
Date: 17 October, 2003

SOURCE¹:GlobespanVirata, Inc.

TITLE: 3/50 System Spectral Compatibility

ABSTRACT

The present contribution evaluates the spectral compatibility of a high speed system that combines an extended Upstream channel up to ~276KHz and an Overlap OL Quad Spectrum Downstream that starts at ~25.875KHz.

The system maximum expected performance is 3Mb/s Upstream and 50Mb/s Downstream.

Based on the results obtained in the contribution and according to the 2003 refined Soumusho Spectral compatibility rules, we recommend that Extended Upstream Overlap System can be deployed in the same quad as protected systems up to ~3.25km.

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1 Introduction

The present contribution evaluates the spectral compatibility of an high speed system that combines an extended Upstream channel up to ~276KHz and an Overlap OL Quad Spectrum Downstream that starts at ~25.875KHz.

Section 2 details Upstream and Downstream masks features. Section 3 gives maximum expected performance results. Spectral Compatibility tables are provided in section 4.

2 Extended Upstream OL Mask Definition

2.1 Downstream: Quad Spectrum OL

Figure 1 and table 2-1 give the features of the Overlap Quad Spectrum Mask, taken from JJ-100 R2 September 2003.

Figure 1. Quad Spectrum Overlap Mask, Plot based on Peak Values

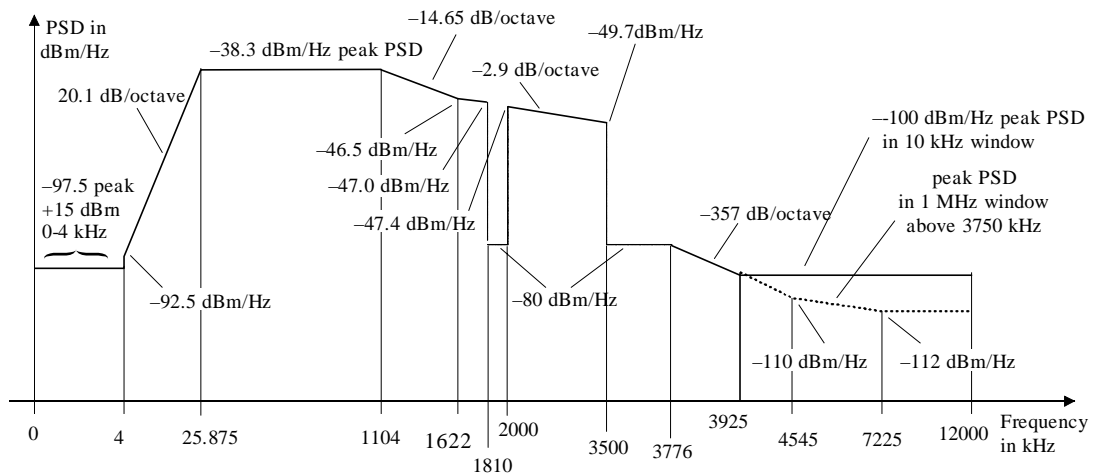


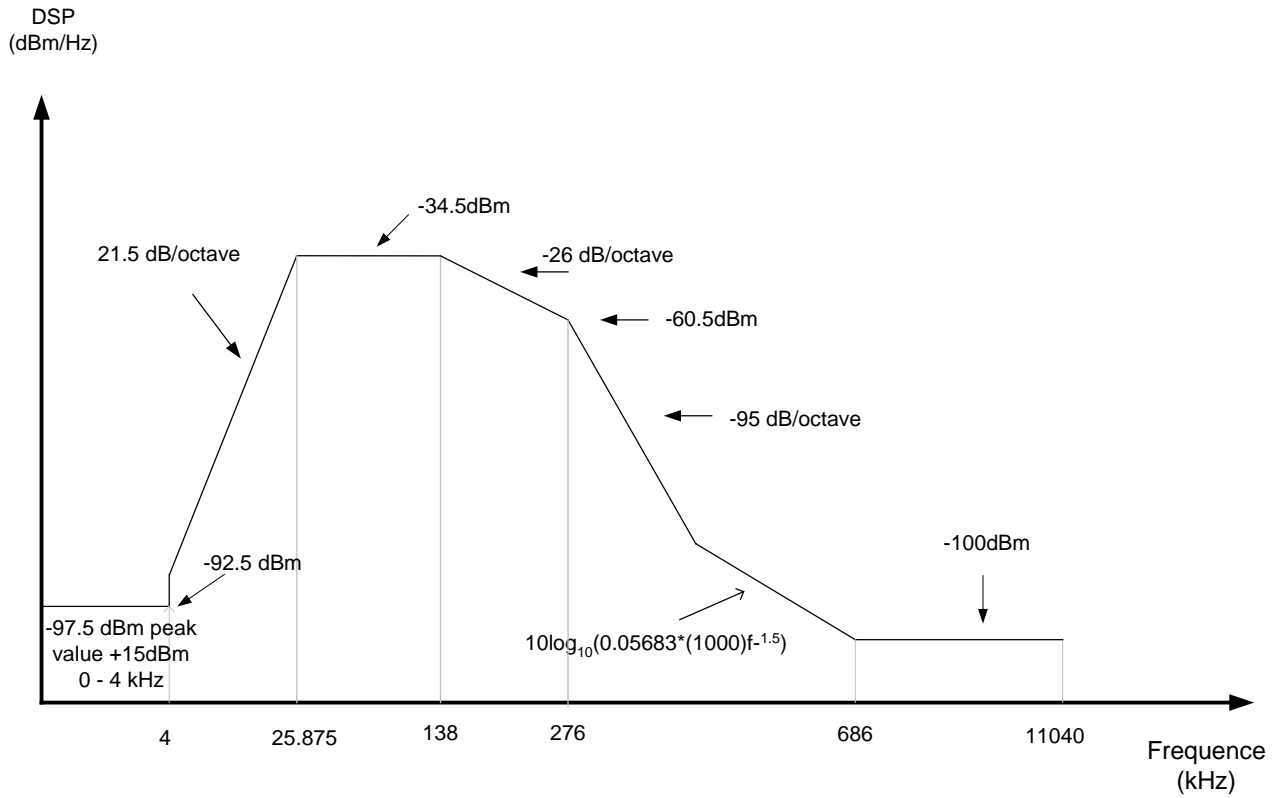
Table 2-1. Quad Spectrum Mask Peak Values

(kHz)	PSD(dBm/Hz)
0	-97.5
4	-97.5
4	-92.5
10	Interpolated
25.875	-38.3
1104	-38.3
1622	-46.5
1810	-47.0
1810	-80.0
2000	-80.0
2000	-47.4
3500	-49.7
3500	-80.0
3776	-80.0
3925	-100
4545	-110
7225	-112
12000	-112

2.2 Extended Upstream Mask

Figure 2 and table 2-2 give the features of the Extended Upstream Mask.

Figure 2. Extended Upstream Mask Plot based on Peak Values



Frequency (kHz)	PSD (dBm/Hz) Peak values
$0 < f < 4$	-97.5
$4 < f < 25.875$	"-92.5 + 21.5.log2.(f/4)"
$25.875 < f < 138$	-34.5
$138 < f < 276$	"-34.5 - 26.log2.(f/138)"
$276 < f < f_int$	"-60.5 - 95.log2.(f/276)"
$f_int < f < 686$	$10\log_{10}(0.05683*(1000f)^{-1.5})$
$f > 686$	-100

Table 2-2. Extended values, frequency is

Upstream Mask, Peak given in KHz

3 Spectral Compatibility Tables

3.1 Reference Tables

Table 3-1 displays reference performance of protected systems.

Table 3-1. Protected Systems Reference table

Dist	TCM-ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C		G.992.2 Annex C					
	DS	US	(FDM)		DS	US	DBM		FBM		DBM		FBM	
0.5	144	144	7104	832	3008	832	7104	832	2624	288	3008	832	1088	288
0.75	144	144	6784	832	2944	832	6912	832	2592	288	2944	832	1088	288
1	144	144	5952	832	2624	832	6368	832	2528	288	2752	832	1088	288
1.25	144	144	4896	800	2272	800	5696	800	2496	288	2528	800	1088	288
1.5	144	144	3840	768	1824	768	5024	800	2432	288	2272	800	1088	288
1.75	144	144	2496	736	1440	736	4192	768	2400	288	2016	768	1088	288
2	144	144	1696	704	960	704	3680	736	2336	288	1696	736	1088	288
2.25	144	144	1088	640	640	640	3296	704	2240	288	1504	704	1088	288
2.5	144	144	704	576	352	576	3008	672	2080	288	1312	672	1056	288
2.75	144	144	480	512	160	512	2720	640	1856	288	1216	640	1056	288
3	144	144	320	448	96	448	2368	576	1536	288	1184	576	1024	288
3.25	144	144	224	352	64	352	1984	512	1280	288	1152	512	992	288
3.5	144	0	128	288	32	288	1632	480	1056	288	1120	480	928	288
3.75	0	0	64	224	32	224	1344	448	832	256	1088	448	832	256
4	0	0	32	192	0	192	1088	416	640	256	1024	416	704	256
4.25	0	0	0	160	0	160	928	416	480	256	928	416	576	256
4.5	0	0	0	128	0	128	768	384	352	224	832	384	416	224
4.75	0	0	0	96	0	96	608	352	224	224	704	352	288	224
5	0	0	0	64	0	64	416	352	128	224	544	352	192	224

3.2 Extended Upstream OL System Spectral Compatibility Impact Tables

Table 3-2 gives the performance of protected systems in the presence of 5 extended Upstream overlap systems, as disturbers (1 Intra-Quad plus 4 Inter-Quad).

Table 3-2. Extended Upstream overlap System Spectral Compatibility Impact.

Dist	TCM-ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
			(FDM)				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	7104	832	3008	832	7104	832	2624	288	3008	832	1088	288
1	144	144	7072	832	3008	832	7072	832	2592	288	3008	832	1088	288
1.25	144	144	6944	832	3008	832	6944	832	2560	288	3008	832	1088	288
1.5	144	144	6848	832	2976	832	6848	832	2528	288	2976	832	1088	288
1.75	144	144	6752	832	2976	832	6752	832	2496	288	2976	832	1088	288
2	144	144	6592	800	2912	800	6592	800	2432	288	2912	800	1088	288
2.25	144	144	6368	768	2848	768	6368	768	2336	288	2848	768	1056	288
2.5	144	144	6016	704	2752	704	6016	704	2208	256	2752	704	1024	256
2.75	144	144	5504	672	2624	672	5504	672	2016	224	2624	672	960	224
3	144	144	4768	608	2496	608	4768	608	1760	224	2496	608	928	224
3.25	144	144	3776	512	2368	512	3776	512	1376	192	2368	512	864	192
3.5	0	0	2944	448	2144	448	2944	448	1088	160	2144	448	768	160
3.75	0	0	2208	352	1856	352	2208	352	800	128	1856	352	672	128
4	0	0	1568	288	1536	288	1568	288	576	96	1536	288	544	96
4.25	0	0	1088	224	1216	224	1088	224	384	64	1216	224	448	64
4.5	0	0	704	160	896	160	704	160	256	32	896	160	320	32
4.75	0	0	416	96	576	96	416	96	128	32	576	96	192	32
5	0	0	192	64	320	64	192	64	64	32	320	64	96	32

3.3 Delta Reference - Extended Upstream OL Spectral Compatibility Impact Tables

Table 3-2 gives the difference between Reference performance of protected systems and their performance in the presence of 5 Extended Upstream Overlap systems disturbers. According to table 3-3, Extended Upstream System has no impact with Annex C DBM and TCM-ISDN up to ~3.25km.

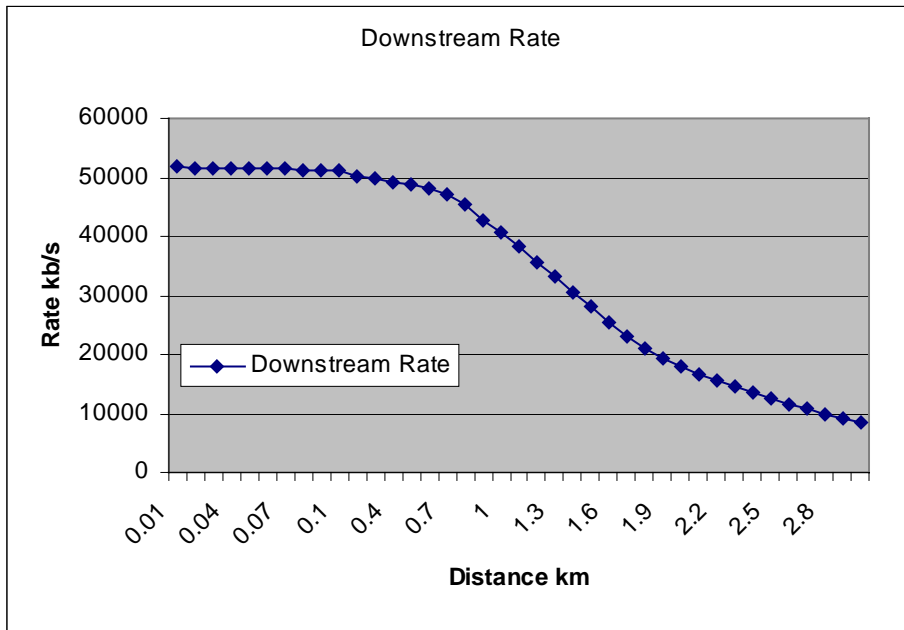
Table 3-3. Reference performance minus Performance with Extended Upstream Overlap system

Dist	TCM-ISDN		G.992.1 Annex A		G.992.2 Annex A		G.992.1 Annex C				G.992.2 Annex C			
			(FDM)				DBM		FBM		DBM		FBM	
	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US
0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.75	0	0	-320	0	-64	0	-192	0	-32	0	-64	0	0	0
1	0	0	-1120	0	-384	0	-704	0	-64	0	-256	0	0	0
1.25	0	0	-2048	-32	-736	-32	-1248	-32	-64	0	-480	-32	0	0
1.5	0	0	-3008	-64	-1152	-64	-1824	-32	-96	0	-704	-32	0	0
1.75	0	0	-4256	-96	-1536	-96	-2560	-64	-96	0	-960	-64	0	0
2	0	0	-4896	-96	-1952	-96	-2912	-64	-96	0	-1216	-64	0	0
2.25	0	0	-5280	-128	-2208	-128	-3072	-64	-96	0	-1344	-64	32	0
2.5	0	0	-5312	-128	-2400	-128	-3008	-32	-128	32	-1440	-32	32	32
2.75	0	0	-5024	-160	-2464	-160	-2784	-32	-160	64	-1408	-32	96	64
3	0	0	-4448	-160	-2400	-160	-2400	-32	-224	64	-1312	-32	96	64
3.25	0	0	-3552	-160	-2304	-160	-1792	0	-96	96	-1216	0	128	96
3.5	144	0	-2816	-160	-2112	-160	-1312	32	-32	128	-1024	32	160	128
3.75	0	0	-2144	-128	-1824	-128	-864	96	32	128	-768	96	160	128
4	0	0	-1536	-96	-1536	-96	-480	128	64	160	-512	128	160	160
4.25	0	0	-1088	-64	-1216	-64	-160	192	96	192	-288	192	128	192
4.5	0	0	-704	-32	-896	-32	64	224	96	192	-64	224	96	192
4.75	0	0	-416	0	-576	0	192	256	96	192	128	256	96	192
5	0	0	-192	0	-320	0	224	288	64	192	224	288	96	192

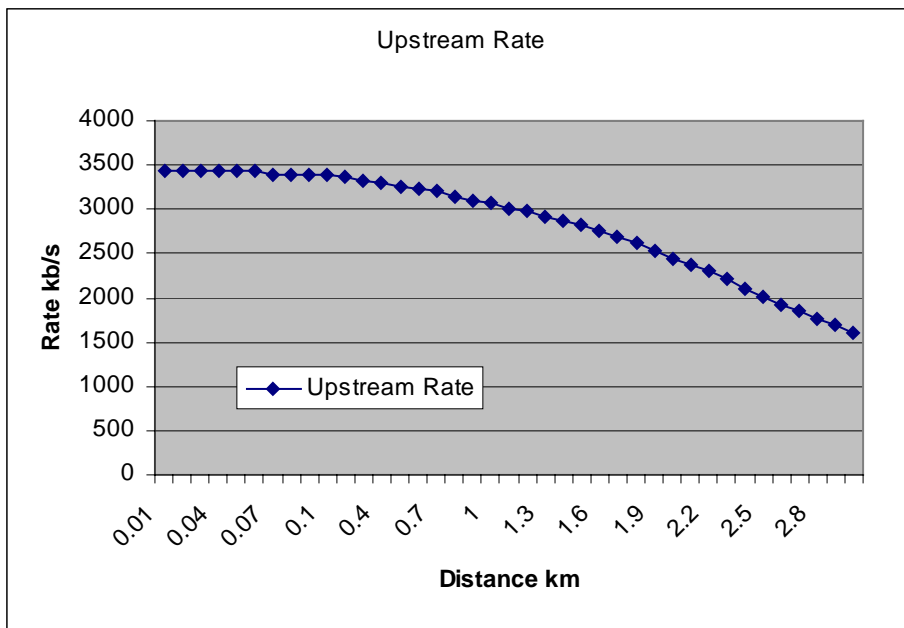
4 Maximum Expected Performance (for Information Only)

Figures 3 and 4 provides maximum expected performance of the extended Upstream overlap System: -140dBm/Hz white noise only is considered. The other simulation conditions are as follows: Bit loading between 2 and 15 bits; 70dB of echo rejection; 5dB of Net Coding Gain; 6dB margin Upstream and Downstream Channels.

**Figure 3. Extended Upstream OL Maximum Expected performance (-140dBm/Hz Noise Only),
Downstream Channel rate versus reach**



**Figure 4 Extended Upstream OL Maximum Expected performance (-140dBm/Hz Noise Only),
Upstream Channel rate versus reach**



5 Conclusions & Recommendations.

According to the 2003 refined Soumusho Spectral compatibility rules, we recommend that Extended Upstream Overlap System can be deployed in the same quad as protected systems up to 3.25km.