Development of 16F, Low-Loss, IEC-Grade B, MMC High-Density Optical Connector and Corresponding Cleaning Tool

○Kota Yamanaka (1) , Shuhei Kanno (1) , Yuya Sakaguchi (1) , Satoshi Shida (1) ,
Yasuyuki Wada (1) , Takaaki Ishikawa (1) , Kansei Shindo (1) , Mike Hughes(2), Sharon Lutz (2) , Jeff Hendrick (2)

(1)Fujikura Ltd., Japan
(2) US Conec Ltd., USA

Fiber Optics Network Product R&D Department
Optical Component Division
Fujikura Ltd.

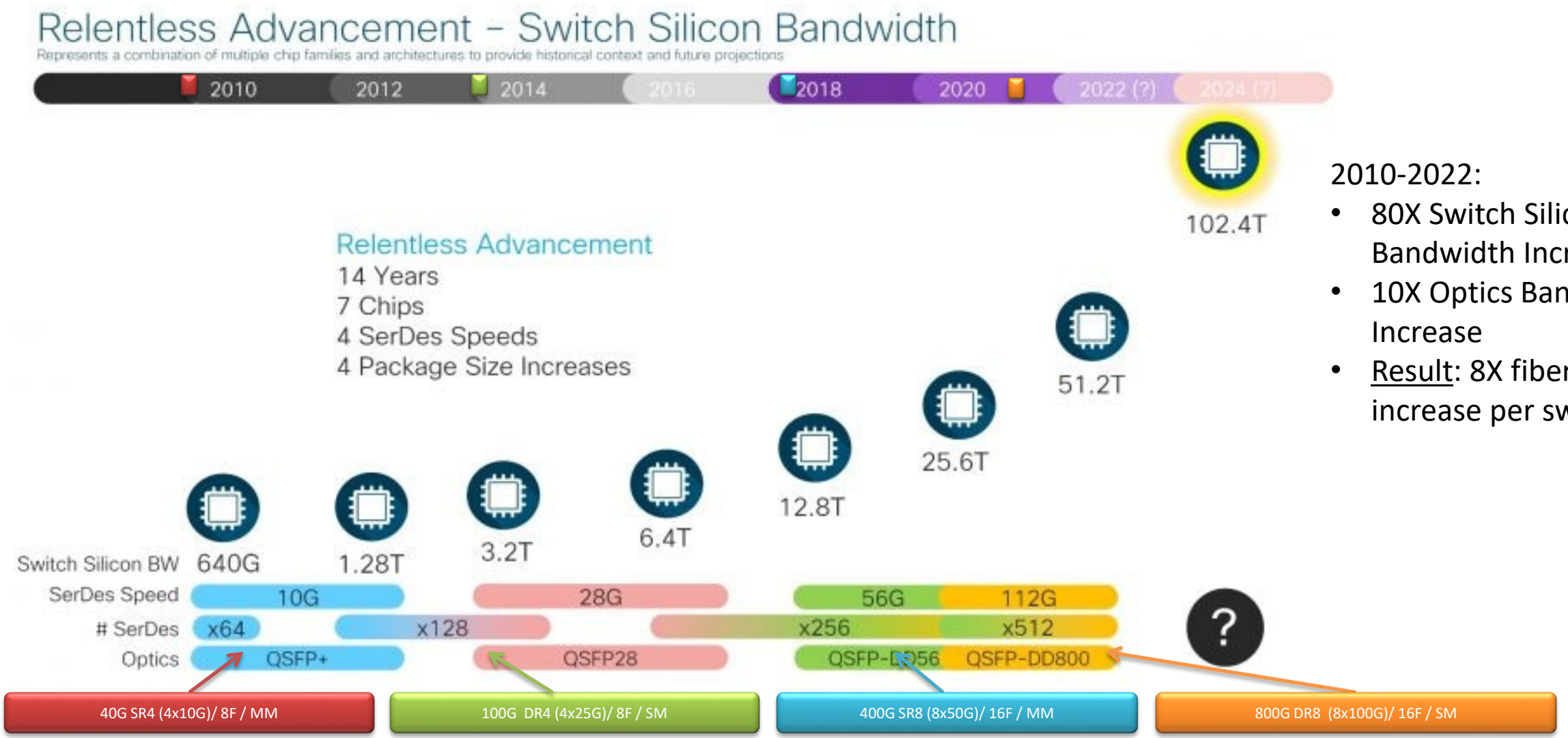
2022 IWCS International Cable & Connectivity Symposium.

Contents

2022 IWCS International Cable & Connectivity Symposium.

Introduction

Decade of Switch Silicon, SerDes, + Parallel Optics



2010-2022:

- 80X Switch Silicon Bandwidth Increase
- 10X Optics Bandwidth Increase
- Result: 8X fiber (or λ) increase per switch

Source: Cisco / SP360: Service Provider /Co-Packaged Optics and an Open Ecosystem; R. Chopra
US Conec Ltd., /Optical Connectivity Considerations for Co-Packaged Optics; Tom Mitcheltree

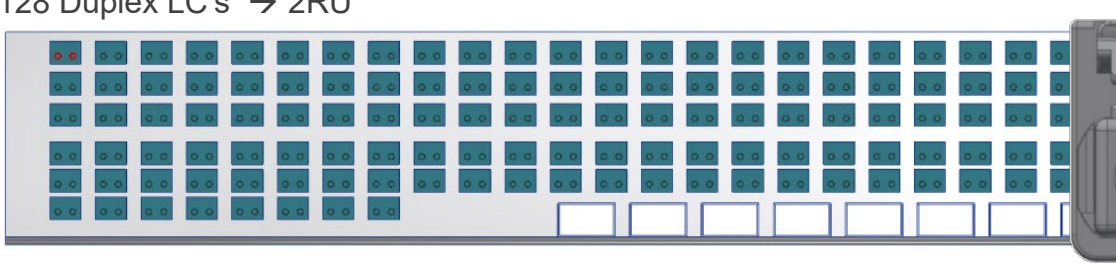
Introduction

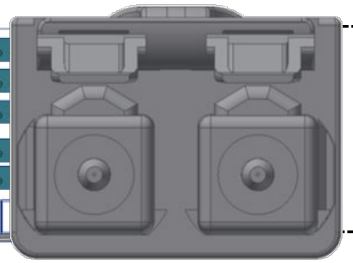
Front Panel Density Considerations: 1st Gen - 51.2TB CPO

FR 256f

DR 1024f

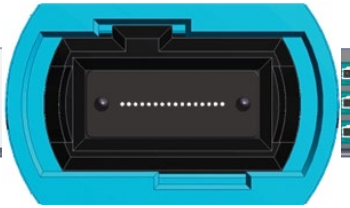
128 Duplex LC's → 2RU



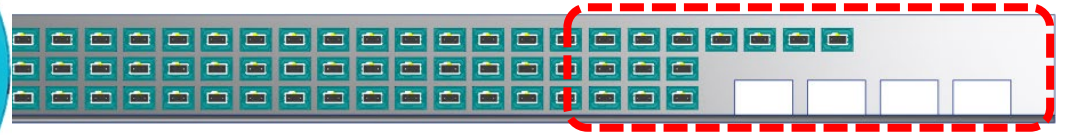


512 Duplex LC's → 8RU??

16 MPO-16's → 1RU

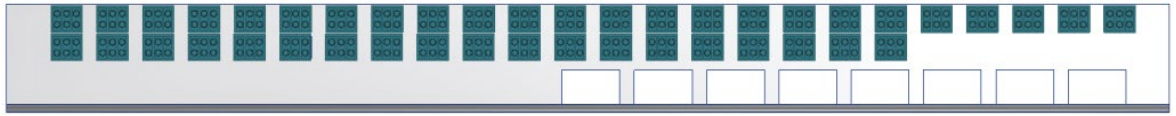


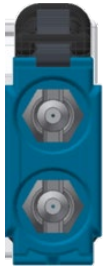
64 MPO-16's → 1RU



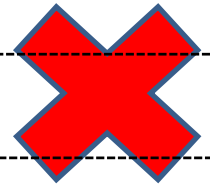
not enough utility area.

128 MDC's → 1RU





512 MDC's → 2-3RU??



16 MMC-16's → 1RU

64 MMC-16's → 1RU

* MXC-32 roughly the same density as MMC-16

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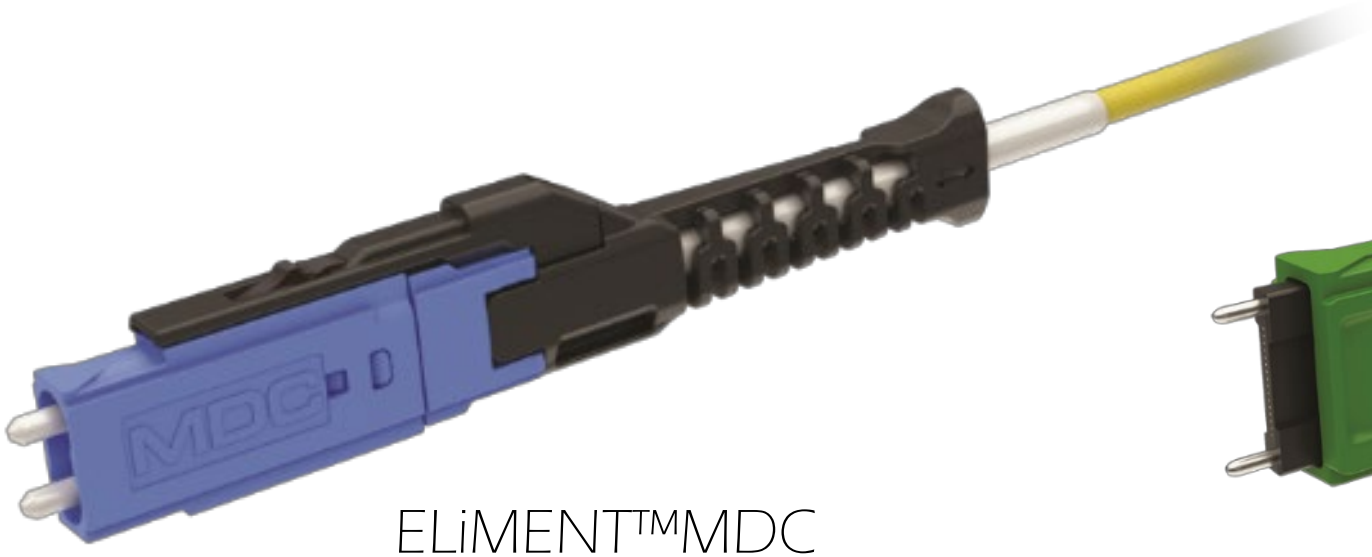
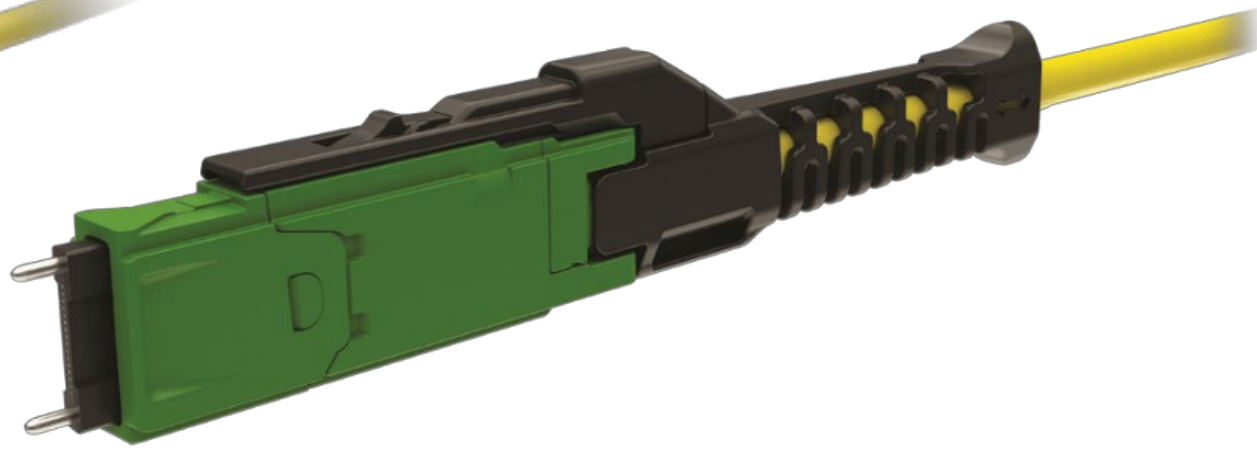
Introduction

- ✓ **USConec and Fujikura collaborate to develop next generation miniature optical connector (MMC/MDC) solutions**

- **ELiMENT™ MDC is already in the market**
- **MMC will be released in the second half of 2022.**



ELiMENT™MDC

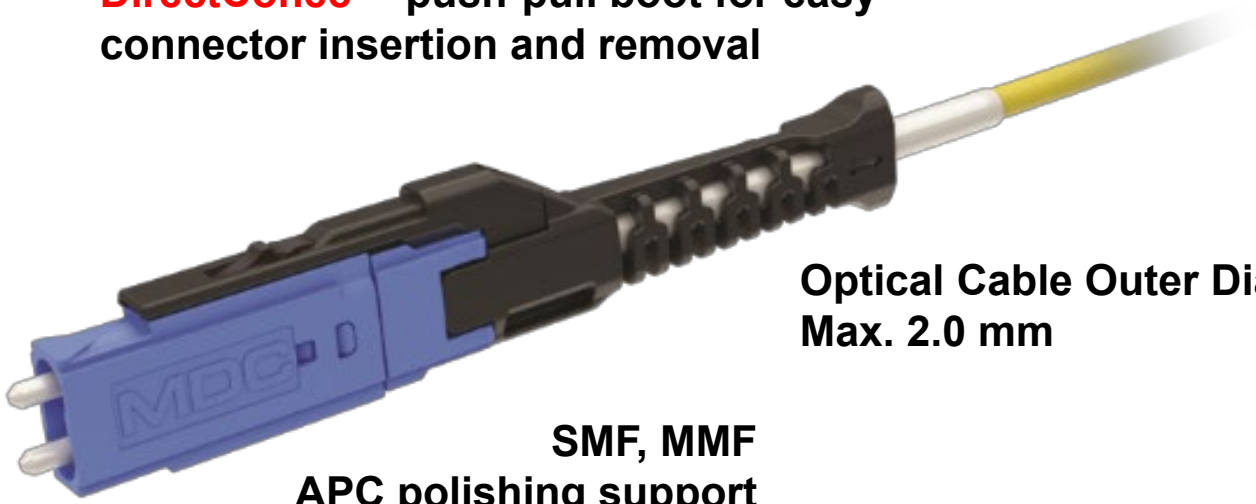


Mimi-Multi-Connector

ELiMENT™, a trademark of US Conec Ltd.

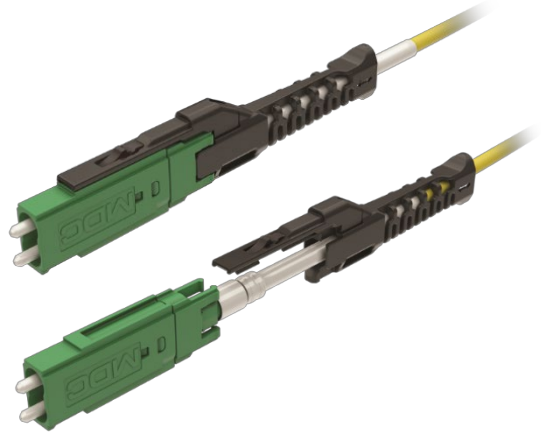
MDC format

DirectConec™ push-pull boot for easy connector insertion and removal



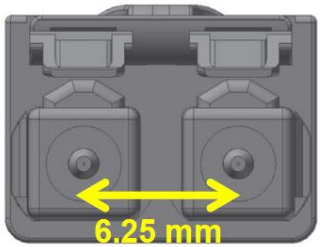
Optical Cable Outer Diameter Max. 2.0 mm

SMF, MMF
APC polishing support



No exposed optical fiber
Easy polarity conversion

ELiMent™MDC



Duplex LC

- **QSFP-DD/SFP-DD/OSFP MSA specified optical interface**
- **Complies with IEC standard insertion loss class B (max. value 0.25 dB @ ≥ 97%)**
- **Compliant with Telcordia GR-326 and TIA-568**
- **One-Click® for MDC/IBC™ Optical connector cleaner**

3x cabling port density over the Duplex LC connector

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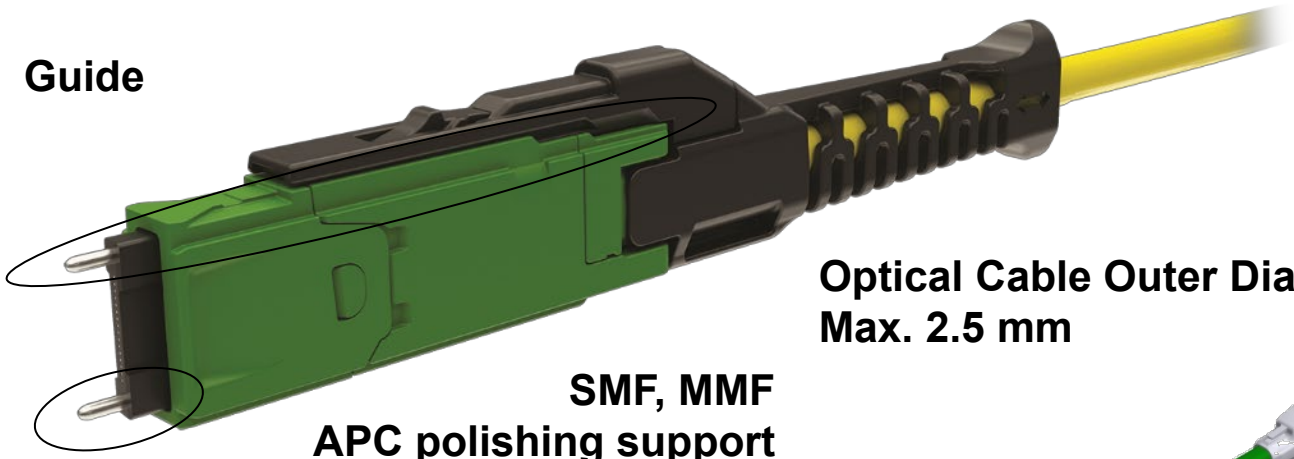
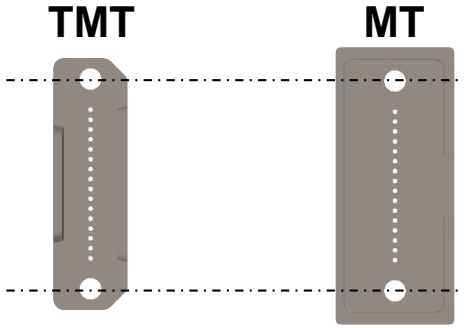
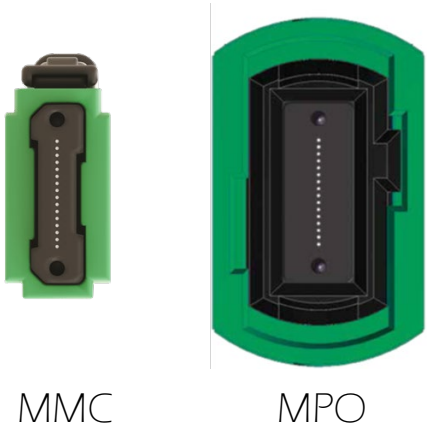
Structure and Design : MMC(1)

DirectConec™ push-pull boot for easy connector insertion and removal





- **Proven conventional MT mechanical and fiber alignment structure**
- **Compatible with standard 250 micron OD and pitch optical fibers**



3x cabling port density over the MPO format

- **Low-loss, IEC Grade B insertion loss performance (0.25dB 97% random intermate)**
- **Compliant with Telcordia GR-1435 (expected)**
- **Standard cabling industry infrastructure support including IBC™/One-Click™ cleaners, polishers, interferometers, and optical testing equipment**

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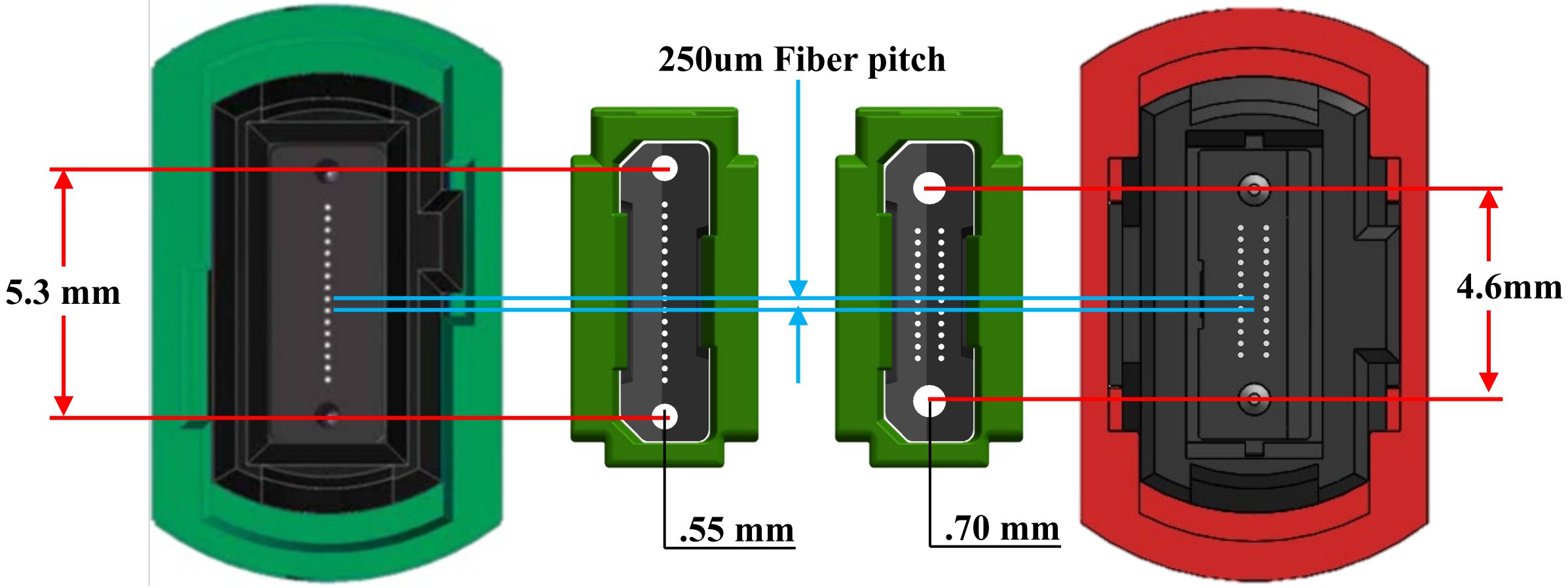
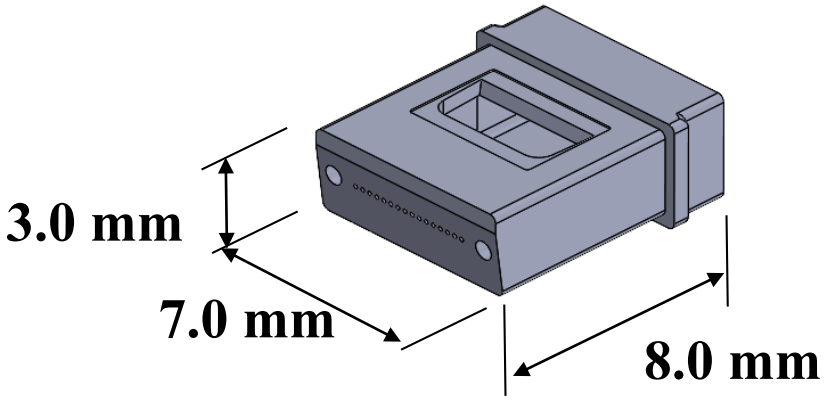
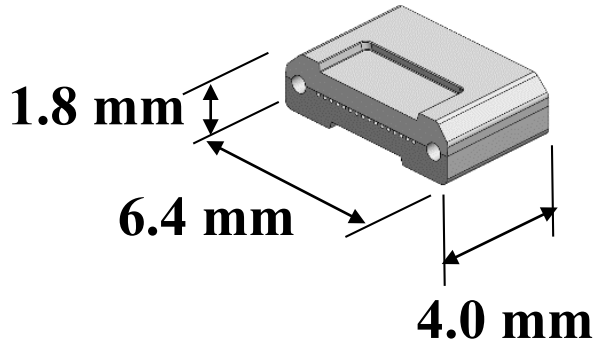
Structure and Design : MMC(2)

- MMC was designed to be fully compatible with the MPO format.
  It is constant even at two rows.

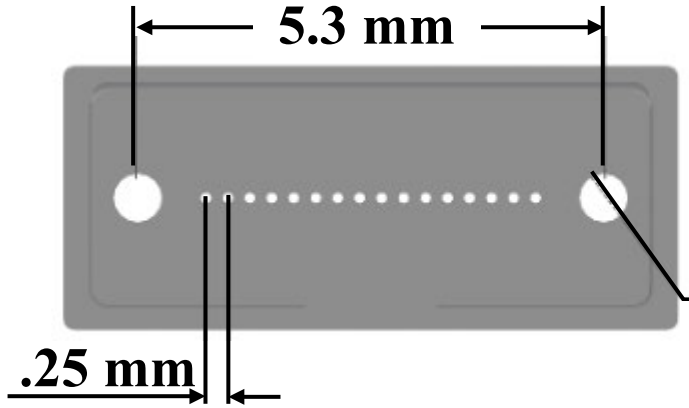


Structure and Design : MMC(3)

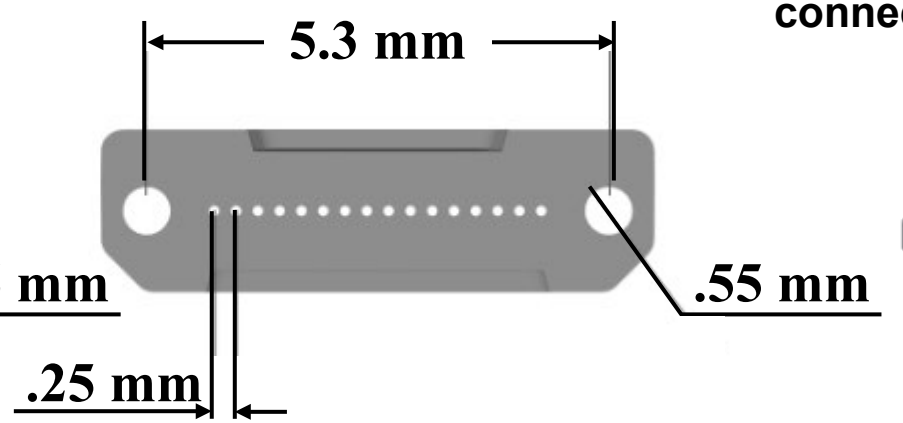




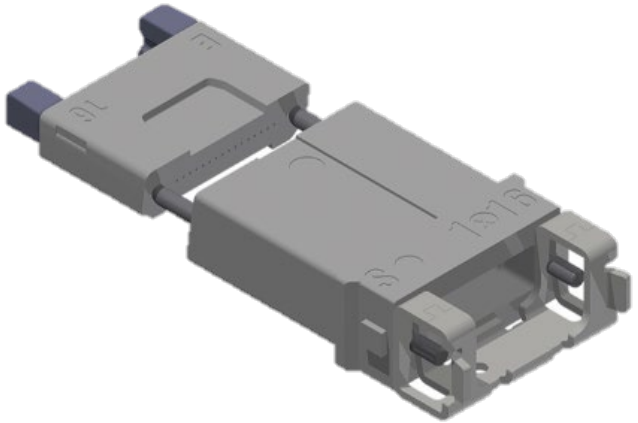
- Proven alignment structure of MT-16 and Intermateable with MT-16 technology
- 16 fibers at 250 micron pitch.
- Compatible with 250, 200, and 165 micron fibers.
- Ideal for on-board fiber management, as well as transceivers and hardened connector embodiments.



MT ferule



TMT ferule



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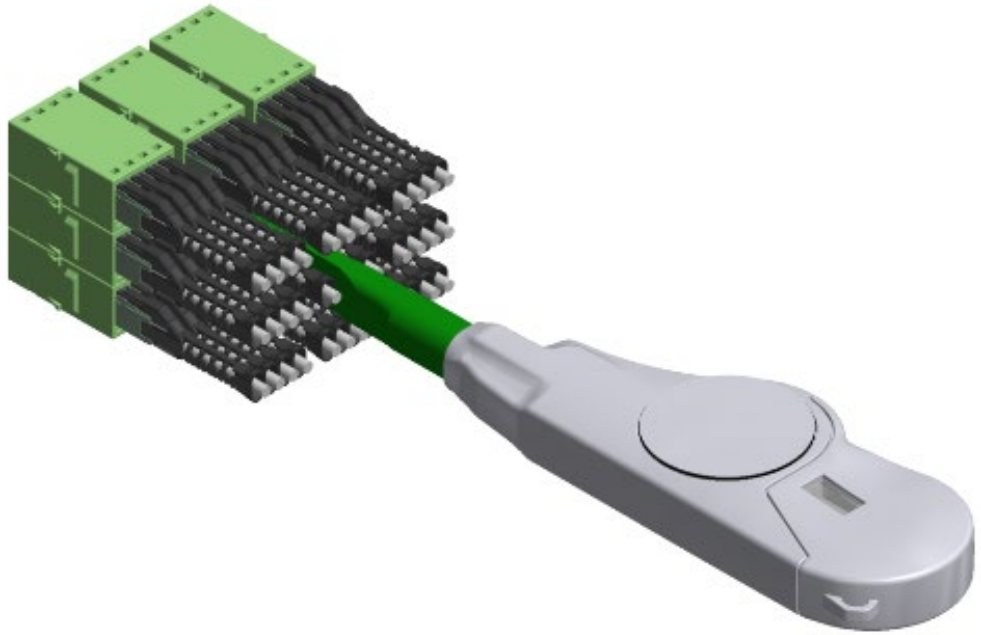
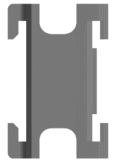
Structure and Design : MMC Cleaner

- **The MMC Cleaner is designed to clean high-density connectors one port**

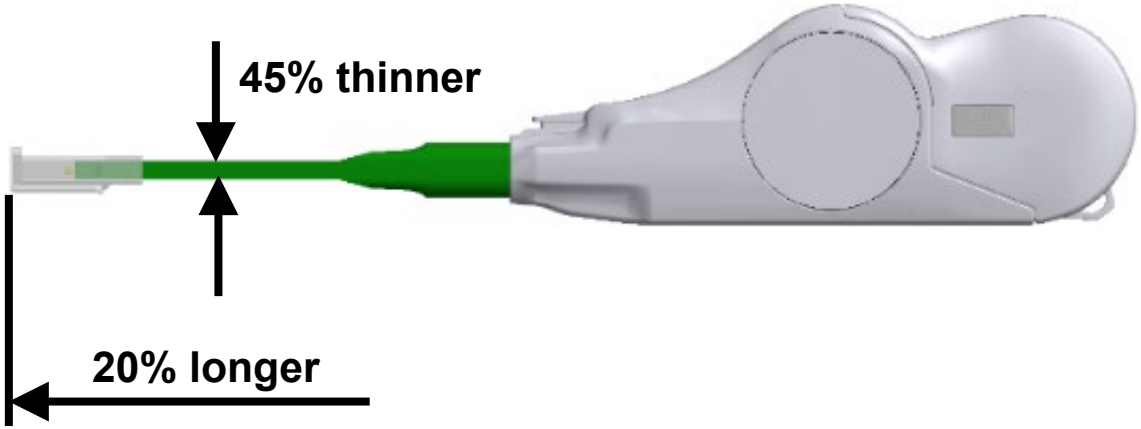




Tip optimized
for TMT ferule

For MPO

For MMC



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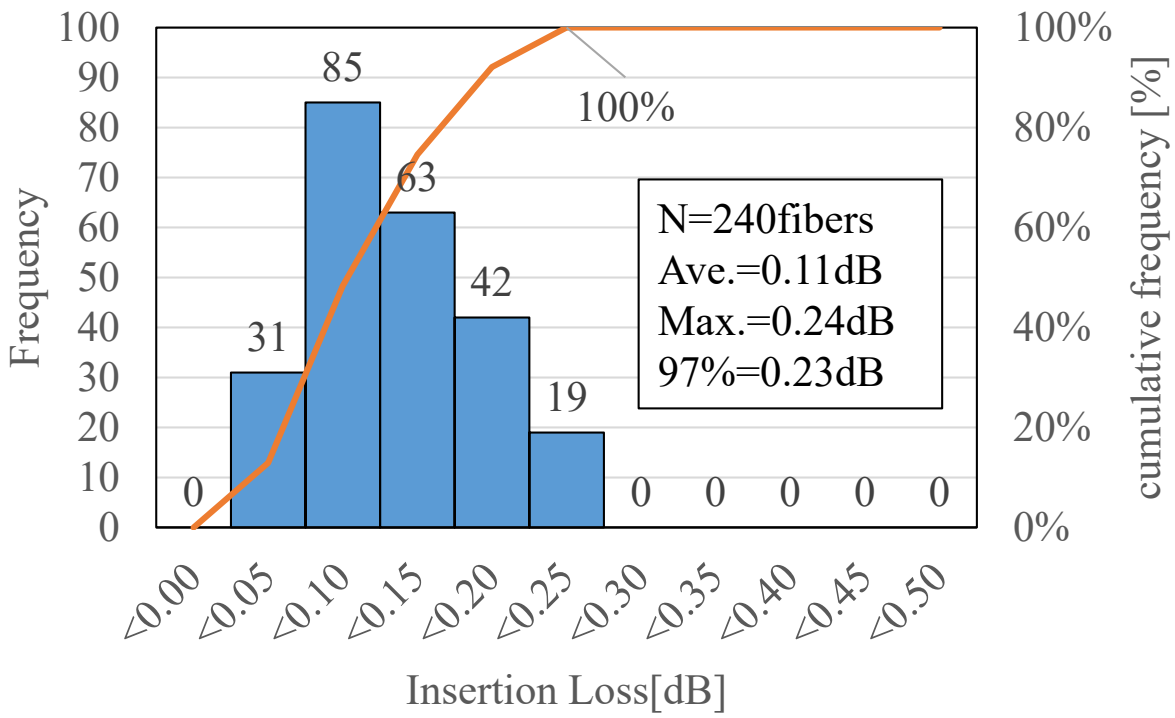
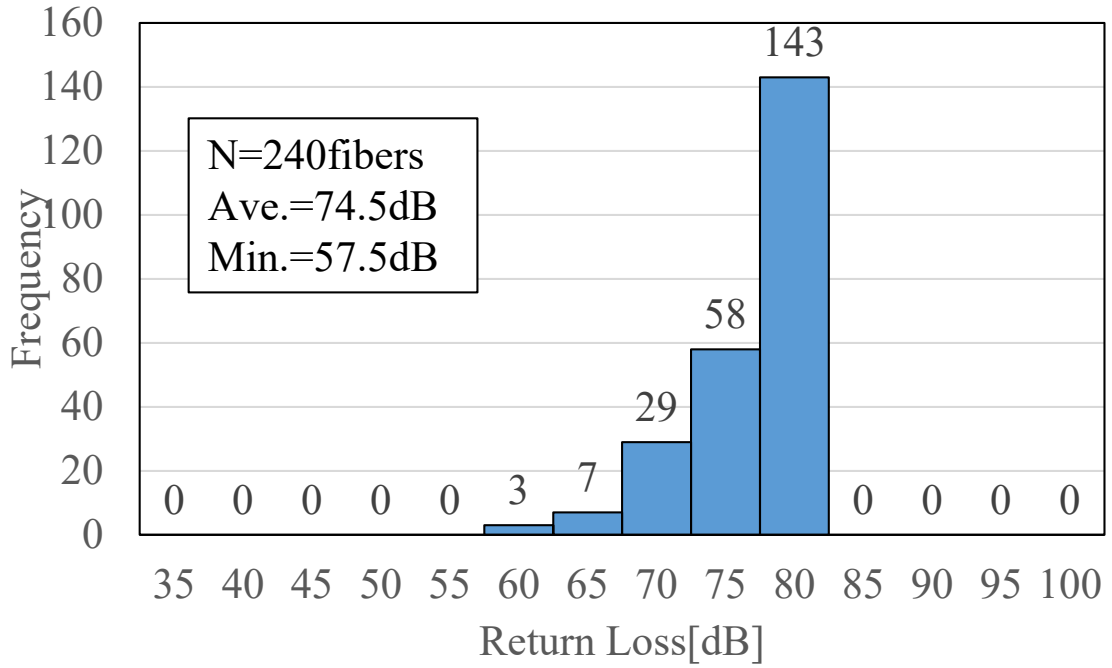
Contents

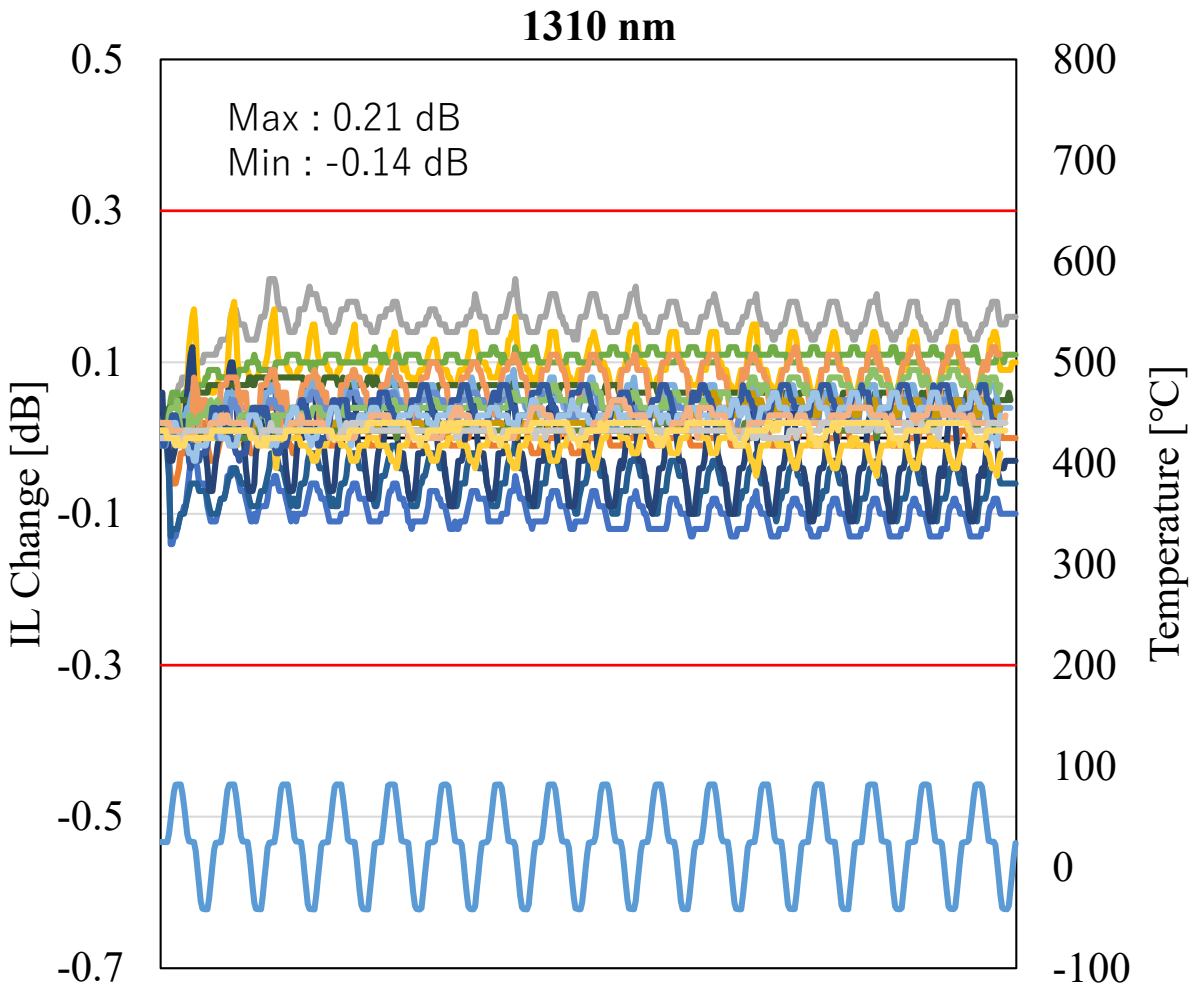
Optical performance 1x16 MMC, 1310nm

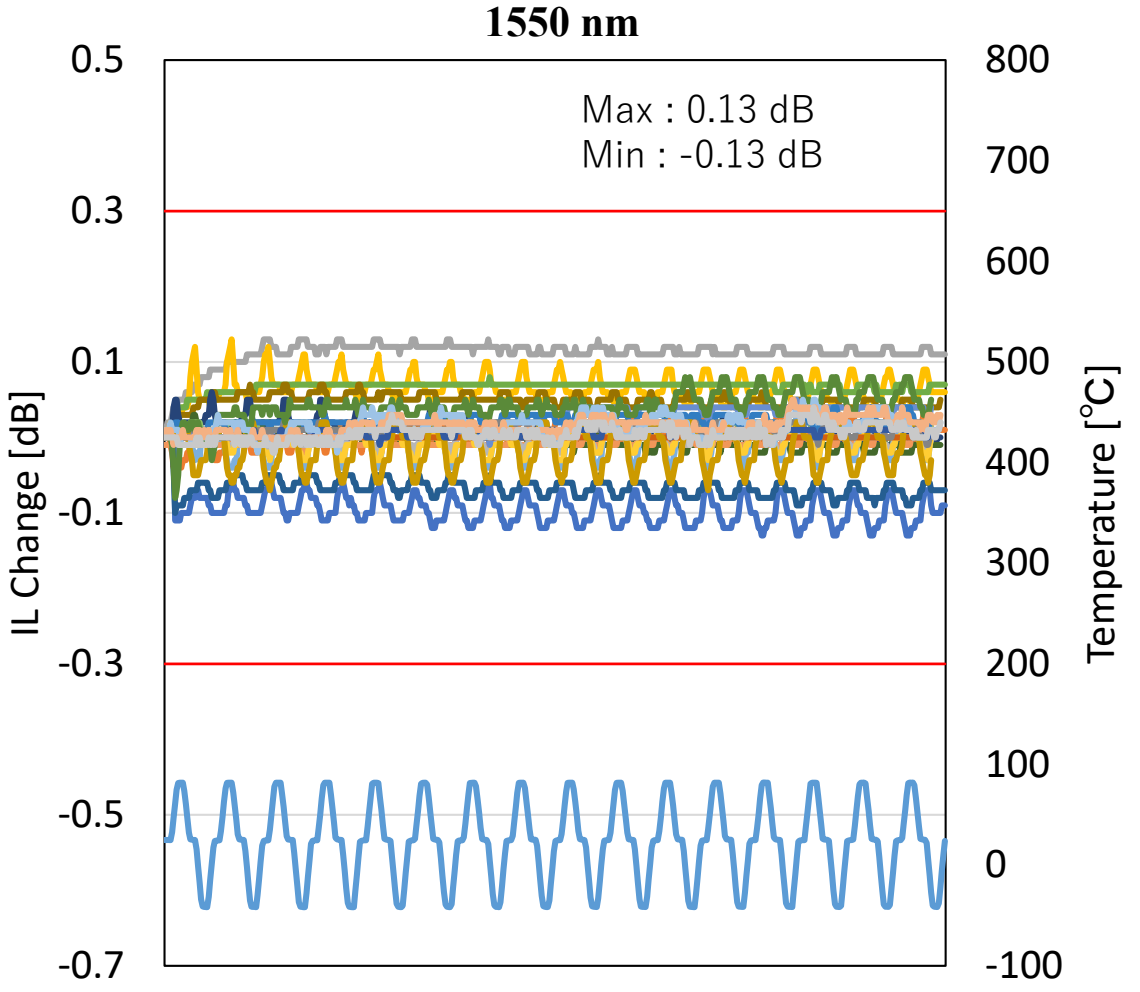




N …Sample size of fibers
Ave. …Average of all IL and RL measurements
Max. …Maximum value of all IL measurements
<97%. …Value that ranks 97% in the IL measurement data sorted from the smallest to the largest
Min. …Minimum value of all RL measurements

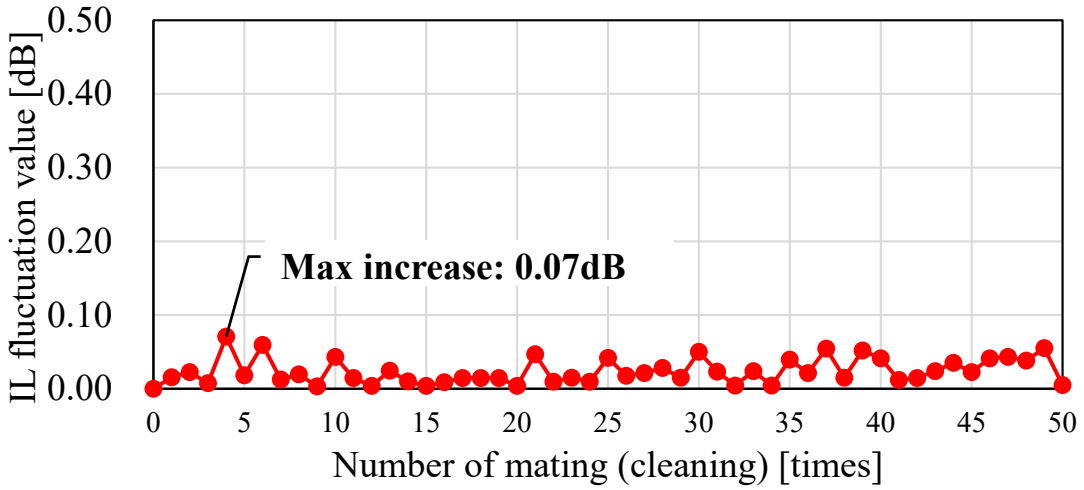
Environmental Testing

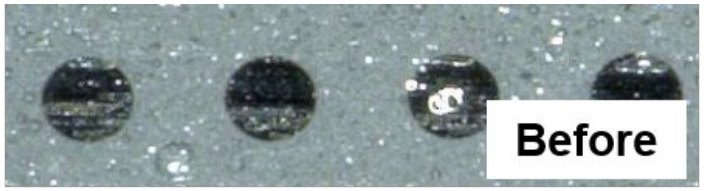


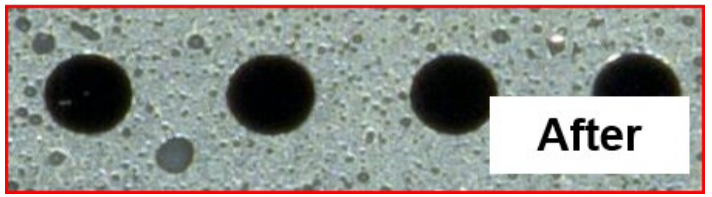


Mechanical Testing

Test		Criteria	Results
Vibration		IL ≦ 0.8 dB, IL change ≦ 0.3dB RL ≧ 50dB	IL ≦ 0.35 dB IL change ≦ 0.25 dB RL ≧ 55.3 dB
Flex		IL ≦ 0.8 dB IL change ≦ 0.3dB RL ≧ 50dB	IL ≦ 0.51 dB IL change ≦ 0.16 dB RL ≧ 56.4 dB
Twist		IL ≦ 0.8 dB IL change ≦ 0.3dB RL ≧ 50dB	IL ≦ 0.50 dB IL change ≦ 0.01 dB RL ≧ 56.3 dB
Transmission with Applied Load	Measure w/Load (0deg)	• After test IL ≦ 0.8 dB IL change ≦ 0.3dB RL ≧ 50dB • During Applied Load IL change ≦ 0.5dB RL ≧ 50dB	• After test IL ≦ 0.50 dB IL change ≦ 0.08 dB RL ≧ 66.3 dB • During Applied Load IL change ≦ 0.09 dB RL ≧ 66.4 dB
	Measure w/Load (90deg)	• After test IL ≦ 0.8 dB IL change ≦ 0.3dB RL ≧ 50dB • During Applied Load IL change ≦ 0.5dB RL ≧ 50dB	• After test IL ≦ 0.59 dB IL change ≦ 0.09 dB RL ≧ 66.6 dB • During Applied Load IL change ≦ 0.04 dB RL ≧ 66.2 dB
Impact		IL ≦ 0.8 dB IL change ≦ 0.3dB RL ≧ 50dB	IL ≦ 0.58 dB IL change ≦ 0.16 dB RL ≧ 62.1
Durability		IL ≦ 0.8 dB IL change ≦ 0.3dB RL ≧ 50dB	IL ≦ 0.18 dB IL change ≦ 0.07dB RL ≧ 68.1







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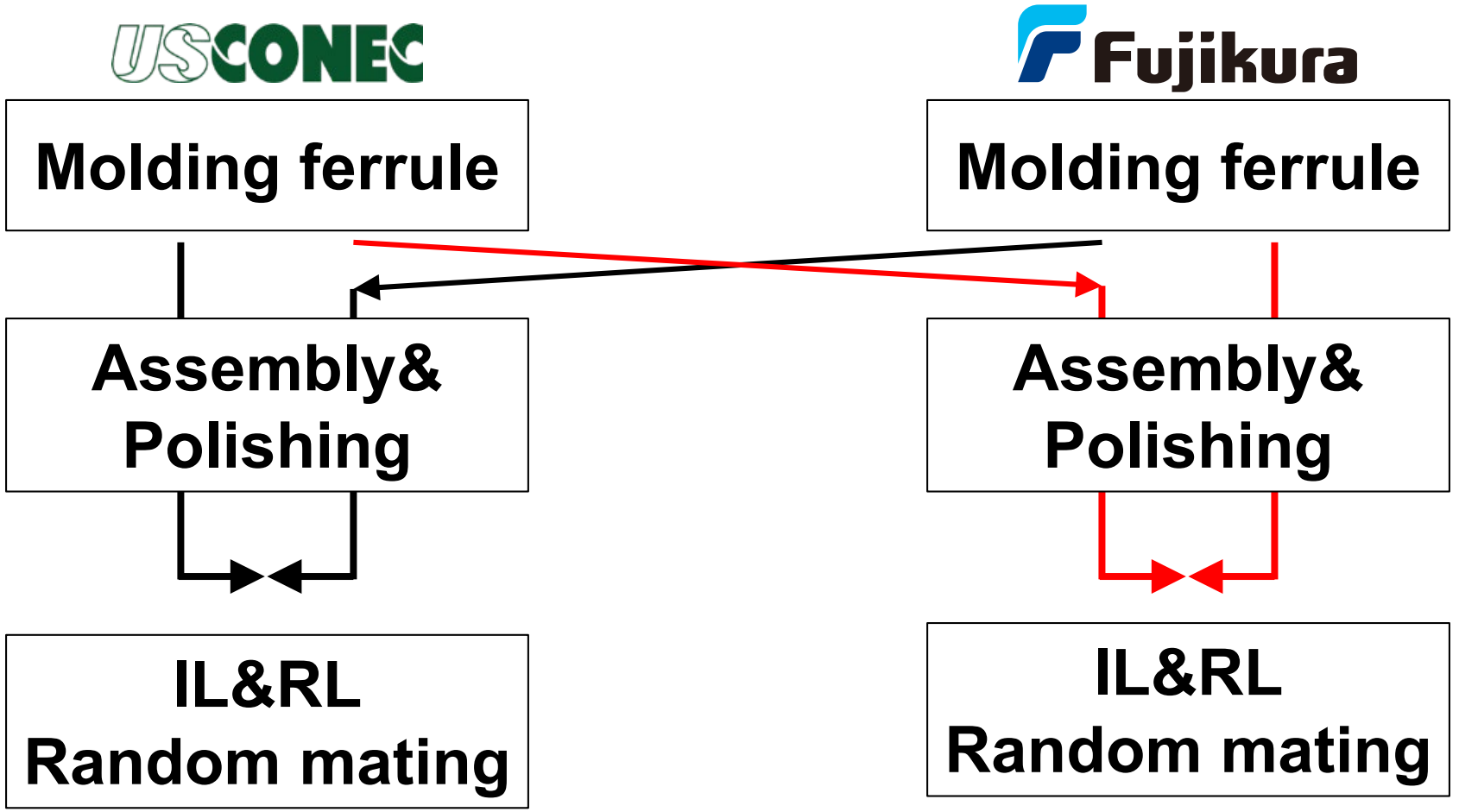
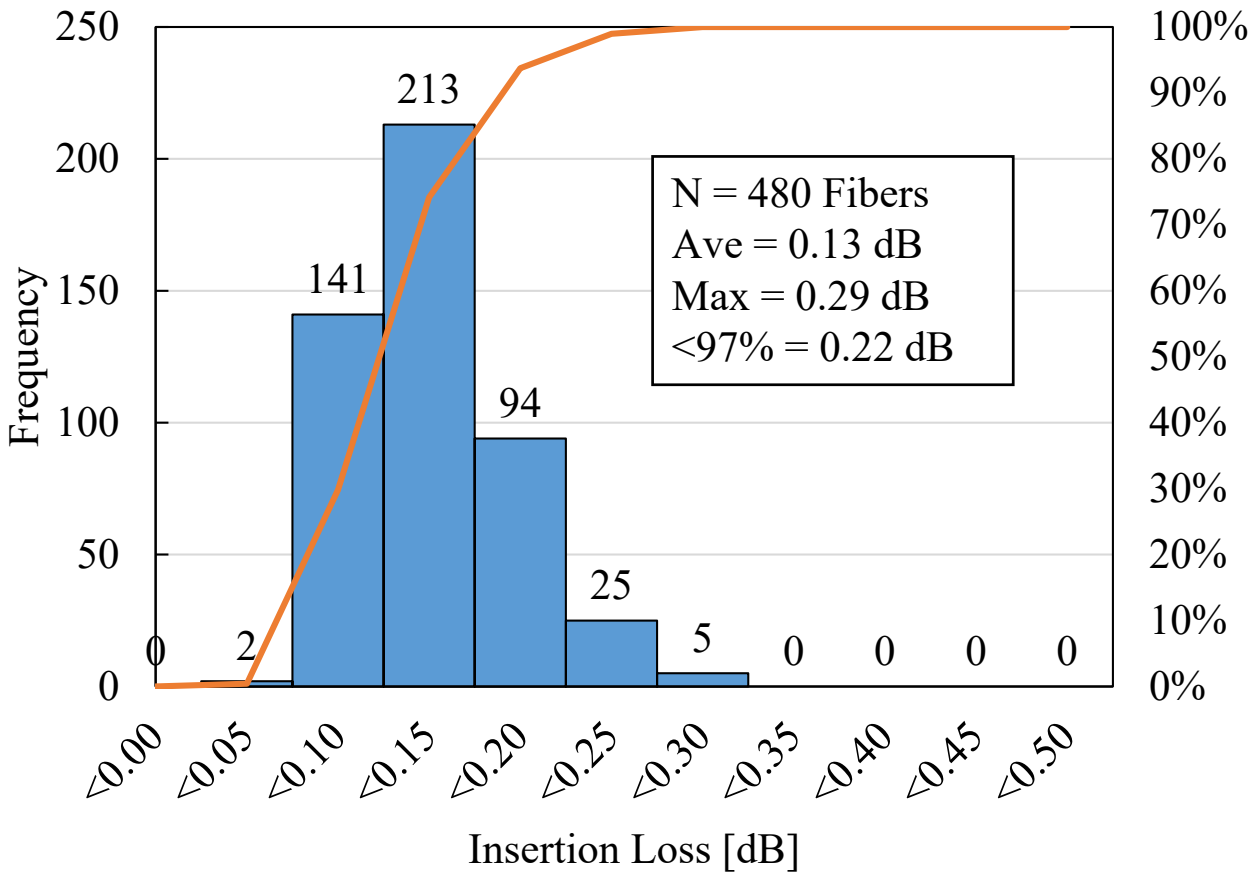
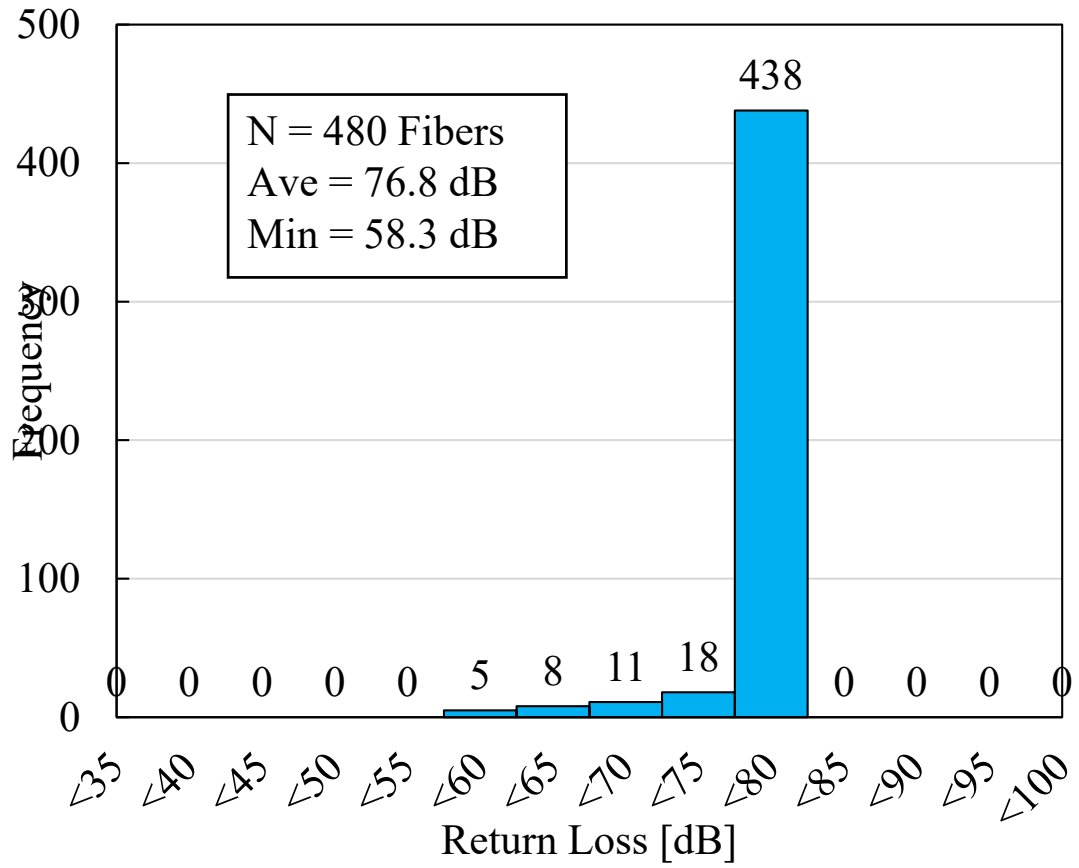
Intermateability - condition



Intermateability - Results





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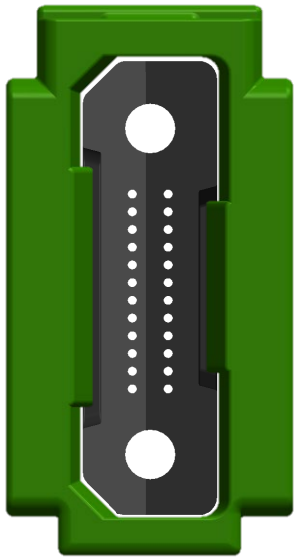
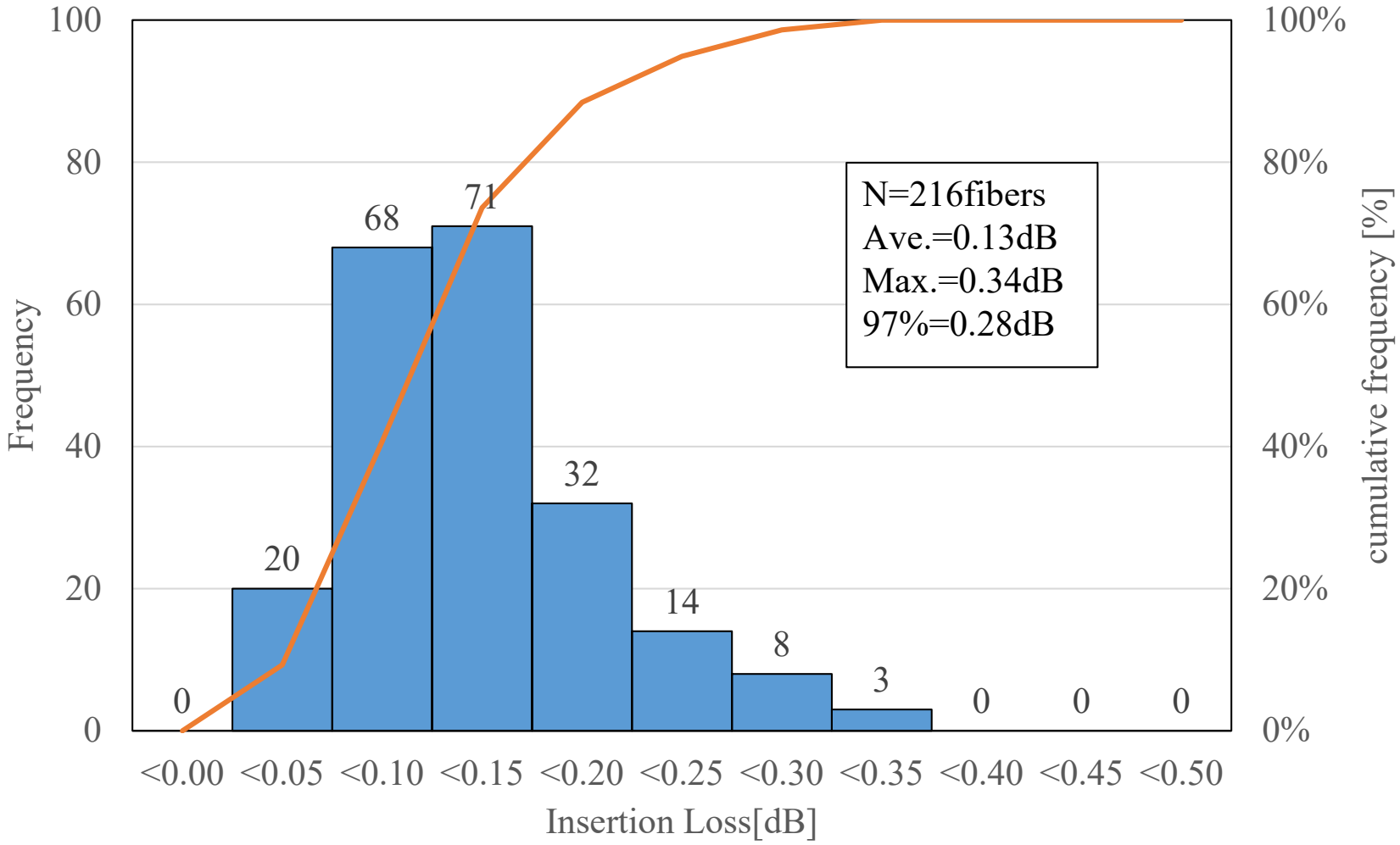
Preliminary 2-row MMC results



24f-MMC



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Contents

Conclusion

i. Hi-Density and Hi-Performance

With an increase of three times the panel density over MPO and improved insertion loss performance over IEC Grade B specification, the MMC connector meets the industry needs for density and performance. The MMC connector has demonstrated environmental and mechanical stability meeting industry expectations.

ii. Connector design verification

Excellent intermateability results indicate that the MMC connector design is able to sustain optical performance IEC- Grade-B.

iii. Usability

Development of a suitable cleaning tool allows for easy installation and maintenance.

iv. Next Step

We will continue to develop additional ferrule varieties including 2 row versions as well as a variety of connectors in the MMC product line.

Shaping the future with “tsunagu” technology.

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Optical Component Division

http://www.opticalcomponent.fujikura.com/