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Power Budget Confirmation

January, 2015
Yazaki Corporation
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1. Briefing

O-GEAR performed the test to determine the target of power budget allocation.

< Results >

- **Launch Power at TP2: -2.6dBm (average)**
- **Gigabit Ethernet communication was confirmed to be successful at room temperature.**
- **Launch Power at TP3 as follows:**
  15m with 4 inline connectors: -13.1 to -13.8dBm
  40m without inline connector : -11.6 to -12.2dBm
- **Central Wavelength of LED: 649.3nm (average)**

< Next Step >

Confirm whether the communication is successful or not when testing with the change of ambient temperature.

*** O-GEAR: Optical Gigabit Ethernet for Automotive aRchitecture**

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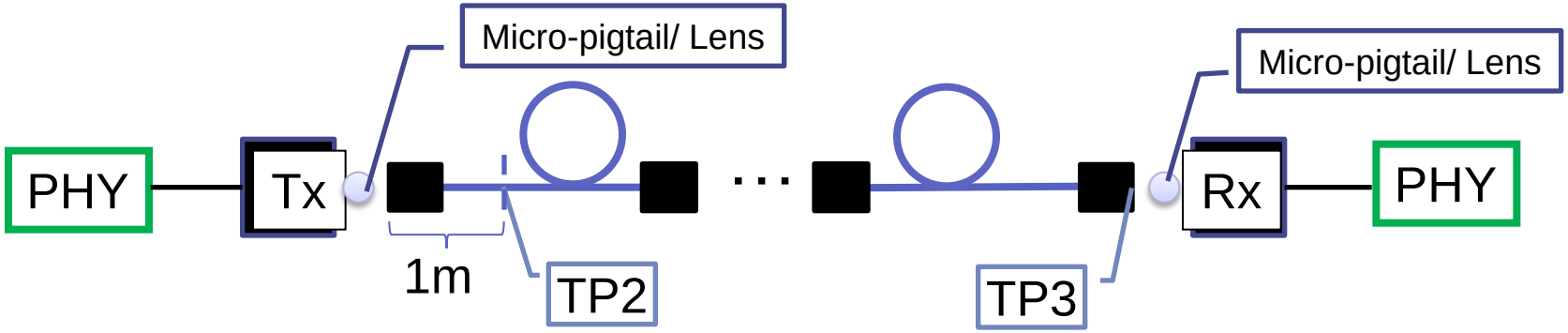
2. Definition of the power budget and test points



- **Allocated multi-valued systems for optical communications and set the test points as described above .**
- **Tested the launch power for each TP2 and TP3 and also the communication in the entire system to see the feasibility of current multi-valued system for optical communications.**
  TP2：Launch Power with 1m POF（including coupling loss for Tx connector）
  TP3：Launch Power with 15m POF with 4 inline connectors and 40m without inline connector（including coupling loss for Tx connector）

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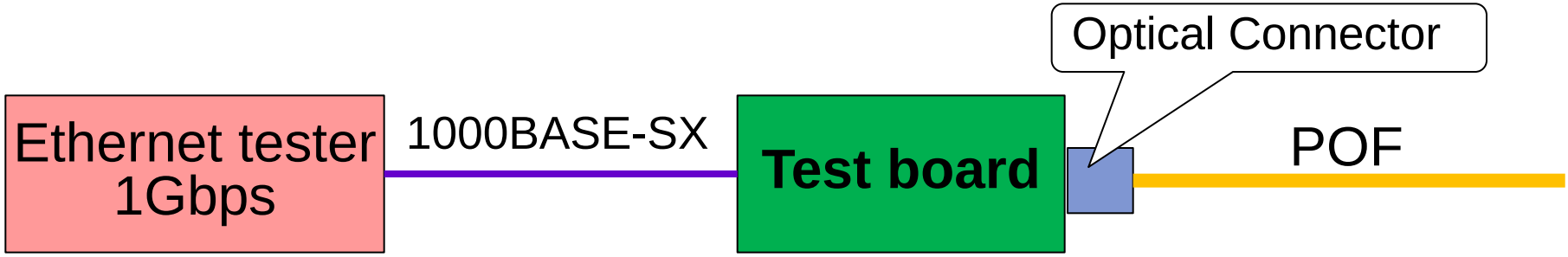
3. Measurement Conditions

Measuring Equipment:

- Test Board：Test Board PHY:KD-1012 (KDPOF)
- Optical Connector: X41281-P902 (YAZAKI)
- POF：GHAN – 4001 (Mitsubishi Rayon)
- Ethernet Tester：AccessOne FE/GbE L2 TESTER 1070A (NEC Networks & System Integration)
- Optical Power Meter：205A (Photom)
- Attenuator: OVR-660-FC (Fujitok)
- Optical Spectrum Analyzer: AQ-6315A (ANDO)



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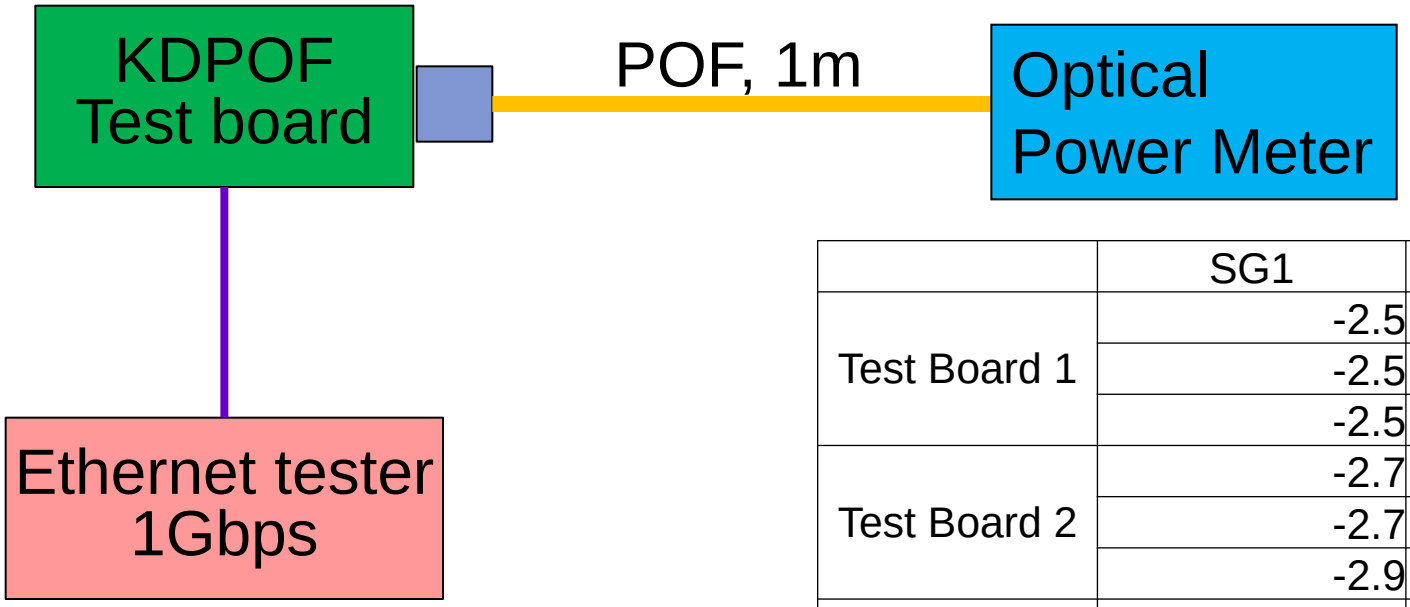
4. Test Result of TP2

Test Setup



Unit: dBm

	SG1	SG2
Test Board 1	-2.5	-2.4
	-2.5	-2.5
	-2.5	-2.5
Test Board 2	-2.7	-2.8
	-2.7	-2.9
	-2.9	-2.7
Test Board 3	-2.3	-2.7
	-2.4	-2.8
	-2.5	-2.9
Test Board 4	-2.5	-2.5
	-2.6	-2.6
	-2.7	-2.7
Ave	-2.6	-2.7
Min	-2.9	-2.9
Max	-2.3	-2.4
Ave	-2.6	

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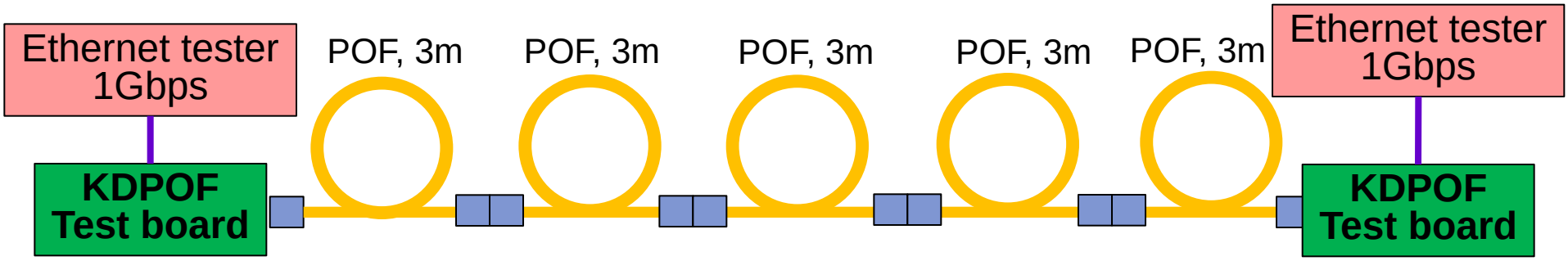
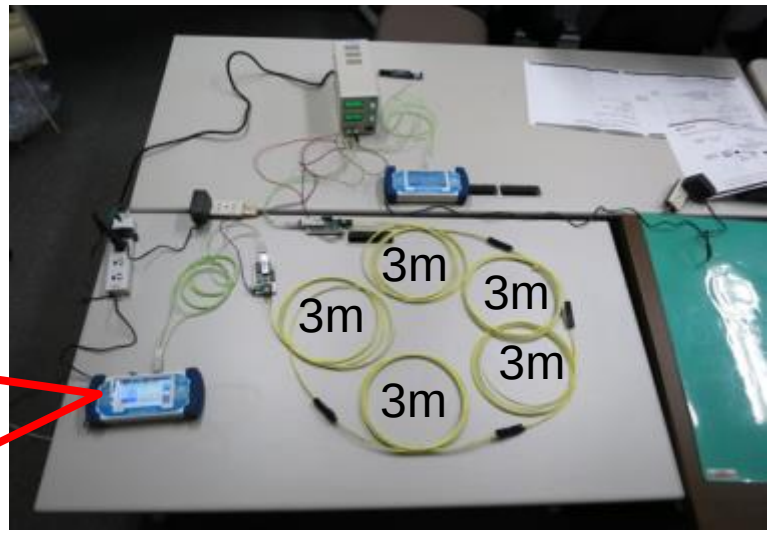
5. Communication Test (15m with4 inline connectors)

Test Setup





Communication : Good

TP3: -13.1 to -13.8 dBm

(n=4)

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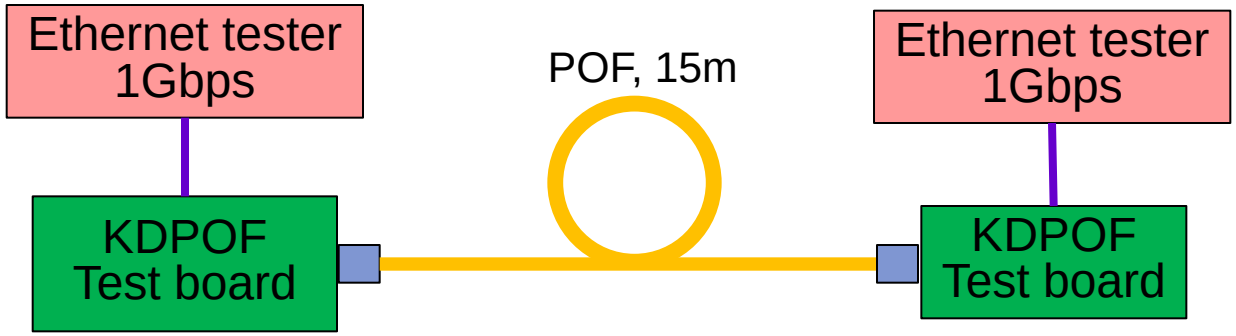
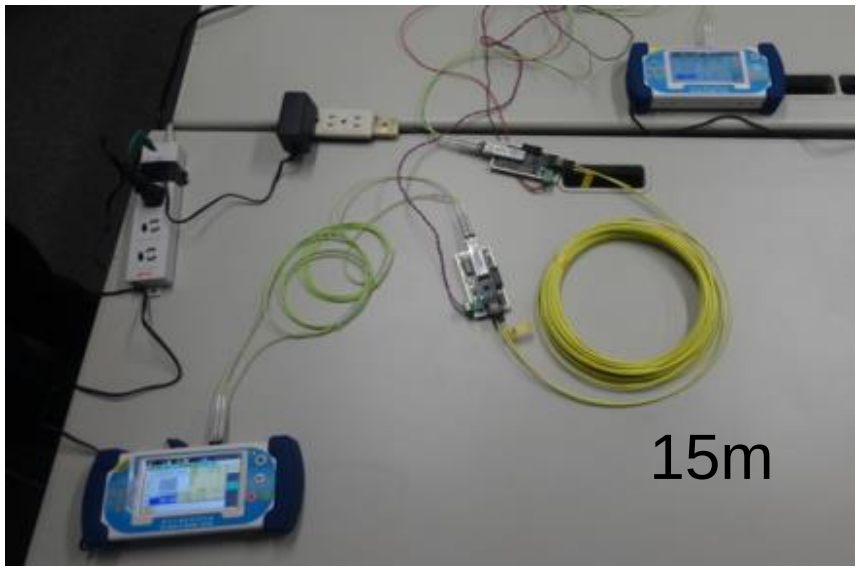
6. Communication Test (15m without inline connectors)

Test Setup





Communication : Good
TP3: -6.9 to -7.6 dBm
(n=4)

<Predict the transmission loss of POF by the replacement method>
Since TP2 is -2.6 dBm, the POF attenuation will be 0.30 to 0.35 dB/m.
{(-2.6) - (-7.6)} / (15-1) = **0.35 dB/m**, {(-2.6) - (-6.9)} / (15-1) = **0.30 dB/m**

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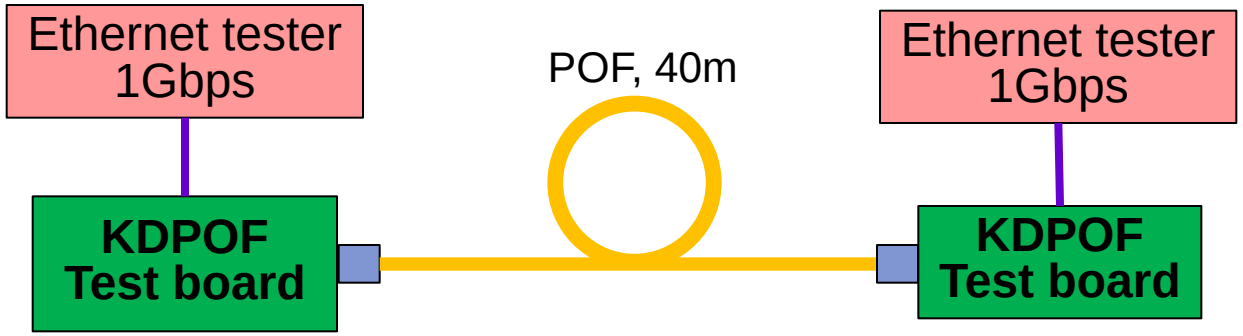
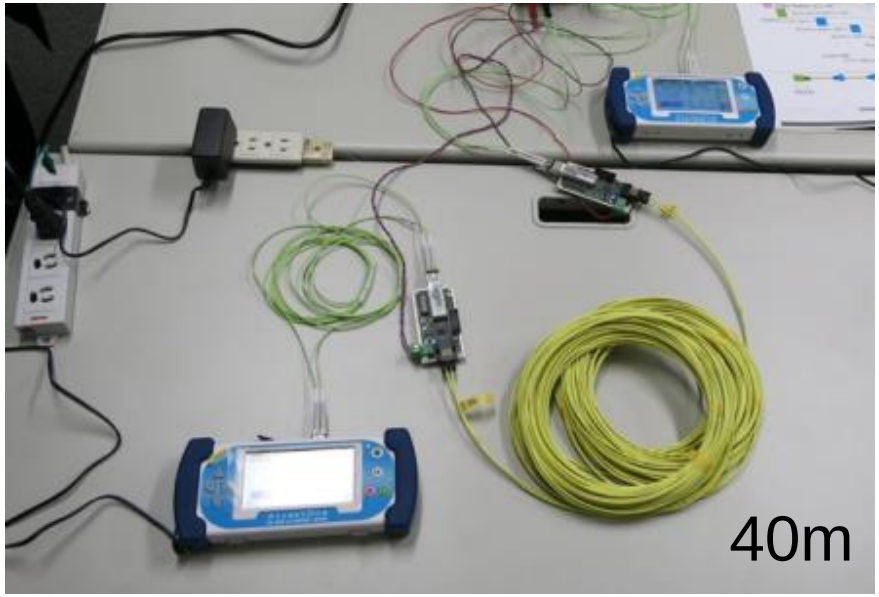
7. Communication Test (40m without inline connectors)

Test Setup





Communication : Good
TP3: -11.6 to -12.2 dBm
(n=4)

<Predict the transmission loss of POF by the replacement method>
Since TP2 is -2.6 dBm, the POF attenuation will be 0.23 to 0.25 dB/m.
{(-2.6) - (-11.6)} / (40-1) = **0.23 dB/m**, {(-2.6) - (-12.2)} / (40-1) = **0.25 dB/m**

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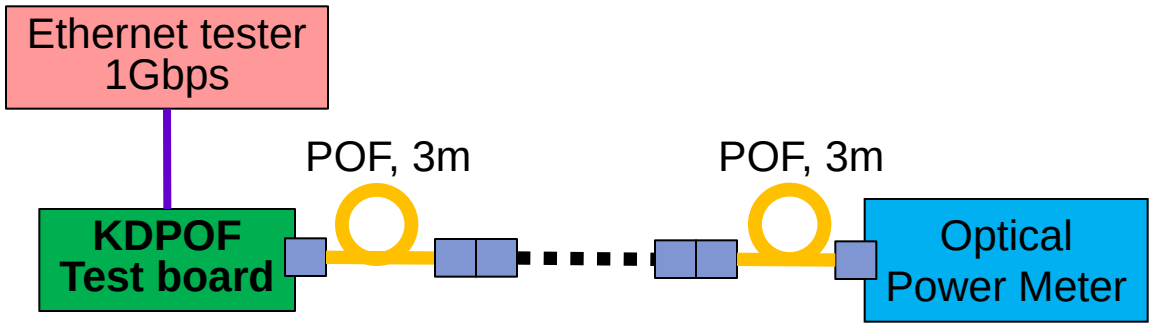
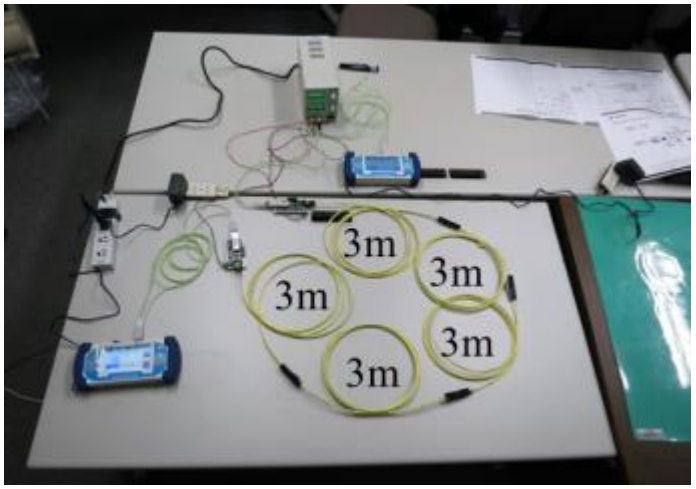
8. Inline Connector Measurement

Test Setup





<Procedure>

Measure the optical power by increasing the number of 3m POF cable up to 5 pieces

	SG #1			SG #2			Ave dB	ΔAverage
	dBm	dBm	dBm	dBm	dBm	dBm	dB	dB
15m w/ 4 inlines	-14.3	-14.2	-14.3	-13.7	-13.8	-13.8	-14.0	2.1
12m w/ 3 inlines	-12.2	-12.1	-12.0	-11.8	-11.9	-11.8	-12.0	2.5
9m w/ 2 inlines	-9.4	-9.4	-9.4	-9.5	-9.5	-9.5	-9.5	2.4
6m w/ 1 inline	-7.0	-7.1	-7.1	-7.1	-7.0	-7.1	-7.1	2.6
3m w/o inline	-4.5	-4.4	-4.4	-	-	-	-4.4	

<Predict inline connector loss>

The above ΔAve values indicate inline coupling loss with 3mPOF attenuation

Given that 1dB of POF transmission loss, the inline connector loss will be from **1.1dB to 1.6 dB**

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9. Test Result of λ at TP2

Test Setup

	λc	Δλ
	Nm	nm
Test board 1	649.3	25.434
Test board 2	650.0	27.086
Test board 3	649.3	29.774
Test board 4	648.7	25.738
Ave	**649.3**	27.0

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10.Summary

The test results of communication show as follows:

	TP2	TP3	Comm.
1m w/o inline conn.	-2.6dBm	-	-
15m w/o inline conn.	-	-6.9 to -7.6 dBm	Good
15m w/ 4 inline conn.	-	-13.1 to -13.8 dBm	Good
40m w/o inline conn.	-	-11.6 to -12.2 dBm	Good

Transmission Loss:0.30 to 0.35dB/m（at 15m）
0.23 to 0.25dB/m（at 40m）
Inline Connector Loss: 1.37 to 1.75dB/pcs

Next Step:

- **Confirm whether the communication is successful or not when testing with the change of ambient temperature.**

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Thank you