POF Cable Plant Loss Budget Evaluated at the Optical Signal Level -1

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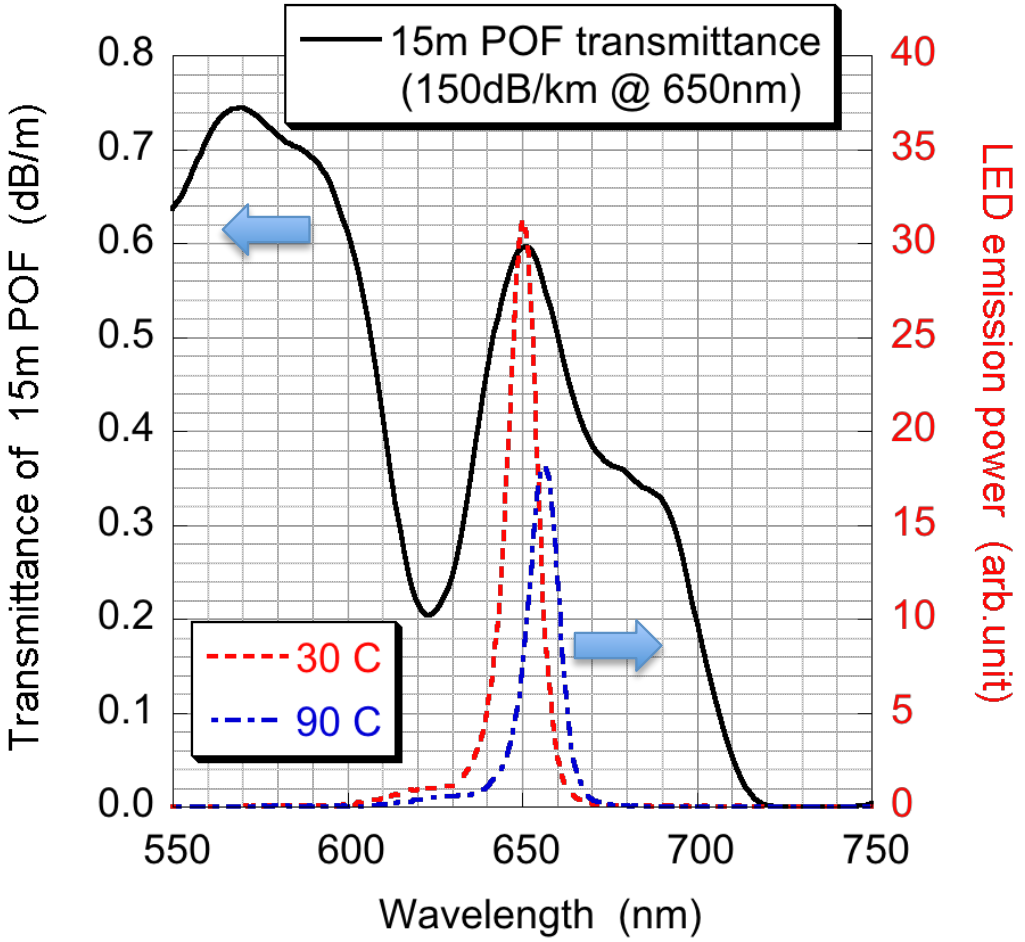
POF Promotion

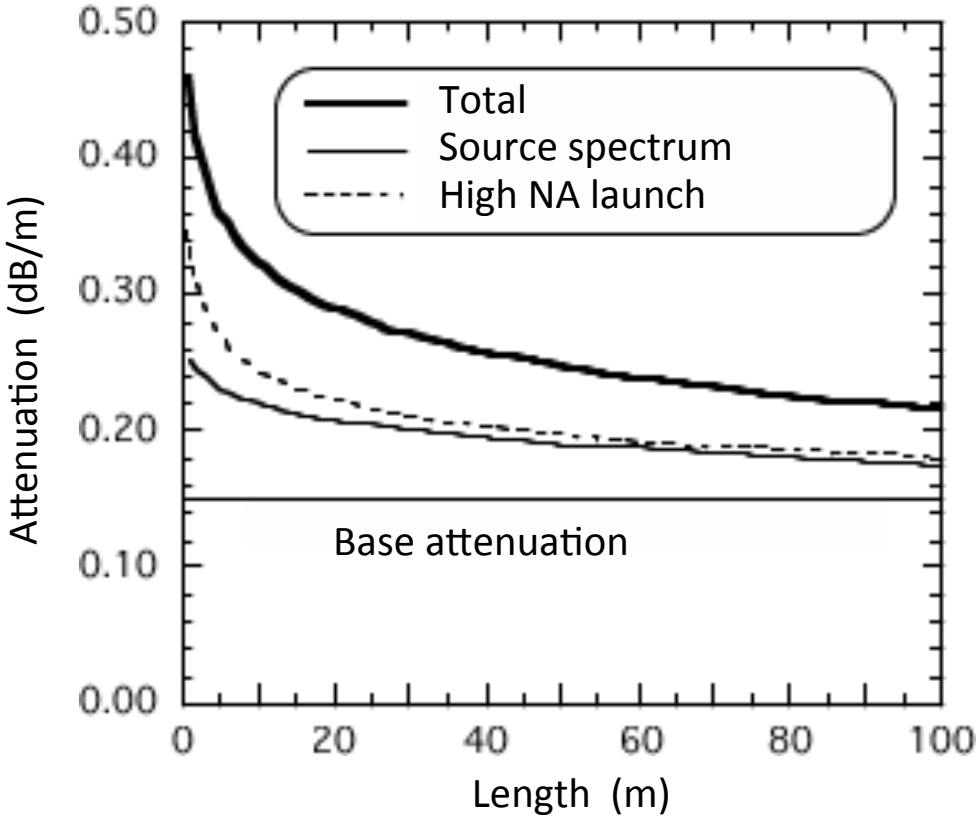
Evaluation at the Optical Signal Level

Characteristics	Subject	Status
Transmission Loss	Base transmission loss	We have enough data
	Loss increment due to the temperature and humidity	Well verified
	Transmission loss change due to the temperature dependence of light source	Evaluation on the way
Bandwidth	Launch condition dependence	We have some data
Connection Loss	Base connection loss	
	Lateral offset	
	Tilt	
	End separation	
	Environment (Vibration, temperature, etc.)	

Transmission Loss Change due to the Temperature Dependence of the Light Source and Launch Condition

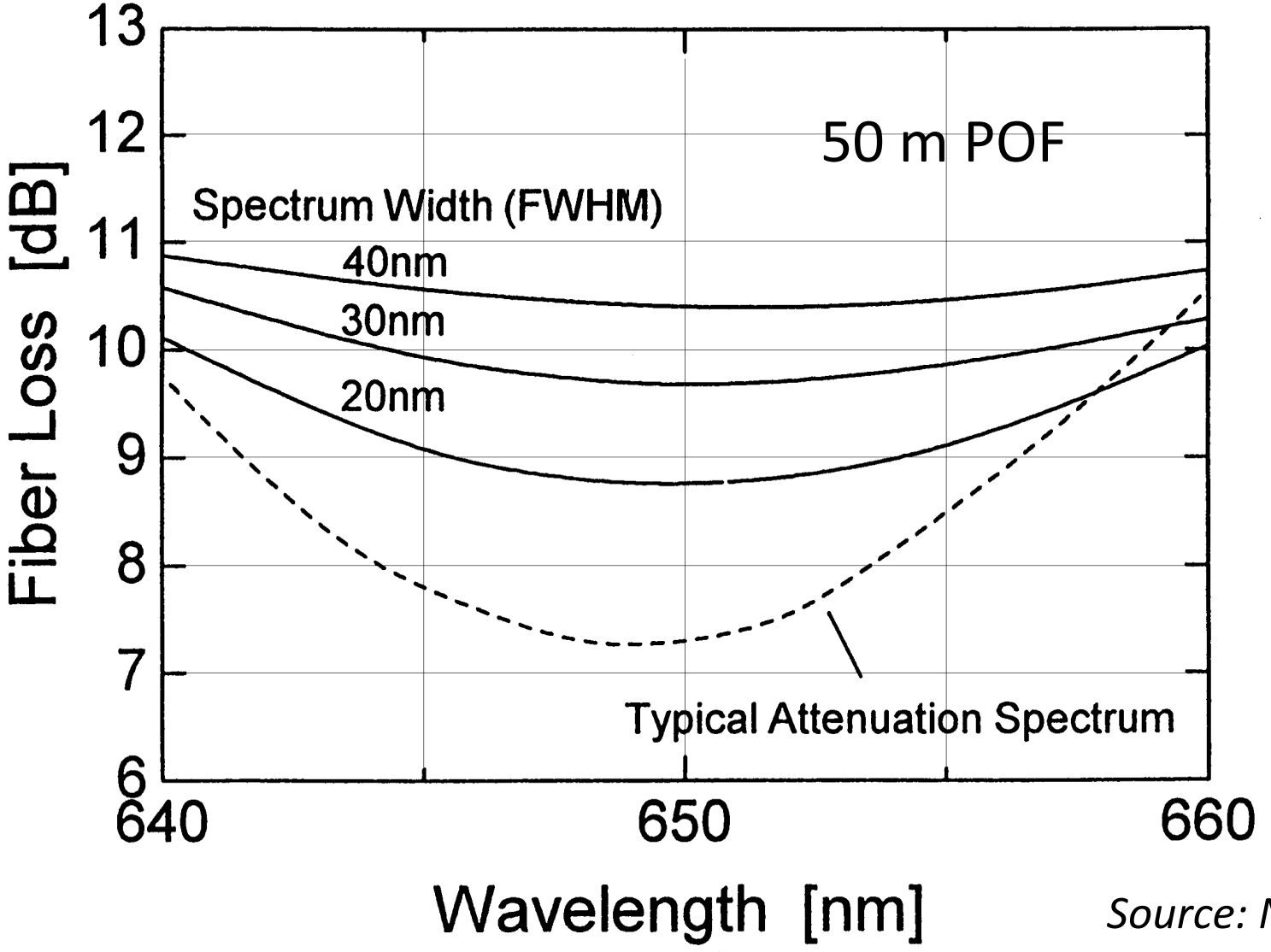


Loss Increment Factor:
Source spectrum and Launch NA



What we have evaluated at the ATM Forum and IEEE 1394b are

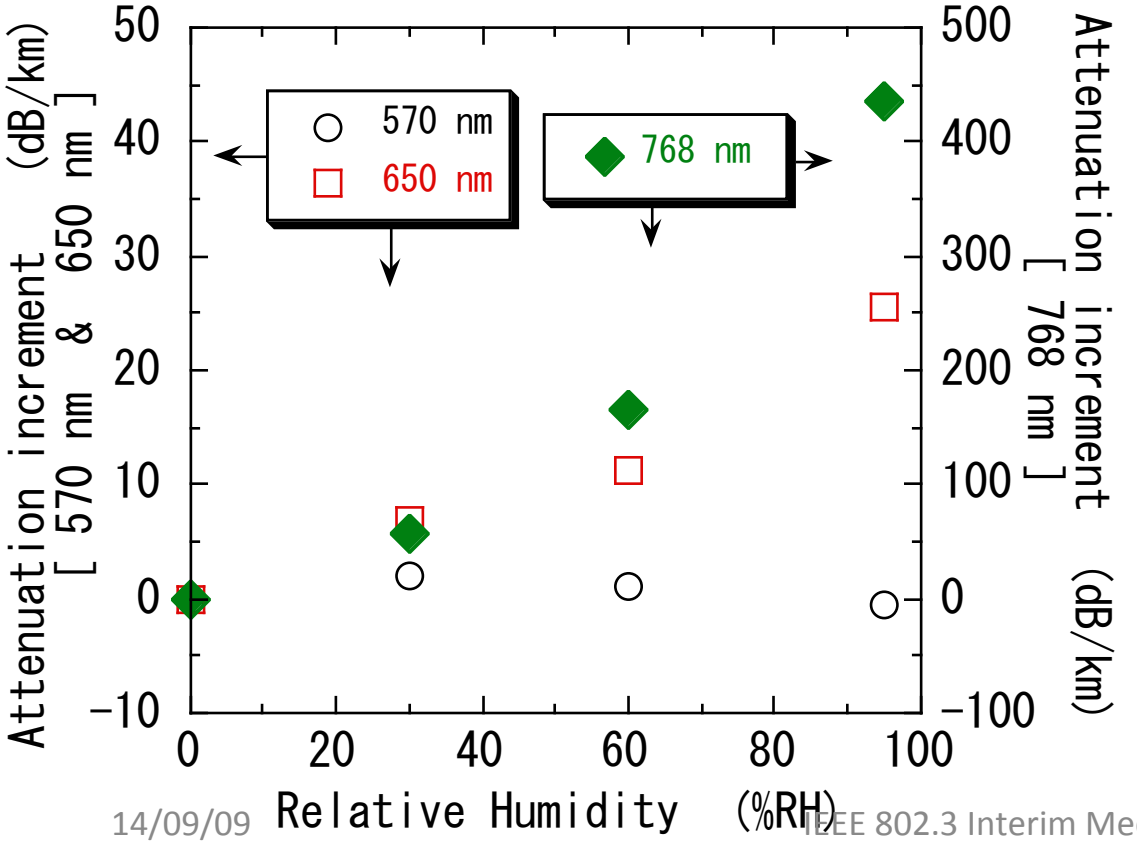
Transmission Loss Depends on the Peak Wavelength and Width of the Emission Spectrum of the Light Source



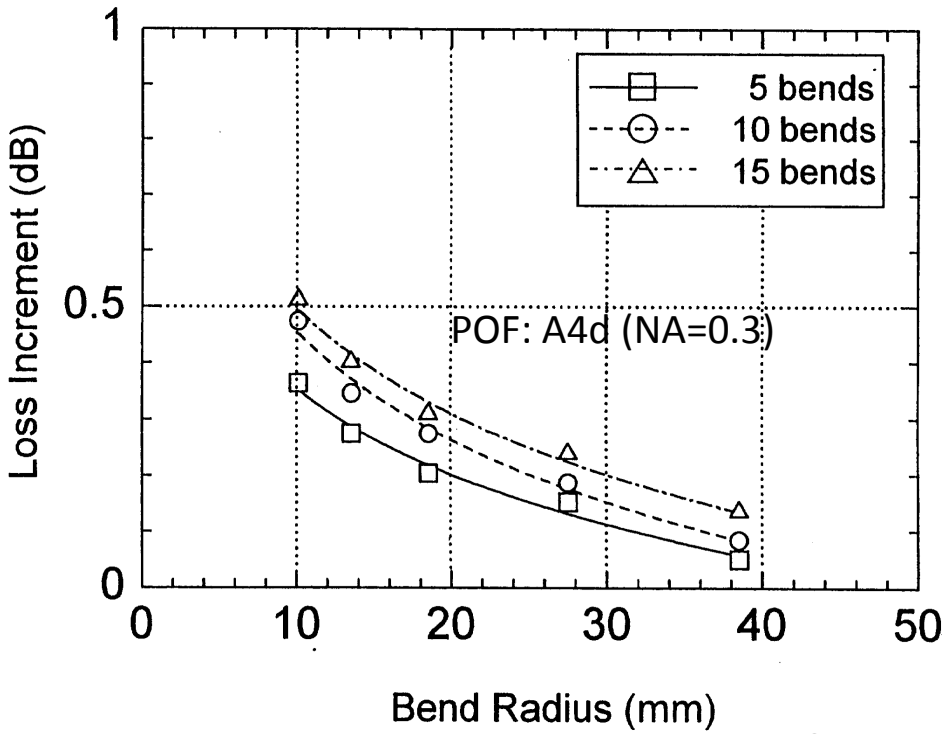
Source: NEC
LED: NL2100

Loss Increment due to the Environment and Macrobend

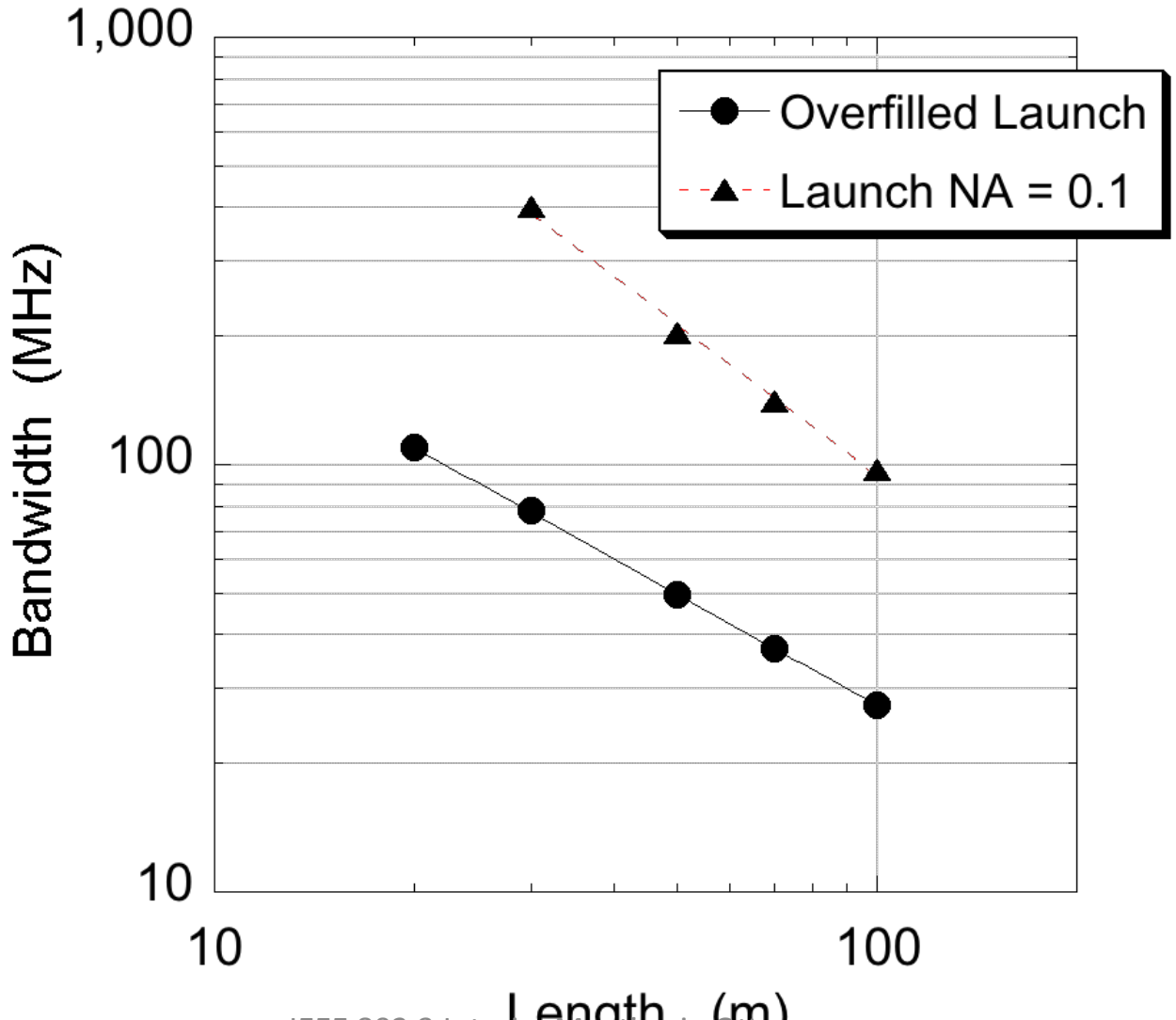
Loss increment due to the ambient humidity



Macrobend loss



Launch Condition Dependence of POF Bandwidth



Connection Loss Evaluation

Base connection loss

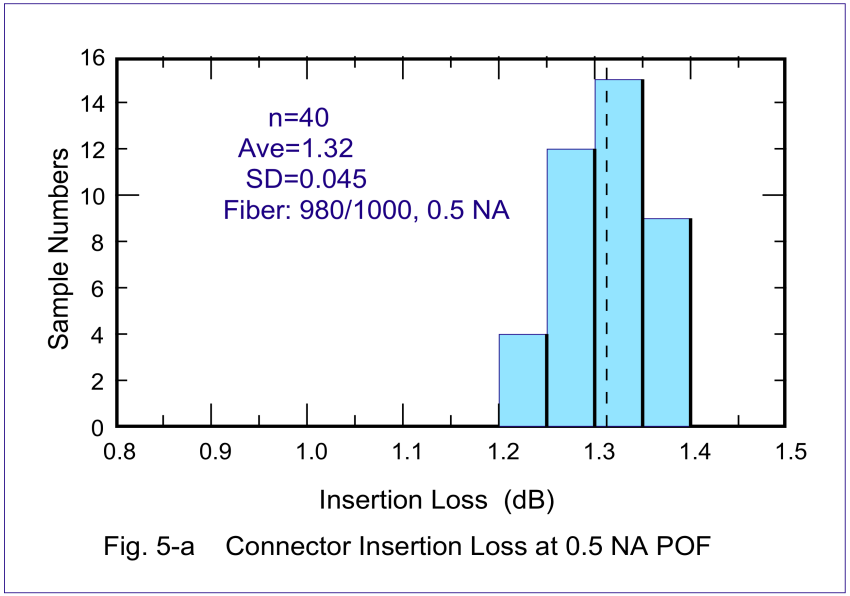


Fig. 5-a Connector Insertion Loss at 0.5 NA POF

Environmental Test Results

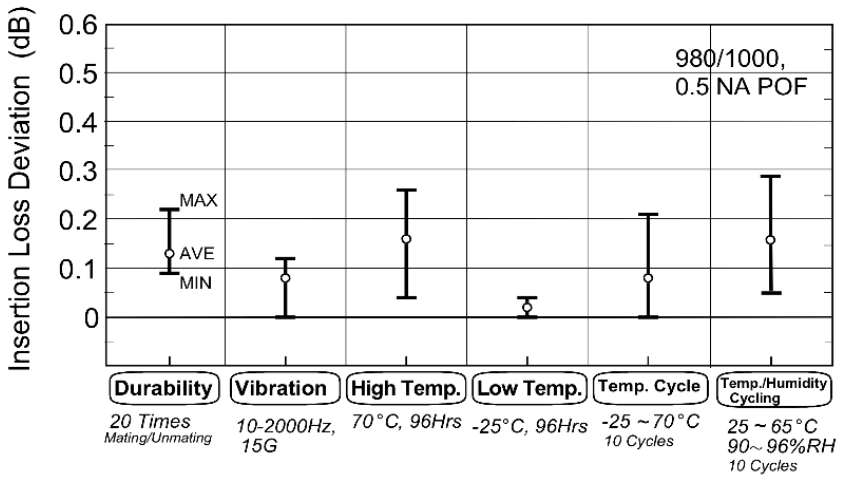
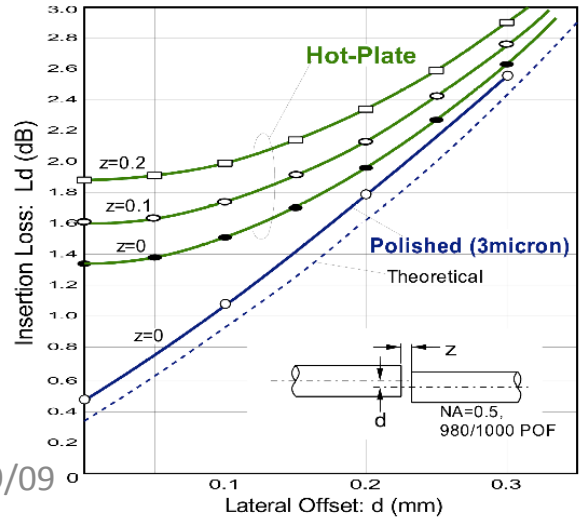


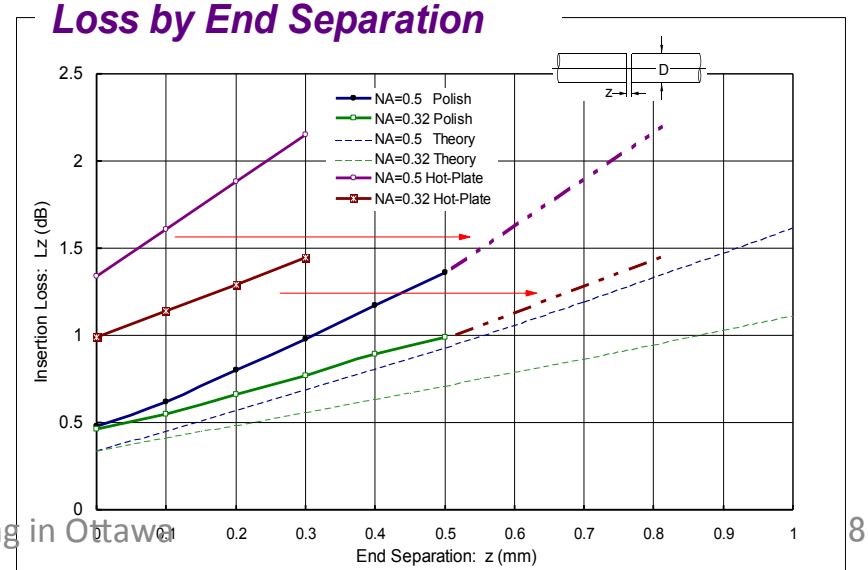
Fig. 8 Environmental Test Results

Source: AMP at IEEE 1394b

Loss by Lateral Offset



Loss by End Separation



POF Cable Plant Loss Budget of IEEE 1394b S100/S200

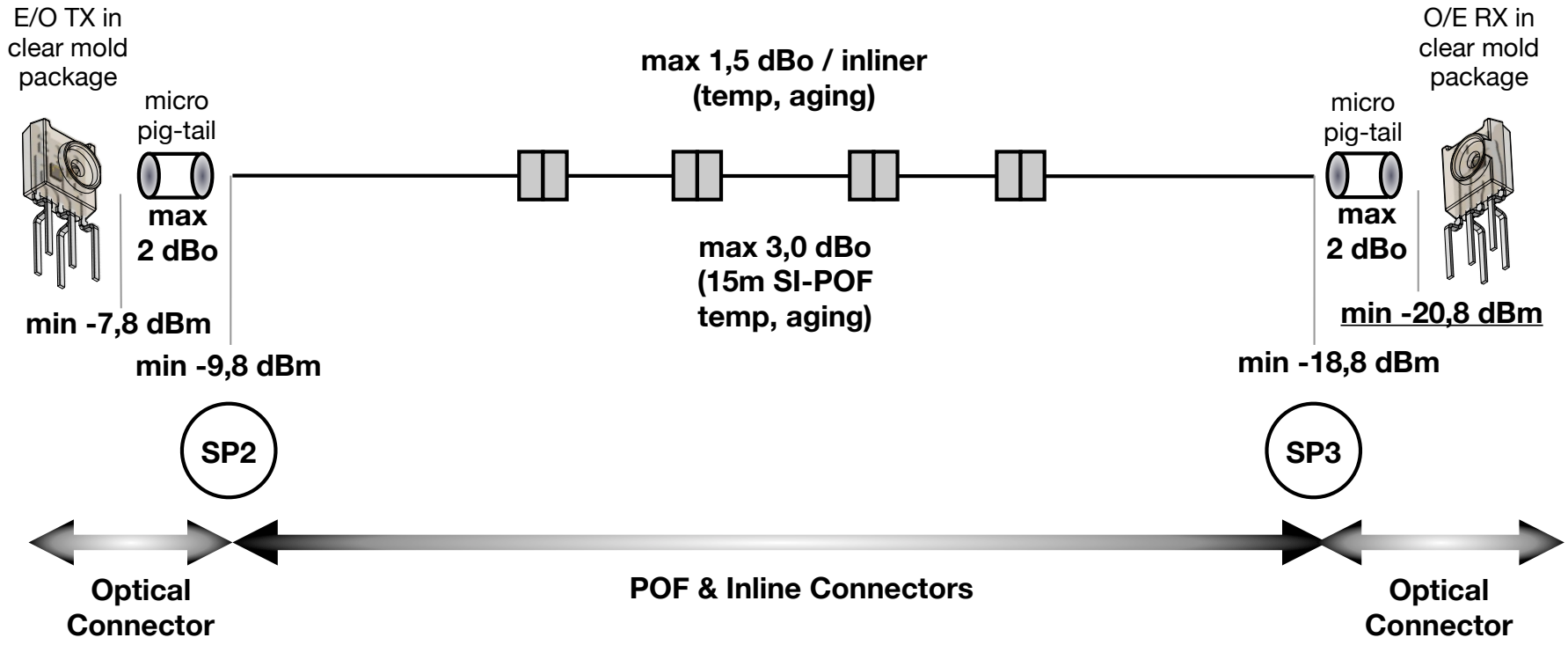
Transmission loss of 50 m POF (A4d) without connection

Loss factor	Typical (dB)	Worst (dB)	Condition
Base transmission loss	7.3	7.8	650nm, Launch NA=0.1
Environment	0	0.8	70 C, 95 %RH
Launch NA	0.2	0.5	0.2 < Launch NA <0.3
Spectrum of the light source	3.1	3.4	λp=660nm, FWHM=40nm
Macrobend loss	0	0.5	10 quarter bends, 25mmR
Total	10.6	13.0	

- Maximum POF Attenuation = 0.26 dB/m
- Maximum connection loss = 2.08 dB / connection

Transmission length is shortened 8 m a connection.

Automotive link budget: 15 meters + 4 inliners

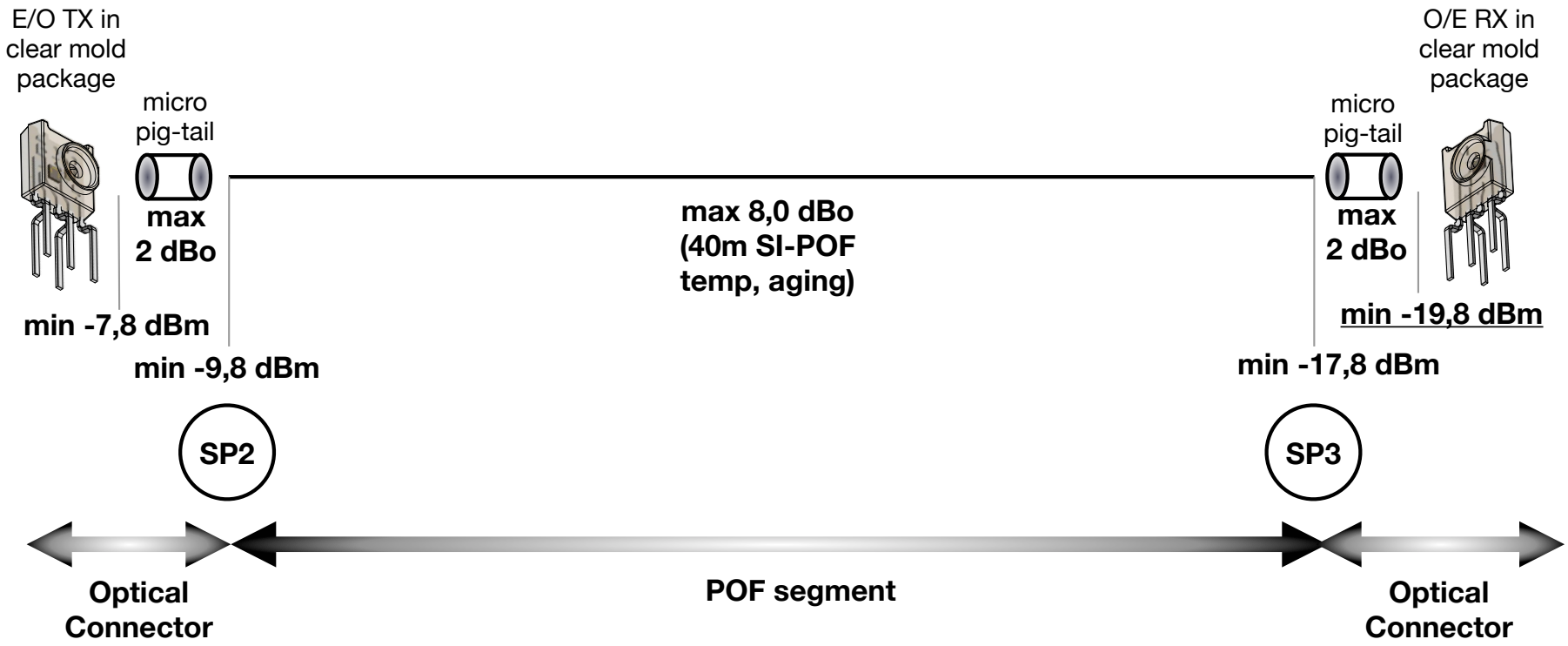


- Red LED: AOP max. 1,5 dBm, min -7,8 dBm in temperature range, aging and optical alignment tolerances. ER min. 8 dB, max 12 dB
- Fiber attenuation: max. 0,2 dBo/meter considering aging under EMD launching condition ➤ 3 dBo for 15 m
- Inliner attenuation: max. 1,5 dBo / inliner in temperature and aging ➤ max. 6 dBo for 4 inliners
- **RX sensitivity requirement for max. temperature and aging: -20,8 dBm**

- Worst case POF Attenuation = 0.26 dB/m => 3.9 dB
- Worst case connection loss = 2.08 dB / connection => 8.3 dB

Total => 12.2 dB

Automotive link budget: 40 meters

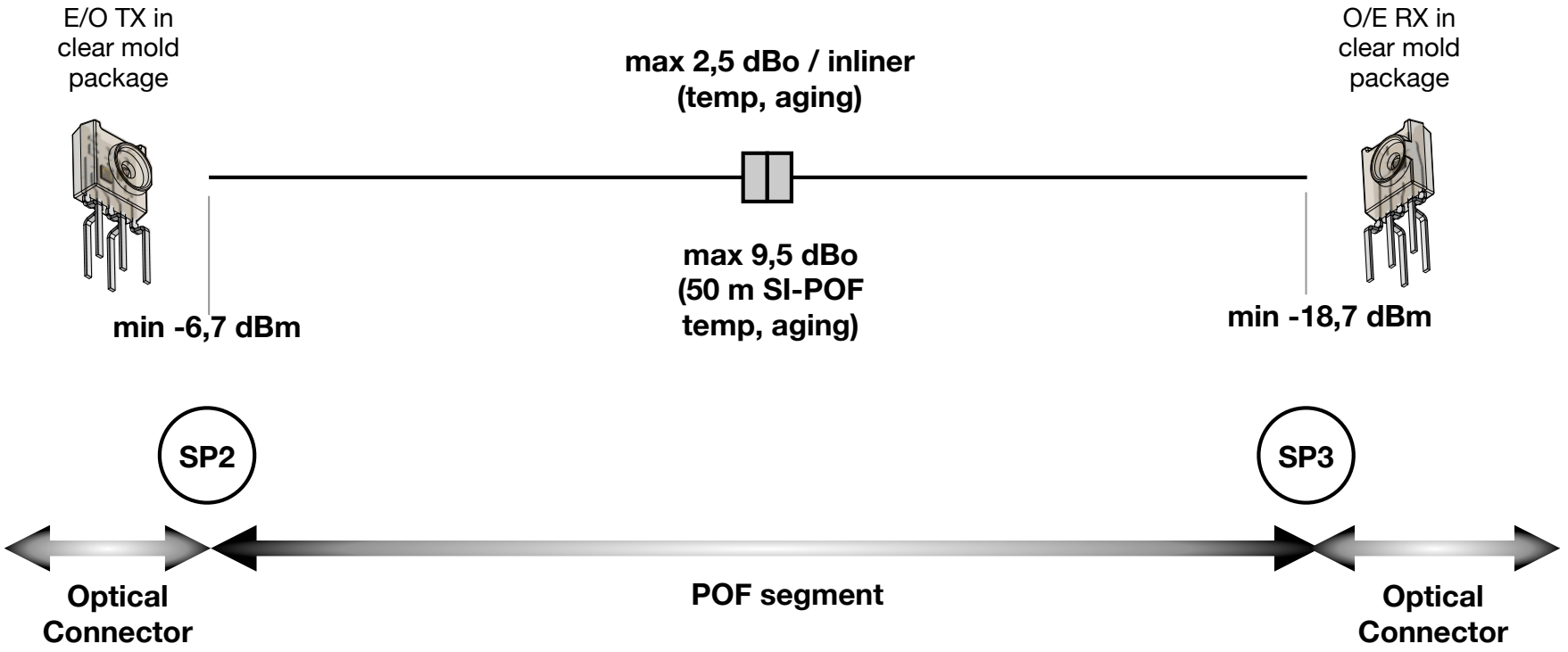


- Red LED: AOP max. 1,5 dBm, min -7,8 dBm in temperature range, aging and optical alignment tolerances. ER min. 8 dB, max 12 dB
- Fiber attenuation: max. 0,2 dBo/meter considering aging under EMD launching condition ➤ 8 dBo for 40 m
- **RX sensitivity requirement for max. temperature: -19,8 dBm**

- Maximum POF Attenuation = 0.26 dB/m => 10.4 dB
- Maximum connection loss = 2.08 dB / connection => 0.0 dB

Total => 10.4 dB

Consumer link budget: 50 meters



- Red LED: AOP max. -1 dBm, min -6,7 dBm in temperature range, aging and optical alignment tolerances. ER min. 8 dB, max 12 dB
- Fiber attenuation: max. 0,19 dBo/meter considering aging under EMD launching condition ➤ 9,5 dBo for 50 m
- Inliner attenuation: max. 2,5 dBo / low cost inliner in temperature and aging
- **RX sensitivity requirement for max. temperature: -18,7 dBm**

- Maximum POF Attenuation = 0.26 dB/m => 13.0 dB
- Maximum connection loss = 2.08 dB / connection => 2.1 dB

Total => 15.1 dB

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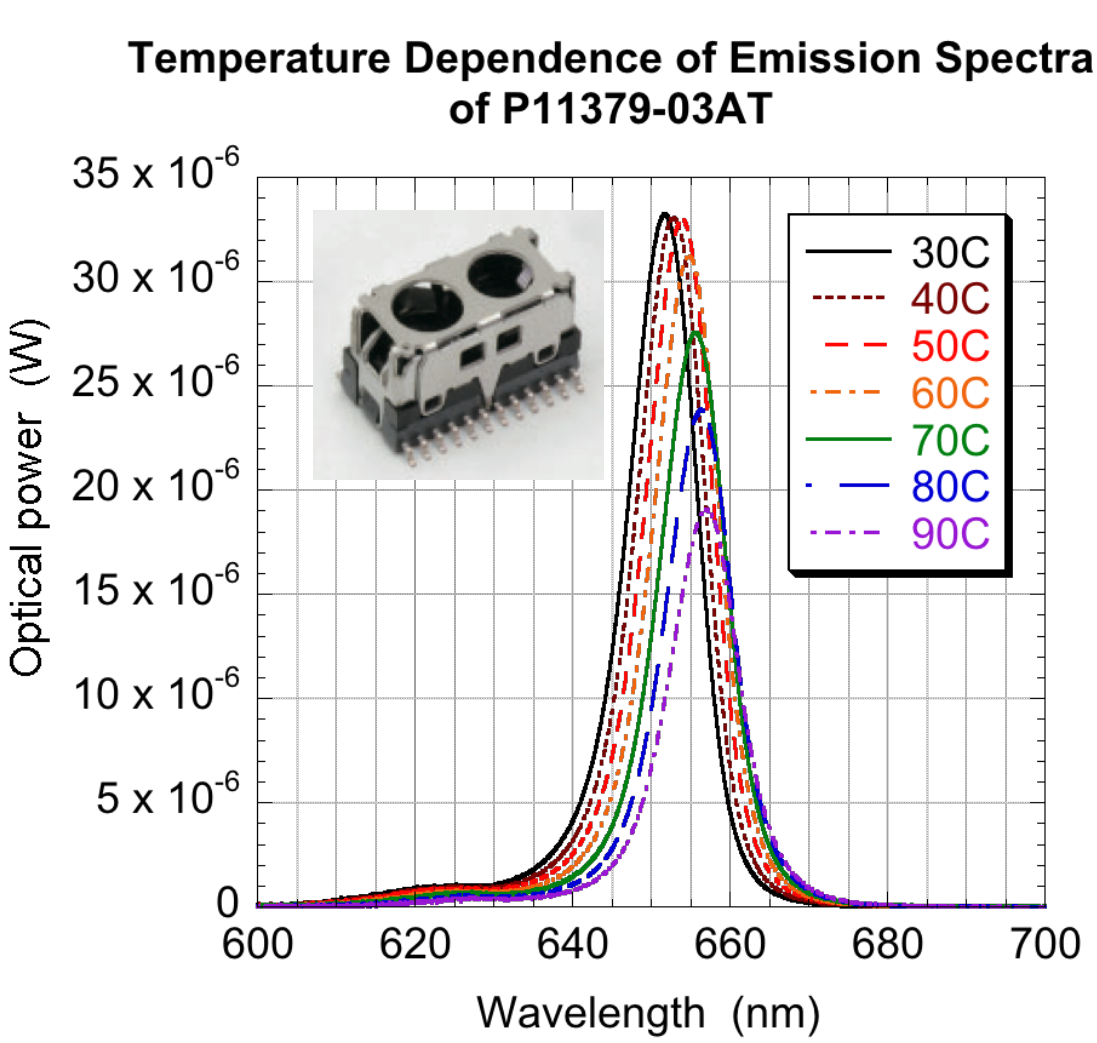
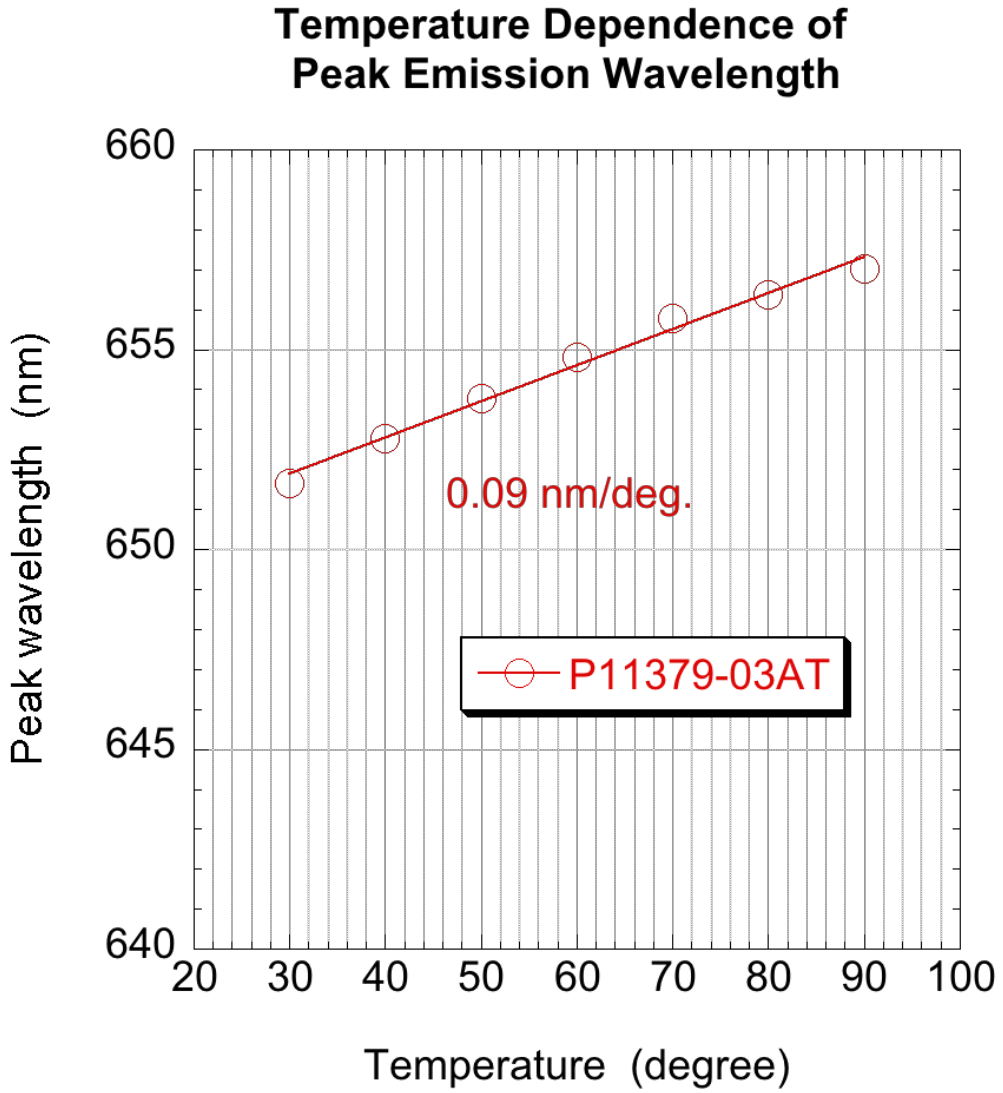
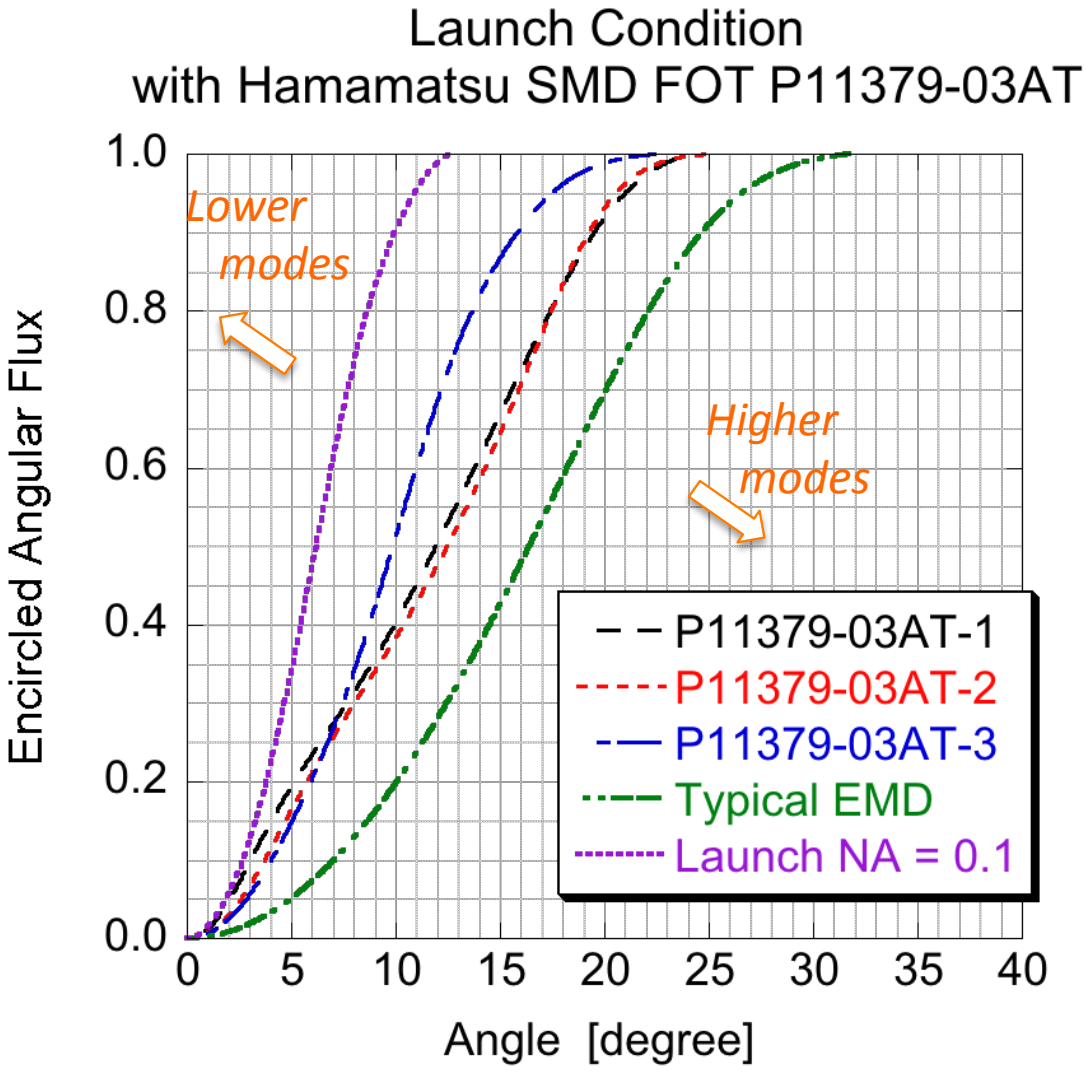
Temperature Dependence of Emission Spectrum of the Light Source





Launch Condition with FOT



Launch condition with Hamamatsu Photonics P11379-04AT is

- Higher than the L.C. for POF shipment inspection (Launch NA = 0.1)
- Lower than typical EMD of category A4a.2 POF

- I will continue evaluating
- I need AVAGO Tx

Thank you!