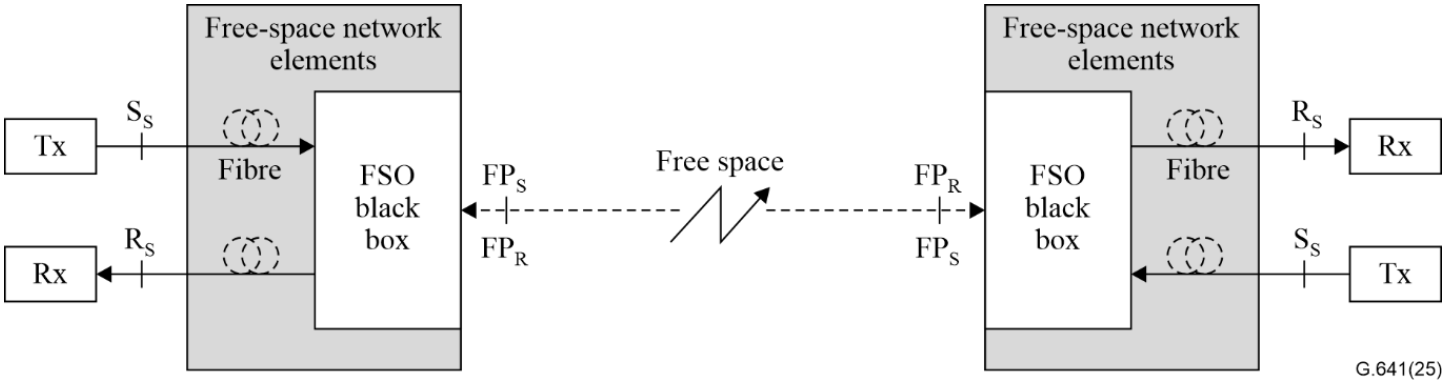
ITU-T Study Group 15

G.641 Terrestrial free-space optics for mobile backhaul with short reach interfaces

Recommendation ITU-T G.641 provides optical interface specifications for free-space optics (FSO) applications, primarily intended for mobile backhaul with short reach. Applications are defined using optical interface parameters. This Recommendation specifies both the FSO interface and the fibre interface.

Fig. 1 Point to Point FSO system configuration and interfaces



ITU-T G.959.1 – Optical transport network physical layer interfaces

This Recommendation serves as a compendium for technical definitions, design aspects, and analysis methods useful for devising recommendations for optical transmission systems.

Overview of FSO Systems

The standard identifies two vital physical boundary mappings to achieve vendor-independent optical interoperability over short terrestrial hops:

Tributary Interface (Ss/Rs)

Maps client-side single-channel transceivers directly into the FSO converter, maintaining data rate and protocol transparency.

Air Interface (FPs /FPr)

Standardizes physical free-space transmission end points.Decouples proprietary ATP (Acquisition, Tracking & Pointing) mechanical systems.

System Parameters & Tolerances

To secure eye-safety limits and maintain connection performance, the standard defines strict bounds for physical parameters:

Transmitter Beam Radius: 10 mm to 100 mm waist

Divergence Angle limit: < 500prad

Max Alignment Error sway: < 100urad

Rx Power Range: 0 dBm (max) down to -26 dBm sensitivity

Note: Refer to ITU-R P.1814/P.1817/F2106 for for information.

Key Take aways:

First of its kind: Standardizes optical parameters to enable multi-vendor compatibility across FSO systems.

Protocol & rate transparent: Allows transparent backhauling of physical client signals (like 10G/25G NRZ client optical lines).

Decoupled ATP: Enables vendors to design specialized tracking hardware while maintaining unified port interfaces.

Weather Resilient: Integrates robust attenuation models for Fog, Rain, and Wet/Dry snow to ensure guaranteed margins.

Built-In Eye Safety: Mandates compliance with IEC 60825 laser classes, capping transmit power to eye safety level.

© International Telecommunication Union 2026