Qualified Partner Programme QPP

FO Measurement Technique

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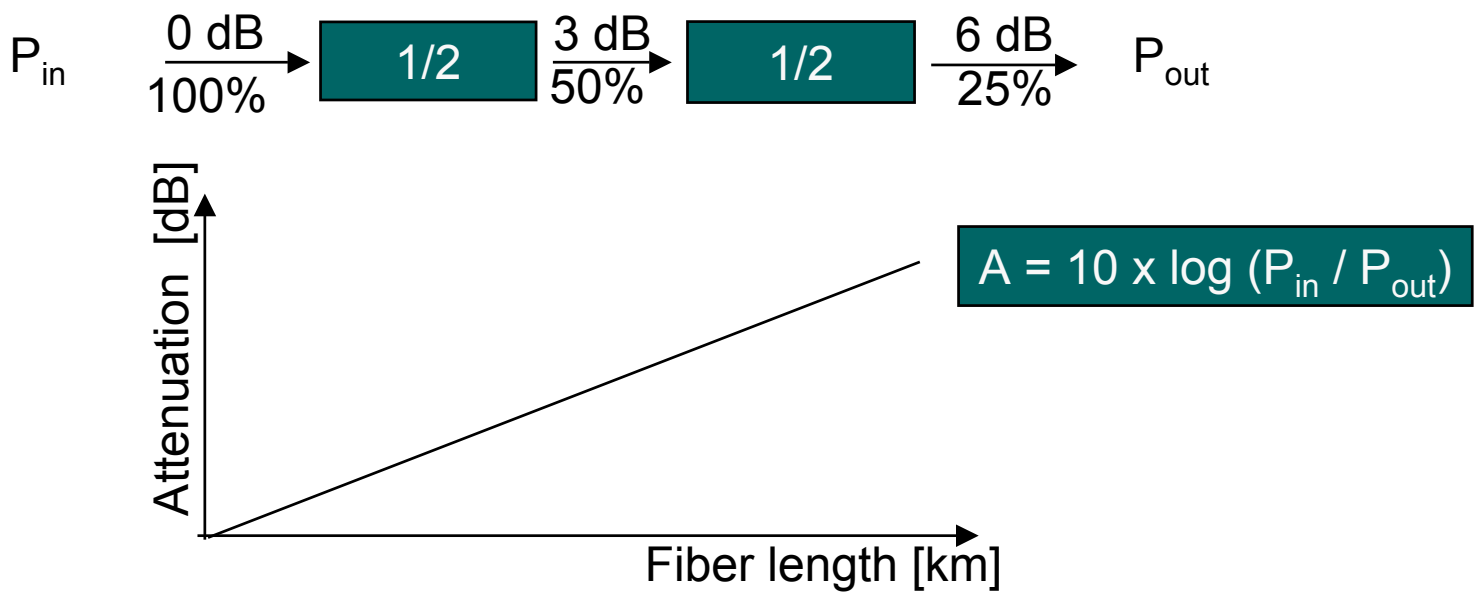
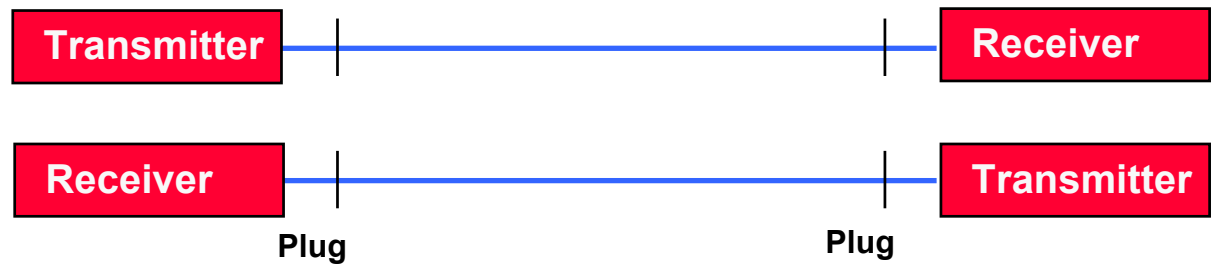
R&M
Convincing cabling solutions

dB (decibel)

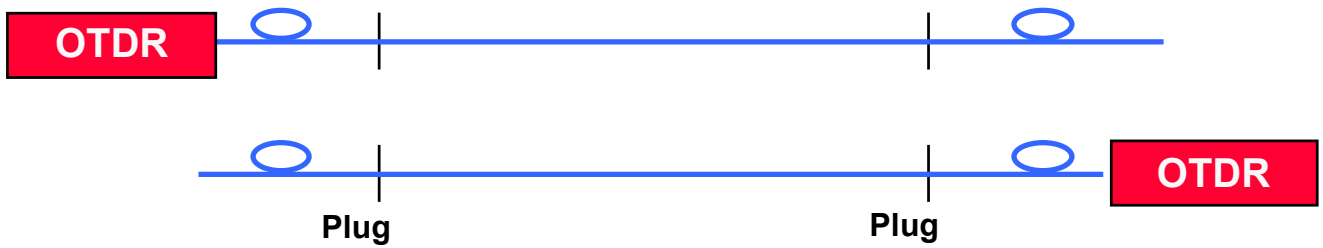

P in
0 dB
100%
1/2
3 dB
50%
1/2
6 dB
25%
P out
Attenuation [dB]
Fiber length [km]
A = 10 x log (P in / P out)

Attenuation measurement / measuring principles

Power measuring



Backscatter measuring (OTDR)



When to employ which method

Power meter:

- always with terminated cable ends
- to measure the actual link loss

Backscatter measuring:

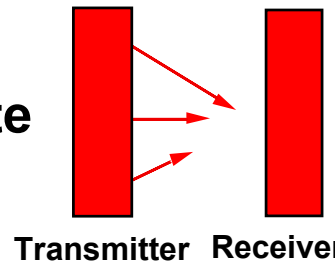
- when there is a closure
- on cables of over 200 m
- in difficult tracks
- for fault tracking

PMD measuring:

- on singlemode links with very high transmission rates (>2 km)

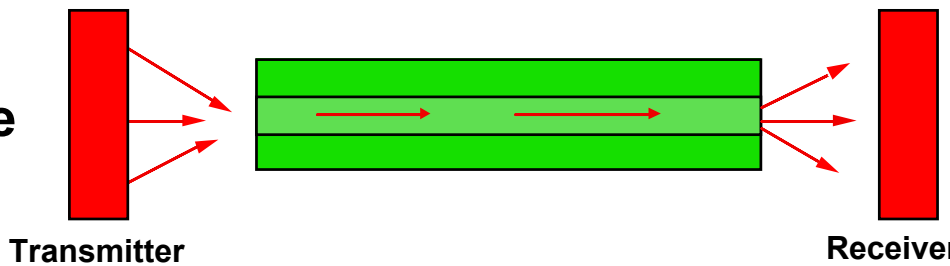
The principle of level measuring / power measuring

Calibrate



Value = 100% → Attenuation = 0

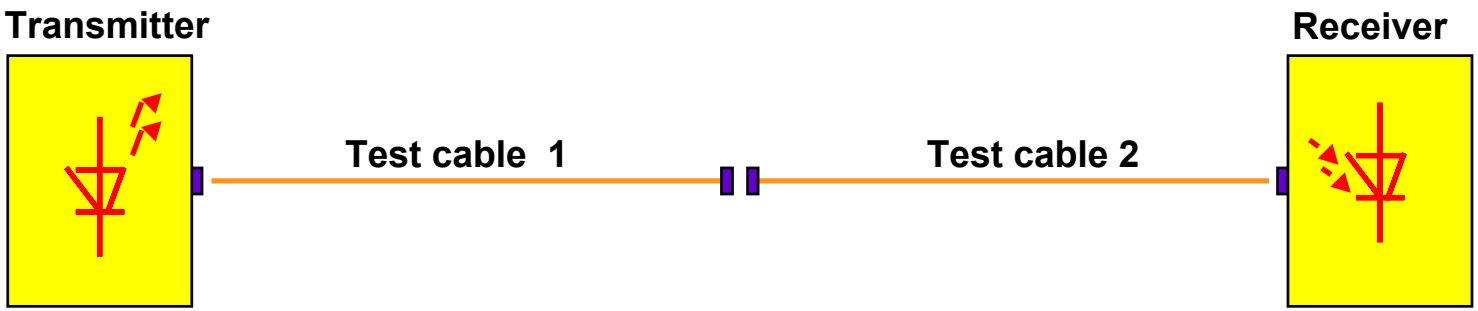
Measure

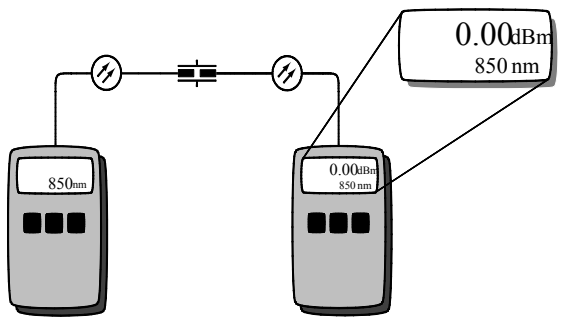


Value = x% → Attenuation = y

Level measuring / power measuring

1. Reference measuring

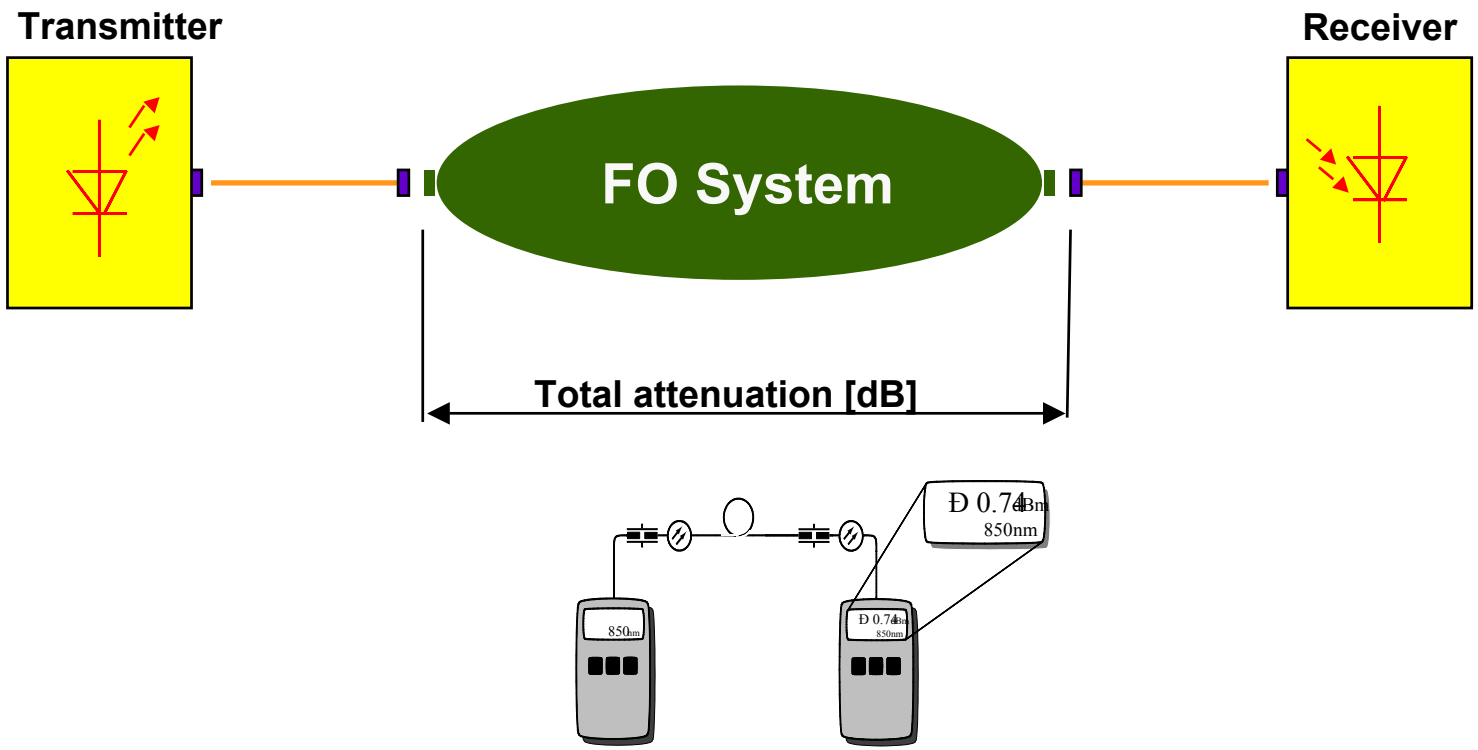




Adjust:
attenuation = 0 dB

Level measuring / power measuring

2. Measuring the system's attenuation



Power measuring characteristics

- Very accurate measurement
- Simple (economical) test equipment
- Very suitable for the testing of an installation
- Does not detect the cause of attenuation

NOYES
FIBER SYSTEMS

Light sources to measure the parameters

(power source)

• Weight	field-capable
• Battery lifespan / type	customary batteries
• Battery display	
• Wavelength	850/1300 or 1310/1550 nm
• Light source (laser / LED)	laser only for SM and long distances
• Output (dB)	max. link loss
• Stability	measuring accuracy
• Connector	adapters (ST / SC / MT-RJ...)

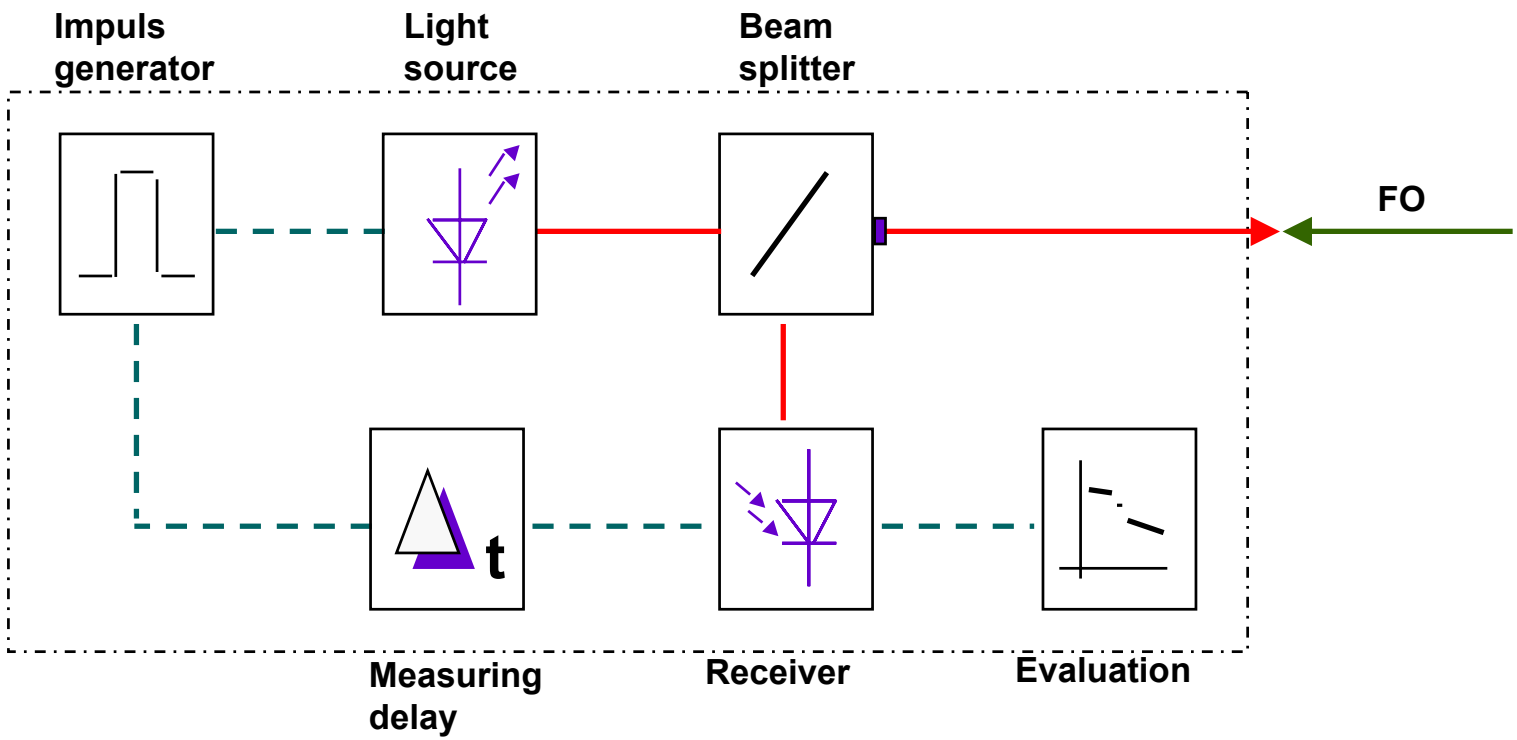
Optical fiber transmission links

Application	Light source	Wavelength	Transmitter (dBm)	Receiver (dBm)	Dynamic ratio (dB)
Telecom	Laser/SM	1310 nm 1550 nm	+3...-6 0...-10	-40...-45 -40...-45	34...48 40...45
Data transmission	LED/MM	850 nm 1300 nm	-10...-20 -10...-20	-30...-35 -30...-35	10...25 10...25
CATV	Laser/SM	1300 nm 1550 nm	+10...0	0...-10	10...20

Powermeter parameters

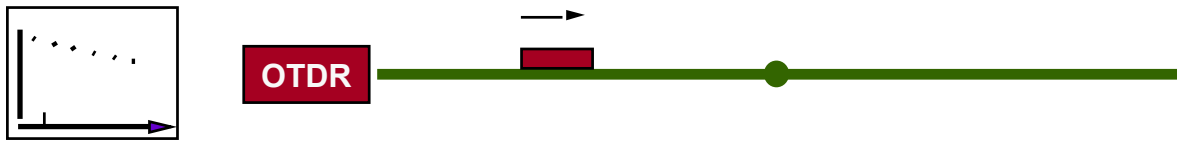
• Weight	field-capable
• Battery lifespan / type	customary batteries
• Battery display	
• Wavelength	840 ....1650 nm
• Measuring range	high dynamic ratio
• Measuring accuracy	
• Measuring units	dBm, dB (mW, µW)
• Connector	adapters (ST / SC / MT-RJ...)
• Storage	yes / no

Optical time domain reflectometer OTDR

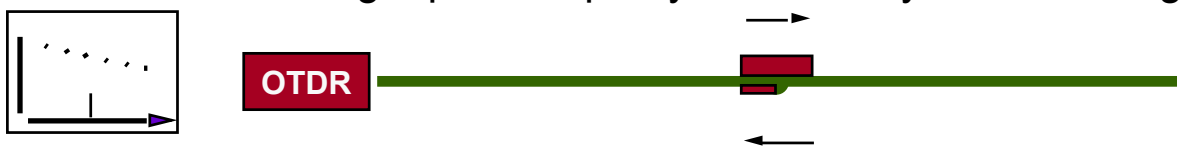


OTDR measuring procedure

A light pulse propagates in an optical waveguide.



The light pulse is partly reflected by an interfering effect.



The reflected light pulse is detected by the OTDR.

Typical and standardised attenuation values

Fusion splice

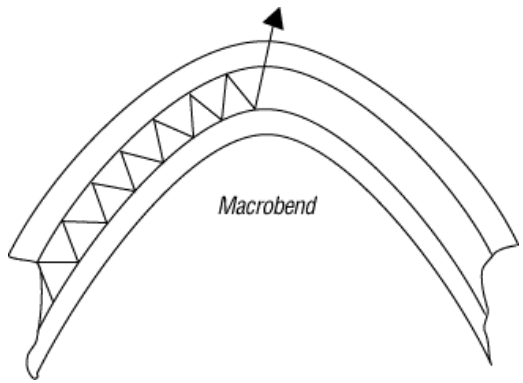
- Typical:
  - MM: approx. 0.05 dB
  - SM: approx. 0.10 dB
- According to standard (EN 50173 (draft 2001):
  - MM: 0.3 dB
  - SM: ditto MM

Connector (IL / RL)

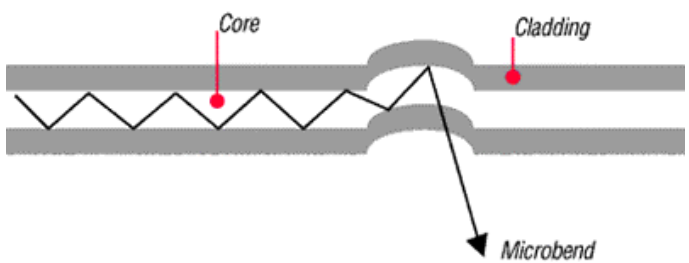
- Typical:
  - MM: RL: 30 dB IL: approx. 0.3 dB
  - SM RL: 45 dB IL: approx. 0.1 - 0.2 dB
- According to standard (EN 50173 (draft 2001):
  - MM: RL: 20 dB IL: 0.50 dB for 95% of the plugged connections
0.75 dB for 100% of the plugged connections
  - SM: RL: 35 dB IL: not specified / dito MM

Further causes of attenuation

Macrobending:



Mikrobending:



An example of an OTDR waveform

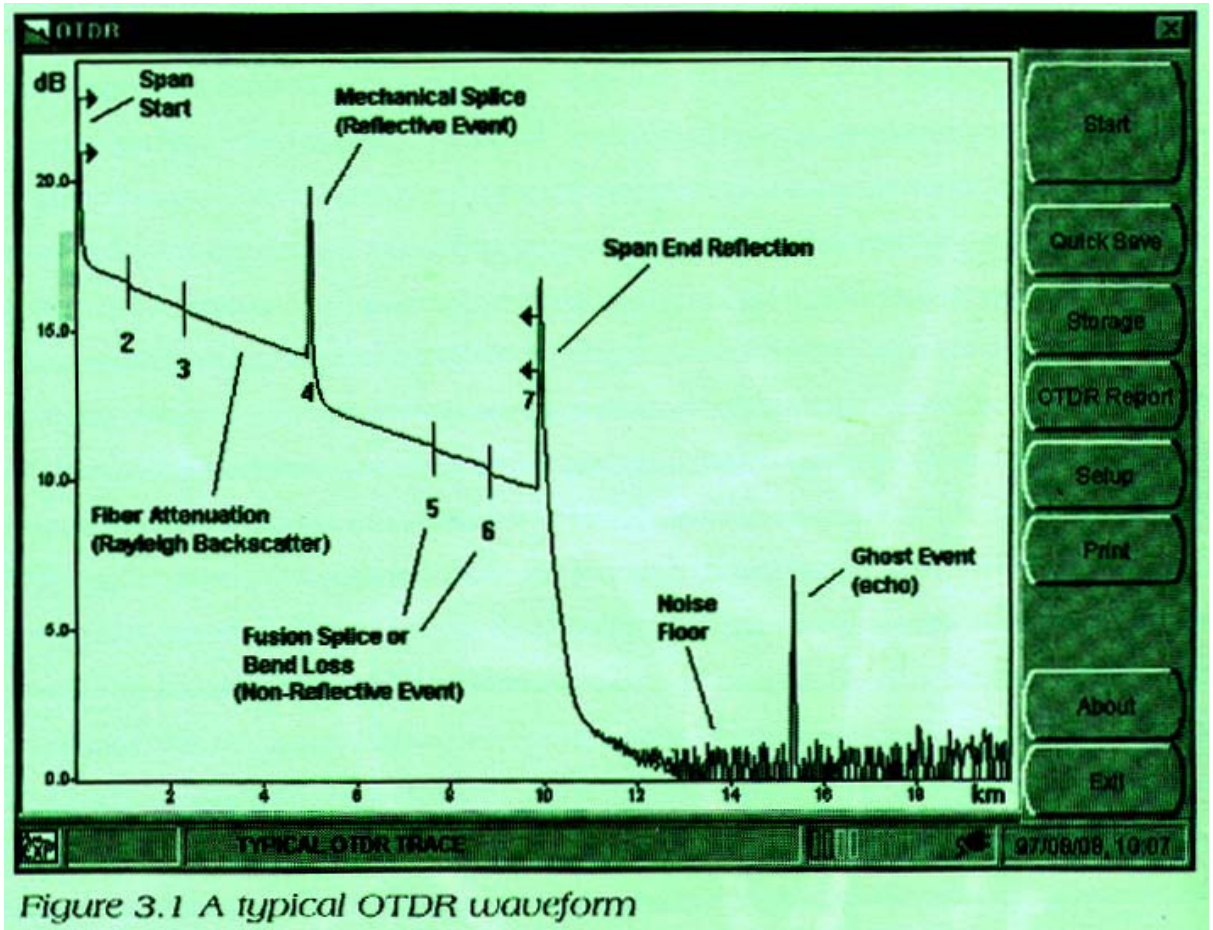
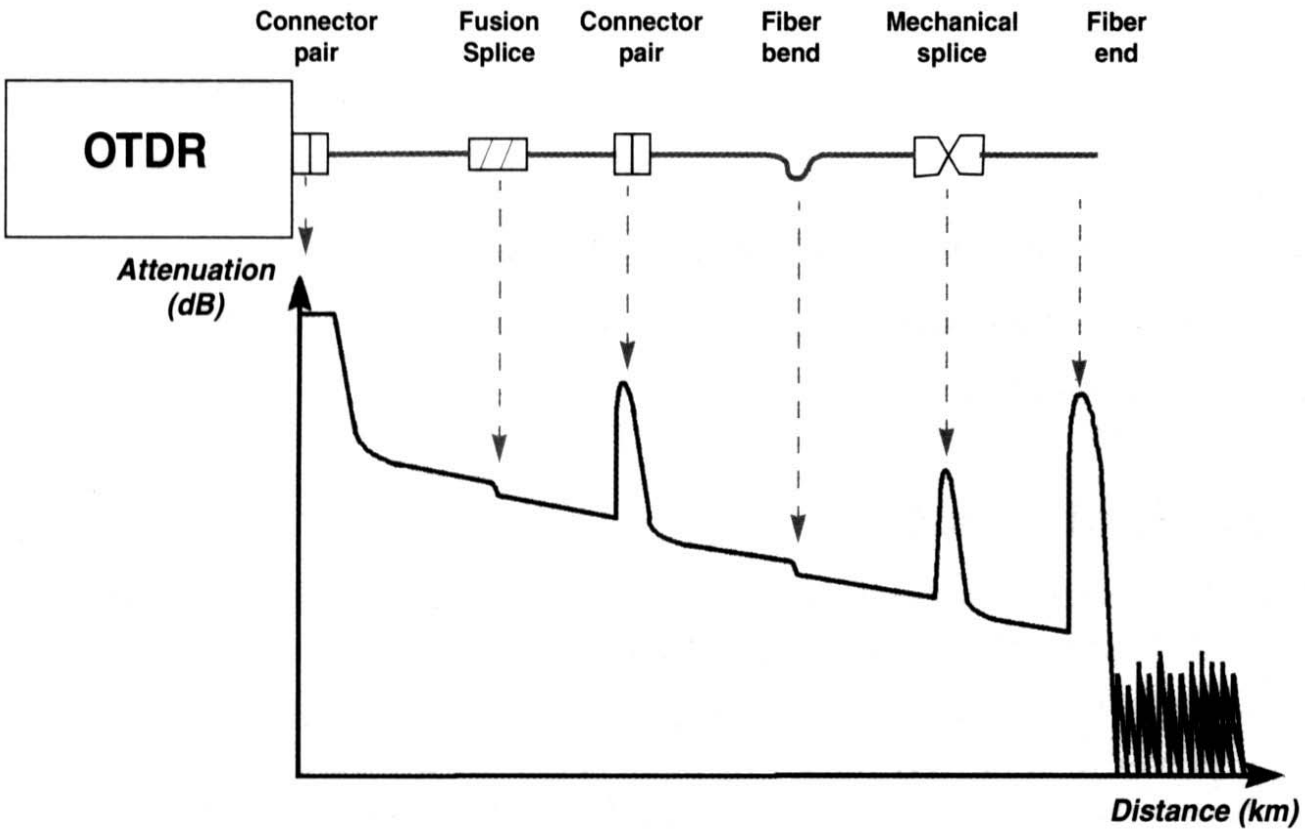


Figure 3.1 A typical OTDR waveform

An example of an OTDR waveform



Typical OTDR trace

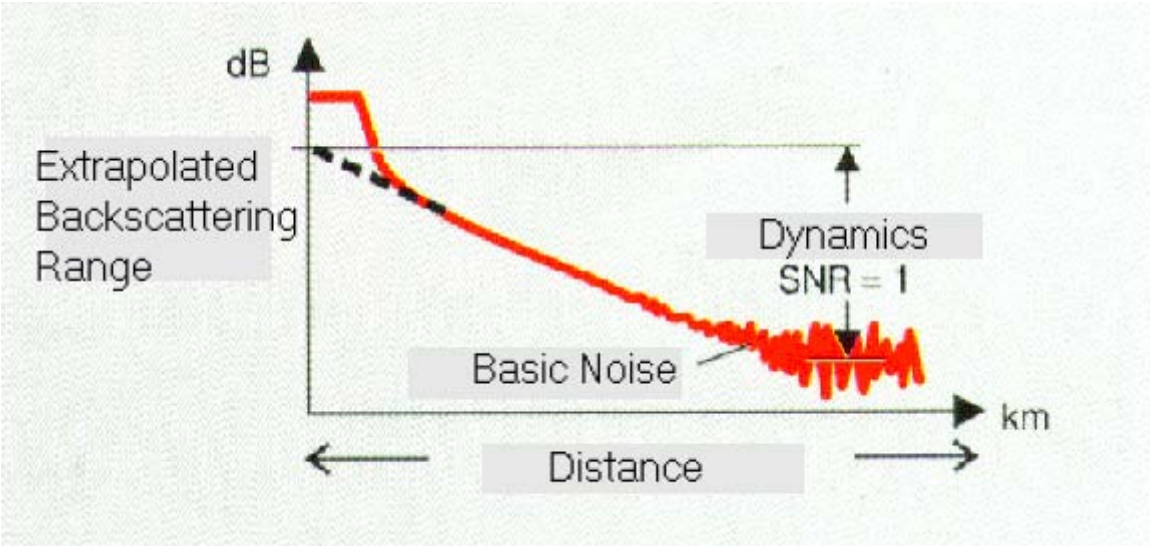
OTDR characteristics

- Very accurate measurement
- Local resolution partly less than 1 meter
- Very suitably for measuring an installation
- Allows fault diagnosis and fault localization

OTDR parameters

• Weight	field-capable
• Battery lifespan	approx. 6 h
• Display (TFT, b/w)	contrast <--> price
• Wavelength	850/1300 or 1310/1550 nm
• Dynamic ratio (dB)	max. link losses
• Pulse width (ns)	localisation accuracy
• Event dead zone	resolution
• Initial dead zone	launch / resolution
• Sampling points	measuring accuracy
• Connector	adaption
• Storage	storage capacity
• Interfaces	printer, etc.
• Software	user-friendliness

Dynamic ratio in an OTDR



Event dead zone in an OTDR

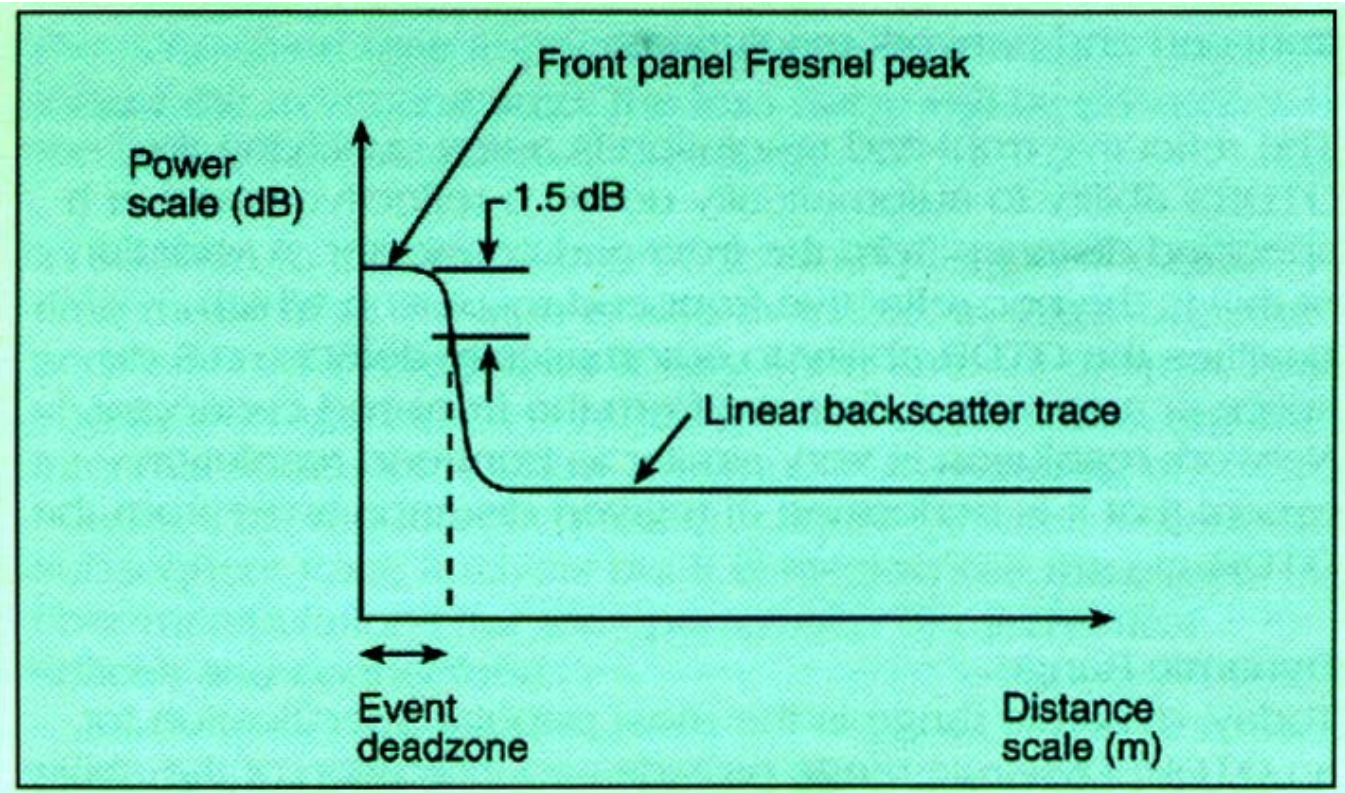


Figure 3.3 Event dead zone

Attenuation dead zone in an OTDR

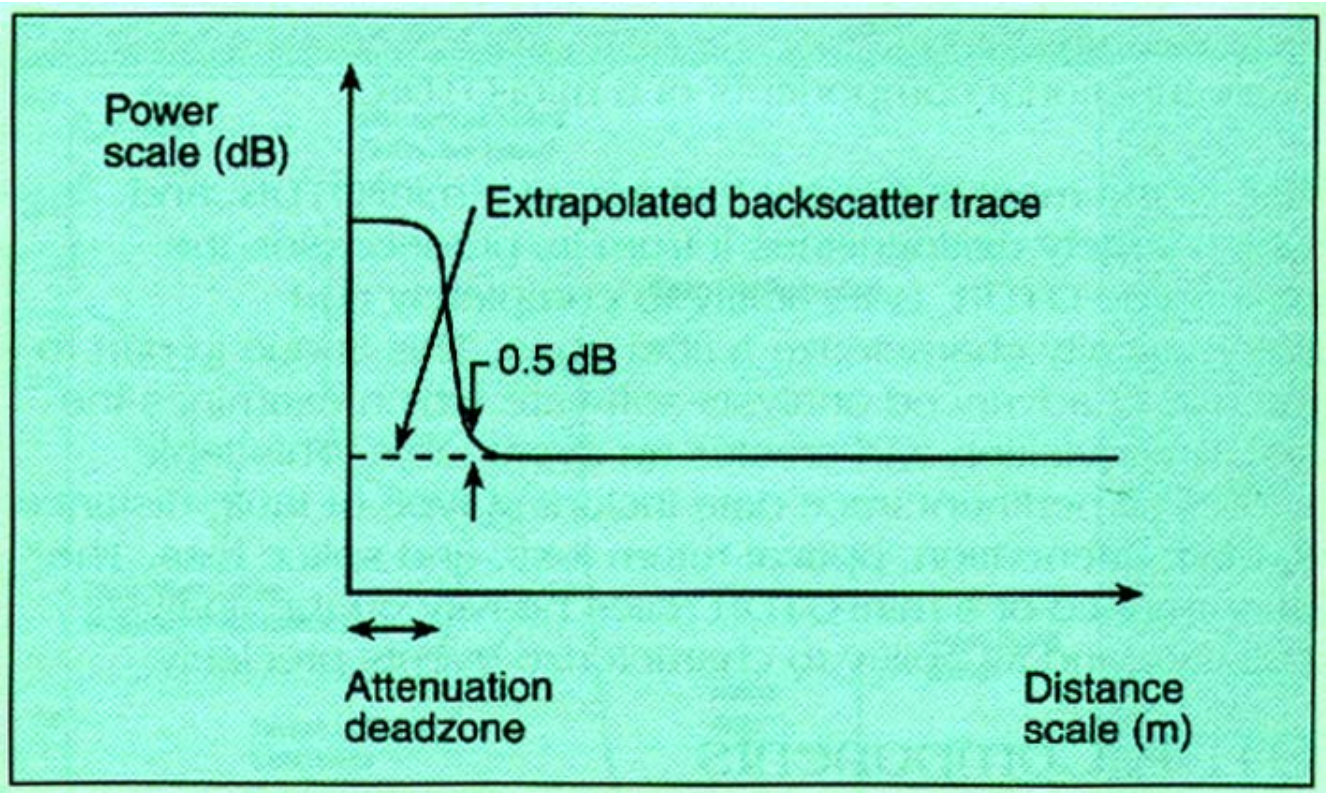


Figure 3.4 Attenuation dead zone

Ghosts and OTDR?

Secondary reflection ("Ghost")