

2021-The Year of Records in Long-Reach Transmission

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Internet data traffic continues to experience exponential growth reflecting the increased demand for a greater variety of services and acceleration in adoption of high-resolution video and video conferences. This has become particularly pronounced in the pandemic era when face-to-face meetings and travel became limited, making video conferences essential to conducting business across the globe. At Corning, many years of innovation related to ultra-low loss and large effective-area fibers are helping network operators make their network more reliable and capable to withstand future bandwidth growth.

In 2021, Corning contributed to three records in the field of long-haul optical fiber communications. These records represent important milestones and demonstrate how far we can push the existing and emerging networks.

1. The longest 800G transmission over terrestrial fiber.



This work demonstrated 800G transmission over 1600 km - this is the record-long distance demonstrated for such a high-speed data transmission to date [1], achieved via a unique blend of system and fiber innovations. On the system side, this was enabled by continuous improvements in modem fabrication, coding and modulation techniques, and the use of Raman + EDFA amplifiers. Transmission performance was further enhanced using Corning® TXF® fiber, an ultra-low-loss, large-effective-area ITU-T G.654.E fiber, with 0.166 dB/km typical attenuation. This provides the total capacity per fiber in excess of 35 Tbit/s for a fully lit C-band system. This work highlights the readiness of 800G technology for use in medium and long-reach routes.

2. The lowest attenuation for 80-micron fibers.



During the 2021 OFC Conference, Corning's SMF-28® ULL S+ fiber claimed record-low attenuation of 0.152 dB/km for a fiber with an effective area of 80 μm^2 and its suitability to achieve trans-oceanic transmission with cable capacity of more than 300 Tb/s. More importantly, such an ultra-low level of attenuation shows the pathway toward further reduction in cost per bit - the main criteria of many subsea systems being designed today. Available in a smaller, 200 μm outer diameter, SMF-28 ULL S+ fiber is world's first for higher fiber density, cost-optimized subsea systems, and represents Corning's response to the ever-changing subsea industry needs.

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3. The longest Quantum Key Distribution distance.



Quantum Key Distribution (QKD) is an emerging application for data transmission to provide a more secure transmission channel compared to classical, non-quantum channels. One of the key requirements for QKD is the need to operate at low optical power levels, or even transmitting single photons in some scenarios. As a result, fiber attenuation becomes a critical parameter in QKD links to enable ultra-long transmission distances. In June 2021, a record-long 600 km QKD transmission was reported using a terrestrial Corning® SMF-28® ULL optical fiber [3]. These outstanding results show that QKD can be used in long-haul networks with significant reach improvements enabled by SMF-28 ULL fiber.

When Corning invented low-loss optical fiber more than 50 years ago, it began a telecommunications revolution that continues to shape the world. As customers require networks that are more reliable and capable of withstanding future bandwidth demand, Corning continues to innovate and deliver solutions to address these challenges. Corning's TXF fiber, SMF-28 ULL S+ fiber, and SMF-28 ULL fiber demonstrate an excellent performance, providing an improvement in reach, capacity and density for variety of existing and emerging long-distance applications.

References

- [1] R. Maher et. al. Tu6D.2 OFC 2021;
- [2] Downie J.D. et. al. M5E.3.OFC 2021;
- [3] Pittaluga et al. Nat. Photon. 15, 530–535 (2021)

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