



Power Budget Confirmation

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■ Agenda

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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**
- **Peak Wavelength of LED: 649.3nm (average)**

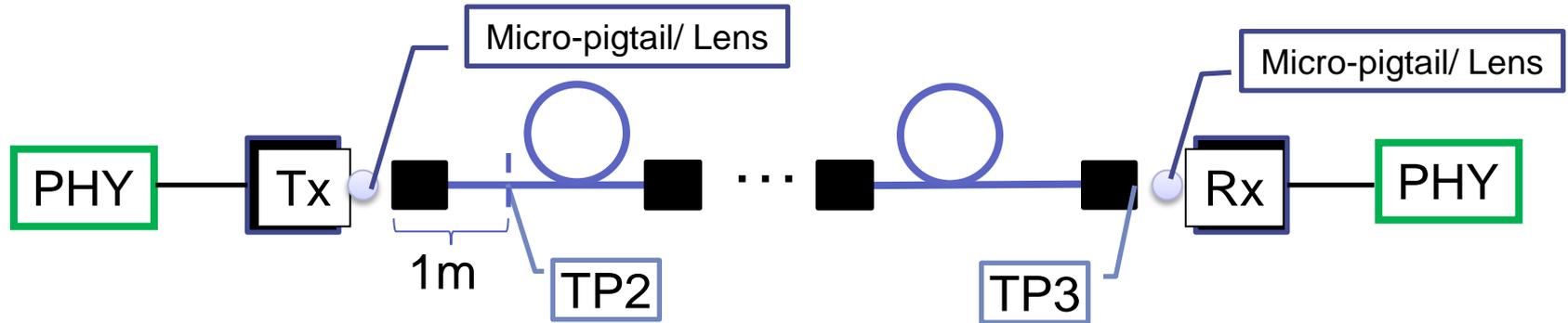
< Next Step >

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

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



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)

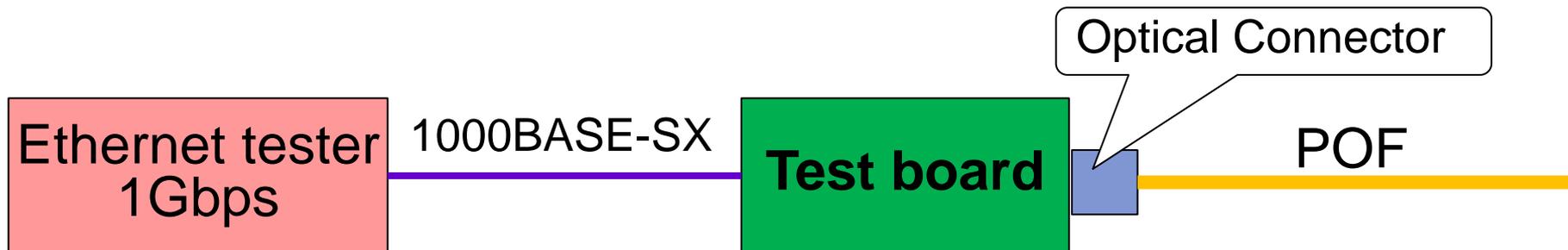
TP3: Launch Power with 15m POF with 4 inline connectors and 40m without inline connector (including coupling loss for Tx connector)



3. Measurement Conditions

Measuring Equipment:

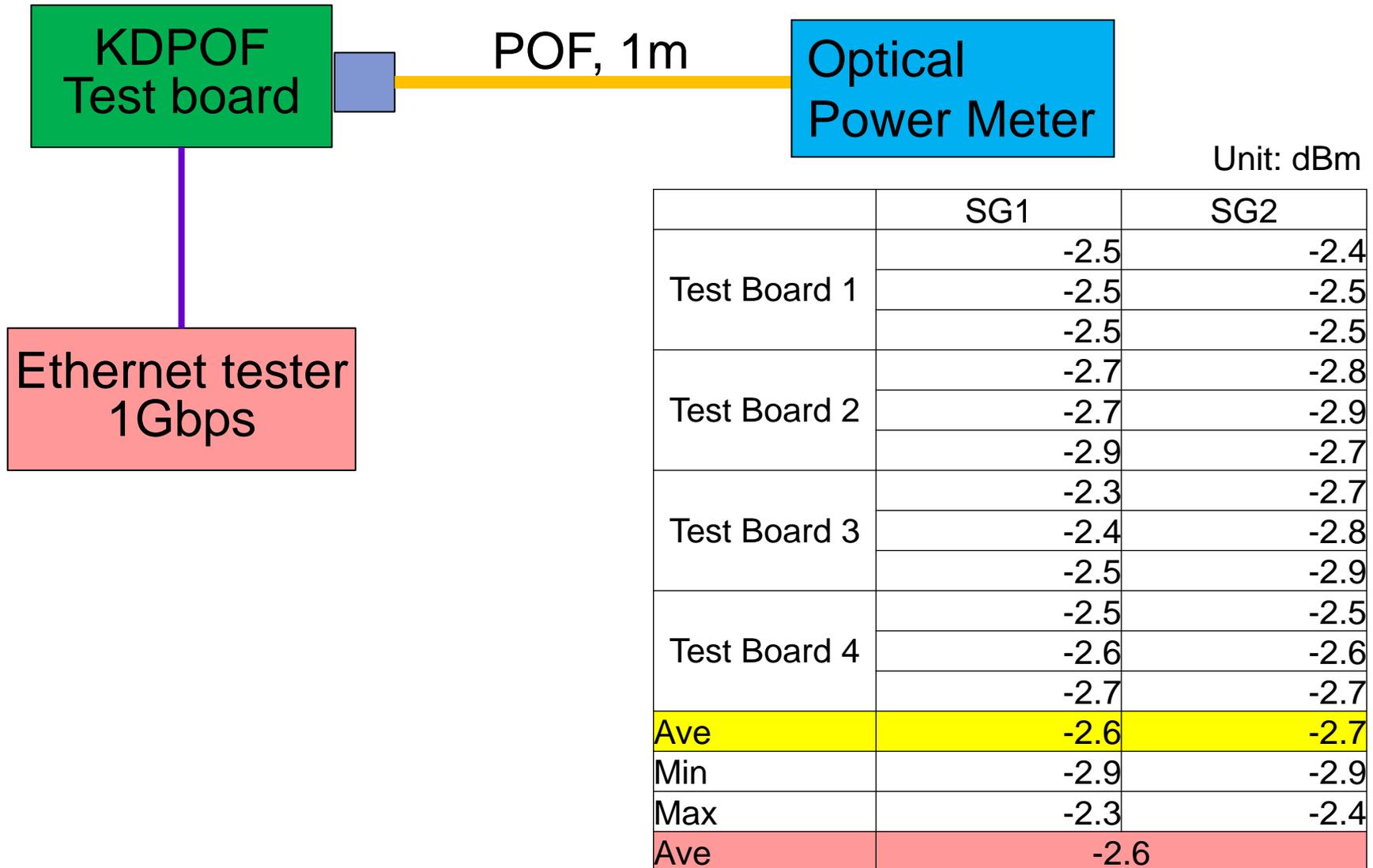
- Test Board: Test Board PHY:KD-1012 (KDPOF)
- Optical Connector: X41281-P902 (YAZAKI)
- POF: GHAN – 4001 (Mitsubishi Rayon)
- Ethernet Tester: AccessOne FE/GbE L2 TESTER 1070A (NEC Networks & System Integration)
- Optical Power Meter: 205A (Photom)
- Attenuator: OVR-660-FC (Fujitok)
- Optical Spectrum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





4. Test Result of TP2

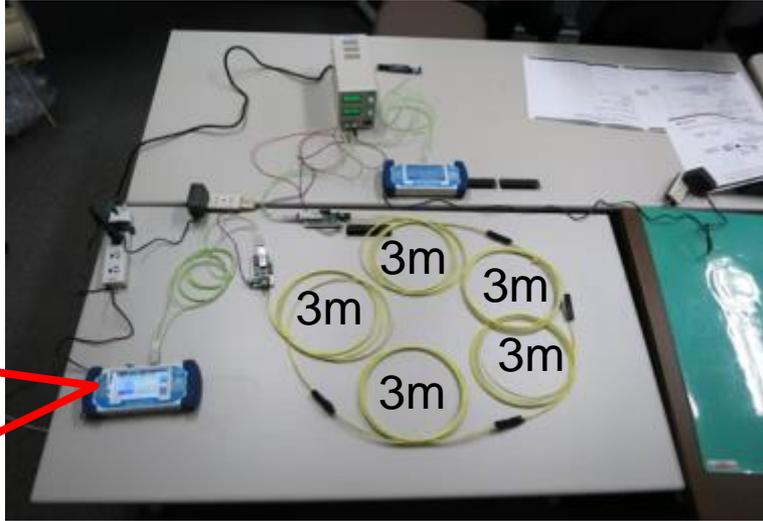
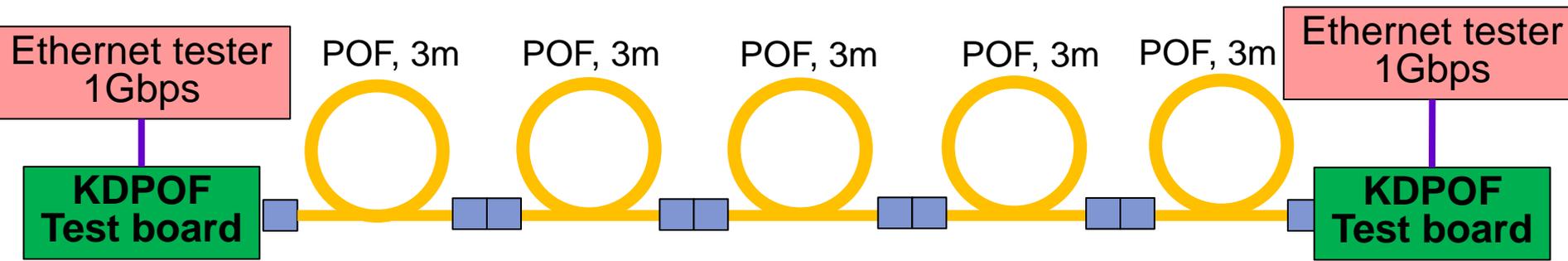
Test Setup





5. Communication Test (15m with 4 inline connectors)

Test Setup

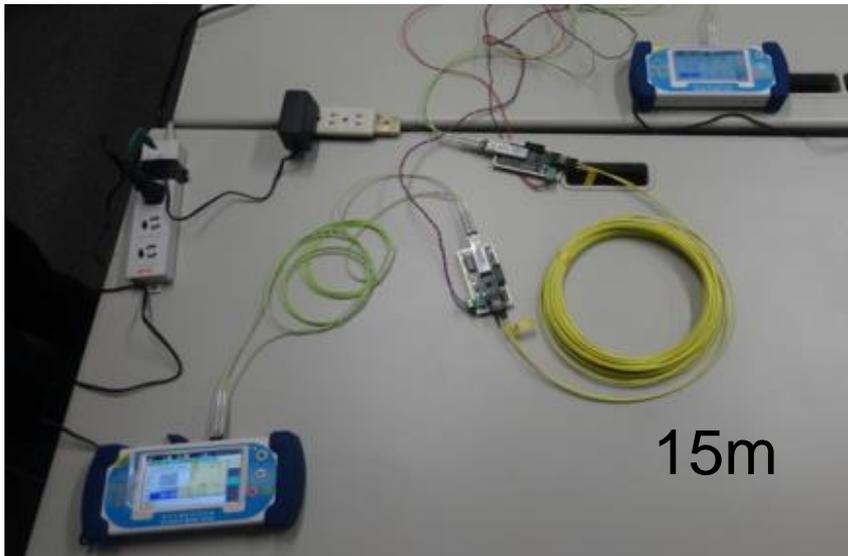
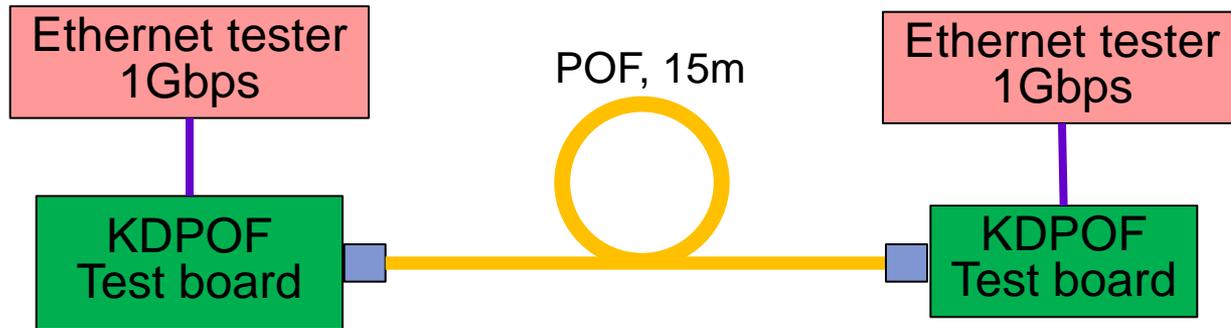


Communication : Good
 TP3: -13.1 to -13.8 dBm
 (n=4)



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>

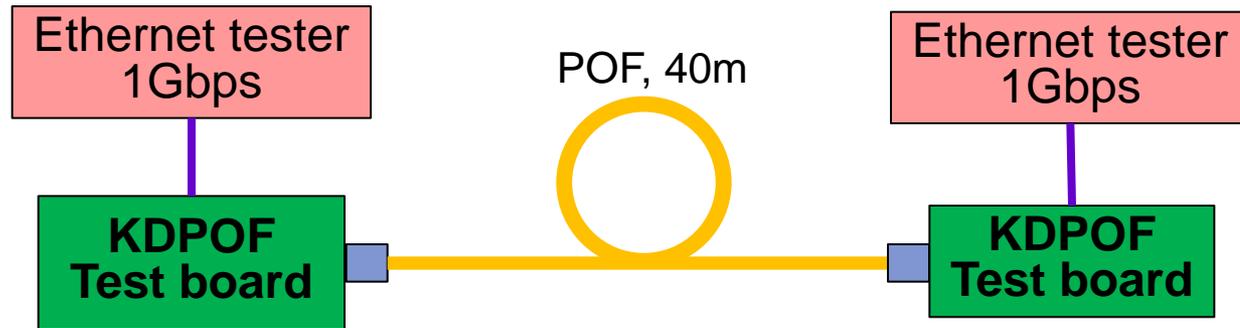
Since TP2 is -2.6 dBm, the POF attenuation will be 0.30 to 0.35 dB/m.

$$\{(-2.6) - (-7.6)\} / (15-1) = \mathbf{0.35 \text{ dB/m}}, \{(-2.6) - (-6.9)\} / (15-1) = \mathbf{0.30 \text{ dB/m}}$$



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>

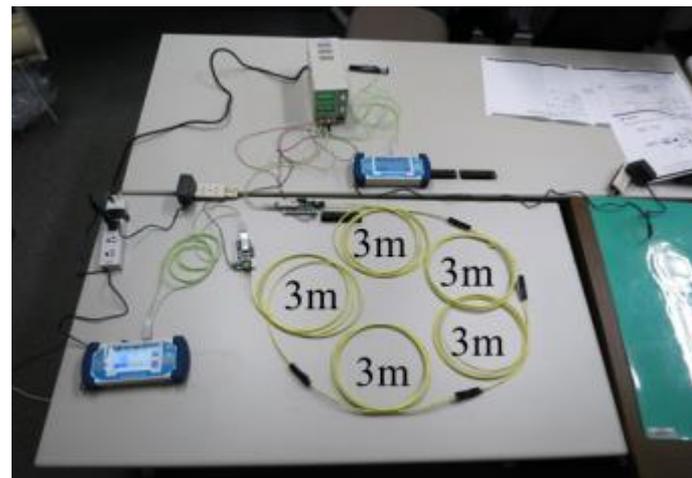
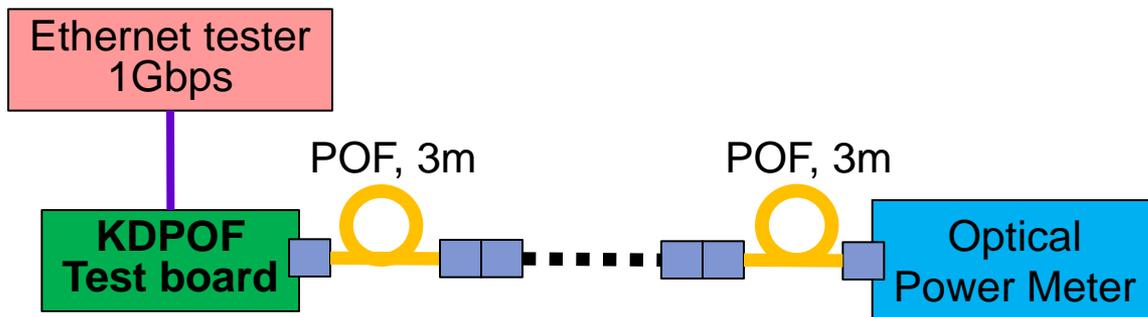
Since TP2 is -2.6 dBm, the POF attenuation will be 0.23 to 0.25 dB/m.

$$\{(-2.6) - (-11.6)\} / (40-1) = \mathbf{0.23 \text{ dB/m}}, \{(-2.6) - (-12.2)\} / (40-1) = \mathbf{0.25 \text{ dB/m}}$$



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	Δ Average
	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 Δ Ave 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**



9. Test Result of λ at TP2

Test Setup



	λ_c	$\Delta\lambda$
	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



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.**



Thank you