

End Face Termination for Butt Coupling (GI-POF)

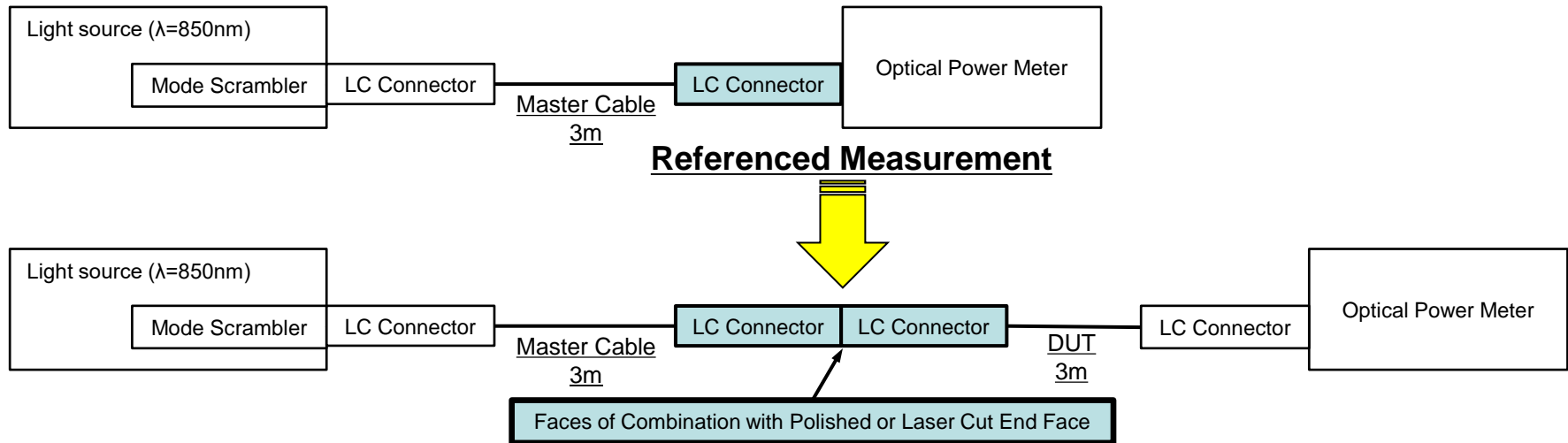
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Adamant Namiki Precision Jewel Co., Ltd.
29th Sept. 2020

IEEE P802.3cz Multi-Gigabit Optical
Automotive Ethernet Task Force

- Laser Cut Process
 - GI-POF
 - Connection Loss
 - Modal Dispersion
 - Eye Pattern and BER
 - End Face Shape
- Additional Evaluation from Sept. 15th
 - 15m / 4 inline connection
 - » Eye Pattern and BER
 - » Modal Dispersion

- GI-POF
 - In this presentation, I evaluated with typical Graded Index (e.g. 50 micron core) plastic optical fiber.
 - Prepared the End Faces Combination of Optical Cables with LC Connector (3m)
 - #1 Polished and Polished
 - #2 Polished and **Laser Cut**
 - #3 **Laser Cut** and **Laser Cut**

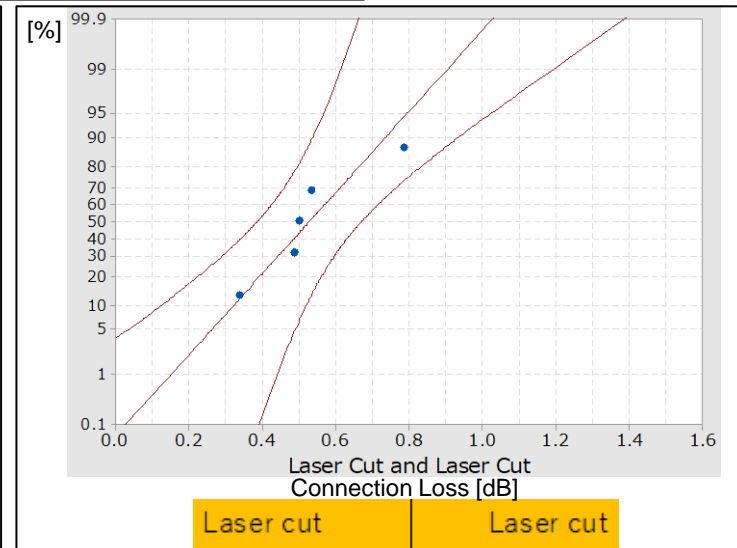
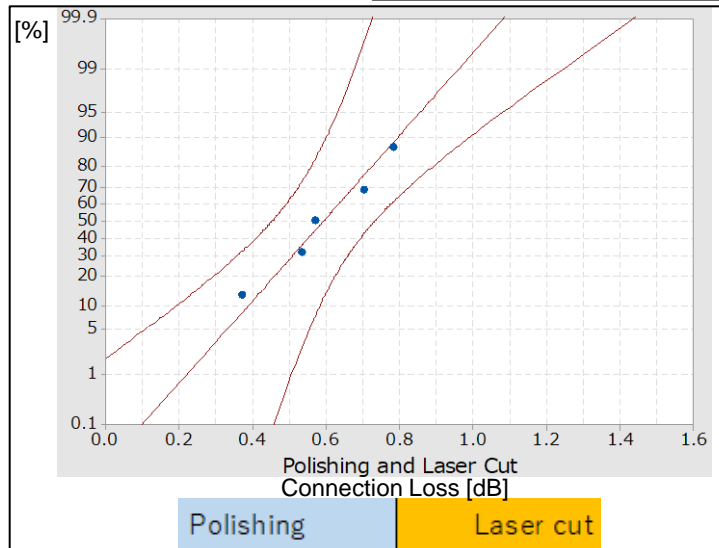
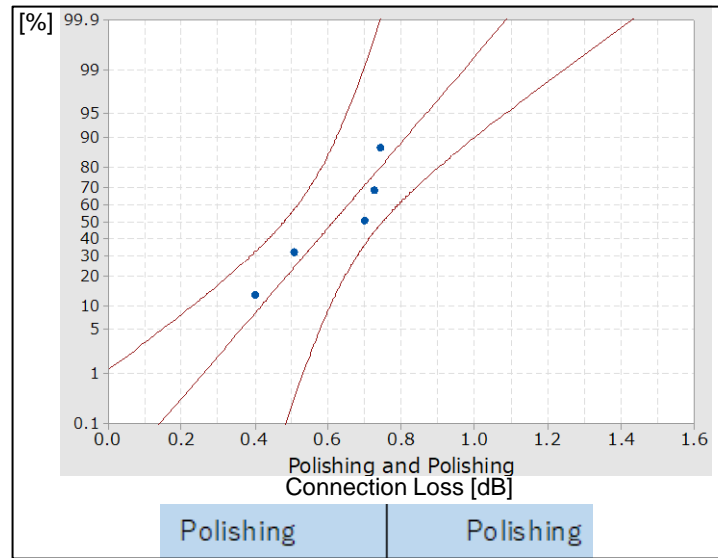
GI-POF Connection Measurement



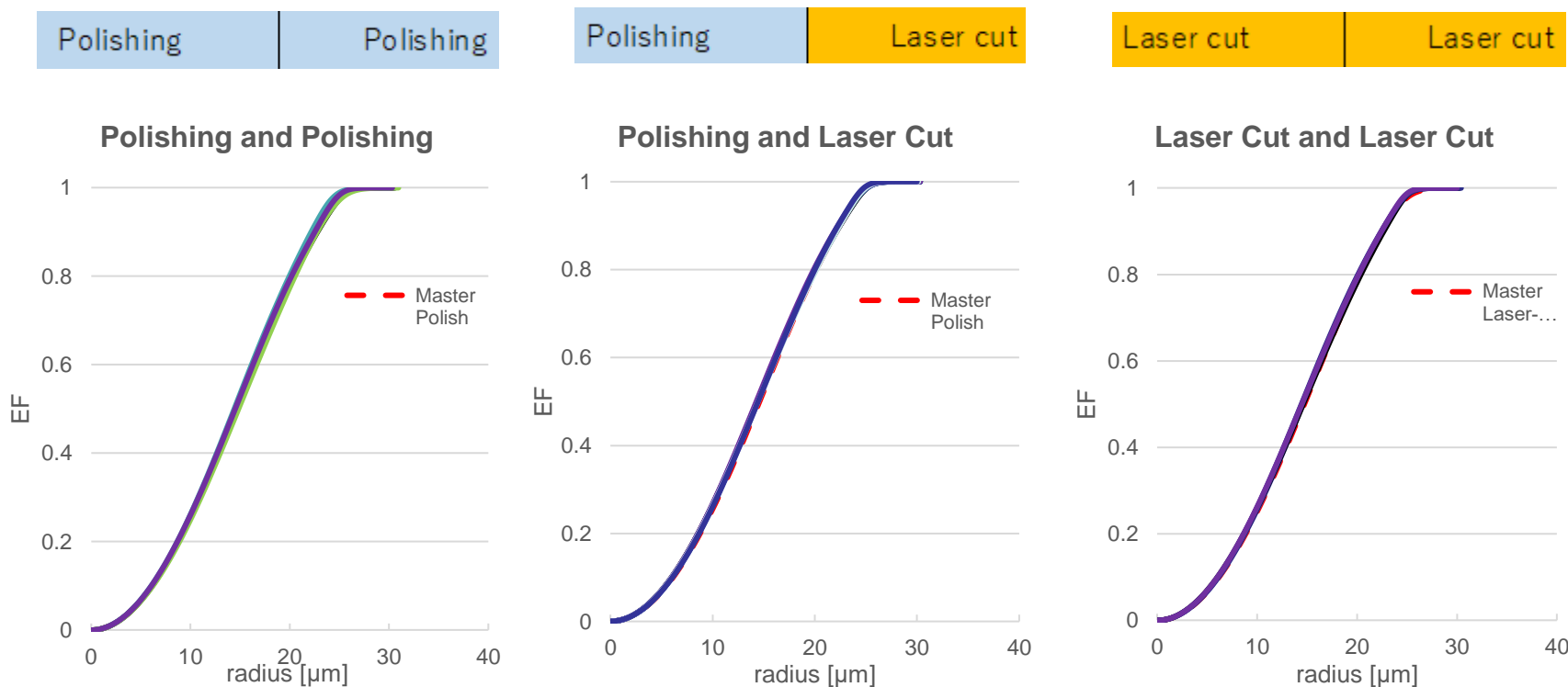
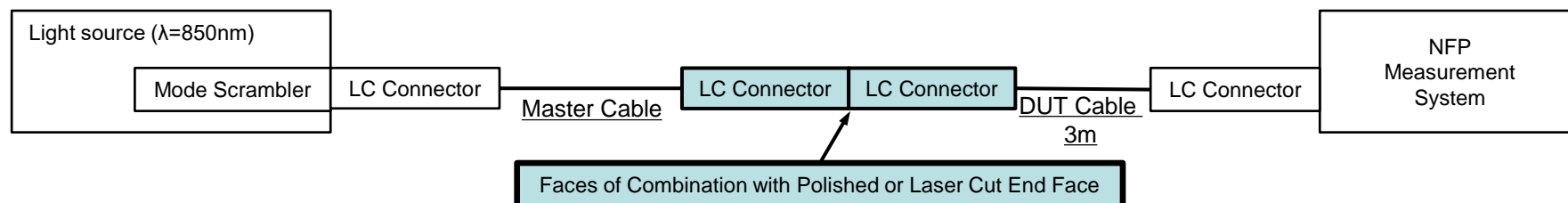
Actual Connection Measurement						
Fiber Type	Side of Master	Side of DUT	Connection	Max.	Min.	Ave.
	End face processing	End face processing	Loss [dB]	[dB]	[dB]	[dB]
GI-POF	Polishing	Polishing	0.725	0.741	0.397	0.613
			0.397			
			0.697			
			0.741			
			0.505			
	Polishing	Laser cut	0.702	0.781	0.370	0.590
			0.370			
			0.530			
			0.781			
			0.569			
	Laser cut	Laser cut	0.335	0.783	0.335	0.526
			0.497			
			0.783			
			0.486			
			0.531			

Probability Plot of Connection Loss

- 95% CI, (Confidence Interval)
 - Normal distribution [Upper/Lower] Fitted line



NFP: Near Field Pattern, Measurement (EF: Encircled Flux, Results)

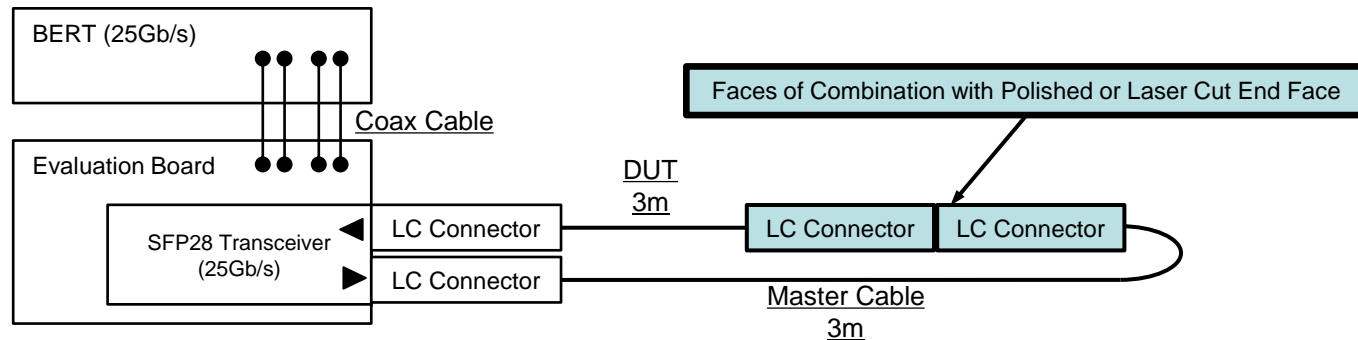


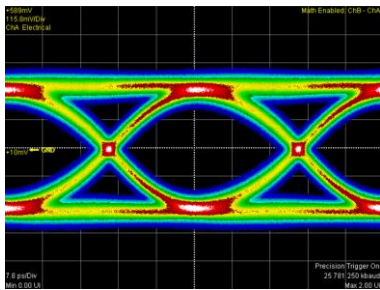
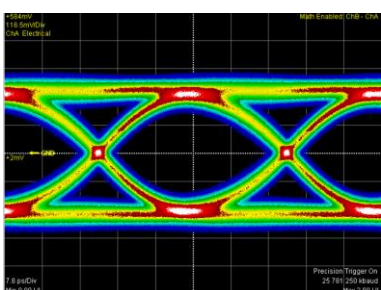
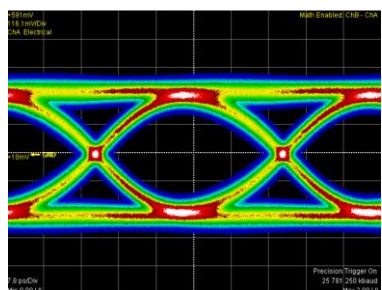
- Evaluation with SFP28(25GBASE-SR) Transceiver

Bit Rate : 25.78Gb/s

BER (Bit rate Error Ratio) : 10^{-12}

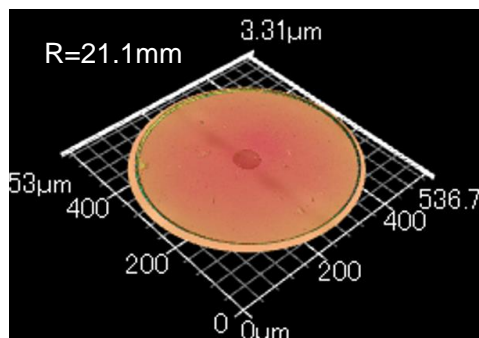
Data Pattern : PRBS2³¹-1



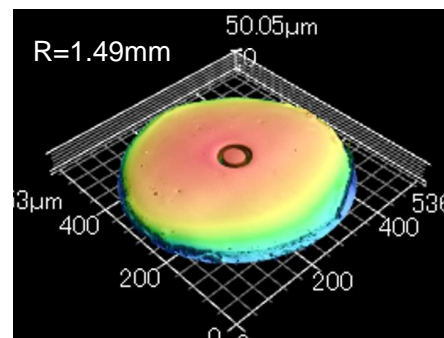
GI-POF Eye Pattern Measurement and BER Results			
End Face Combination	Polished and Polished	Polished and Laser Cut	Laser Cut and Laser Cut
*Eye Pattern			
*BER	10^{-12} [Error Free]	10^{-12} [Error Free]	10^{-12} [Error Free]

*Ambient Temperature = 25 deg. C. (Room Temp.)

- Measurement on 3D Laser Scanning Confocal Microscope



GI-POF
Polished Fiber End Face



GI-POF
Laser Cut Fiber End Face

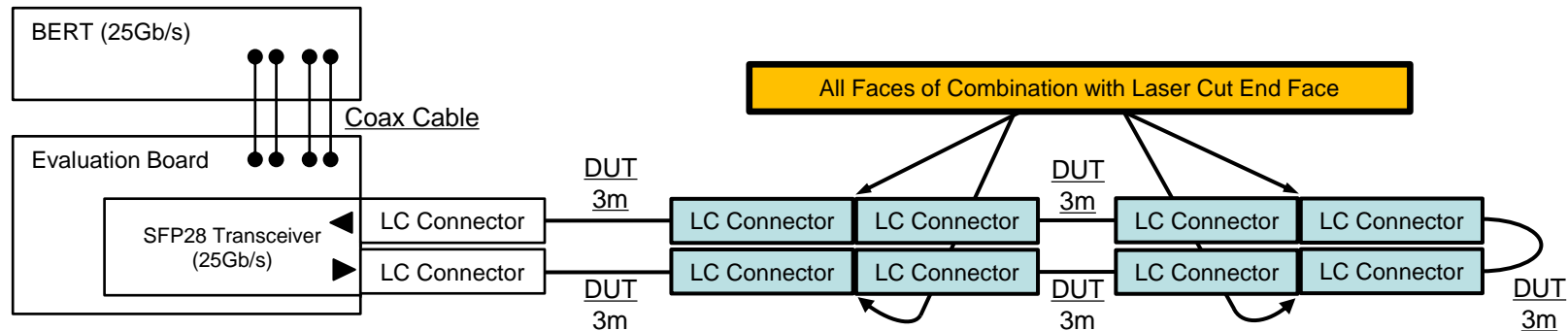
Additional Evaluation from Sept. 15th

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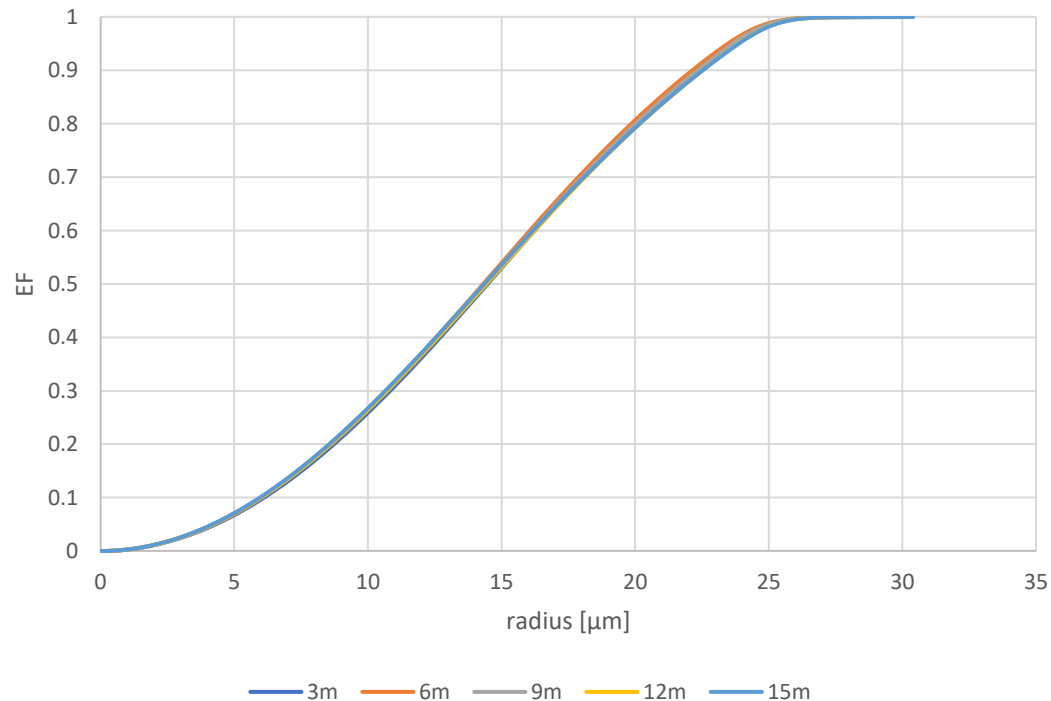


GI-POF Eye Pattern Measurement and BER Results with Laser Cut End Face Combination

Number of Connection(s)	0	1	2	3	4
Length	3m	6m	9m	12m	15m
*Eye Pattern					
*BER	10^{-12} [Error Free]	10^{-12} [Error Free]	10^{-12} [Error Free]	10^{-12} [Error Free]	10^{-12} [Error Free]
*Connection Loss [dB]	0** [**Origin of measurement]	0.226	0.337	0.504	0.791

*Ambient Temperature = 25 deg. C. (Room Temp.)

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- I evaluated laser cut process for GI-POF
 - Laser cut process had successful with GI-POF
 - The connection loss probability plot are shown under 1.5dB with 95% CI, (Confidence Interval)
 - The modal dispersion is similar as usual polishing end-face combination and stable until 15m / 4 inline.
 - The eye pattern and BER looks good with 15m / 4 inline connection.
 - The end face shape could modified and improve with laser cut process.
- So, I confidence the laser cut process is even practical for automotive applications.

Thank you!