calculated according to JJ100.01. For the downstream, the standard ADSL FDM downstream PSD is used. Specifically, the downstream PSD defined in JJ100.01 D.3.1 is used. Note that D.3.1 is for single spectrum downstream.

The upstream PSD is defined in Table 1 (for FEXT bitmap) and Table 2 (for NEXT bitmap). The spectral compatibility calculation results are shown in Tables 3-11.

Table 3: EU-32 Spectral Compatibility

Length [km]	ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
	DS	US	DS	US	DS	US	DBM		FBM		DBM		FBM	
							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
1.0	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	3008	832	6624	832	2432	288	3008	832	1088	288
1.75	144	144	6496	832	2976	832	6496	832	2400	288	2976	832	1088	288
2.0	144	144	6400	832	2976	832	6400	832	2368	288	2976	832	1088	288
2.25	144	144	6240	832	2976	832	6240	832	2304	288	2976	832	1088	288
2.5	144	144	6048	832	2944	832	6048	832	2240	288	2944	832	1088	288
2.75	144	144	5632	800	2944	800	5632	800	2080	288	2944	800	1088	288
3.0	144	144	5088	800	2912	800	5088	800	1888	288	2912	800	1056	288
3.25	144	144	4256	800	2848	800	4256	800	1568	288	2848	800	1056	288
3.5	144	0	3584	768	2752	768	3584	768	1312	288	2752	768	1024	288
3.75	0	0	2976	736	2592	736	2976	736	1088	256	2592	736	960	256
4.0	0	0	2432	736	2368	736	2432	736	896	256	2368	736	864	256
4.25	0	0	1984	704	2112	704	1984	704	704	256	2112	704	768	256
4.5	0	0	1536	672	1792	672	1536	672	576	224	1792	672	640	224
4.75	0	0	1152	640	1376	640	1152	640	416	224	1376	640	512	224
5.0	0	0	832	608	1024	608	832	608	288	224	1024	608	384	224

Table 4: EU-36 Spectral Compatibility

Length [km]	ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
	DS	US	DS	US	DS	US	DBM		FBM		DBM		FBM	
							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
1.0	144	144	6880	832	3008	832	6880	832	2528	288	3008	832	1088	288
1.25	144	144	6752	832	2976	832	6752	832	2496	288	2976	832	1088	288
1.5	144	144	6592	832	2976	832	6592	832	2432	288	2976	832	1088	288
1.75	144	144	6432	832	2944	832	6432	832	2368	288	2944	832	1088	288
2.0	144	144	6304	832	2912	832	6304	832	2336	288	2912	832	1088	288
2.25	144	144	6176	832	2880	832	6176	832	2272	288	2880	832	1056	288
2.5	144	144	5920	832	2848	832	5920	832	2176	288	2848	832	1056	288
2.75	144	144	5536	800	2816	800	5536	800	2048	288	2816	800	1024	288
3.0	144	144	4928	800	2784	800	4928	800	1824	288	2784	800	1024	288
3.25	144	144	4096	800	2688	800	4096	800	1504	288	2688	800	992	288
3.5	144	0	3392	768	2560	768	3392	768	1248	288	2560	768	960	288
3.75	0	0	2784	736	2400	736	2784	736	1024	256	2400	736	896	256
4.0	0	0	2240	736	2176	736	2240	736	832	256	2176	736	800	256
4.25	0	0	1760	704	1888	704	1760	704	640	256	1888	704	704	256
4.5	0	0	1312	672	1568	672	1312	672	480	224	1568	672	576	224
4.75	0	0	960	640	1152	640	960	640	352	224	1152	640	416	224
5.0	0	0	672	608	832	608	672	608	224	224	832	608	288	224

Table 5: EU-40 Spectral Compatibility

Length [km]	ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
	DS	US	DS	US	DS	US	DBM		FBM		DBM		FBM	
							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
1.0	144	144	6880	832	3008	832	6880	832	2528	288	3008	832	1088	288
1.25	144	144	6752	832	2976	832	6752	832	2496	288	2976	832	1088	288
1.5	144	144	6560	832	2944	832	6560	832	2432	288	2944	832	1088	288
1.75	144	144	6400	832	2912	832	6400	832	2368	288	2912	832	1056	288
2.0	144	144	6240	832	2880	832	6240	832	2304	288	2880	832	1056	288
2.25	144	144	6080	832	2816	832	6080	832	2240	288	2816	832	1024	288
2.5	144	144	5824	832	2752	832	5824	832	2144	288	2752	832	1024	288
2.75	144	144	5376	800	2688	800	5376	800	1984	288	2688	800	992	288
3.0	144	144	4768	800	2624	800	4768	800	1760	288	2624	800	960	288
3.25	144	144	3904	800	2496	800	3904	800	1440	288	2496	800	928	288
3.5	144	0	3200	768	2400	768	3200	768	1184	288	2400	768	896	288
3.75	0	0	2560	736	2208	736	2592	736	960	256	2208	736	800	256
4.0	0	0	2016	736	1984	736	2016	736	736	256	1984	736	736	256
4.25	0	0	1504	704	1664	704	1536	704	544	256	1696	704	608	256
4.5	0	0	1120	672	1344	672	1120	672	416	224	1344	672	480	224
4.75	0	0	768	640	960	640	768	640	288	224	960	640	352	224
5.0	0	0	480	608	640	608	480	608	192	224	640	608	224	224

Table 6: EU-44 Spectral Compatibility

Length [km]	ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
	DS	US	DS	US	DS	US	DBM		FBM		DBM		FBM	
							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
1.0	144	144	6848	832	3008	832	6880	832	2528	288	3008	832	1088	288
1.25	144	144	6720	832	2976	832	6720	832	2496	288	2976	832	1088	288
1.5	144	144	6528	832	2912	832	6528	832	2400	288	2912	832	1088	288
1.75	144	144	6336	832	2848	832	6336	832	2336	288	2880	832	1056	288
2.0	144	144	6176	832	2784	832	6176	832	2272	288	2816	832	1024	288
2.25	144	144	5984	832	2720	832	5984	832	2208	288	2752	832	1024	288
2.5	144	144	5696	832	2656	832	5696	832	2112	288	2656	832	992	288
2.75	144	144	5216	800	2560	800	5248	800	1952	288	2592	800	960	288
3.0	144	144	4576	800	2464	800	4608	800	1696	288	2464	800	928	288
3.25	144	144	3712	800	2336	800	3712	800	1376	288	2336	800	864	288
3.5	144	0	3008	768	2208	768	3008	768	1120	288	2208	768	800	288
3.75	0	0	2368	736	2016	736	2368	736	864	256	2016	736	736	256
4.0	0	0	1792	736	1760	736	1792	736	672	256	1760	736	640	256
4.25	0	0	1312	704	1440	704	1312	704	480	256	1440	704	544	256
4.5	0	0	928	672	1120	672	928	672	352	224	1120	672	416	224
4.75	0	0	576	640	736	640	608	640	224	224	768	640	288	224
5.0	0	0	352	608	448	608	352	608	128	224	448	608	160	224

Table 7: EU-48 Spectral Compatibility

Length [km]	ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
	DS	US	DS	US	DS	US	DBM		FBM		DBM		FBM	
							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
1.0	144	144	6848	832	3008	832	6848	832	2528	288	3008	832	1088	288
1.25	144	144	6688	832	2944	832	6720	832	2496	288	2976	832	1088	288
1.5	144	144	6464	832	2880	832	6496	832	2400	288	2912	832	1088	288
1.75	144	144	6272	832	2816	832	6272	832	2336	288	2816	832	1056	288
2.0	144	144	6080	832	2720	832	6112	832	2272	288	2752	832	1024	288
2.25	144	144	5856	832	2624	832	5888	832	2176	288	2656	832	992	288
2.5	144	144	5568	832	2528	832	5600	832	2080	288	2560	832	960	288
2.75	144	144	5056	800	2432	800	5088	800	1888	288	2464	800	928	288
3.0	144	144	4416	800	2304	800	4416	800	1632	288	2304	800	864	288
3.25	144	144	3520	800	2144	800	3552	800	1312	288	2144	800	800	288
3.5	144	0	2784	768	2016	768	2816	768	1056	288	2016	768	736	288
3.75	0	0	2112	736	1792	736	2144	736	800	256	1824	736	672	256
4.0	0	0	1568	736	1536	736	1600	736	608	256	1536	736	576	256
4.25	0	0	1120	704	1216	704	1120	704	416	256	1248	704	448	256
4.5	0	0	736	672	928	672	736	672	288	224	928	672	352	224
4.75	0	0	416	640	576	640	448	640	160	224	576	640	224	224
5.0	0	0	192	608	288	608	224	608	64	224	320	608	128	224

Table 8: EU-52 Spectral Compatibility

Length [km]	ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
	DS	US	DS	US	DS	US	DBM		FBM		DBM		FBM	
							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
1.0	144	144	6848	832	3008	832	6848	832	2528	288	3008	832	1088	288
1.25	144	144	6656	832	2944	832	6688	832	2496	288	2944	832	1088	288
1.5	144	144	6432	832	2848	832	6464	832	2400	288	2880	832	1056	288
1.75	144	144	6208	832	2752	832	6240	832	2304	288	2784	832	1024	288
2.0	144	144	5984	832	2656	832	6016	832	2240	288	2688	832	992	288
2.25	144	144	5760	832	2528	832	5792	832	2144	288	2560	832	960	288
2.5	144	144	5440	832	2432	832	5472	832	2016	288	2432	832	896	288
2.75	144	144	4896	800	2272	800	4928	800	1824	288	2304	800	864	288
3.0	144	144	4224	800	2112	800	4256	800	1568	288	2144	800	800	288
3.25	144	144	3328	800	1952	800	3360	800	1248	288	1984	800	736	288
3.5	144	0	2560	768	1792	768	2592	768	960	288	1824	768	672	288
3.75	0	0	1920	736	1568	736	1952	736	736	256	1600	736	608	256
4.0	0	0	1376	736	1312	736	1376	736	512	256	1344	736	480	256
4.25	0	0	896	704	1024	704	928	704	352	256	1024	704	384	256
4.5	0	0	544	672	736	672	576	672	192	224	736	672	288	224
4.75	0	0	288	640	416	640	288	640	96	224	416	640	160	224
5.0	0	0	96	608	160	608	96	608	32	224	192	608	64	224

Table 9: EU-56 Spectral Compatibility

Length [km]	ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
	DS	US	DS	US	DS	US	DBM		FBM		DBM		FBM	
							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
1.0	144	144	6816	832	2976	832	6848	832	2528	288	2976	832	1088	288
1.25	144	144	6624	832	2912	832	6656	832	2464	288	2944	832	1088	288
1.5	144	144	6368	832	2816	832	6400	832	2368	288	2816	832	1056	288
1.75	144	144	6144	832	2688	832	6144	832	2272	288	2720	832	1024	288
2.0	144	144	5920	832	2560	832	5920	832	2208	288	2592	832	960	288
2.25	144	144	5632	832	2432	832	5664	832	2112	288	2464	832	928	288
2.5	144	144	5280	832	2304	832	5312	832	1984	288	2336	832	864	288
2.75	144	144	4736	800	2112	800	4768	800	1792	288	2144	800	800	288
3.0	144	144	4064	800	1952	800	4064	800	1504	288	1984	800	736	288
3.25	144	144	3136	800	1760	800	3136	800	1152	288	1792	800	672	288
3.5	144	0	2368	768	1600	768	2368	768	896	288	1600	768	608	288
3.75	0	0	1728	736	1344	736	1728	736	640	256	1344	736	512	256
4.0	0	0	1184	736	1088	736	1184	736	448	256	1088	736	416	256
4.25	0	0	736	704	800	704	736	704	288	256	832	704	320	256
4.5	0	0	384	672	544	672	384	672	160	224	544	672	192	224
4.75	0	0	160	640	256	640	160	640	64	224	288	640	96	224
5.0	0	0	0	608	64	608	0	608	0	224	96	608	32	224

Table 10: EU-60 Spectral Compatibility

Length [km]	ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
	DS	US	DS	US	DS	US	DBM		FBM		DBM		FBM	
							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
1.0	144	144	6816	832	2976	832	6816	832	2528	288	2976	832	1088	288
1.25	144	144	6624	832	2912	832	6624	832	2464	288	2912	832	1088	288
1.5	144	144	6336	832	2784	832	6368	832	2368	288	2784	832	1056	288
1.75	144	144	6080	832	2656	832	6080	832	2272	288	2688	832	992	288
2.0	144	144	5824	832	2496	832	5856	832	2176	288	2528	832	960	288
2.25	144	144	5536	832	2336	832	5568	832	2080	288	2368	832	896	288
2.5	144	144	5120	832	2176	832	5152	832	1920	288	2208	832	832	288
2.75	144	144	4544	800	1952	800	4576	800	1696	288	1984	800	736	288
3.0	144	144	3840	800	1760	800	3872	800	1440	288	1792	800	672	288
3.25	144	144	2880	800	1568	800	2912	800	1088	288	1600	800	608	288
3.5	144	0	2144	768	1344	768	2176	768	800	288	1376	768	512	288
3.75	0	0	1504	736	1120	736	1504	736	576	256	1120	736	416	256
4.0	0	0	960	736	864	736	992	736	352	256	896	736	320	256
4.25	0	0	544	704	608	704	544	704	192	256	640	704	224	256
4.5	0	0	256	672	384	672	256	672	96	224	384	672	128	224
4.75	0	0	32	640	128	640	32	640	0	224	128	640	32	224
5.0	0	0	0	608	0	608	0	608	0	224	0	608	0	224

Table 11: EU-64 Spectral Compatibility

Length [km]	ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
	DS	US	DS	US	DS	US	DBM		FBM		DBM		FBM	
							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
1.0	144	144	6816	832	2976	832	6816	832	2528	288	2976	832	1088	288
1.25	144	144	6592	832	2880	832	6592	832	2464	288	2912	832	1088	288
1.5	144	144	6272	832	2752	832	6304	832	2336	288	2752	832	1024	288
1.75	144	144	5984	832	2592	832	6016	832	2240	288	2592	832	960	288
2.0	144	144	5728	832	2400	832	5728	832	2144	288	2432	832	896	288
2.25	144	144	5408	832	2240	832	5440	832	2016	288	2272	832	832	288
2.5	144	144	4960	832	2016	832	4992	832	1856	288	2048	832	768	288
2.75	144	144	4352	800	1760	800	4384	800	1632	288	1792	800	672	288
3.0	144	144	3584	800	1568	800	3616	800	1344	288	1600	800	608	288
3.25	144	144	2688	800	1344	800	2720	800	992	288	1344	800	512	288
3.5	144	0	1888	768	1120	768	1920	768	704	288	1120	768	416	288
3.75	0	0	1280	736	864	736	1312	736	480	256	896	736	320	256
4.0	0	0	768	736	672	736	768	736	288	256	672	736	256	256
4.25	0	0	384	704	448	704	384	704	128	256	448	704	160	256
4.5	0	0	128	672	256	672	128	672	32	224	256	672	96	224
4.75	0	0	0	640	0	640	0	640	0	224	0	640	0	224
5.0	0	0	0	608	0	608	0	608	0	224	0	608	0	224

The deployment restriction based on calculations in Tables 3-11 is summarized in Table 12.

Table 12: Deployment restriction of Annex C extended upstream

EU PSD	Deployment restriction(km)
EU-64	3.5
EU-60	3.75
EU-56	4.0
EU-52	4.25
EU-48	4.25
EU-44	4.75
EU-40	No limit
EU-36	No limit

When Annex C extended upstream is used with double or quad downstream, the downstream PSD defined in JJ100.01 D.19.1 (for double downstream) or D.26.1. (for quad downstream) will be used. The spectral compatibility calculation results are exactly the same as those in Tables 3-11. Therefore, the same deployment restriction shown in Table 12 also applies to Annex C extended upstream with double or quad downstream.

4. Summary

This contribution addresses issue 1.7.6 in the Issues List. It is proposed that the updated flat extended upstream PSDs based on newly defined G.992.5 Annex M defined herein be adopted for Annex C extended upstream PSDs for bandwidth up to bin 64.