<Appendix>

■ Roles of the individual companies

・KDDI and KDDI Research

Development of bi-directional O-band coherent DWDM transmission technology that enables high-capacity transmission

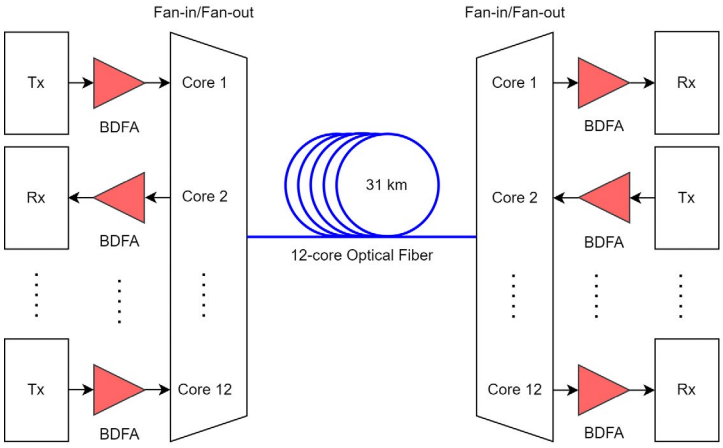

Fig. 2: Image of bi-directional O-band coherent DWDM transmission system

・Furukawa Electric and OFS

Development of O-band Bismuth-doped optical fiber amplifier that efficiently compensates optical fiber loss over a wide bandwidth in a single unit

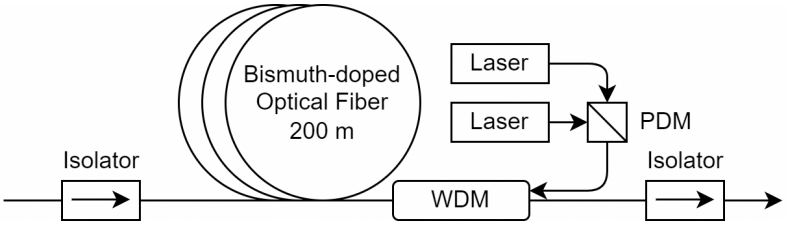

Fig. 3: Composition of O-band Bismuth-doped optical fiber amplifier (BDFA).
WDM: Wavelength Division Multiplexer, PDM: Polarization Division Multiplexing

・Sumitomo Electric

Development of high-density uncoupled 12-core optical fiber that significantly improves transmission capacity per fiber

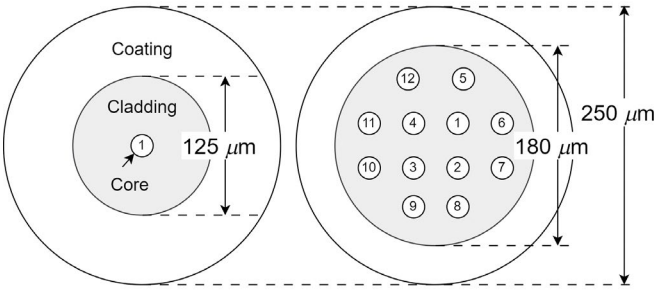

Fig. 4: Image of a 12-core optical fiber (right) with 12 cores densely arranged in the same standard 250 μm coating outer diameter as conventional optical fiber (left)

The O-band has an advantage in that it can reduce the signal processing load to compensate for wavelength dispersion (Note 8) because the effect of wavelength dispersion is smaller than that of the C-band, but it has a drawback that the quality of the optical signal is easily degraded due to nonlinear optical effects (Note 9). Therefore, the O-band has been considered unsuitable for increasing the capacity of optical fiber communication systems. KDDI Research has developed O-band coherent DWDM transmission technology that enables high-capacity transmission by suppressing nonlinear optical effects through optimization of the transmission power of optical signals.

Wavelength division multiplexing of more optical signals is effective in increasing the capacity of optical fiber communication, but this requires optical fiber amplifiers that can amplify a broader wavelength band. The BDFA developed by Furukawa Electric and OFS can amplify optical signals over the entire O-band, which is broader than the C-band and L-band combined. This experiment showed that an ultrawideband comparable to the C+L band can be achieved by amplifying coherent DWDM signals over 9.6 THz in the O-band.

Furthermore, by applying multi-core optical fiber, in which multiple cores that are paths for optical signals are arranged in a single optical fiber, the transmission capacity per optical fiber can be expanded by the number of cores. Sumitomo Electric has focused on the fact that optical signals in the O-band are more strongly confined by the core than in the C-band, and it has developed an uncoupled 12-core optical fiber with 12 independent cores densely clustered within the standard optical fiber outer diameter of 250 μm.

It was demonstrated that, by combining these three technologies, the total available bandwidth per optical fiber can be extended to 115.2 THz, and a 484 Tbps high-capacity transmission experiment was successfully conducted as one example. This is the world's largest bandwidth and transmission capacity in a demonstration experiment for a single wavelength band, not a combination of multiple wavelength bands.