DATANET
ASSETS

Power Budgets

A common assumption made is that the connection between the sending (Tx) and receiving (Rx) transceiver is always of good quality. However, this connection ("link") may not be as good as what is expected or required. Transceiver specifications, length of the link and connectors (such as a patch panel) can influence the quality of the connection. This can lead to connection errors that have an adverse effect on the operation of the network. With the ever-increasing speed of networks, the connection errors will start to have greater impacts.

Before a fiber optic connection is made, it must be ensured that sufficient optical power is available for the connection to function properly. To achieve this, the so-called power link budget for the connection must be calculated. The power link budget is the maximum amount of optical power that can be sent through the connection. If the optical power is too high or too low, this will lead to an increase in bit errors (BERs). When a power value is too high, the receiver may become saturated (meaning it cannot process everything), while when the value is too low the signal will be disrupted.

To calculate the estimated power budget (P_B), the lowest value of the Transmitter power (P_T) and the lowest receiver sensitivity value (P_R) are used.

$$P_B = P_T - P_R$$

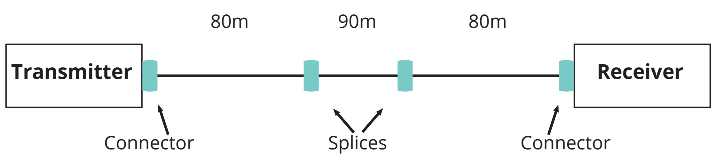
Example: (Tx transmitter = -3.2 dBm; Rx receiver = -8dBm)

$$P_B = (-3.2dBm) - (-8dBm)$$

$$P_B = 4.8dBm$$

When the power budget is known, the Power Margin (P_M) must be calculated. This is the value that remains when Link Loss (LL) is deducted from the Power Budget (P_B). Link loss can be caused by fiber attenuation, connectors, patch panels, and splices.

$$P_M = P_B - LL$$



The table below provides estimated values for loss factors as set by the Fiber Optics Organization (www.FOA.org).

Component	**Attenuation**
Connector	0.3 dBm
MPO	0.75 dBm
Splice	0.3 dBm

Component	**Attenuation**
MM cable 850nm	3 dBm/km
MM cable 1300nm	1 dBm/km
SM cable 1310nm	0.5dBm/km
SM cable 1550nm	0.4 dBm/km

If the value for P_M is greater than 0 (zero), the power budget is enough to establish a well-functioning link between the sending and receiving transceivers.

Example: *P_B = 4.8 dBm, 2 connectors; Fiber cable: 250m multimode link 850nm; 2 splices.*

$P_M = P_B - LL$

$P_M = (4.8\ dBm) – (2\ (0.3\ dBm) - 250m\ (3\ dBm/km) – 2\ (0.3\ dBm))$

$P_M = (4.8\ dBm) – (0.6\ dBm - 0.75\ dBm - 0.6\ dBm)$

$P_M = 4.8dBm – 1.95dBm$

$P_M = 2.85\ dBm$

As the power margin in this example is far greater than zero it would be enough to satisfy the need for flawless transmission of data between transmitter and receiver.

When the power budget is too high the solutions is to add an attenuator to the link in order to decrease the power budget of the link. However, when the power budget is too low there are several solutions. Using a different transceiver type (with different Tx / Rx specifications), having the link work at a lower speed, or adding an amplifier to the link would help obtain the required values.