10GBASE-T
Call For Interest
Technical Feasibility

Contributors:

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Cabling – Standards and Usage

Cabling	IEEE	TIA/EIA-568-B	ISO/IEC 11801	% of cable * (99-2000-2001-2002)**(*2005*)
Category 5	10/100BASE-T 1000BASE-T- with the additional parameters specified in TIA/EIA-TSB95	Published Standard: Not recommended for new installations	ISO/IEC 11801 2nd Edition: Components Enhanced to ~5e	%40-30-12-4-*>0*
Category 5e	10/100/1000BASE-T	Published Standard	ISO/IEC 11801 2nd Edition – Class D Channel	%45-54-70-71-*15*
Category 6	10/100/1000BASE-T	Published Standard	Published Standard	%10-11-13-(20 –40)-*85*

*Category 3 - %5

***Frost and Sullivan - North America - Premises Wiring Media Markets: Report#6328-62- Published 2001**

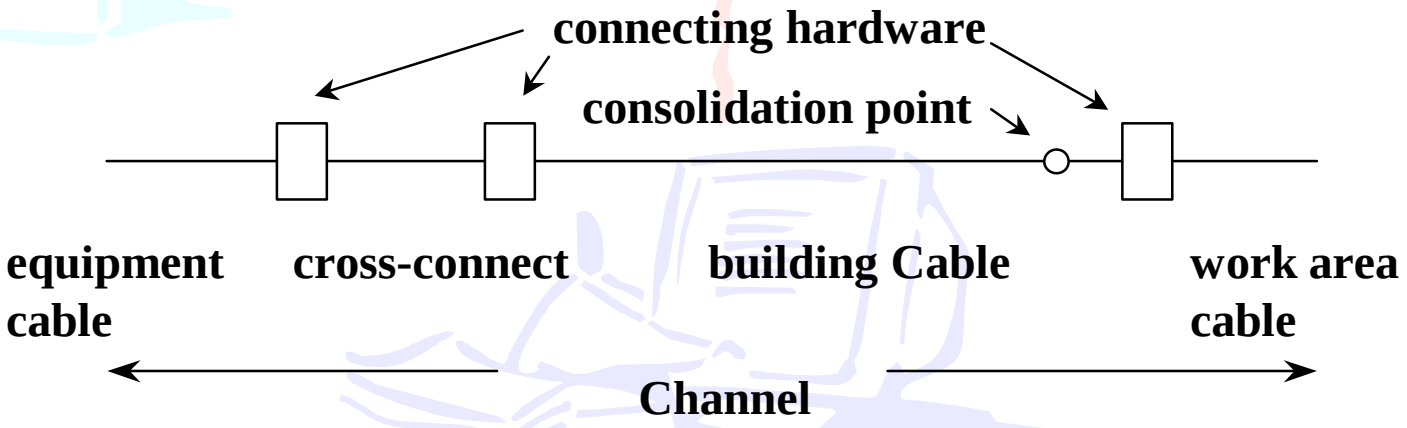
****BSRIA Reports on Horizontal Structured Cabling (NA)**

Cabling - Specifications

***Category 5e Channel Transmission Performance**

Frequency MHz	Ins. Loss Max (dB)	NEXT Min (dB)	ACR Min (dB)	PSNEXT Min (dB)	PSACR Min (dB)	ELFEXT Min (dB)	PSELFEXT Min (dB)	Return Loss Min (dB)	Prop. Delay Max (ns/100m)	Delay Skew Max (ns/100m)
1	2.2	>60	>57.8	>57	>54.8	57.4	54.4	17	580	50
4	4.5	53.5	49	50.5	46	45.4	42.4	17	562	50
8	6.3	48.6	42.3	45.6	39.3	39.3	36.3	17	557	50
10	7.1	47	39.9	44	36.9	37.4	34.4	17	555	50
16	9.1	43.6	34.5	40.6	31.5	33.3	30.3	17	553	50
20	10.2	42	31.8	39	28.8	31.4	28.4	17	552	50
25	11.4	40.3	28.9	37.3	25.9	29.4	26.4	16	551	50
31.25	12.9	38.7	25.8	35.7	22.8	27.5	24.5	15.1	550	50
62.5	18.6	33.6	15	30.6	12	21.5	18.5	12.1	549	50
100	24	30.1	6.1	27.1	3.1	17.4	14.4	10	548	50

(*ISO/IEC 11801 2nd edition -Class D)



Cabling - Specifications

*Category 6 Channel Transmission Performance

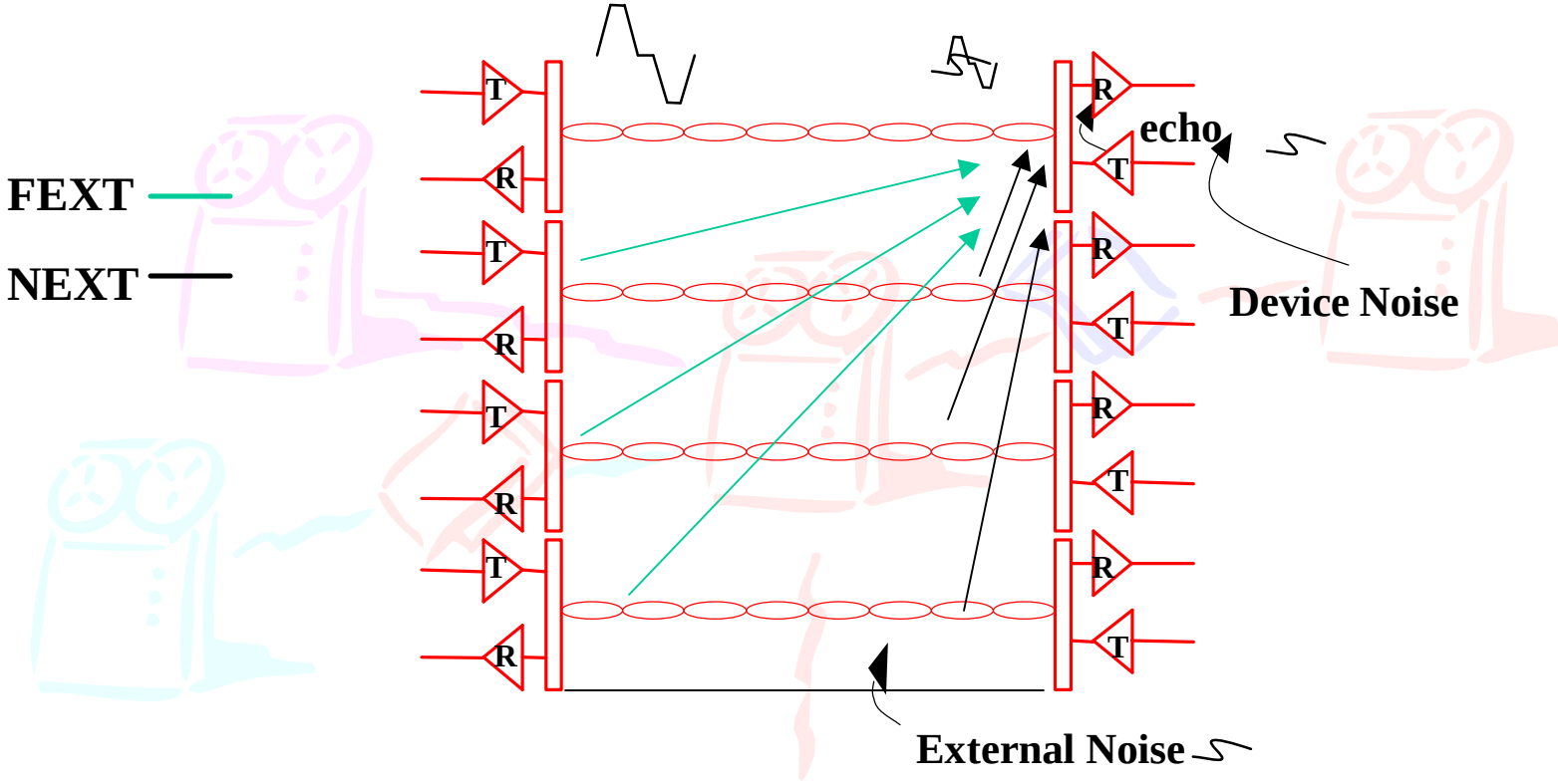
Frequency MHz	Ins. Loss Max (dB)	NEXT Min (dB)	ACR Min (dB)	PSNEXT Min (dB)	PSACR Min (dB)	ELFEXT Min (dB)	PSELFEXT Min (dB)	Return Loss Min (dB)	Prop. Delay Max (ns/100m)	Delay Skew Max (ns/100m)
1	2.1	>65	>62.9	>62	>59.9	63.3	60.3	19	580	50
4	4	63	59	60.5	56.5	51.2	48.2	19	562	50
8	5.7	58.2	52.5	55.6	49.9	45.2	42.2	19	557	50
10	6.3	56.6	50.3	54	47.7	43.3	40.3	19	555	50
16	8	53.2	45.2	50.6	42.6	39.2	36.2	18	553	50
20	9	51.6	42.6	49	40	37.2	34.2	17.5	552	50
25	10.1	50	39.9	47.3	37.2	35.3	32.3	17	551	50
31.25	11.4	48.4	37	45.7	34.3	33.4	30.4	16.5	550	50
62.5	16.5	43.4	26.9	40.6	24.1	27.3	24.3	14	549	50
100	21.3	39.9	18.6	37.1	15.8	23.3	20.3	12	548	50
200	31.5	34.8	3.3	31.9	0.4	17.2	14.2	9	547	50
250	35.9	33.1	-2.8	30.2	-5.7	15.3	12.3	8	546	50

(*~ISO/IEC 11801 2nd edition -Class E)

Difference in Channel Transmission Performance (Cat 6 vs. Cat 5e)

Frequency MHz	Ins. Loss Max (dB)	NEXT Min (dB)	ACR Min (dB)	PSNEXT Min (dB)	PSACR Min (dB)	ELFEXT Min (dB)	PSELFEXT Min (dB)	Return Loss Min (dB)	Prop. Delay Max (ns/100m)	Delay Skew Max (ns/100m)
1	-0.1	>5	>5	>5	>5	5.9	5.9	2	0	0
4	-0.5	9.5	10	10	10.5	5.8	5.8	2	0	0
8	-0.6	9.6	10.2	10	10.6	5.9	5.9	2	0	0
10	-0.8	9.6	10.4	10	10.8	5.9	5.9	2	0	0
16	-1.1	9.6	10.7	10	11.1	5.9	5.9	1	0	0
20	-1.2	9.6	10.8	10	11.2	5.8	5.8	0.5	0	0
25	-1.3	9.7	11	10	11.3	5.9	5.9	1	0	0
31.25	-1.5	9.7	11.2	10	11.5	5.9	5.9	1.4	0	0
62.5	-2.1	9.8	11.9	10	12.1	5.8	5.8	1.9	0	0
100	-2.7	9.8	12.5	10	12.7	5.9	5.9	2	0	0

Terms of Impairment



Achievable data rate based on signal-to-noise ratio

Noise - Cabling Parameter	Noise - External to devices	Noise - Internal to devices
Crosstalk -NEXT/FEXT	Alien Crosstalk	device noise
Balance- conversion loss	EMI - transient/wide band	
Return Loss		

Some issues for the study group…….

- Alien NEXT –bundled 4-pair cables
  - Poorly characterized in specifications
  - Installation-dependent
  - Use signal processing or shielding?
- Cable Characterization Beyond 100 MHz
- Trade-off - Category versus Length
  - length dependent cabling parameters

Feasibility Framework

- **Support a speed of 10 Gb/s at the MAC**
- **Support media selected from ISO/IEC 11801**
- **Meet or exceed FCC/CISPR Class A or Better operation**
- **Compatibility with 1000BASE-T**
- **Bit Error Rate of less than or equal to - 10^{-10} - 10^{-12}**
- **……**

Multivendor Support

PHY Vendor	Approach	Technology, Line code	100m feasible?	25m feasible?	Support Study Group
Accelerant	Digital adaptive equalizers	CMOS, PAM	Not on Cat5	Cat5e feasible	Yes
Cicada	Extension of 1000BT +FEXT cancellation	CMOS, PAM	STP feasible	Cat 6 feasible	Yes
Mysticom	Analog + DSP	CMOS, PAM	Not on Cat5	Cat6 maybe	Yes
Plato Labs	Extension of 1000BT +FEXT cancellation Analog adaptive filters	CMOS, PAM	Cat5e feasible	Cat5e feasible	Yes
SolarFlare	Evolution of 1000BT, FEXT mitig. + MIMO	CMOS, PAM	Cat5e feasible	Cat5e feasible	Yes
TellCos	Enhanced 1000BT Unified impediment cancellation	CMOS, Possibly PAM	Cat5e feasible	Cat5e feasible	Yes

Common Characteristics Of Proposals

- 250 – 625 MHz used bandwidth
- Limited launch power
- Coded multilevel PAM line codes
- High performance equalization
- CMOS technology