Gigabit Ethernet
Extended Temperature
10 km Dual Fiber
Proposal for Baseline Text

Steve Joiner

Ignis Optics

steve.joiner@ignisoptics.com

- Objective:
  Provide a family of physical layer specifications:

  1000BASE-X extended temperature range optics

- What does this specifically mean?
  - Extend temperature range expectation
    - See next slide
  - Extend existing 5 km SM 1000Base-LX to 10 km ?
  - Compatibility with existing 10 km parts now shipping ?

Extended Temperature

- 802.3 specifications do not provide normative environmental requirements – example see clause 38.8

- But uncooled lasers change their optical properties over temperature so we must have an expectation of temperature range in developing optical specifications.

- Propose we add an informative section (annex or note in clause) that states the temperature range used in developing this specification.

- Propose we use Temperature of case of fiber optic package of -40 to +85 degrees C.
  - Assuming 0.4 nm/deg ➔ 50 nm variation (assume laser at temperature relative to case)

Note: This page based on reflector traffic over the past 3 months – THANKS everyone.

10 km specification?

- >= Five companies delivering 10 km gigabit Ethernet products.
    - Stopped searching after five
    - Market obviously exists for 10 km
    - Single fiber EFM solution targeting 10 km
- Propose EFM create a 10 km dual fiber extended temperature link

- A defacto industry standard exists for 10 km Gigabit Ethernet
- Objective: Make the EFM extended temperature compatible with this industry standard.

Key Differences – TX/RX

Specification	1000 BASE-LX	Industry 10 km	Units
TX:			
Avg Tx Power (min) (ER 9 min)	-11	-9.5	dBm
wavelength	1270-1355	1270-1355 or 1285 - 1343	nm
RMS spectral width	4	3 or 2.8	nm
RX:			
Optical Receiver Avg power	-19	-20	dBm

Propose use common industry 10 km specifications

Specification Methodology

- Choose between OMA and ER methodology.
- 1000BASE-LX is ER based specification

Propose OMA based specification

Proposal

- Informative temperature range -40-+85 deg C
- 10 km link length
- Wavelength range = 1270 – 1355 nm
- Use 10GbE link budget spreadsheet to create triple tradeoff curve for spectral width vs. wavelength
- Use OMA spec methodology
- Tx output power (min): -9.5 dBm (ER=9)
- Rx input (min): -20 dBm (ER=9)

Baseline Motion

- The basis for the first draft of the 802.3ah 1000Base-LX extended temperature objective be met with text that uses 1000Base-LX 5 km single mode specification (clause 38) as the starting point with the following changes and additions:
    - Informative temperature range -40-+85 deg C
    - 10 km link length
    - Wavelength range = 1270 – 1355 nm
    - Use EFM link budget spreadsheet (v3.1.16) to create triple tradeoff curve for spectral width vs. wavelength vs OMA
    - Conversion to OMA spec methodology
    - Tx output power (min): -9.5 dBm (ER=9)
    - Rx input (min): -20 dBm (ER=9)

    Made: Steve Joiner; Ignis Optics
    Second: Schelto vanDoorn
 For: No: Abstain:

This motion was amended see next two slides.

- Change wavelength range to 1260-1360
- M: Jack Jewell
- S: Jim Tatum
- F: 27   N: 0   A: 14

Baseline Motion

- The basis for the first draft of the 802.3ah 1000Base-LX extended temperature objective be met with text that uses 1000Base-LX 5 km single mode specification (clause 38) as the starting point with the following changes and additions:
  - Informative temperature range -40-+85 deg C
  - 10 km link length
  - Wavelength range = 1260 – 1360 nm
  - Use EFM link budget spreadsheet (v3.1.16) to create triple tradeoff curve for spectral width vs. wavelength vs OMA
  - Conversion to OMA spec methodology
  - Tx output power (min): -9.5 dBm (ER=9)
  - Rx input (min): -20 dBm (ER=9)

  Made: Steve Joiner; Ignis Optics
  Second: Schelto vanDoorn

  For: 42   No: 0   Abstain: 5

This motion passes.

Parameters for link budget

- Q = 7.04
- Base rate 1250 Mbd
- Uw = 2.9 nm
- Tx pwr OMA = -7.6 dB
- Tx mask X1 = 0.22 UI
           X2 = 0.375 UI
           Y1 = 0.2
- Ts (20-80) = 0.26 ns
- RIN (OMA) = -120 dB/Hz
- RIN_coef = 0.7
- Det Jitter = 160 ps
- DCD_DJ = 65 ps
- MPN (k)(OMA) = 0.5
- Refl Tx = -12 dB

- Target reach = 10 km
- Connections = 2 dB
- C1 = 480 ns.MHz
- Reflection Noise factor = 0.6
- Attenuation 0.5 dB
- NomSensOMA = -20.3 dBm
- Refl Rx = -12 dB
- Rec_BW = 1000 Mhz
- C_rx = 329 ns.MHz
- RMS Baseline wander = 0.025
- Test Rx BW = 1000 MHz
- Test source ER = 9

Parameters used in link budget spreadsheet