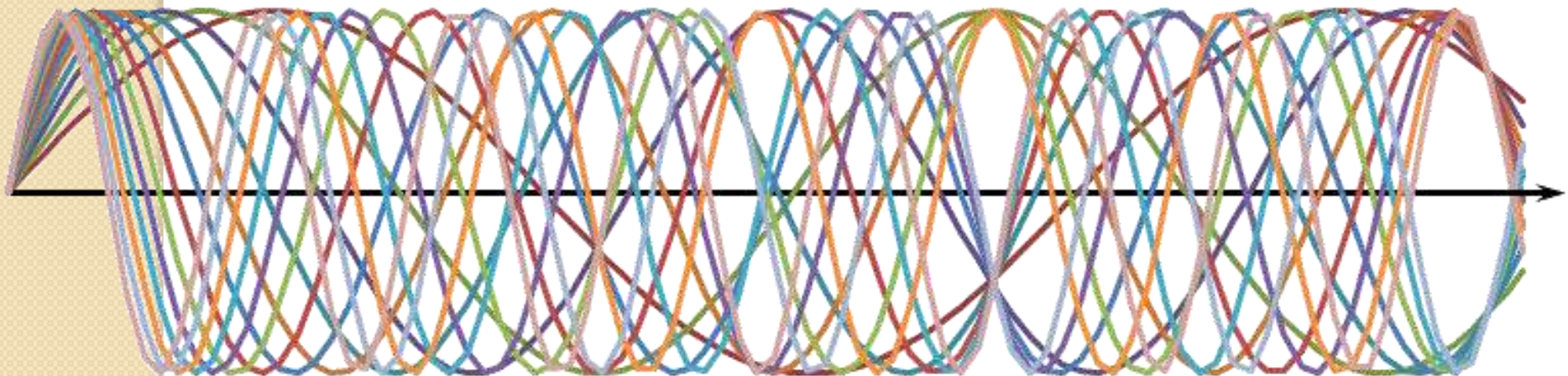


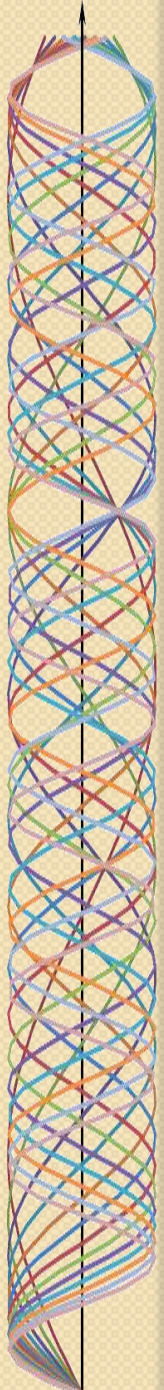
IEEE p802.3bn EPoC

Channel Model Ad Hoc committee

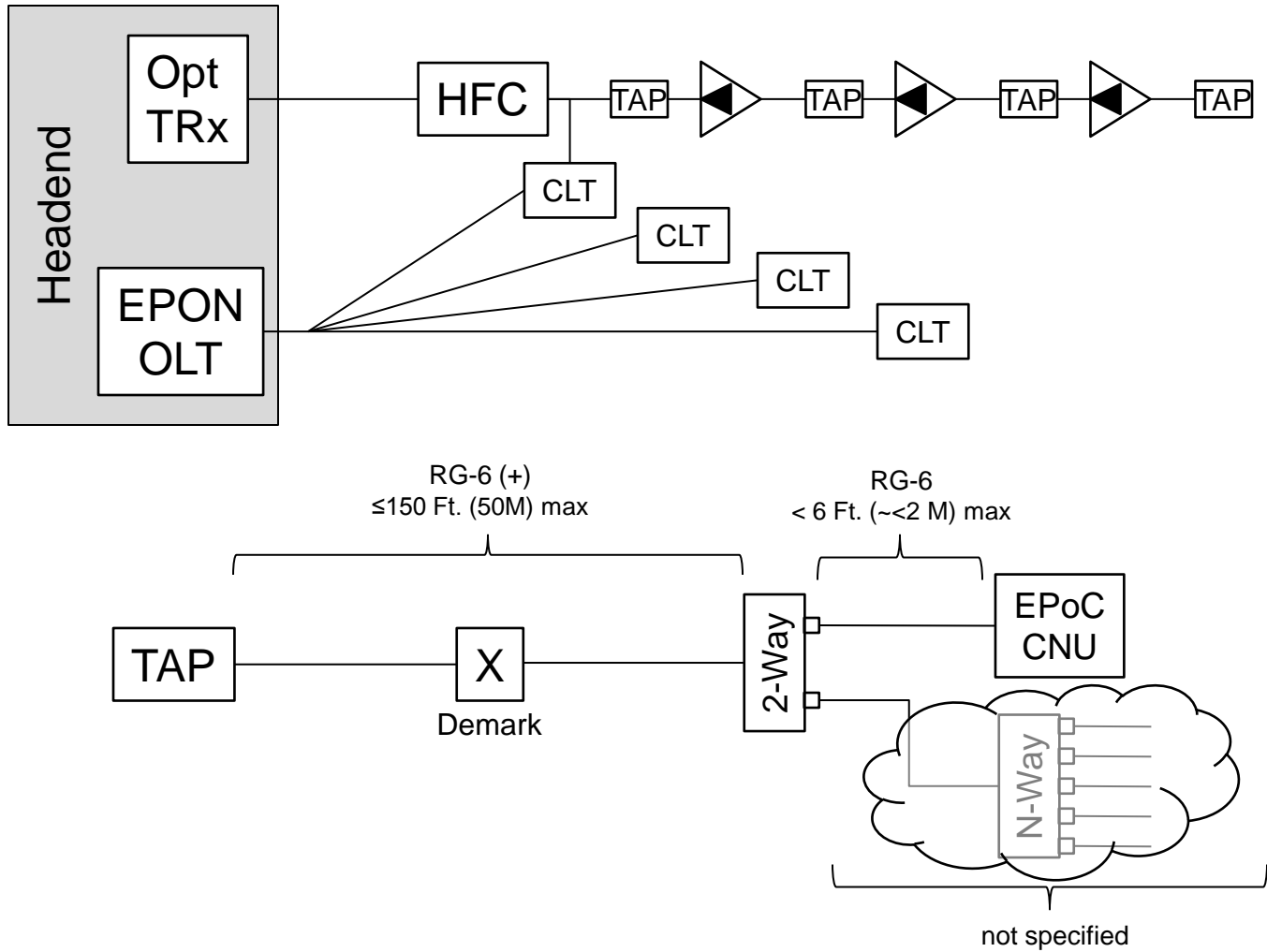
Baseline Channel Model

C h a n n e l M o d e l A d H o c





Baseline Topology



Baseline Parameter Table

(1 of 6)

Downstream

System Description

HFC D/S Spectrum

1.0 GHz

Cascade Depth

N+3

Channel Loading

48 Analog (32 removed for EPoC) + 75 Digital + EPoC Band (digital PSD@-6 dBc)

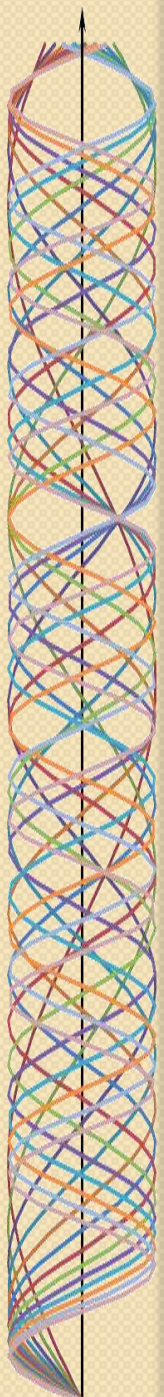
Optical Architecture

Linear Optics 1310 nm (nominal link length)
Legacy, EPoC RF Coupled after Node

Home Architecture

Up to max drop length & 2-way splitter

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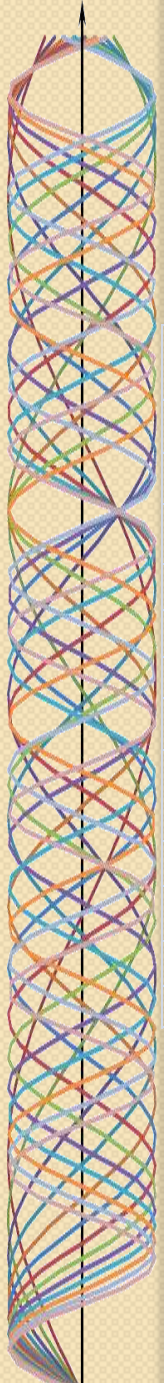


Baseline Parameter Table

(2 of 6)

Downstream

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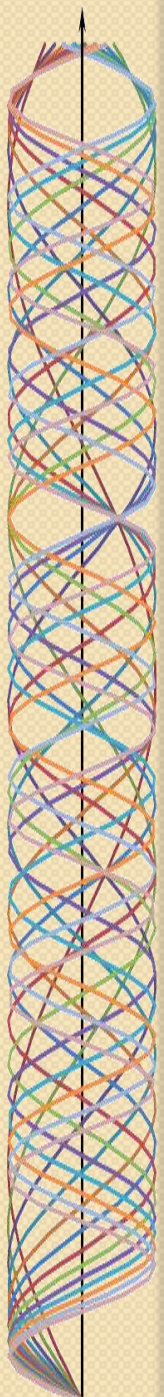
	#	Parameters	Nominal Channel Conditions ¹	Notes/Dependency
Spectrum	1	Frequency range	54 MHz - 1 GHz	
	2	OFDM Bandwidth	192 MHz	
RF Level	3	OFDM Power at CPE Input (dBmV)		Notes 2-4
		6 MHz BW	-2	
		24 MHz BW	4	
		96 MHz BW	10	
		192 MHz BW	14	Note 5
SNR	4	SCN Ratio (Signal to Composite Noise Ratio)	44	Note 6
		Variation over 6 MHz BW (dB)	N/A	Reference Basis 6 MHz
		Variation over 24 MHz BW (dB)	1.5	
		Variation over 96 MHz BW (dB)	2.5	
		Variation over 192 MHz BW (dB)	3.0	

Baseline Parameter Table

(3 of 6)

Downstream

Interference				
Narrowband	5	CTB Interference (20 kHz BW)		Notes 7, 8
		# of interfered subcarriers @ 35-40 dBc	0%	
		40-45	1%	
		>45	0%	
	6	CSO Interference (20 kHz BW)		Note 9
		# of interfered subcarriers @ 35-40 dBc	0%	
		40-45	0%	
		45-50	2%	
		>50	0%	
	7	Narrowband Interference (Other)		
		Bandwidth (MHz)	N/A	
		Level, dBc (PSD)	N/A	
Wideband	8	Burst Interference		Note 10
		Bandwidth (MHz)	30	
		Level, dBc (PSD)	-20	
		Duration (usec)	16	
		Period (Hz)	Infrequent	
	9	Impulse (white) Noise		Note 11
		Level, dBc (PSD)	N/A	
		Duration (nsec)	N/A	
		Period (kHz)	N/A	

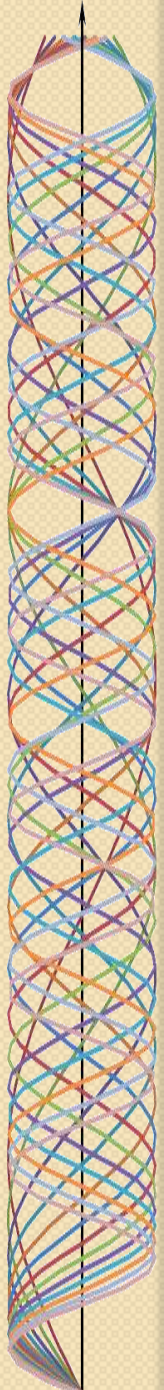


Baseline Parameter Table

(4 of 6)

Downstream

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Freq Response			
Amplitude	10	Amplitude Slope	Note 12
		dB/MHz	0.01
Amplitude Variation	11		SCTE Definition, Echo not included
		(dB pk-pk/6 MHz)	1
		(dB pk-pk/24 MHz)	3
		(dB pk-pk/192 MHz)	5
		(dB pk-pk/Total DS BW)	9
Phase	12	Group Delay Variation, nsec	
		Over 24 MHz	
		Mid Band	25
		Band Edge (24 MHz)	145
		Over 192 MHz	
		Mid Band	200
Echo	13	Echo Profile, dBc	Notes 13, 14
		.5 usec	-20
		1 usec	-25
		1.5 usec	-30
		2 usec	-35
		3 usec	-40
		4.5 usec	-45
	5 usec	-50	
Spurious Modulation	14	AM/Carrier hum modulation %	3%

Baseline Parameter Table

(5 of 6)

Downstream

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Freq Response				
Amplitude	12	Amplitude Slope	Typ Tilt, 1st Tap, not Equalized	
			dB/MHz	0.01
	13	Amplitude Variation		Note 11
		(dB pk-pk/6 MHz)	1	not included
		(dB pk-pk/24 MHz)	2	
		(dB pk-pk/192 MHz)	3	
		(dB pk-pk/Total DS BW)	6	
Phase	14	Group Delay Variation, nsec		
		Over 24 MHz		
		Mid Band	10	
		Band Edge (24 MHz)	50	
		Over 192 MHz		
		Mid Band	70	
		Band Edge (24 MHz)	115	
Echo	15	Echo Profile, dBc	99%	dominant echo - Does not imply multiple
		.5 usec	-20	Note 12
		1 usec	-25	
		1.5 usec	-30	
		2 usec	-35	
		3 usec	-40	
		4.5 usec	-45	
		5 usec	-50	
Spurious Modulation	16	AM/Carrier hum modulation %	3%	Slide 7

Baseline Parameter Table

(6 of 6)

Downstream

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Notes

1	If not defined otherwise, assume typically behaving link but where the behavior is the worst (freq, location)		
2	Frequency dependence of coax for broadband calculations: Loss B (dB) = Loss A (dB) x SQRT(B/A)		
3	Reference virtual port level for 6 MHz signal at 1 GHz; 15 dBmV Tap port level, 100 ft drop, 2-way splitter		
4	(Max Freq - OFDM BW) spectrum range used for drop loss		
5	Small drop slope effect on calculation		
6	SCN includes HFC geography impact (location in cascade depth)		
7	50 kHz Subchannel Reference, Live Video, fully contained within subchannel		
	Subcarriers with Interference (50 kHz subcarriers): Every 70 subcarriers, a cluster of three interferers: I_0 , $I_0 + 25$ kHz, $I_0 - 25$ kHz		
8	Typ = CTB/CSO Worst Case Freq; Good CTB/CSO in low-distortion band, Analog contiguous at low end of band		
	NCTA measurement method (avg); Error rate simulation should account for PAR and peak durations		
9	Worst spectrum regions for CTB and CSO are not the same		
10	D/S Burst Characterization in process; BW based on percentage of errored carriers in 8-Channel wide DOCSIS CM		
	Duration based on large scale CM sweep of UCER with known interleaver settings; Levels per ReDesign channel model		
11	Laser Clipping PSD captured in SCN for out-of-band EPoC Signals		
12	Typical tilt, first tap, not equalized, 50 ft drop assumed (Minimum drop impact)		
13	Echo mask range for a Single Dominant echo - Does not imply an assumptions about multiple echoes.		
14	Meas@700-800 MHz, representative of 99% of modems		

Baseline Parameter Table (1 of 5)

Upstream

System Description		
HFC U/S Spectrum	300 MHz	
Node Architecture	N+3	
Channel Loading	Remote Tx/Rx	
HE Architecture	N/A - EPON Return	
Premise Architecture	Two Way Combining	

Note: “System Description” is extended to 300 MHz in order to evaluate Gbps capacity objectives against 192 MHz of upstream BW. The downstream baseline description used a legacy forward path spectrum (legacy and a return of 85 MHz have nearly identical performance downstream) allowing for D/S evaluation of the more conservative case of a heavier optical and RF load of legacy channels to set impairment levels. The two are not simultaneously compatible – the downstream parameters can only improve as legacy load diminishes such as with 300 MHz of upstream. Alternatively the bandwidth efficiency of the upstream could be evaluated in 85 MHz of return and compared to the objectives in terms of bps/Hz. Using the “linear scaling” clause of the objective.

Baseline Parameter Table

(2 of 5)

Upstream

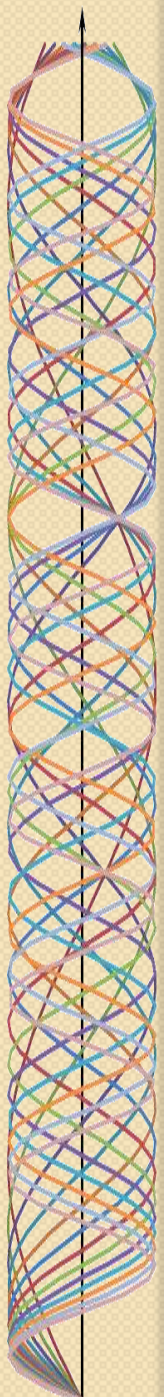
	#	Parameters	Nominal Channel Conditions ¹	Notes/Dependencies
Spectrum	1	OFDM Bandwidth	192 MHz	
	2	Frequency range	100-292 MHz	
Path Loss	3	Path Loss (dB)	44	Max loss to first active
		Variation Freq, 24 MHz BW	1	Note 1
		Variation Freq, 96 MHz BW	2.5	
		Variation Freq, 192 MHz BW	5	
Added Noise	4	Input Noise PSD	- 115 dBmV/Hz	Contributions of amplifiers

Baseline Parameter Table

(3 of 5)

Upstream

Narrowband		Bandwidth	8	
		Level, dBc (PSD)	-40	Note 2
	6	Common Path Distortion		
		dBc	N/A	
		% effected subcarriers	N/A	
	7	Other Bands	TBD	New Upstream spectrum
		dBc	54	Note 3
		% effected subcarriers	TBD	
	Wideband	8	Burst Interference	Note 4
		Bandwidth (MHz)	TBD	Non-white characteristics
		Level, dBc (PSD)	0	
		Duration (usec)	1	
		Period (Hz)	1000	

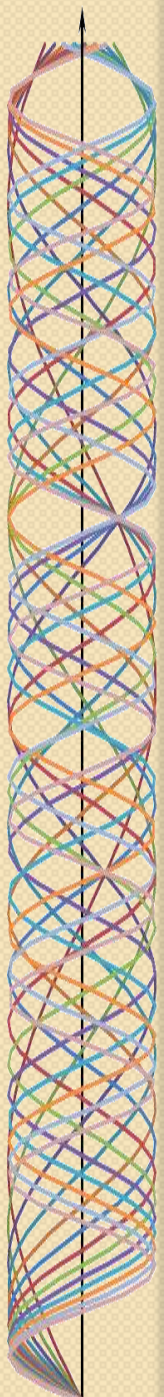


Baseline Parameter Table

(4 of 5)

Upstream

Freq Response				
	9	Amplitude Slope	N/A	Captured in Path Loss
Amplitude	10	Amplitude Variation		included
		(dB pk-pk/24 MHz)	1.5	
		(dB pk-pk/96 MHz)	2.5	
		(dB pk-pk/192 MHz)	3	
Phase	11	Group Delay Variation		
		Over 24 MHz		
		Mid Band	25	
		Band Edge (24 MHz)	280	
		Over 48 MHz		
		Mid Band	50	
		Band Edge (24 MHz)	305	
		Over 192 MHz	575	
Echo	12	Echo Profile, dBc		Note 5-6
		.5 usec	-16	
		1 usec	-22	
		1.5 usec	-29	
		2 usec	-35	
		3 usec	-42	
		4.5 usec	-51	
		5 usec		
	13	AM/Carrier hum	5%	

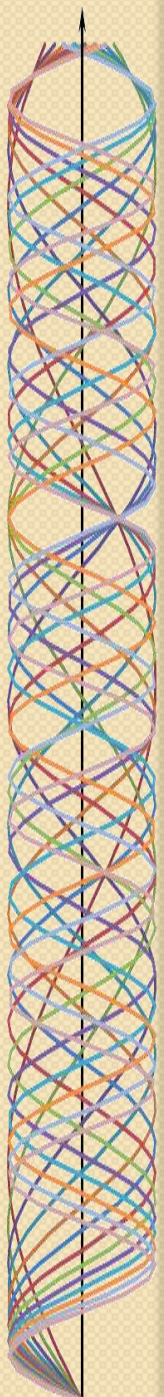


Baseline Parameter Table

(5 of 5)

Upstream

Note 1	Path Loss adopted for consistency although return path, although RF actives include upstream gain
Note 2	Measured samples in MSO location of high field strength environment
Note 3	Projected (for 50 kHz) from acceptable D/S interference levels for analog video band; single dominant ingress point
Note 4	Ref CableLabs 1997 Report "Characterization of Upstream Transient Impairments on Cable Television Systems"
Note 5	Measured Upstream CM (97% criteria) extrapolated to band (30 MHz measured to 100 MHz)
Note 6	Echo mask range for a Single Dominant echo - Does not imply an assumptions about multiple echoes



THANK YOU

C h a n n e l M o d e l A d H o c

