Power Budget

WELCOME!

This program is for calculating power budget of DWDM transmission Link (Link Distance of 80 km to 220 km).

In Basic DWDM long distance link, transceiver, MDU, Directionless ROADM and Degree ROADM are both on the Transmitting and Receiving Sites.

B is a booster amplifier.

P is a pre amplifier

There is an add/drop station between the transmission link.

The length of the L2 should be equal or longer than the L1.

Figure block

Before the calculation start, please choose and input the specification value of the devices.

Fiber Specification

This table show the general value of SM fiber specification.

|  |  |  |
| --- | --- | --- |
| Fiber Type | Attenuation ‘α’ (dB/km) | Dispersion coefficient (ps/nm-km) |
| Single Mode (SM) | 0.275 | 17 |

Reset

Inputting new SM specification to this table is allowed.

User can reset the input value return to general value.

Insertion losses from add/drop port to common port

This table shown the general insertion losses from add/drop to common of MDU, Directionless ROADM and Degree ROADM.

|  |  |  |  |
| --- | --- | --- | --- |
| ROADM Degree | MDU loss(dB) | Directionless ROADM (dB) | Degree ROADM (dB) |
| 2 | 14 | 4 | 4 |
| 4 | 14 | 7 | 7 |
| 8 | 14 | 7 | 7 |

Reset

Inputting new insertion losses specification to this table is allowed.

User can reset the input value return to general value.

Insertion losses from common port to add/drop port

This table shown the general insertion losses common port to add/drop port of MDU, Directionless ROADM and Degree ROADM.

|  |  |  |  |
| --- | --- | --- | --- |
| ROADM Degree | MDU loss(dB) | Directionless ROADM (dB) | Degree ROADM (dB) |
| 2 | 7 | 7 | 7 |
| 4 | 7 | 9 | 9 |
| 8 | 7 | 11 | 11 |

Reset

Inputting new insertion losses specification to this table is allowed.

User can reset the input value return to general value.

Please add the transceiver power value in dB

|  |  |
| --- | --- |
| Minimum Transmit Power (dB) |  |
| Maximum Transmit Power (dB) |  |
| Minimum Receive Power (dB) |  |
| Maximum Receive Power (dB) |  |

Please add the maximum connector loss value for the link

|  |  |
| --- | --- |
| Connector Loss(dB) |  |

EDFA power specification

This table shown the general value of EDFA power specification.

|  |  |
| --- | --- |
| Amplifier Power types | Power Values |
| Flat Gain (FG) | 22 dB |
| Gain Range (G) | 15 to 30 dB |
| Noise Figure (NF) | 5.5 dB |
| Maximum Input Power (Pin max) | 5 dBm |
| Maximum Output Power (Pout max) | 20 dBm |
| Minimum Input Power (Pin min) | -35 dBm |
| Minimum Output Power (Pout min) | -5 dBm |

Reset

Inputting new EDFA specification value to this table is allowed.

User can reset the input value return to general value.

DCM specification

This table show the general types and values of DCM.

|  |  |  |
| --- | --- | --- |
| DCU Modules | Dispersion Compensation (ps/nm) | Insertion Loss (dB) |
| 30 Km | -510 | 4 |
| 40 Km | -680 | 4 |
| 60 Km | -1020 | 4 |
| 80 Km | -1360 | 4 |
| 120 Km | -2040 | 4 |

This program is focus on DWDM link of each channel carrying 10 Gbps of data.

The number of channels in this link should be in the range of 32 channels to 80 channels.

To start the calculation, please input the number of channels (32 channels to 80 channels)

N=

The output power of an amplifier per channel in an N channel DWDM network is

Pout (dBm) = Pin (dBm) + Gain (dB)

Pout /ch = Maximum output power – 10\*log10 (N) =

Per channel output power is

Pin (dBm) + Gain (dB) =

In? channel DWDM link, for single channel calculation the maximum output should be? dBm.

Gain range of the amplifier should be in the range of ? to ?

Please input the length of L1 between the range from 40 km to 80 km.

L1 = ? km

Please input the length of L2 between the range from 40 km to 120 km.

L2 = ? km

Total length of the link =? km

Residual dispersion value should be in the range from -510 ps/nm to 1020 ps/nm.

Total dispersion value of the link = ? ps/nm

Dispersion value too high, please choose the suitable DCM module for the link.

Residual Dispersion = ? ps/nm – (2 x DCM value)

= ? ps/nm (-510 ps/nm < 680 ps/nm < 1020 ps/nm)

Please re choose the suitable DCM module.

Span 1 losses= (attenuation of fiber x length) + (2 x connector losses) + DCM losses

= ? dB

Span 2 losses= (attenuation of fiber x length) + (2 x connector losses) + DCM losses

= ? dB

Minimum transmitter power of the link is ? dBm and minimum receiver sensitivity is ? dBm

Please choose the Transmitting site Degree

Please choose the Add/Drop station site Degree

Please choose the Receiving site Degree

Gain of B1:

B1 I/P power = (Pin1 – MDU Loss – D/L ROADM Loss – Degree ROADM Loss) =

Therefore B1 Gain = ? dB (15 dB < 23 dB < 30 dB)

Gain calculation of P1:

P1 I/P power = B1 O/P power – Span 1 Loss

Therefore P1Gain = dB (15 dB < 27 dB < 30 dB)

Gain calculation of B2:

B2 Input Power = (P1 O/P power – Degree ROADM 1 – Degree ROADM 2) =

Therefore B2 Gain = dB (15 dB < 16 dB < 30 dB)

Gain calculation of P2:

P2 I/P power = B2 O/P power – Span 2 Loss =

Therefore P2 Gain = 34 dB (> 30 dB)

Line amplifier need to add in the L2 link.

Amplifier is placed at a point where minimum gain can be achieved i.e. ? dB

Figure

Line amp O/P power = Gain(dB) + Line amp input power

Line amp input power (dB) = dB

Due to the Line amplifier placement in the L2 link, the link becomes L21 and L22.

L21 fiber loss = B2 O/p power – (Line amp input power + (2 x connector loss)) = dB

Length of L21 = L21 Loss (dB) / α (dB/km) = km

Length of L22 = length of L2 – length of L21= km

L22 fiber loss = length of L22 x α (dB/km) = dB

L22 span loss = Fiber L22 loss + DCM loss + (2 x connector loss) = dB

After calculating I/P, O/P and gain power values for EDFA the last step remaining is calculating the input power at the receiving end connected to the De-Mux

I/P to receiving end = (P2 O/P power – Degree ROADM Loss – D/L ROADM Loss – MDU Loss)

= dBm

The input power at the receiving end should be in the range of minimum transceiver sensitivity and maximum receive power of the transceiver.

Please check and choose the suitable device value for the link.

Component Placement in the Figure

Table for the whole link