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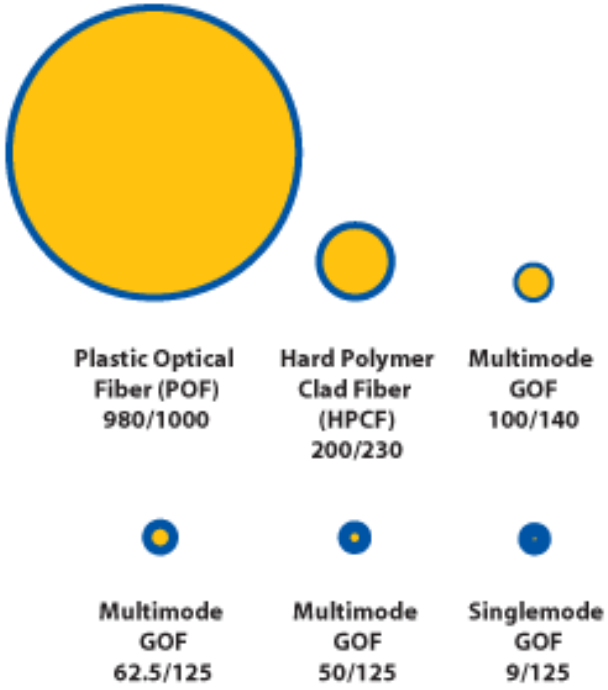
2008 EU-Japan Cooperation Forum on ICT Research

Plastic Optical Fibre (POF) for Fibre-to-the-Device

4th March 2008

John D. Lambkin (jlambkin@firecomms.com)

2200 Airport Business Park
Cork, Ireland



GH4002
Key Parameters

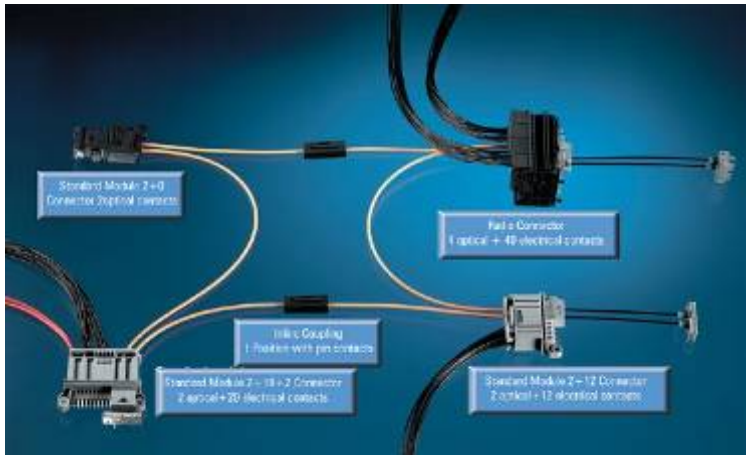
Core: PMMA
Core diameter: 1 mm
NA: 0.5
Bandwidth: 50Mhz.100m
Jacket diameter: 2.2 mm
Attenuation: 170 dB/km
Min attenuation: 650 nm Min
bend radius: 25 mm
Max operating temp: 85^{o}C

MITSUBISHI RAYON CO.,LTD.

Mitsubishi International Corporation

POF in Cars MOST® 25

- Firecomms is a leading supplier of Fibre Optic Transceivers for MOST Networks
- MOST25 Implemented in cars since 2001
- Total 12 million Rx Tx Transceiver pairs sold in 2006, approx. 15 million in 2007
- Over 45 car models supporting MOST
  - BMW, Daimler Chrysler, Audi, VW, Land Rover, Saab, Fiat, Mitsubishi, Jaguar, Volvo, Hyundai and Porsche
- Performance
  - Max 25 Mbps (equivalent to 16 audio channels), Baud rate of 50 Mbps
  - Optical budget: Min input power -10 dBm, Min receive power -23 dBm
  - -40°C to 95°C
  - 15 Year operational life span



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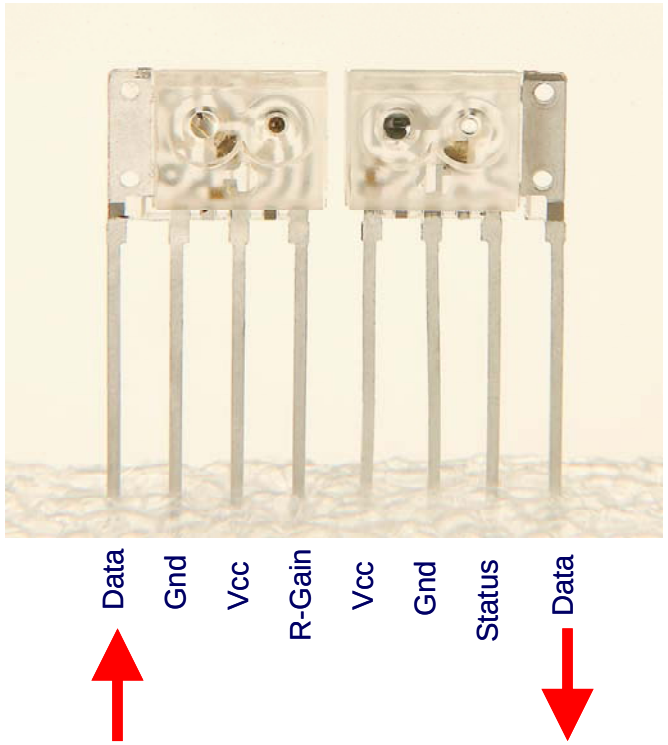
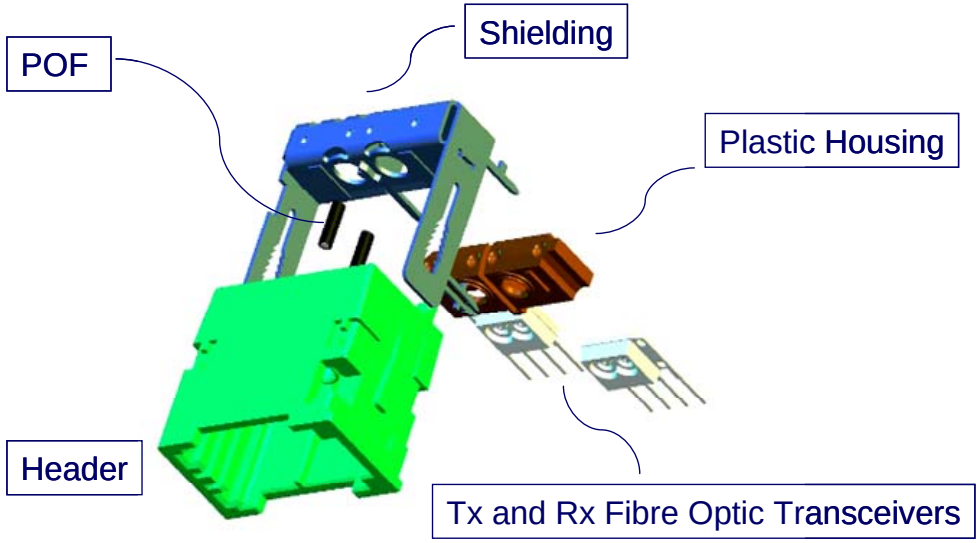
Automotive POF Integrated Transceivers for MOST25 (1.1) Systems





- FCM110-R; FCM110-D
- 50 Mbps MOST25 (1.1) Compliant
- 660 nm RCLED based high temperature emitter
- Automotive approval for use in BMW, DC, Audi, Volvo, VW, Hyundai etc
- Highest optical budget -2 to -28 dBm

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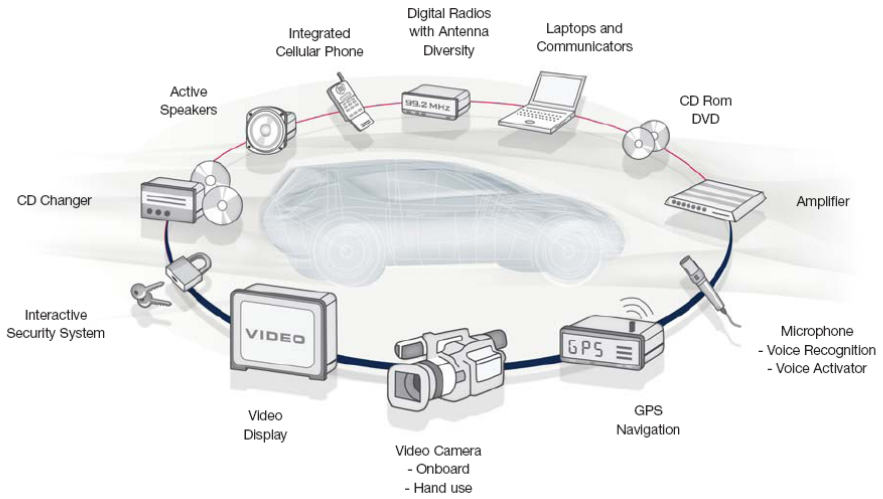
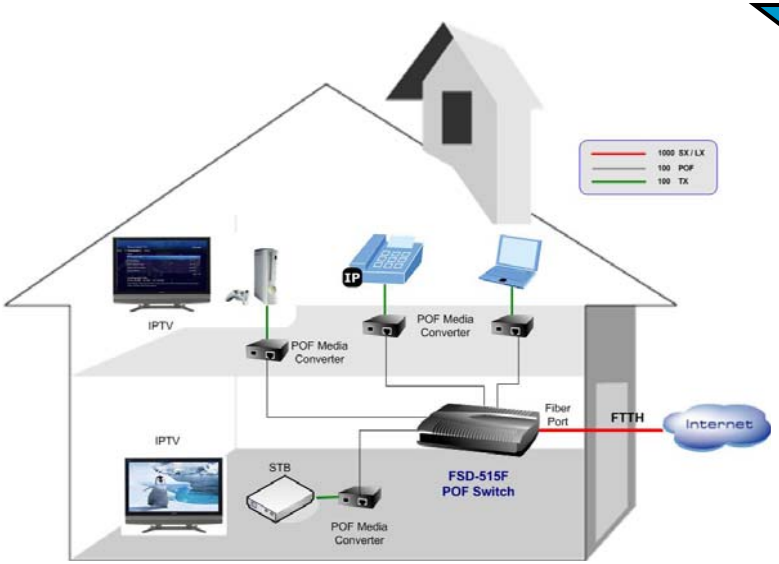
POF Market Trend

- Automotive
  - Advanced digital entertainment networks (MOST 1.1)
  - Early adopter of POF
  - Technology Innovator
  - Low Cost
  - Driven High Reliability & QoS





- Consumer Applications
  - Emerging digital entertainment networks (IPTV)
  - Technology exploiter
  - Needs Low Cost
  - Needs good signal integrity

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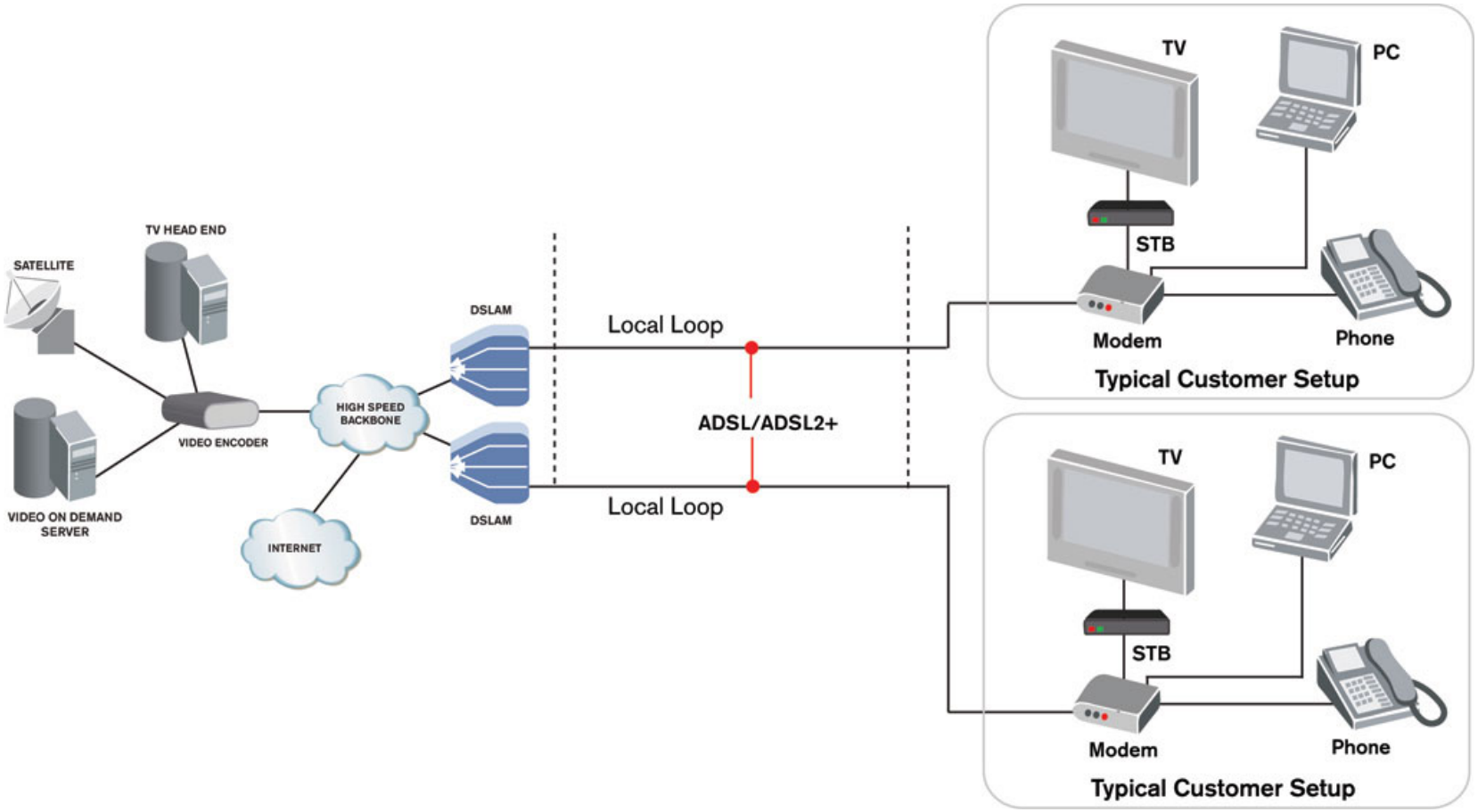
IPTV-over-ADSL Network



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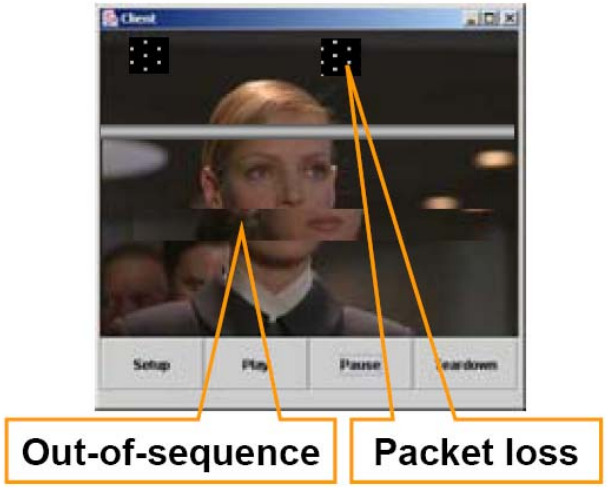
Signal Integrity is Everything



- Packet loss, latency lead & jitter
  - Pixelation
  - Tiling
  - Out of sequence segments
  - Loss of audio
  - Synchronization (lip-sync)
- Packet loss must be <1 %

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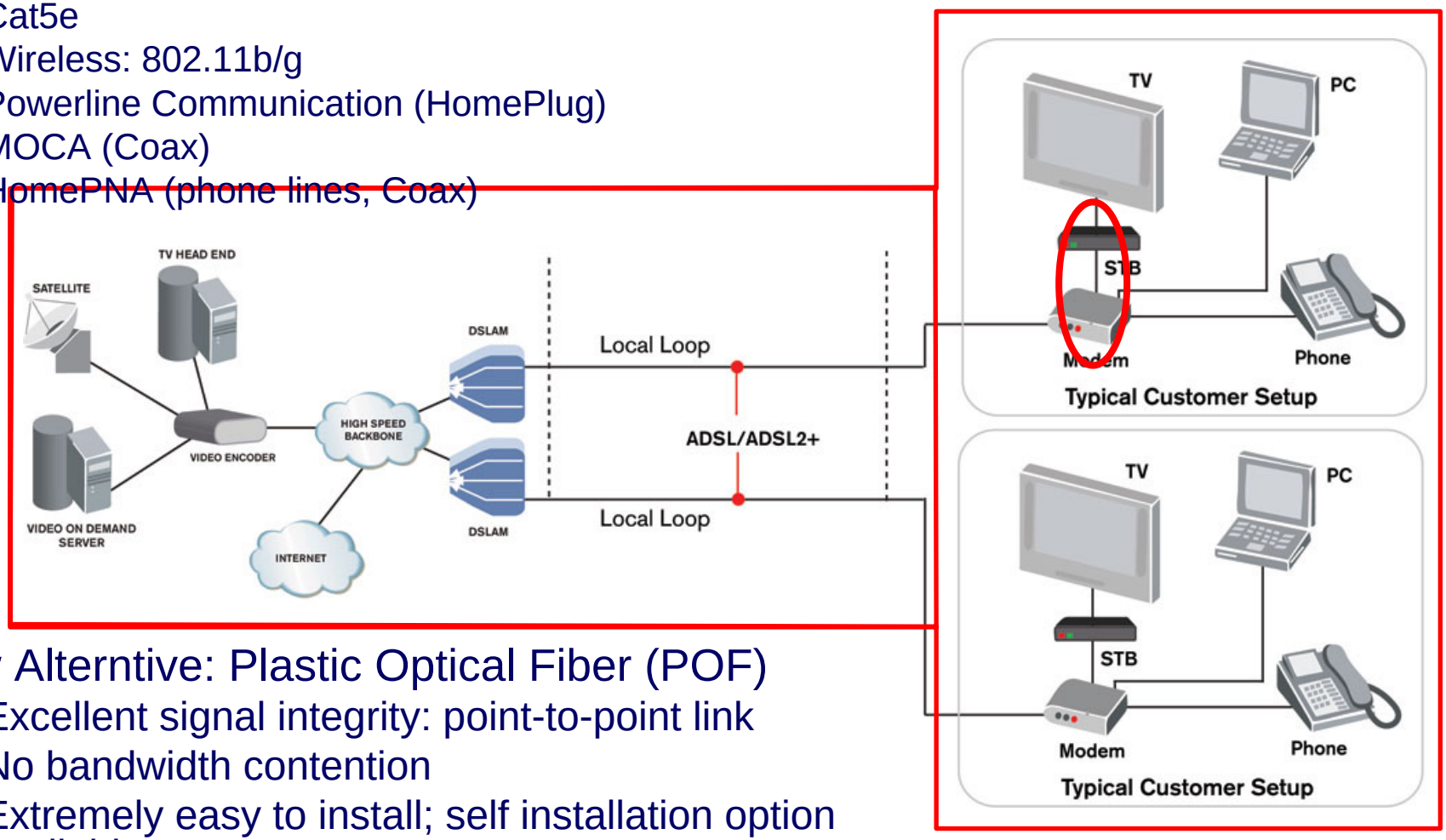
IPTV-over-xDSL Network

- Networking Technologies
  - Cat5e
  - Wireless: 802.11b/g
  - Powerline Communication (HomePlug)
  - MOCA (Coax)
  - HomePNA (phone lines, Coax)



- New Alterntive: Plastic Optical Fiber (POF)
  - Excellent signal integrity: point-to-point link
  - No bandwidth contention
  - Extremely easy to install; self installation option available
  - Install along power lines: No EMI issues

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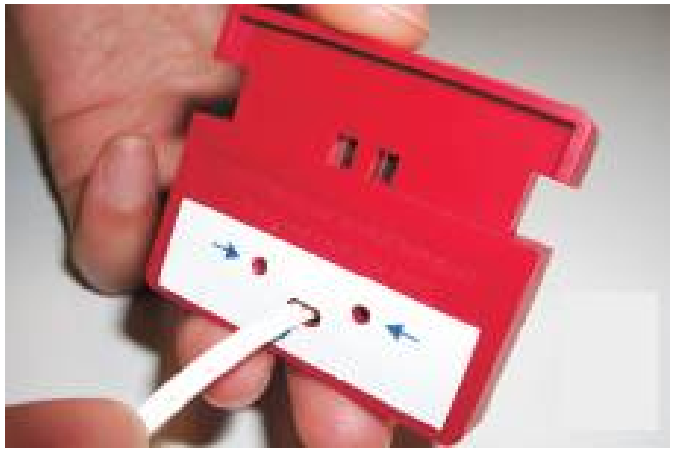
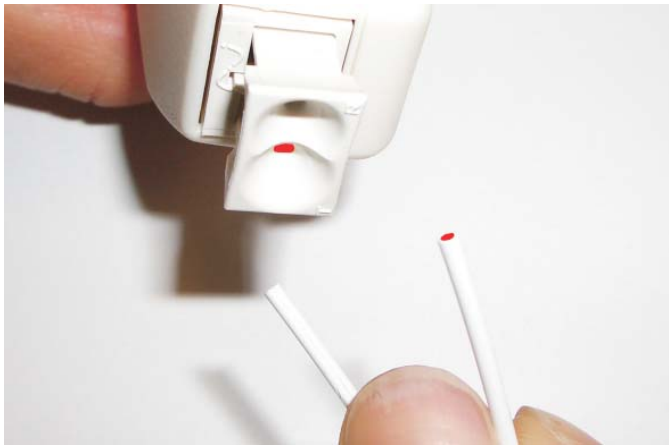
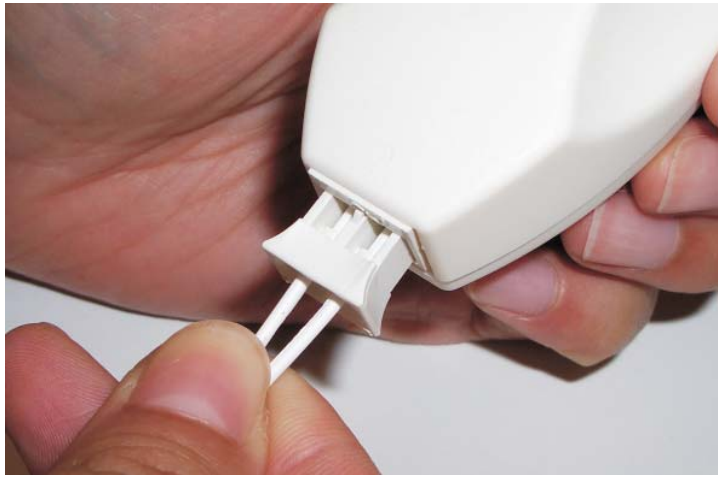
OptoLock® Enabled Fast Ethernet Media Converter



1. Cut to desired length



2. Separate the fibre



3. Insert into OptoLock

4. Lock fibre into place

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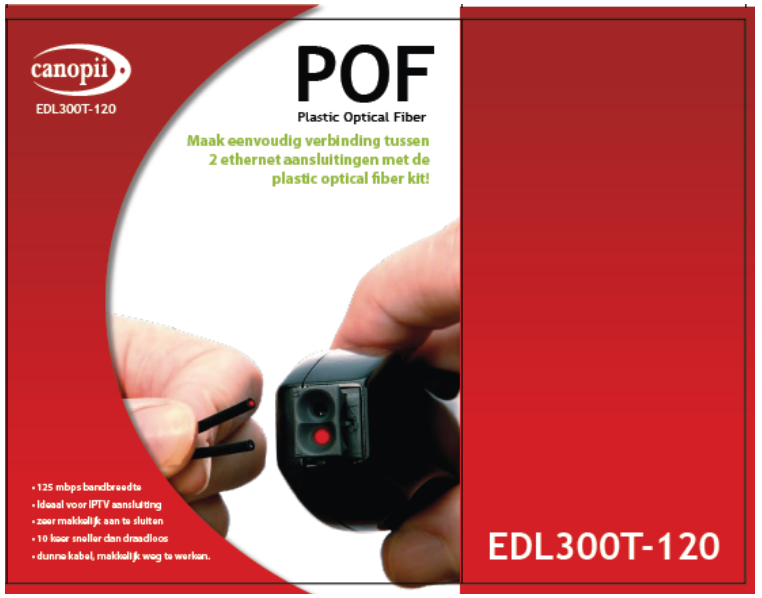
Self Install / Retail / OEM Home Kits



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POF Product Eco-System

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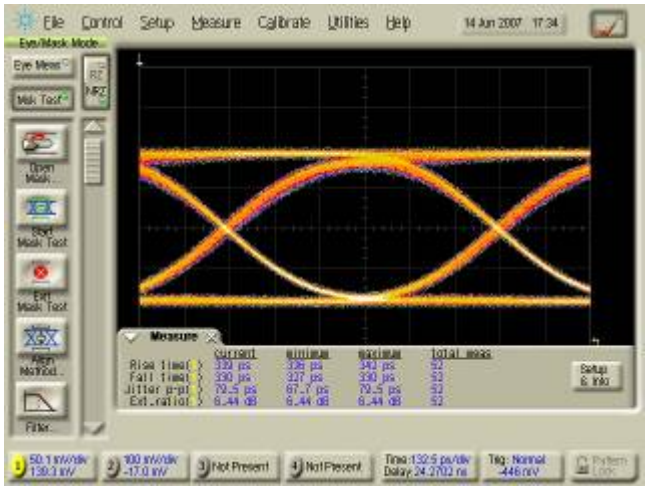
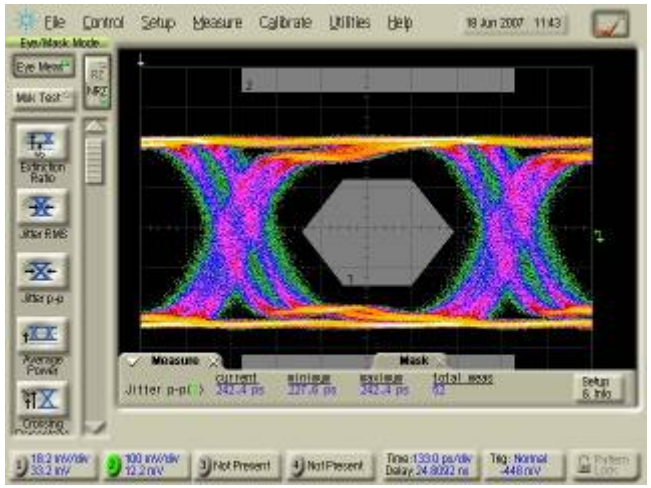
Gbps over SI-POF

Manufacturer	Product Name	Product Number	Fiber Structure	Material	Diameter Core/Fiber (mm)	N.A.	Fiber Length (m)
Mitsubishi Rayon	Eska Mega	MH4002	Step-index	PMMA	0.980 / 1.00	0.300	10

OPTICAL



ELECTRICAL



- 665 nm VCSEL
- 1 % TTF 450,000 hrs (30% drop in power)
- Data rates up to 1.25 Gbps
- 0°C to 50°C Operating temperature
- SMI or *OptoLock*® POF interface
- Single 3.3V power supply
- CML-compatible interface
- Gigabit Ethernet and IEEE1394 S800
- Industry standard 1x9 footprint

OptoLock®

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Extended Reach Gbps SI-POF

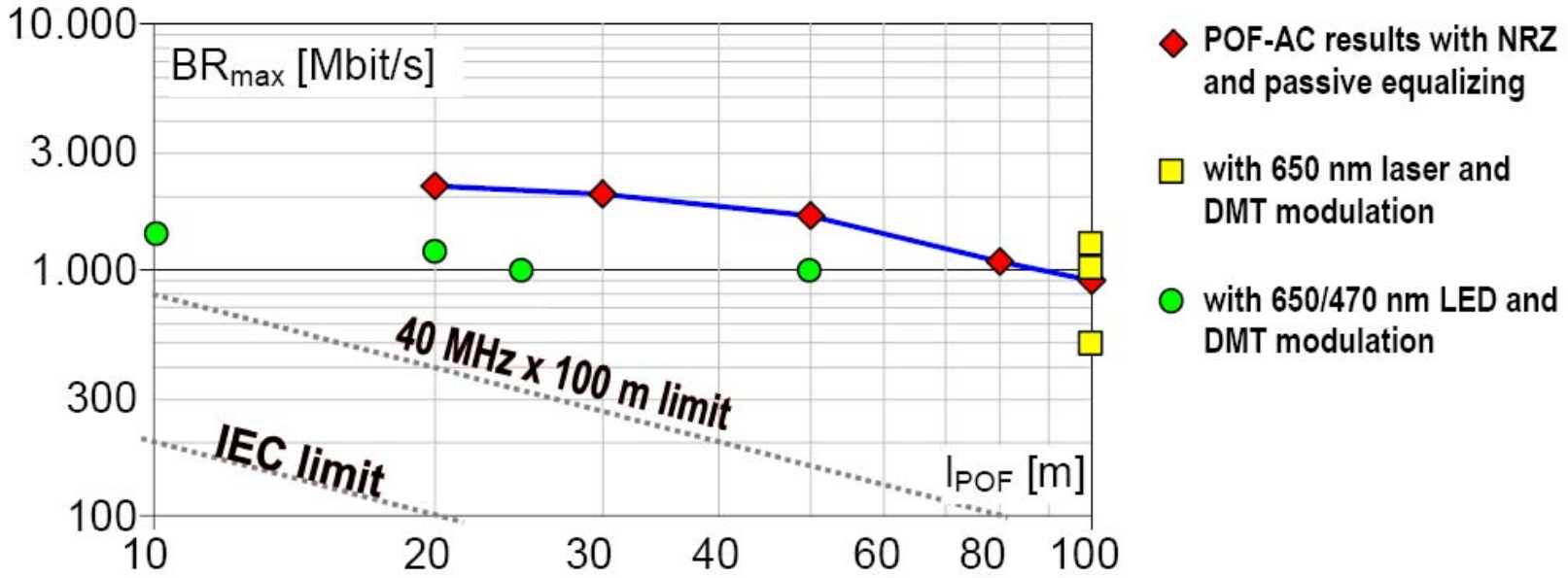

Fig. 2: Capacity of the A4a* SI-POF, based on the 3 dB bandwidth and in laboratory experiments

OWB1.pdf OFC/NFOEC 2008

Olaf Ziemann[1)], Hans Poisel[1)], Sebastian Randel[2)], Jeffrey Lee[3)]

[1)] *Polymer Optical Fiber Application Center, University of Applied Sciences Nuernberg*
Wassertorstraße 10, 90489 Nuernberg/Germany, www.pofac.de; ++49 911 5880 1070/5070, e-mail: olaf.ziemann@pofac.fh-nuernberg.de
[2)] *Siemens AG, Corporate Technology, Information and Communications, Otto-Hahn-Ring 6, 81739, München, Germany*
[3)] *COBRA Research Institute, Technical University of Eindhoven, Den Dolech 2, 5612 AZ, Eindhoven, the Netherlands*

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Low-Cost and Robust 1-Gbit/s Plastic Optical Fiber Link Based on Light-Emitting Diode Technology

S.C.J. Lee[(1)], F. Breyer[(2)], S. Randel[(3)], O. Ziemann[(4)], H.P.A. van den Boom[(1)], A.M.J. Koonen[(1)]

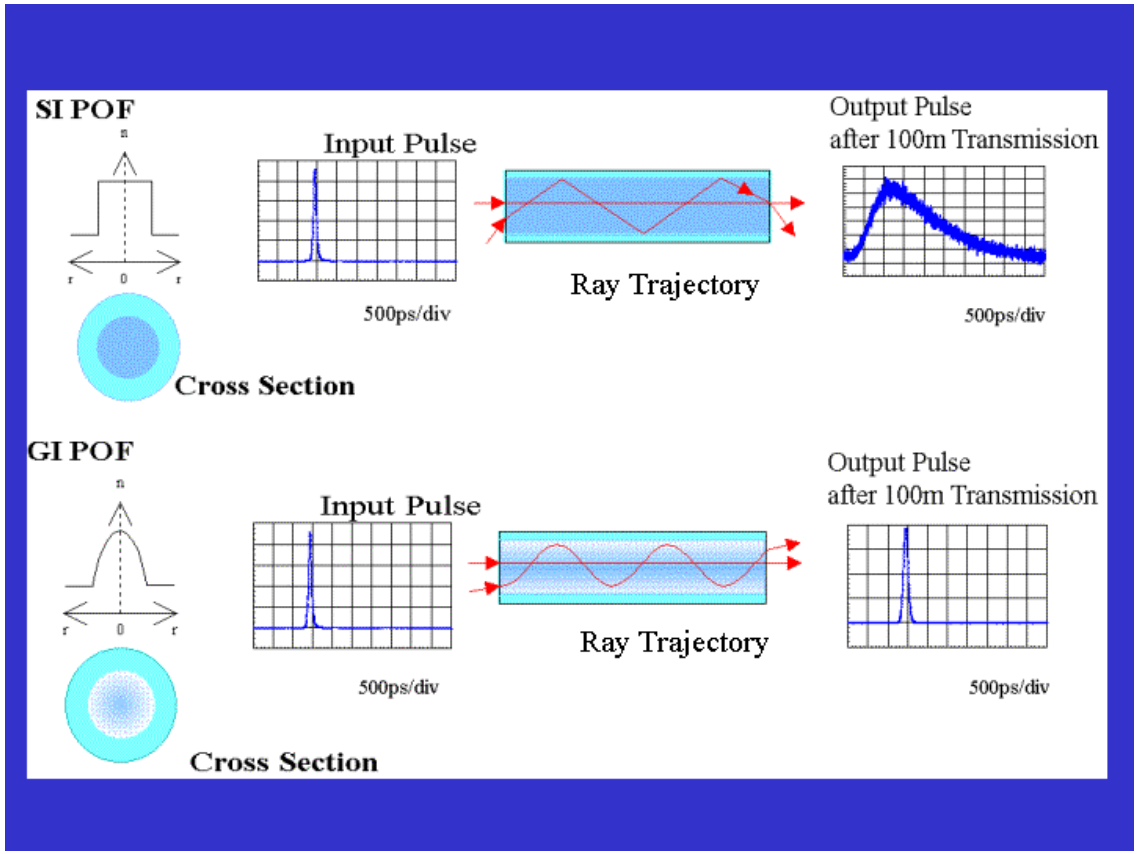
(1) COBRA Research Institute, Technical University of Eindhoven, P.O. Box 513, 5600 MB, Eindhoven, the Netherlands. (2) Institute for Communications Engineering, Technische Universität München, Arcisstrasse 21, 80290, Munich, Germany. (3) Siemens AG, Corporate Technology, Information & Communications, Otto-Hahn-Ring 6, 81739, Munich, Germany. (4) POF Application Center, Wassertorstrasse 10, 90489, Nuremberg, Germany. E-mail: s.c.j.lee@tue.nl

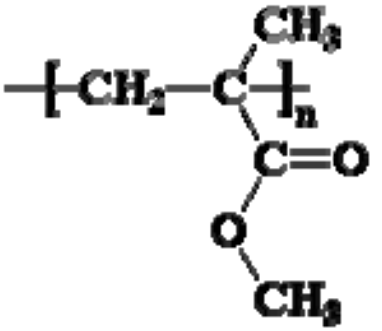
Abstract: 1-Gbit/s transmission is demonstrated over 50 m of step-index PMMA plastic optical fiber (1-mm core-diameter) using a commercial light-emitting diode. This is enabled by use of discrete multitone modulation with up to 64-QAM constellation mapping.

OCIS codes: (060.2330) Fiber optics communications; (060.4080) Modulation

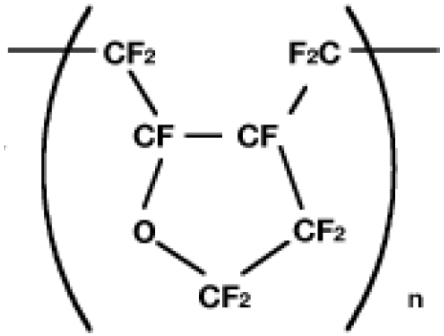
Perfluorinated Plastic Optical Fibre

Keio University





PMMA



Cytop
Perfluorinated

Lucina Fiber

GigaPOF-120SR

Perfluorinated short-reach POF

AGC ASAHI GLASS

Bandwidth for People
Chromis Fiberoptics

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40 Gbps over Perfluorinated POF

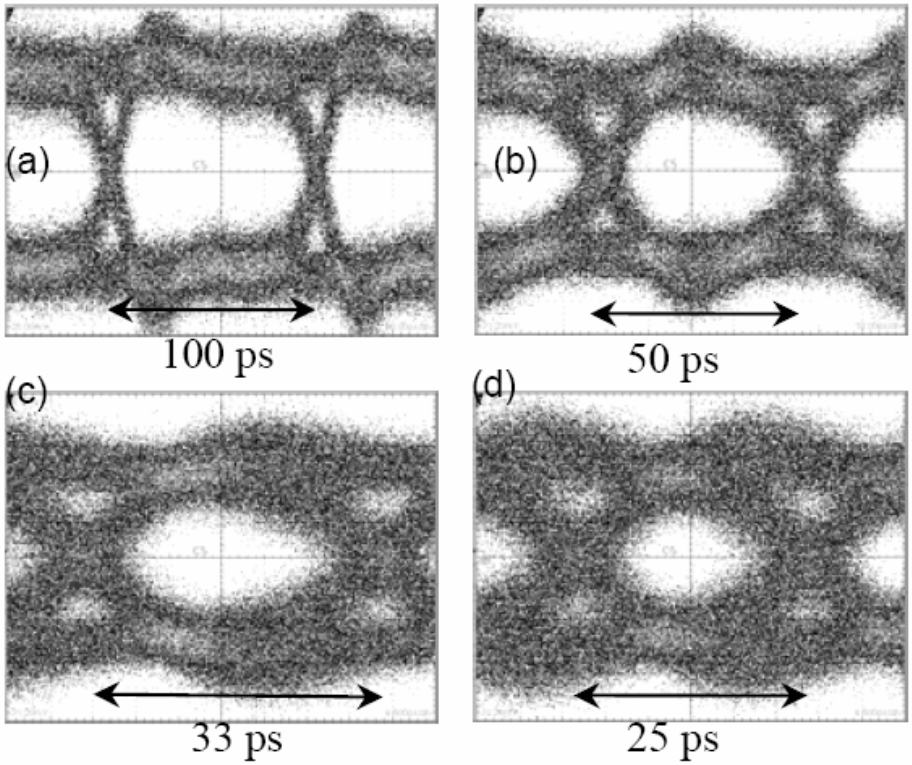

Fig. 2 Eye diagrams for 100 m of 50 μm GI-PF-POF for (a) 10 Gb/s (b) 20 Gb/s (c) 30 Gb/s (d) 40 Gb/s. (PRBS 2^{31}-1).

OFC/NFOEC 2008

OWB2.pdf

Arup Polley and Prof. Stephen E. Ralph

School of Electrical and Computer Engineering
Georgia Institute of Technology
777 Atlantic Drive, Atlanta Georgia 30332-0269
stephen.ralph@ece.gatech.edu

EU Support for POF

- EU Supported projects
  - BREDSELs (Visible VCSEL Technology)
  - AGATHA (Green GaInN devices for POF Applications)
  - HOME PLANET (IEEE1394 Transceivers for POF)
  - POF-ALL (100 Mbps over 200 m of POF for Access Applications)
  - POF-PLUS (1-10 Gbps over SI-POF)

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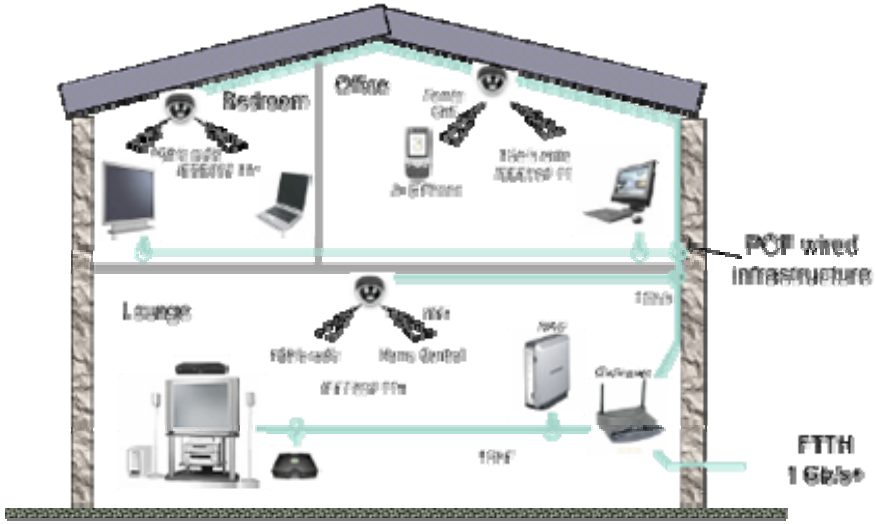
FP7: POF-PLUS

- 1Gbps access speed, and extension to 10Gbps for long-term future-proof solutions: Fibre-to-the-Box
- Physical layer compatibility with existing wireless protocols such as WiFi and WiMax, and future emerging wireless such as UWB;
- Extreme ease of installation, thus lowering Cost of Ownership (CoO) expenditures;
- High Quality of Service (QoS) over cabled non-shared links for video applications



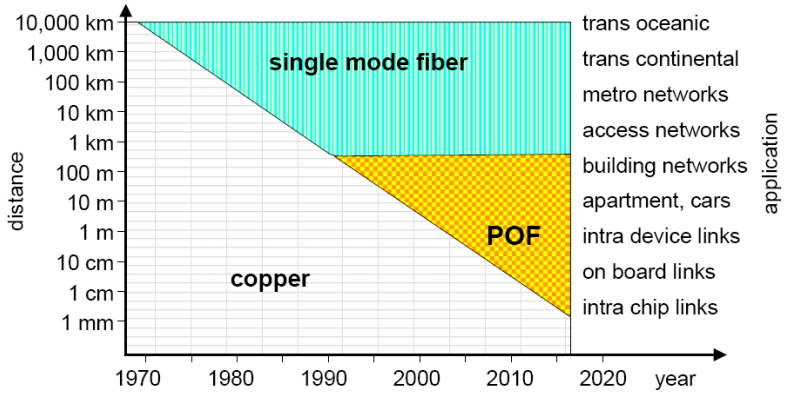


Fig. 1: possible evolution scenario for optical networks

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POF Market, Eco-System & Opportunity

Pros & Cons

- ☑ Japan: POF Manufactures & Developers
- ☑ Europe: Early adopter, automotive, consumer
- ☑ Technology roadmap Gbps over POF
- ☑ New market opportunities: North/South America, China

- ☒ Standards: Fibre & Cables
- ☒ Marketing: POF needs to compete with strong alliances such as Wireless,Power Line Communication, HomePlug, HomePNA,, MOCA etc.

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Thank you for your attention

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