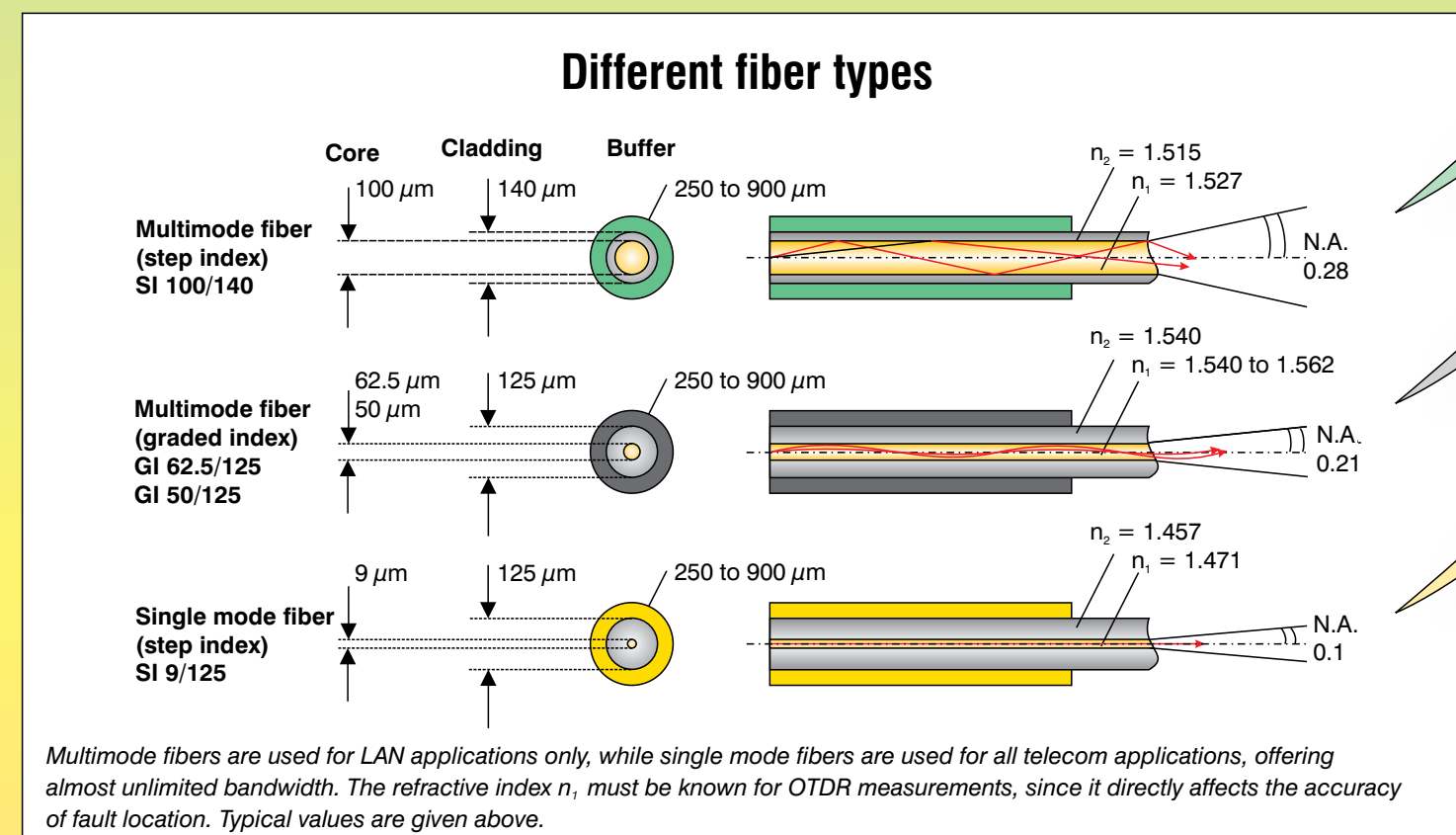
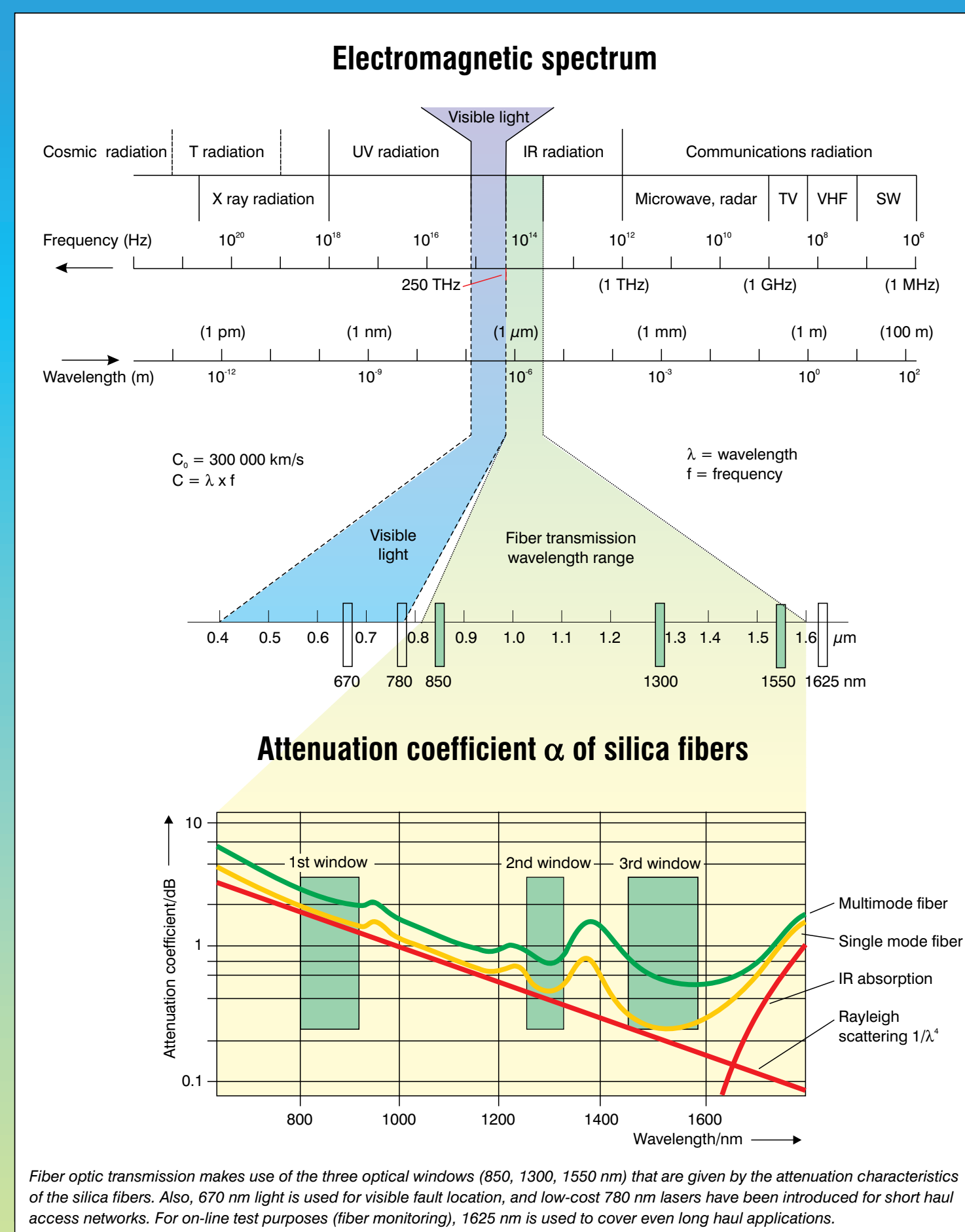
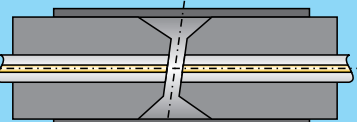
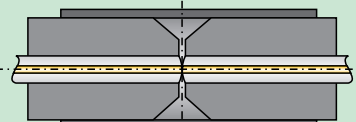
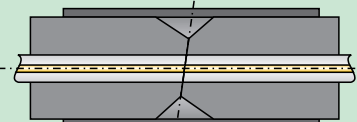
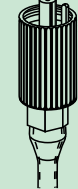
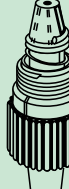
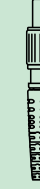
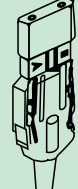
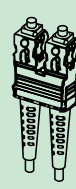




Popular connector types

Angled air-gap connector			Physical contact connector .../PC			Angled physical contact connector .../APC																								
WAN CATV			LAN WAN			WAN CATV																								
																														
<table><tr><td>Insertion loss</td><td>Return loss</td></tr><tr><td>Air-gap</td><td>0.4 to 0.8 dB</td></tr><tr><td>Super</td><td>>60 dB</td></tr></table>			Insertion loss	Return loss	Air-gap	0.4 to 0.8 dB	Super	>60 dB	<table><tr><td>Insertion loss</td><td>Return loss</td></tr><tr><td>Physical contact</td><td><0.5 dB</td></tr><tr><td>Super</td><td>>30 dB</td></tr><tr><td>Ultra</td><td>>40 dB</td></tr><tr><td></td><td>>50 dB</td></tr></table>			Insertion loss	Return loss	Physical contact	<0.5 dB	Super	>30 dB	Ultra	>40 dB		>50 dB	<table><tr><td>Insertion loss</td><td>Return loss</td></tr><tr><td>Angled (8° APC)</td><td><0.5 dB</td></tr><tr><td></td><td>>60 dB</td></tr></table>			Insertion loss	Return loss	Angled (8° APC)	<0.5 dB		>60 dB
Insertion loss	Return loss																													
Air-gap	0.4 to 0.8 dB																													
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Insertion loss	Return loss																													
Angled (8° APC)	<0.5 dB																													
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SIMPLEX															DUPLEX															
VFO	EC/RACE	HRL-11	FC	ST	SC	D4	Biconic	DIN-LSA	E2000	Mini-BNC	F-SMA	Escon	SC Duplex	Duplex-MI FDDI																
																														
			.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC																
			.../APC	.../APC	.../APC			HRL-10	.../APC				.../APC																	



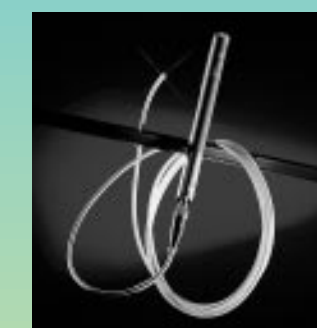
Fiber optics basics and standards

LAN/customer premises network digital transmission standards

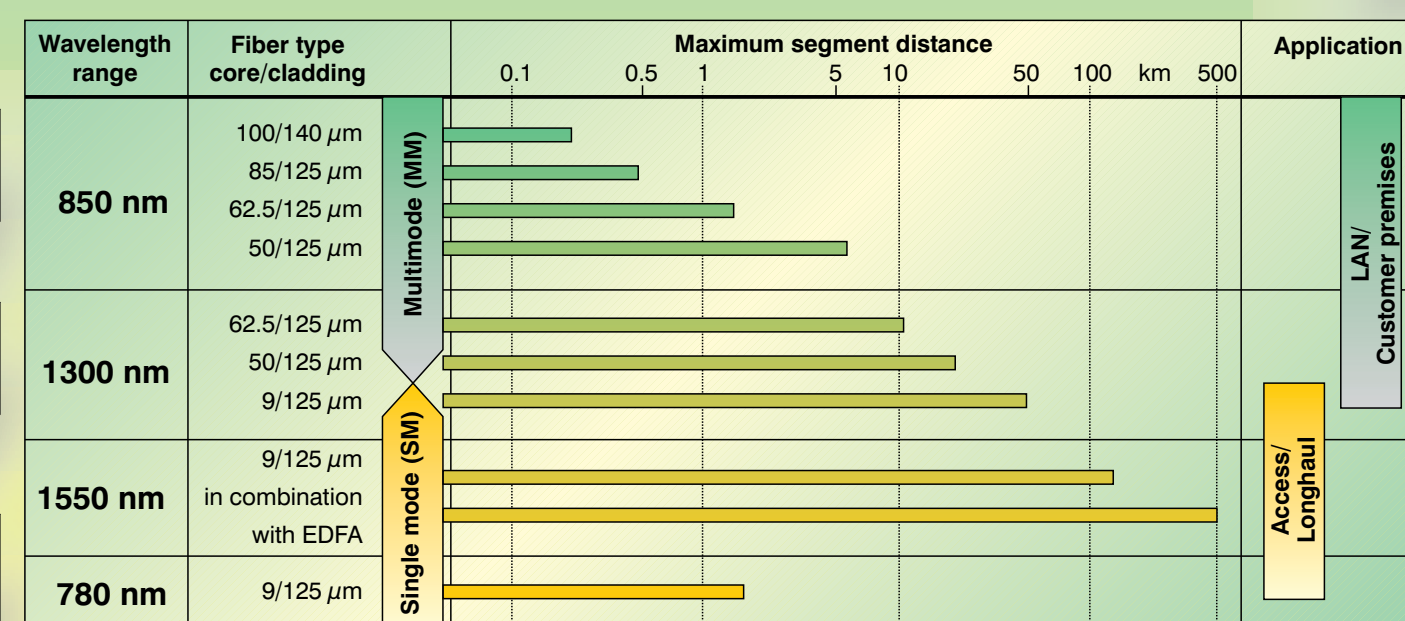
LAN type		CSMA/CD (Ethernet)		Token Bus	Token Ring	FDDI/MM	FDDI/SM	IBM ESCON		Fiber Channel	Definitions: LD = Laser Diode LED = Laser Emitting Diode
Standards	10 BASE F	10 BASE F		ISO/IEC 8802-3 IEEE 802.3	ISO/IEC 8802-5 IEEE 802.5	ISO/IEC 9314-4	ISO/IEC 9314-4			ASC X319.3	
Bit rate (Mbit/s)	10	Active	Passive	5, 10, 20	4, 16	100	Cat.1	Cat.2	200	200	800
Source type	LED	LED		LED	LED	LED	LD		LED	LD	LD
Wavelength (nm)	850	850		850	850	1300	1300		1300	1300	
Range	790 to 910	800 to 910	820 to 910	800 to 910	800 to 910	1270 to 1380	1270 to 1340	1290 to 1330			
Power range (dBm)	-12 to -15	-12 to -20	-11 to -15	-7 to -11	-13 to -22	-14 to -20	-14 to -20	0 to -4	-20	-9	
Receiver dynamic range (dBm)	(BER 10 ⁻⁹)								BER 10 ⁻⁹		
Max. network extent (km)	-9 to -27	-12 to -32.5	-27 to -41	-31/41 to -11/-21	-12 to -30	-14 to -31	-14 to -31	-15 to -37	-35	-36	
Max. segment distance (km)		4.5				200	200		6	60	
Fiber type	1	2	2	1	2	2	2		2	20	1
	62.5 to 85/125	62.5 to 85/125		50/125	50/125	62.5 to 85/125	9/125 SM		50/125	9/125 SM	62.5
Connector type	F-SMA	100/140		50/125	62.5/125	100/140			62.5/125		9/125 SM
	ST		F-SMA	Duplex-MIC ST	Duplex-MIC ST	Duplex-MIC ST	SM Duplex-MIC		Duplex ESCON		SC
				Biconic Mini-BNC F-SMA	Biconic Mini-BNC F-SMA						

Measurement tasks		Single solutions						Complete solutions	
Power Loss	Power meter	OLP-5						OFS-1	OFC-1
	Power meter + Source	OMK-5 (OLS-5 + OLP-5)							
Fault location	Visible fault locator	OFV-1						OFS-1	OFC-1
	OTDR	OFT-30							
	Documentation	FiberPRO							
	Archiving	FiberPRO							

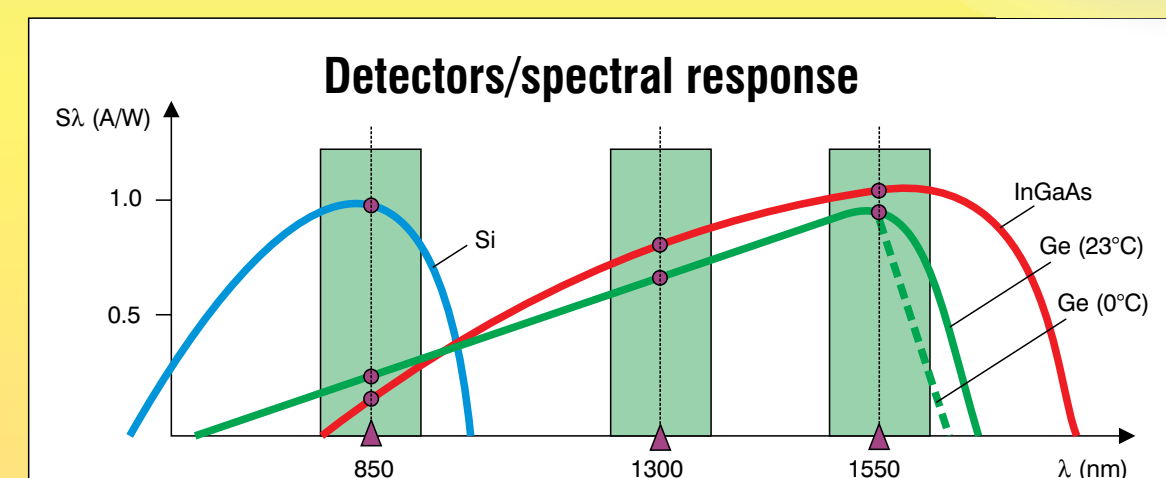
Measurement tasks		Single solutions						Complete solutions	
Power Loss	Power meter	OLP-5						OFS-1	OFC-1
	Power meter + Source	OMK-5 (OLS-5 + OLP-5)							
Fault location	Visible fault locator	OFV-1						OFS-1	OFC-1
	OTDR	OFT-30							
	Documentation	FiberPRO							
	Archiving	FiberPRO							



Application areas for fiber optics technology

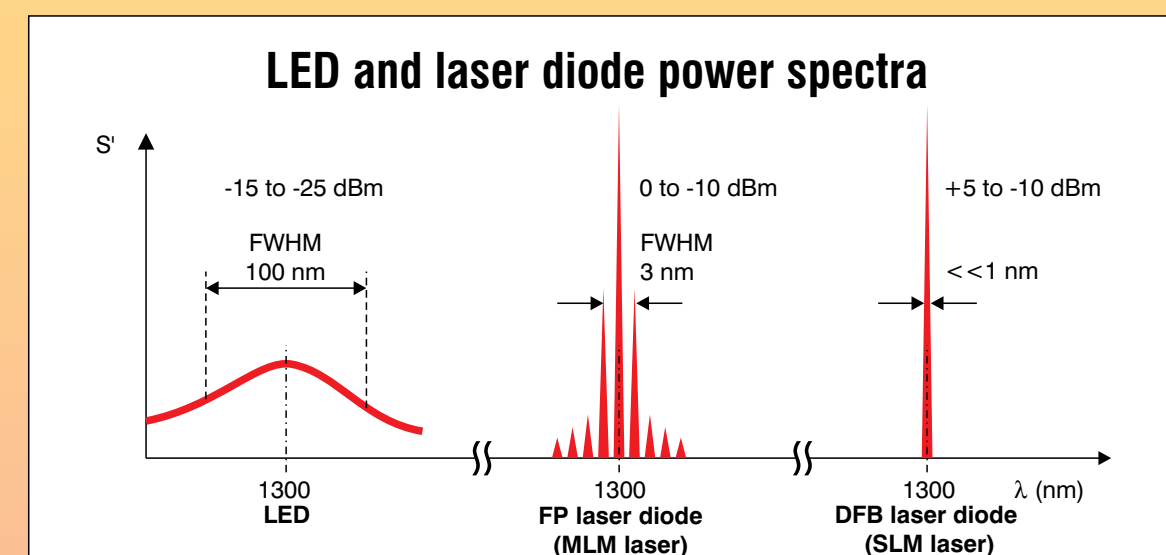


Values given are based on typical applications for LAN, access and longhaul networks
850/1300 nm MM, bit rates around 10 Mbit/s.
1300/1550 nm SM, bit rates up to 10 Gbit/s.
780 nm SM, bit rates around 10 Mbit/s (application in access networks).



Different photodiodes are used for different applications.

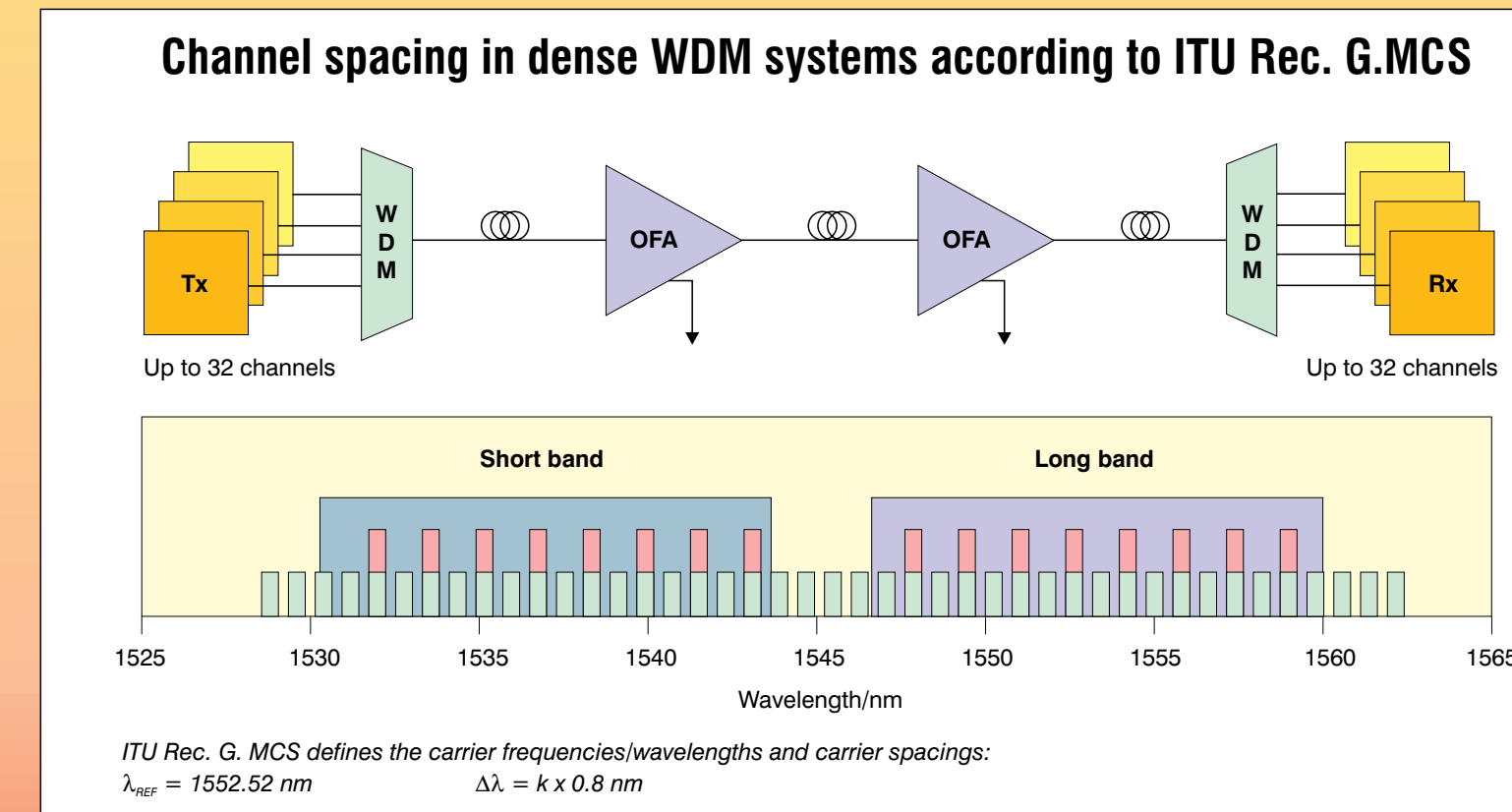
- Si:** Silicon photodiodes are the best choice for applications in the visible light range (400 and 1000 nm).
- Ge:** Germanium detectors cover all three optical windows and are suitable for applications from 750 to 1600 nm.
- InGaAs:** Indium Gallium Arsenide detectors are ideal for wavelengths >1000 nm (particularly in the 3rd optical window), due to the almost flat response characteristic up to 1700 nm.



The type of fiber used and the characteristics of the source impose limits on system performance. The narrower the spectral bandwidth of the source diode, the higher the possible frequency bandwidth/bit rate of the system. LEDs are used for short haul, low bit rate systems, e.g. LANs. Laser diodes are used in longhaul, high bit rate systems that use single mode fibers. **Multi-Longitudinal Mode (MLM)** lasers, also known as **Fabry-Perot (FP)** lasers, and **Single Longitudinal Mode (SLM)** or **Distributed Feedback (DFB)** lasers are used for these applications.

Access/longhaul network digital transmission standards

Standard		ANSI/T1.105.06	SDH					ITU-T/G.957	SONET				Definitions:
Bit rate (Mbit/s)			OC-1 51.840	OC-3 155.520	OC-12 622.080	OC-48 2488.320	OC-192 9953.280		STM-1 155.520	STM-4 622.080	STM-16 2488.320	STM-64 9953.280	
Source	Type	Intra-office approx. 2 km	LED/MLM	LED/MLM	LED/MLM	MLM	not defined	Short reach	LED/MLM	LED/MLM	MLM	not defined	
Optical path	Wavelength/nm		1300	1300	1300	1300			1300	1300	1300		
	Power range/dBm		-23 to -14	-15 to -8	-15 to -8	-12 to -5				-15 to -8	-15 to -8		-10 to -3
	Min. ext. ratio/dB		8.2	8.2	8.2	8.2				8.2	8.2		8.2
	Range/dB		0 to 7	0 to 7	0 to 7	0 to 7				0 to 7	0 to 7		0 to 7
Receiver	ORL/dB	NA	NA	NA	>20		NA	>24	>24				
	SBR/dB	NA	NA	NA	<25		NA	<27	<27				
	Dynamic range/dBm	-31 to -14	-23 to -8	-23 to -8	-20 to -5		-23 to -8	-23 to -8	-18 to -3				
	Penalty/dB	1	1	1	1		1	1	1				
Source	SBR/dB	NA	NA	NA	<25		NA	NA	<27				
	Type	MLM/SLM	MLM/SLM	MLM/SLM	SLM	SLM	MLM/SLM	MLM/SLM	SLM	SLM			
	Wavelength/nm	1300/1550	1300/1550	1300/1550	1300/1550	1530 to 1565	1300/1550	1300/1550	1300/1550	1530 to 1565			
	Power range/dBm	-15 to -8	-15 to -8	-15 to -8	-5 to 0	ffs	-15 to -8	-15 to -8	-5 to 0	ffs			
Optical path	Min. ext. ratio/dB	8.2	8.2	8.2	8.2	8.2	8.2/10	8.2/10	8.2/10	8.2			
	Range/dB	0 to 12	0 to 12	0 to 12	0 to 12	ffs	0 to 12	0 to 12	0 to 12	ffs			
	ORL/dB	NA	NA	>24	>24	24	NA	>24	>24	24			
	SBR/dB	NA	NA	<27	<27	<27	NA	<27	<27	<27			
Receiver	Dynamic range/dBm	-23 to -8	-23 to -8	-18 to 0	-18 to 0	-18 to 0	-23 to -8	-23 to -8	-18 to 0	-18 to 0			
	Penalty/dB	1	1	1	1	2	1	1	1	2			
	SBR/dB	NA	NA	<27	<27	<27	NA	<27	<27	<27			
	Source	Type	MLM/SLM	MLM/SLM	MLM/SLM	MLM/SLM	SLM	MLM/SLM	MLM/SLM	SLM	SLM		
Optical path	Wavelength/nm	1300/1550	1300/1550	1300/1550	1300/1550	1300/1550	1300/1550	1300/1550	1300/1550	1530 to 1565			
	Power range/dBm	-5 to 0	-5 to 0	-3 to 2	-4 to 1	ffs	-5 to 0	-3 to 2	-4 to 1	ffs			
	Min. ext. ratio/dB	10	10	10	8.2/10	10	10	10	8.2/10	10			
	Range/dB	10 to 28	10 to 28	10 to 24	10 to 20	ffs	10 to 28	10 to 24	10 to 20	ffs			
Receiver	ORL/dB	NA	>20	>20/24	>24	24	>20	>24	>24	24			
	SBR/dB	NA	<25	<27	<27	<27	<25	<27	<27	27			
	Dynamic range/dBm	-34 to -10	-34 to -10	-28 to -8	-26 to -9	-26 to -9	-34 to -10	-28 to -8	-26 to -9	-26 to -9			
	Penalty/dB	1	1	1	1/2	2	1	1	1/2	2			
	SBR/dB	<-25	<-25	<-27/-14	<-27/-14	<-27	<-25	<-27	<-27	2			
Measurement tasks			Single solutions									Complete solutions	
Receiver dynamic test	Attenuator		OLA-15										
Power	Power meter		OLP-15A/-16A/-18A (OLP-18A when EDFA are used)										
Loss	Power meter + Source		OMK-14A (OLP-15A + OLS-15A) or OMK-15A (OLP-15A + OLS-15A + OLA-15)										
	Visible fault locator		OVF-1										
Fault location	OTDR		OFT-5/-50/-50A/-50B										
	Documentation		FiberPRO									OFS-1	OFC-1
	Archiving		FiberPRO										



OMS-100 with OSP-102A

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