

## Technical Note

**Subject:** Optical Fiber Extender Reach Calculations  
**Product Name:** Products with Optical Fiber Modules  
**Technical Note Date:** August 25, 2021

### Using the OSP SFP+ Module



By default, OSP SFP+ is already inserted into all Kramer optical products.

**Kramer offers both duplex and simplex transceiver modules as specified below.**

**Duplex (dual-fiber strand) modules:**

- **OSP-MM1:** Optical MM 850nm 10G SFP+ Transceiver (usually included in the package).
- **OSP-SM10:** Optical SM 1310nm 10G SFP+ Transceiver (can be purchased separately).

**Simplex (single-fiber strand) module:**

- **OSP-SM10S:** Optical SFP+ Transceiver Pair over 10G 1270/1330nm Simplex SM Fiber (can be purchased separately).

### Replacing the OSP SFP+ Modules

**Before deciding to replace the default SFP+ transceiver, consider the infra-structure of the installation area, the desired distance, optical loss budget and typical expected loss.**



When replacing the optical transceivers, use compatible SFP+ optical **transceiver modules on both** extender paired end-point units.

### Notes on Connecting the OSP SFP+ Modules



**OSP-MM1** and **OSP-SM10** modules are designed to be used only with LC(UPC) **blue** or LC(PC) **white** connectors. Using an LC(APC) **green** connector with the module causes poor performance and can damage the module connector.

For all other cable connections that do not connect directly to the **OSP-MM1** or **OSP-SM10** modules, such as the optical patch panel and bulk cables illustrated **below**, we recommend using Angled Physical Contact (APC) **green** connectors for improved end-to-end reach performance.



When using OSP modules consider the following:

- Modules are Class 1 Laser products.
- There may be Invisible laser radiation present.
- Avoid long-term viewing of laser.
- Avoid the use of magnifying viewing aids or instruments (such as binoculars, telescopes, microscopes and magnifying lenses, but not spectacles or contact lenses).
- Avoid placing optical devices in the emitted beam that could cause the concentration of the laser radiation to be increased.



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### Optical Reach Evaluation

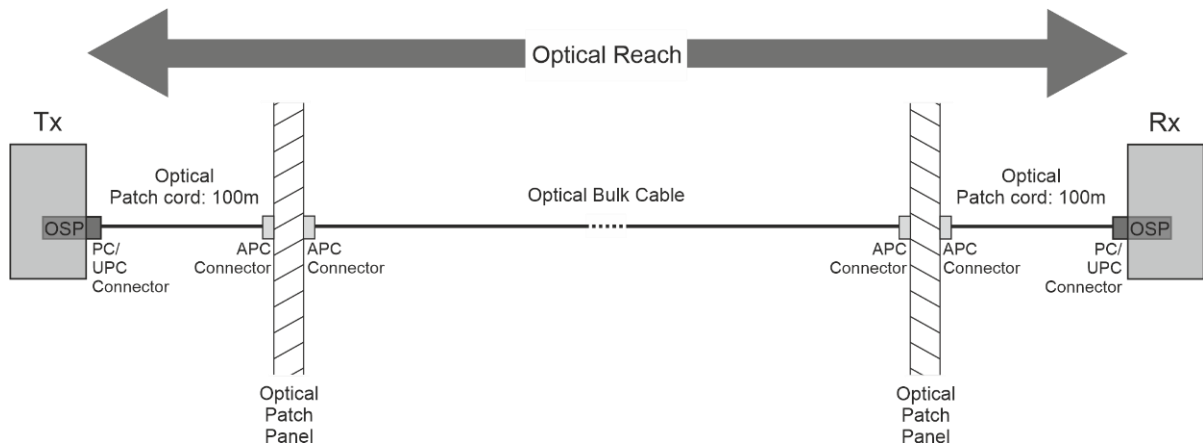
The following table defines various typical Fiber cable characteristics, used for optical reach evaluation:

Cable Category	Core Diameter [μm]	Wavelength	Fiber Loss [dB/km]	Connector Loss [dB]	Splice Loss [dB]
<b>MM OM1</b> [G.651.1]	62.5/125	850nm	3	Typical: 0.3 Max.: 0.75	0.3
<b>MM OM2</b> [G.651.1]	50/125		2.5		
<b>MM OM3</b> [G.651.1, Laser Optimized]					
<b>MM OM4</b> [G.651.1, Laser Optimized]					
<b>MM OM5</b>					
<b>SM OS1</b> [G.652A/B]	8	1310nm	1		
<b>SM OS2</b> [G.652C/D]			0.4		

The following examples show how to calculate dB loss during optical signal transmission over fiber optical infrastructure.

In this optical system layout example:

- Both Optical Product transmitter and receiver are connected to a patch panel via 100m patch cords.
- There are 6 connectors and no splices.



System Layout Example for Optical Reach Evaluation

For multi-mode lines (**MM OM3 cable category, as defined in the table above**):

- Maximum loss budget is: 8.6dB.
- Typical loss per connector is 0.3dB.
- Typical loss for each patch cord (100m) is 0.25dB.
- Fiber-optic loss is 2.5 dB/km.

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**Multi-mode bulk line budget is:  $8.6 - (0.3 \times 6 + 0.25 \times 2) = 6.3\text{dB}$ .**

**Evaluated bulk line length is:  $6.3/2.5 \approx 2.5\text{km}$ .**

**For single-mode lines (SM OS1 cable category, as defined in the table above):**

- Maximum loss budget is: 11.9dB.
- Typical loss per connector is 0.3dB.
- Typical loss for each patch cord (100m) is 0.1dB.
  - **Fiber-optic loss is 1 dB/km.**

**Single-mode bulk line loss budget is:  $11.9 - (0.3 \times 6 + 0.1 \times 2) = 9.9\text{dB}$ .**

**Evaluated bulk line length is:  $9.9/1 \approx 9.9\text{km}$ .**



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