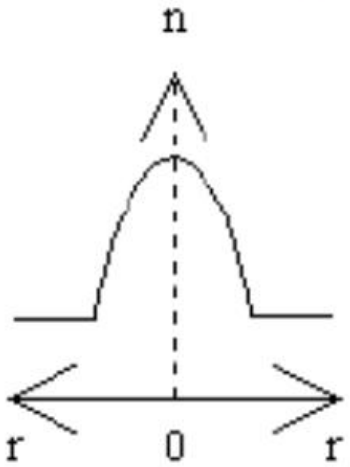
GI-POF for automobile

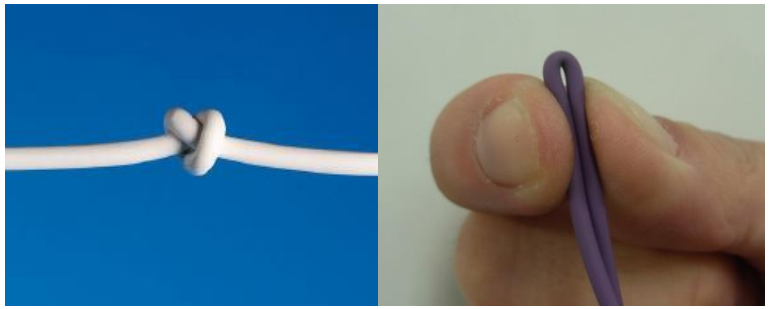
Yuji Watanabe , AGC Inc.

IEEE802.3dh Hybrid Plenary Meeting, July 2022

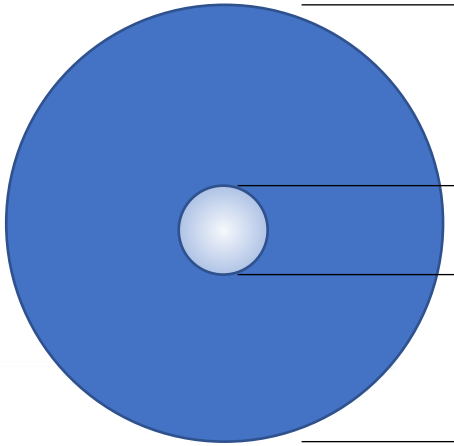
Structure of GI-POF

Index profile of core
(Graded index)





Robustness against tight bend

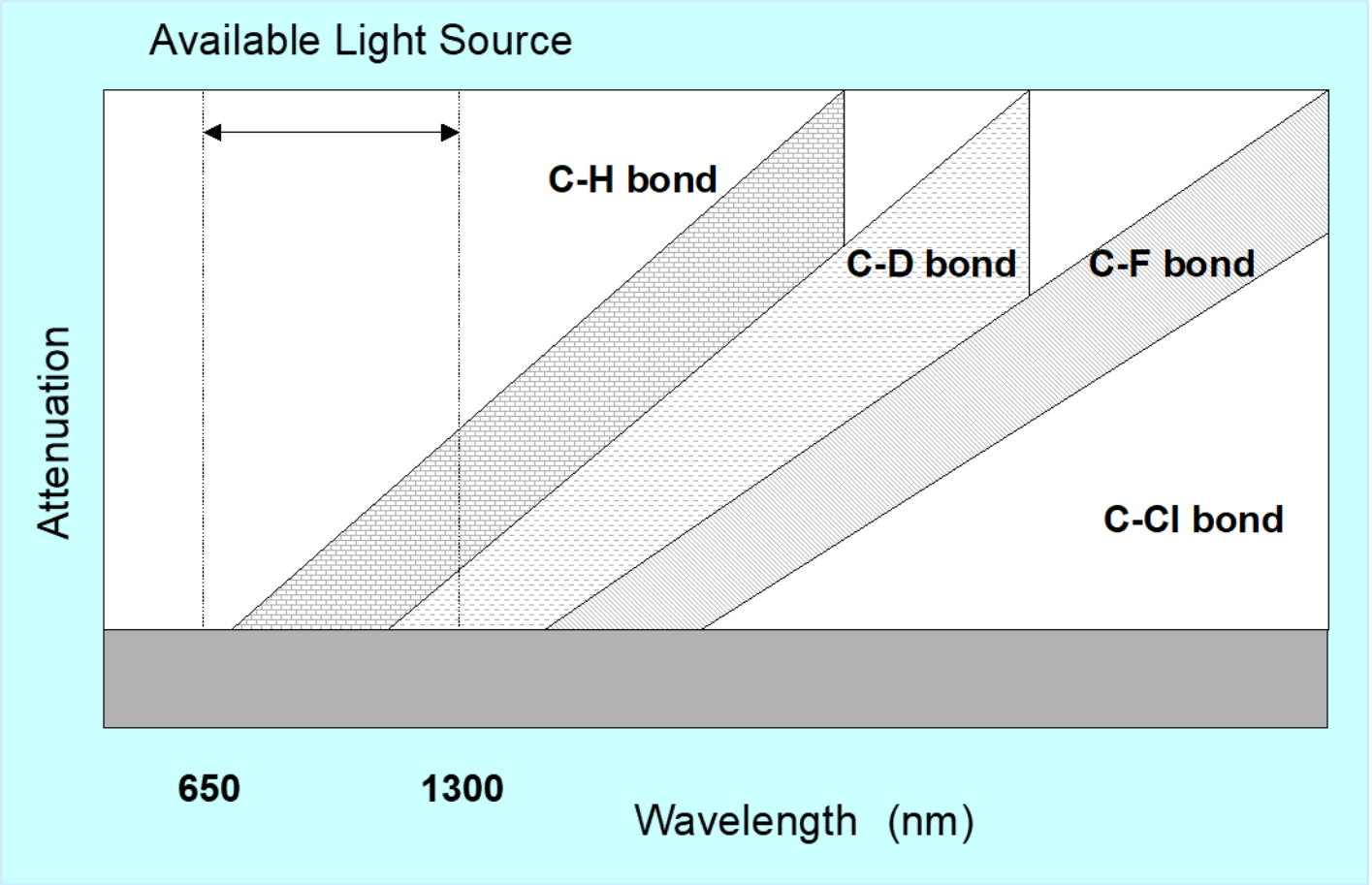


Core (55 μm)
Perfluorinated polymer

Reinforcement layer
(No need to remove)
490 μm

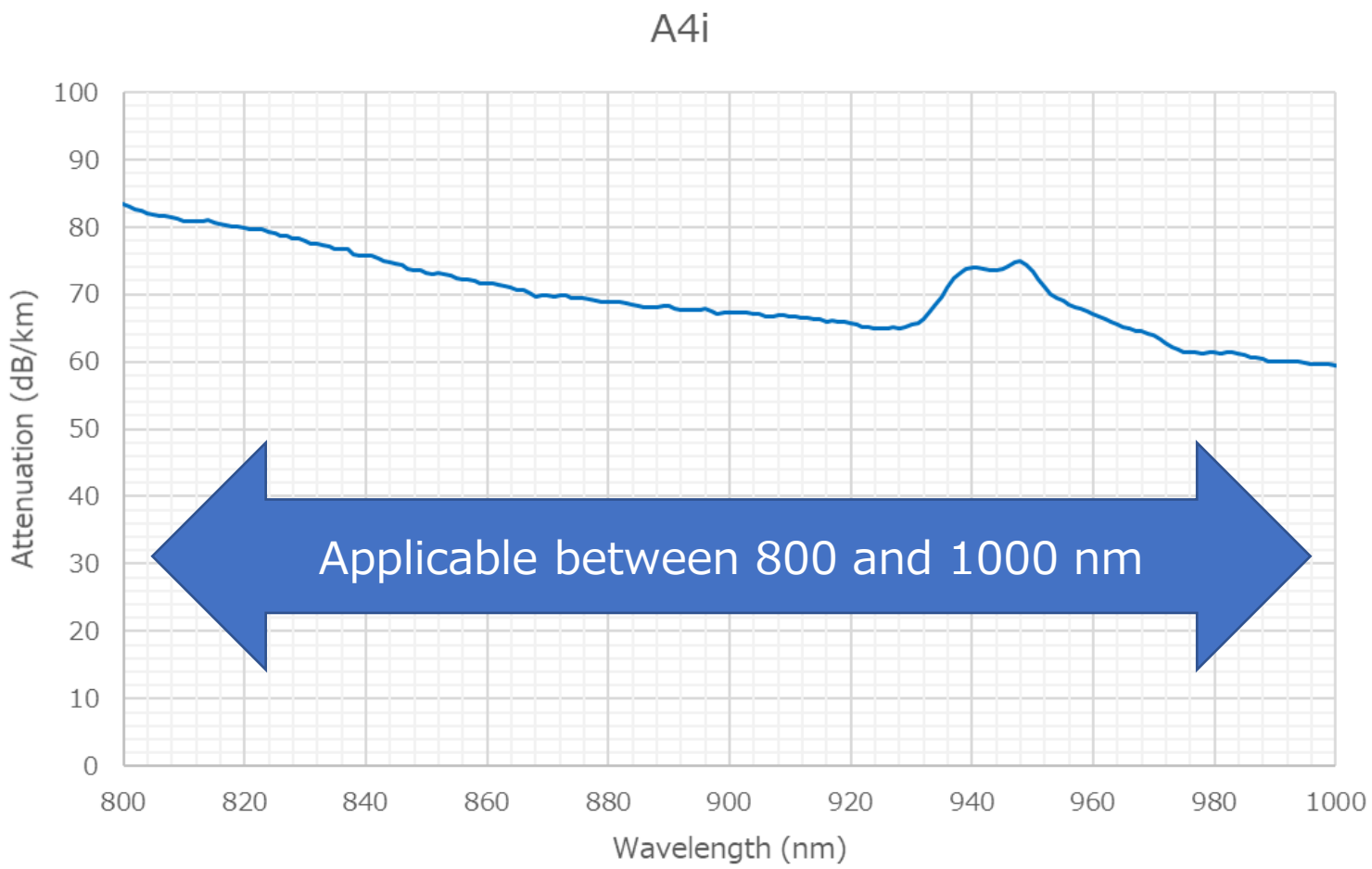
IEC 60793-2-40 A4i fiber

Light absorption by molecular bonds



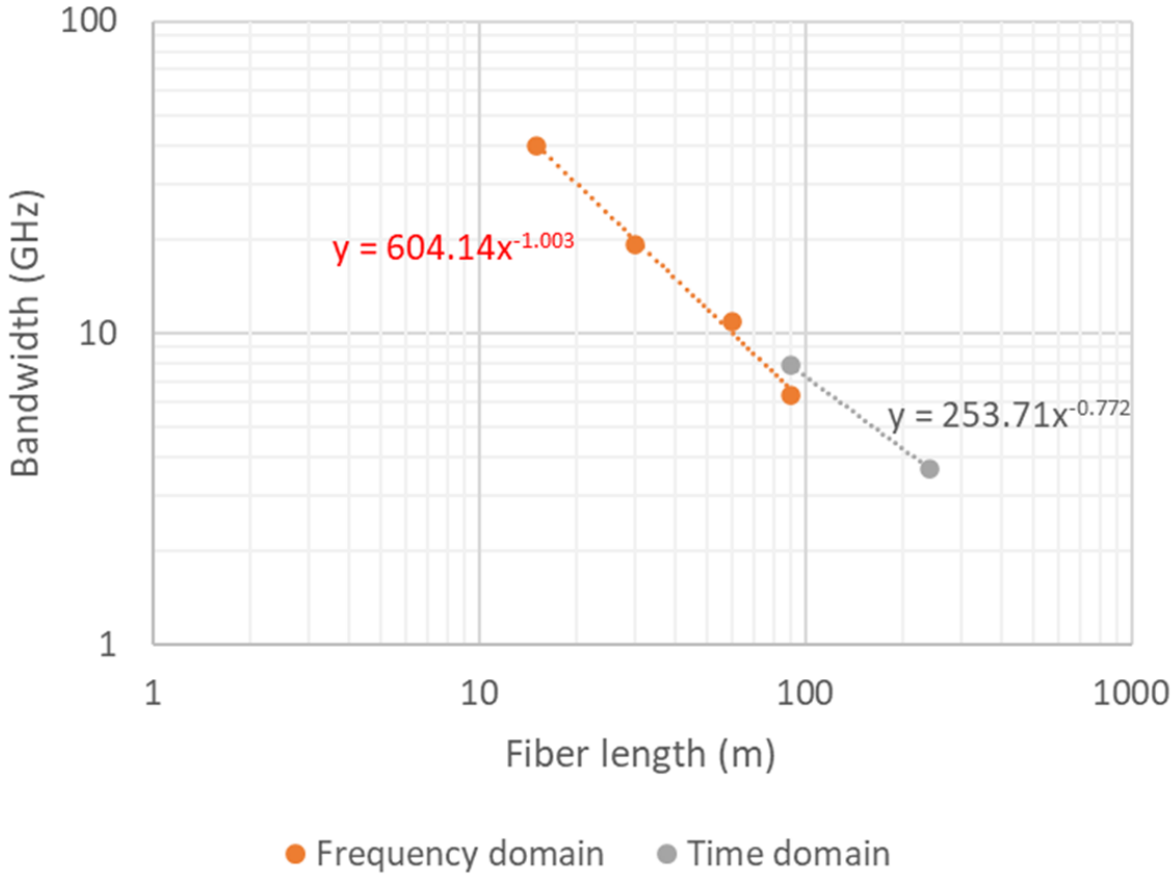
C-H (Carbon and Hydrogen) bond has high absorption for near infrared light.
Absorption of near infrared light can be reduced by replacing hydrogen with heavier molecules such as D (deuterium), F (Fluorine) and Cl (Chlorine).

Spectral attenuation of GI-POF(A4i)



Because perfluorinated polymer has no C-H bond, GI-POF (A4i fiber) has low attenuation between 800 and 1000 nm comparing to conventional SI-POF.
802.3cz PHY (980nm) and 850nm PHY is applicable with GI-POF.

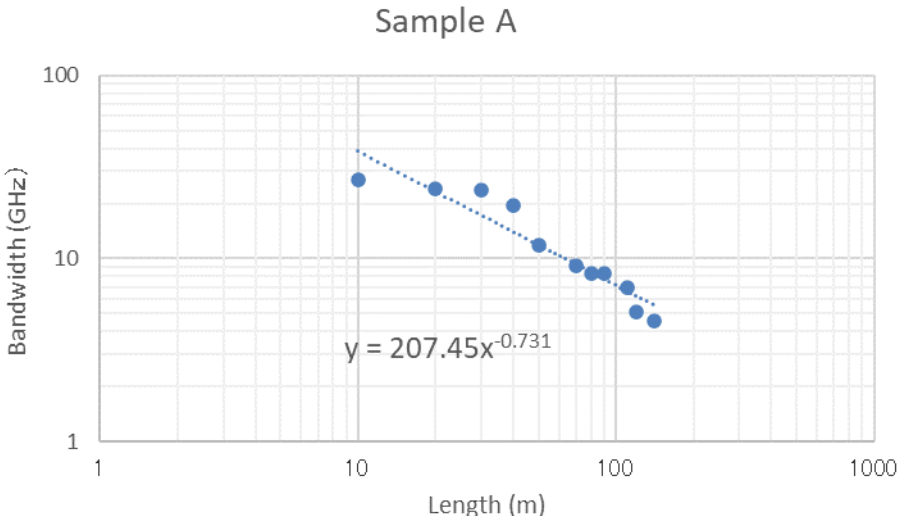
Bandwidth of A4i (1)

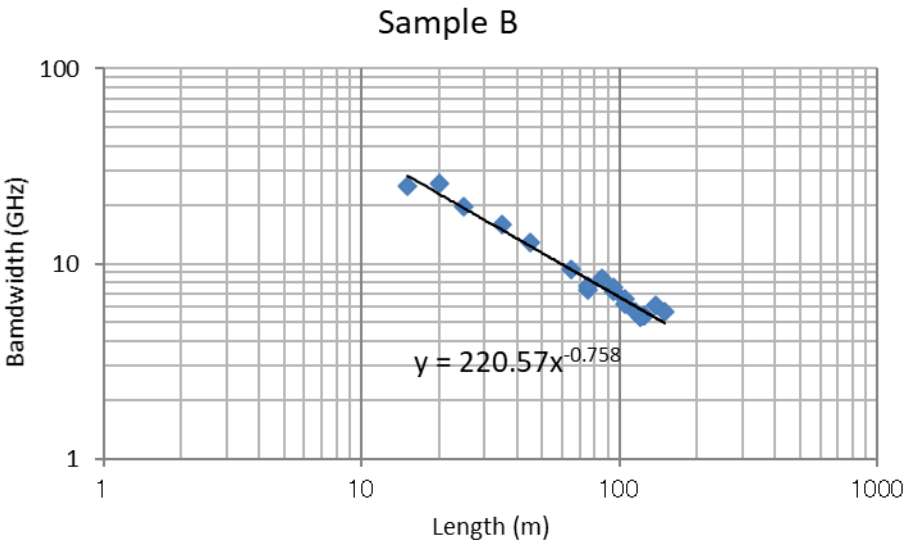


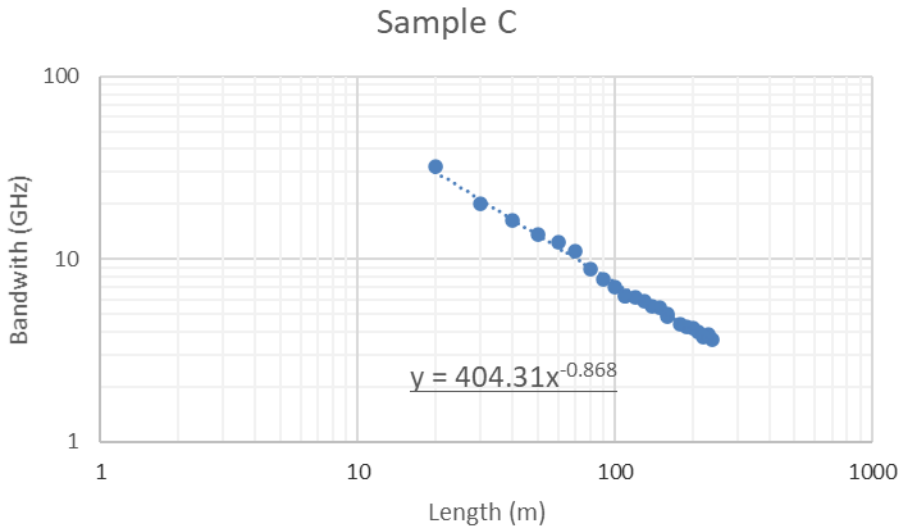
https://www.ieee802.org/3/cz/public/jan_2022/watanabe_3cz_01_0122_Bandwidth_gipof_short_length.pdf

Bandwidth measurement results for short GI-POF was reported at 802.3cz January 2022 virtual interim meeting.

Bandwidth of A4i (2)



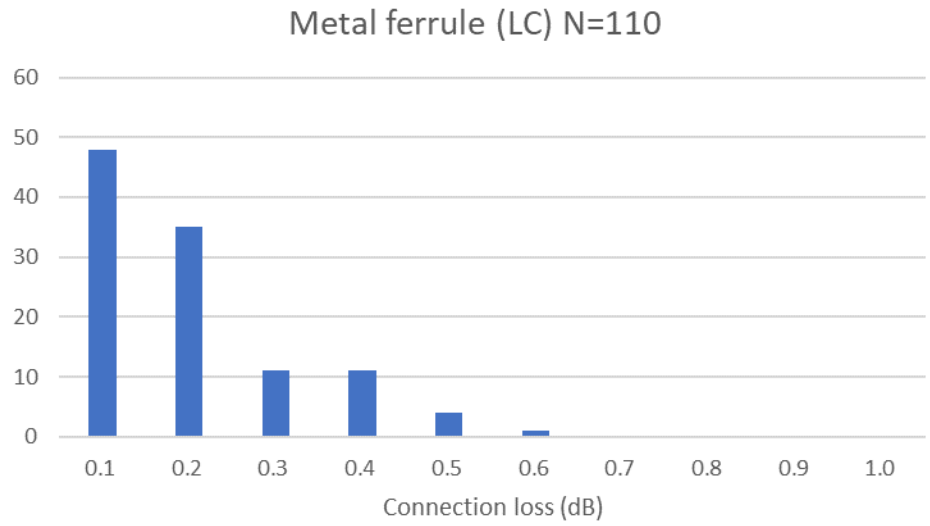


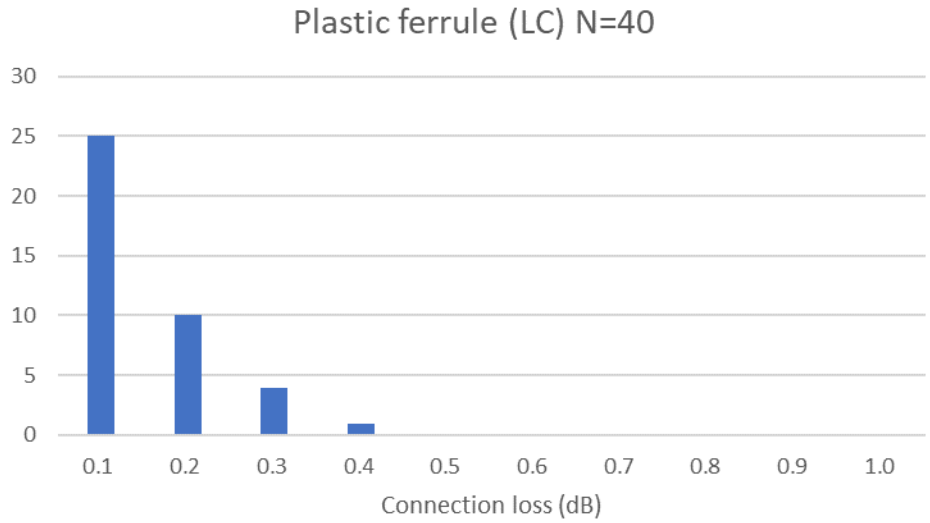


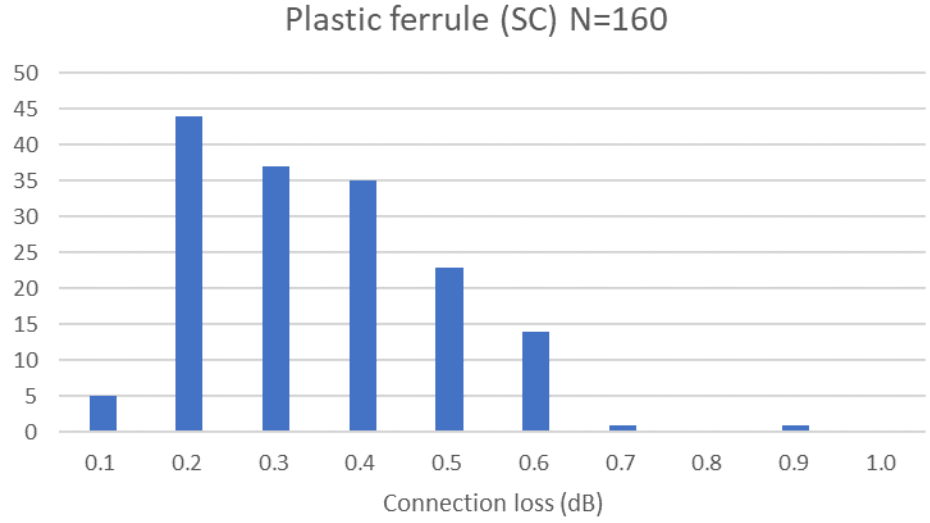
Measured by time domain method

Although GI-POF has high mode coupling, bandwidth of 20GHz over 15m can be achieved.

Connection loss for various ferrule types







Condition: Butt joint, Polished surface

	Metal ferrule (LC)	Plastic ferrule (LC)	Plastic ferrule (SC)
Average (dB)	0.152	0.112	0.309
σ	0.118	0.075	0.216
N	110	40	160

IS for POF (IEC60793-2-40)

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Revision of IEC60793-2-40

Sub-category	A4i (GI-POF)	A4j (New)
Core diameter (μm)	55 ±5	55 ±5
Cladding diameter (μm)	490 ±5	490 ±5
Numerical aperture Na ff *1	0.24 ± 0.025	0.24 ± 0.025
Operating wave-length(s) (nm)	850	850 - 980
Applications	Industrial data trans-mission	Automobile
*1Naff is numerical aperture measured by far field pattern method.		

Proposed transmission properties of A4j

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Attribute	Unit	Limit
Attenuation at 850 nm	dB/100 m	10
Minimum modal bandwidth at 850 nm	GHz over 15 m	20
Attenuation at 980 nm	dB/100 m	TBD
Minimum modal bandwidth at 980 nm	GHz over 15 m	TBD
Macrobending loss at 850 nm (10 turns around a 25 mm radius quarter circle)	dB	≤ 0,1
Zero dispersion wavelength, λ0	Nm	1 200 ≤ λ0 ≤ 1 650
Zero dispersion slope, S0	ps/(nm2 · km)	≤ 0,06

Summary

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- Comparing to conventional SI-POF, GI-POF has low attenuation in near infrared wavelengths due to utilizing perfluorinated polymer.
- 20GHz Bandwidth over 15 m is achievable for GI-POF
- Revision of IEC60793-2-40 to include automobile grade GI-POF have started at IEC/SC86A/WG1

Thank you for your attention.