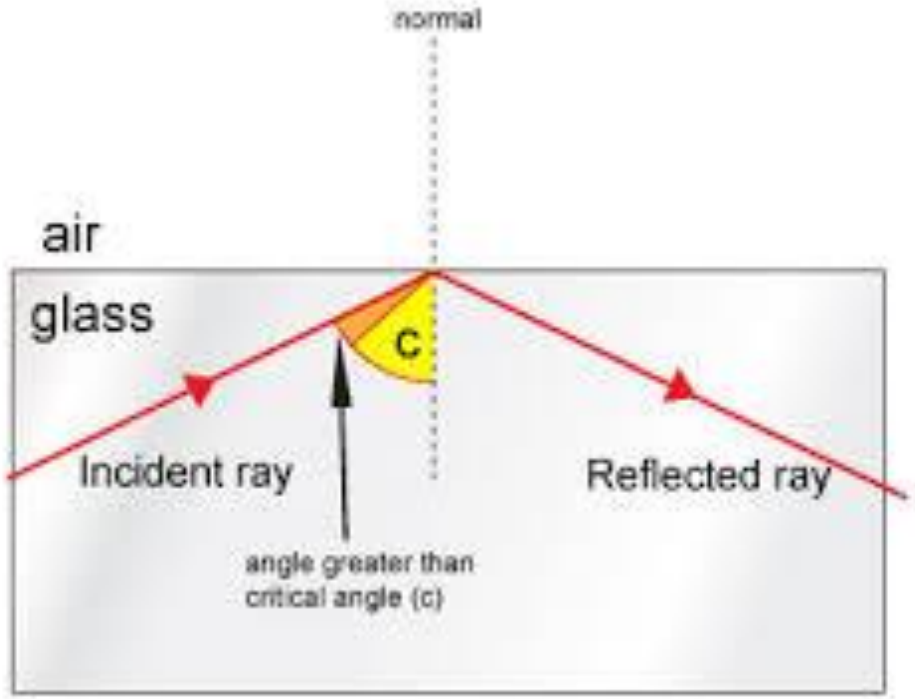
OPTICAL AND TRANSMISSION

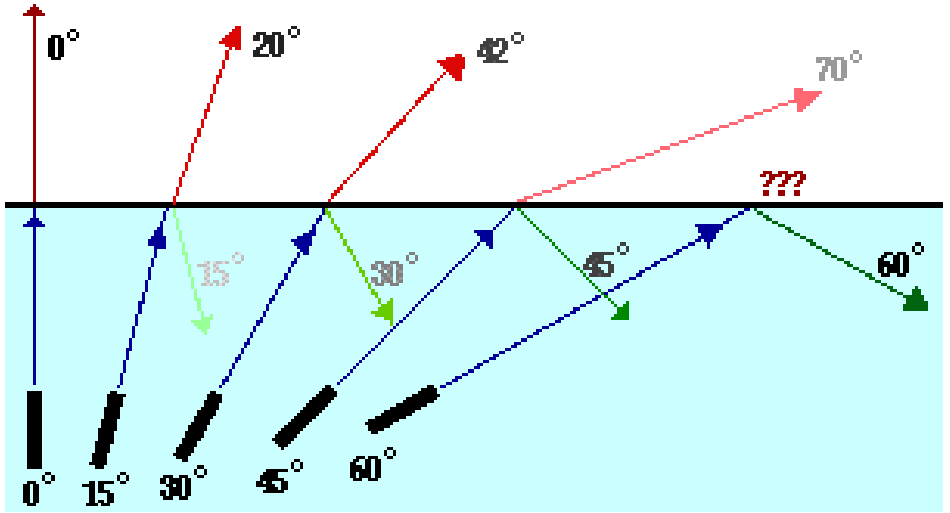
Presented by Min Thein Htet

BASIC LIGHT PRINCIPLE FOR COMMUNICATOIN

- Reflection
- Refraction
- Total Internal reflection

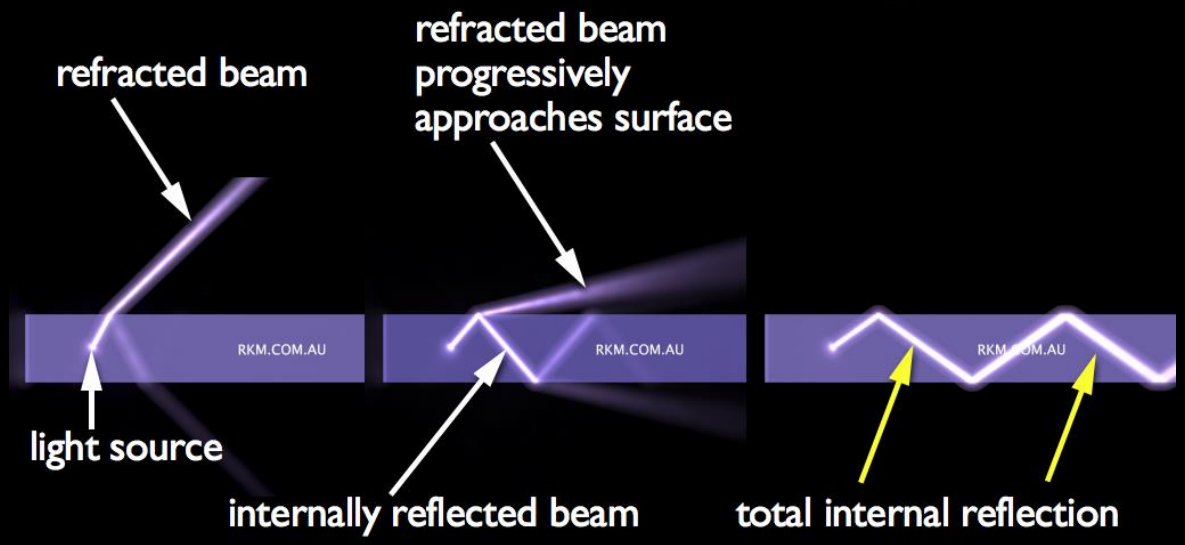


As the angle of incidence increases from 0 to greater angles ...



...the refracted ray becomes dimmer (there is less refraction)
...the reflected ray becomes brighter (there is more reflection)
...the angle of refraction approaches 90 degrees until finally a refracted ray can no longer be seen.

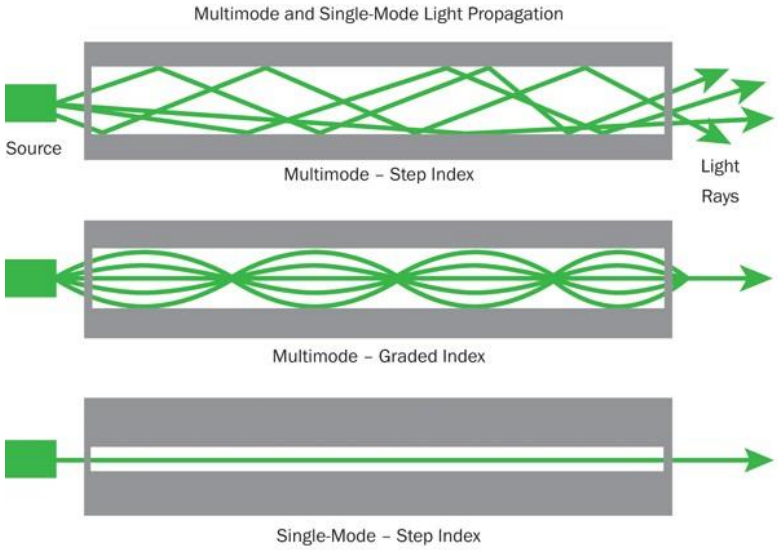
Total Internal Reflection of Light

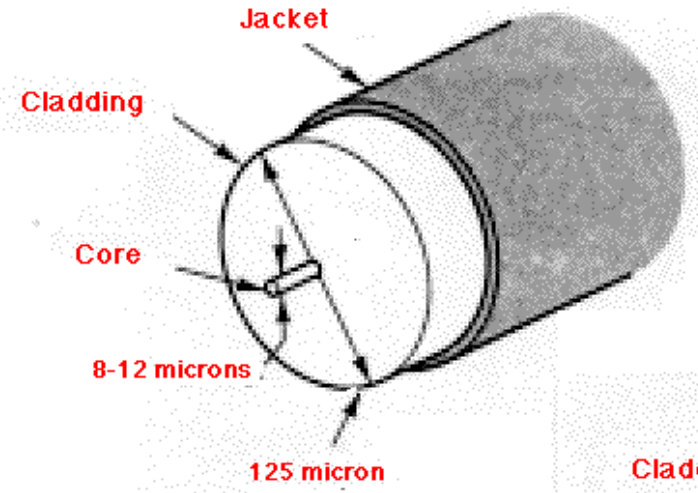


FIBER TYPE

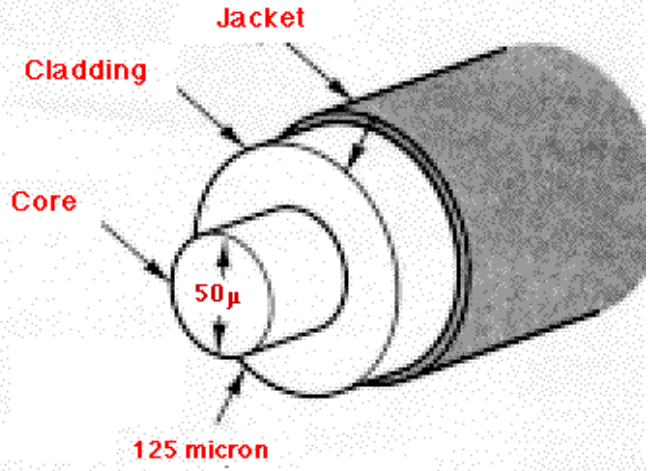
- Multi Mode
- Single Mode

Fiber Type		Multimode	Multimode	Singlemode
Core diameter		50µm	62.5µm	8 – 10µm
Attenuation (dB/km)	850nm	2.5	3.5	N/A
	1300/1310nm	0.8	1.4	0.3
	1550nm	N/A	N/A	0.2





Single mode cable

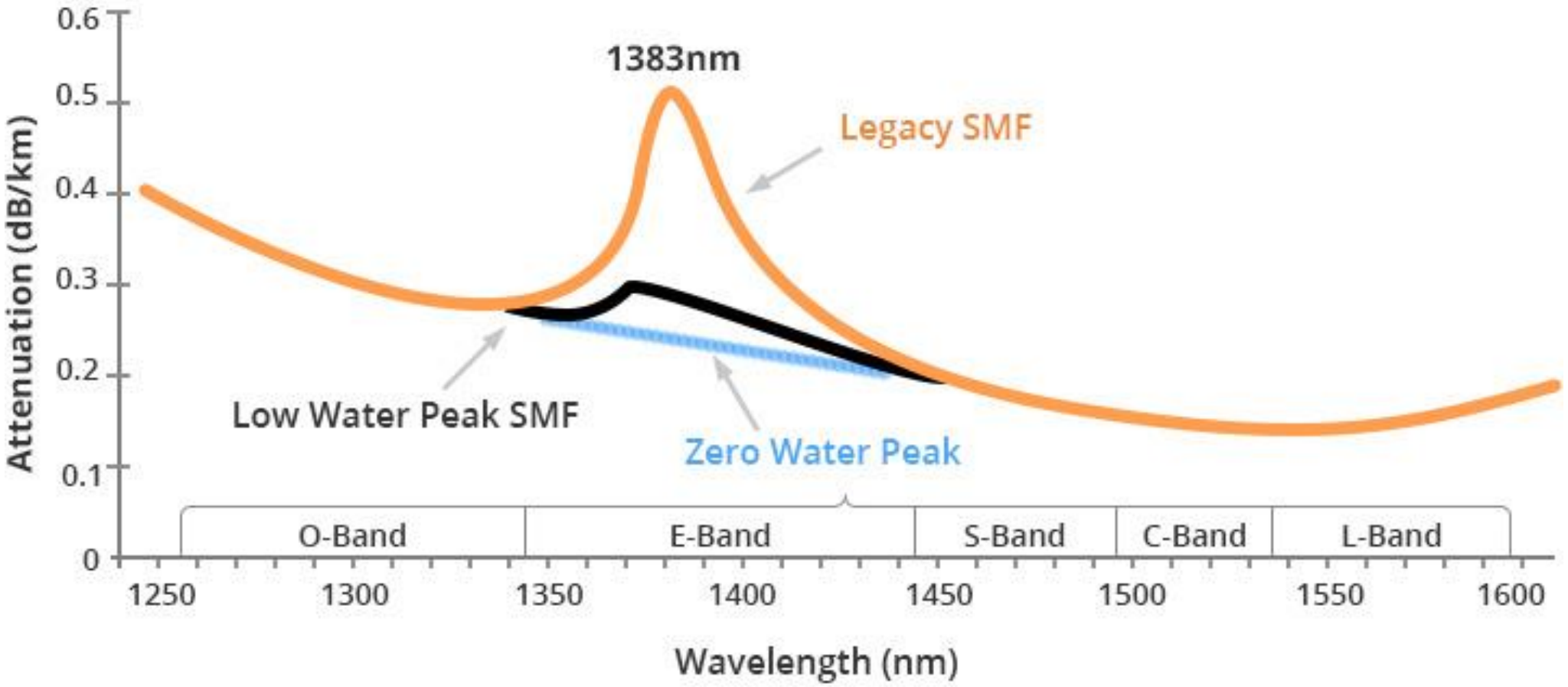


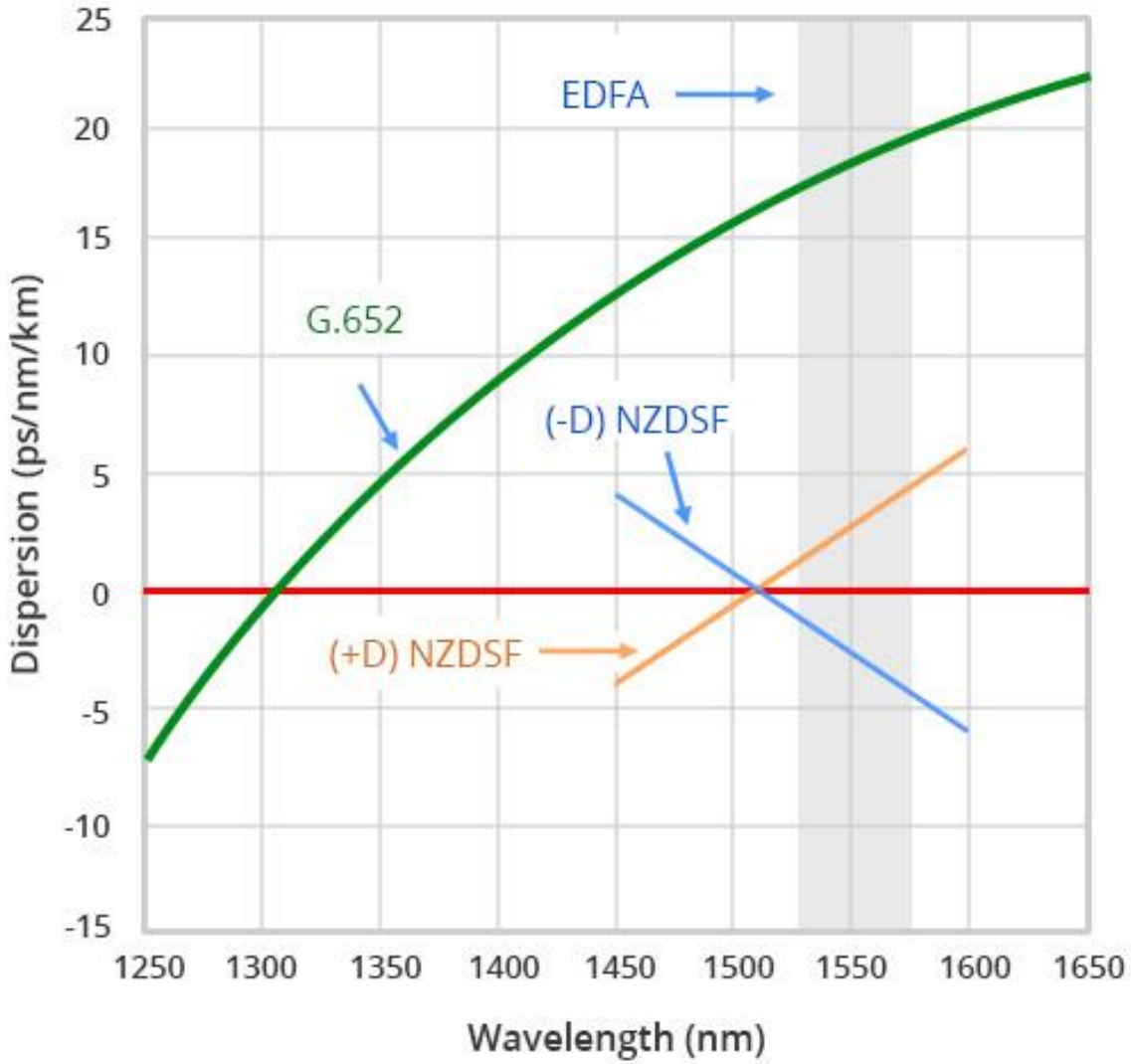
Multi mode cable

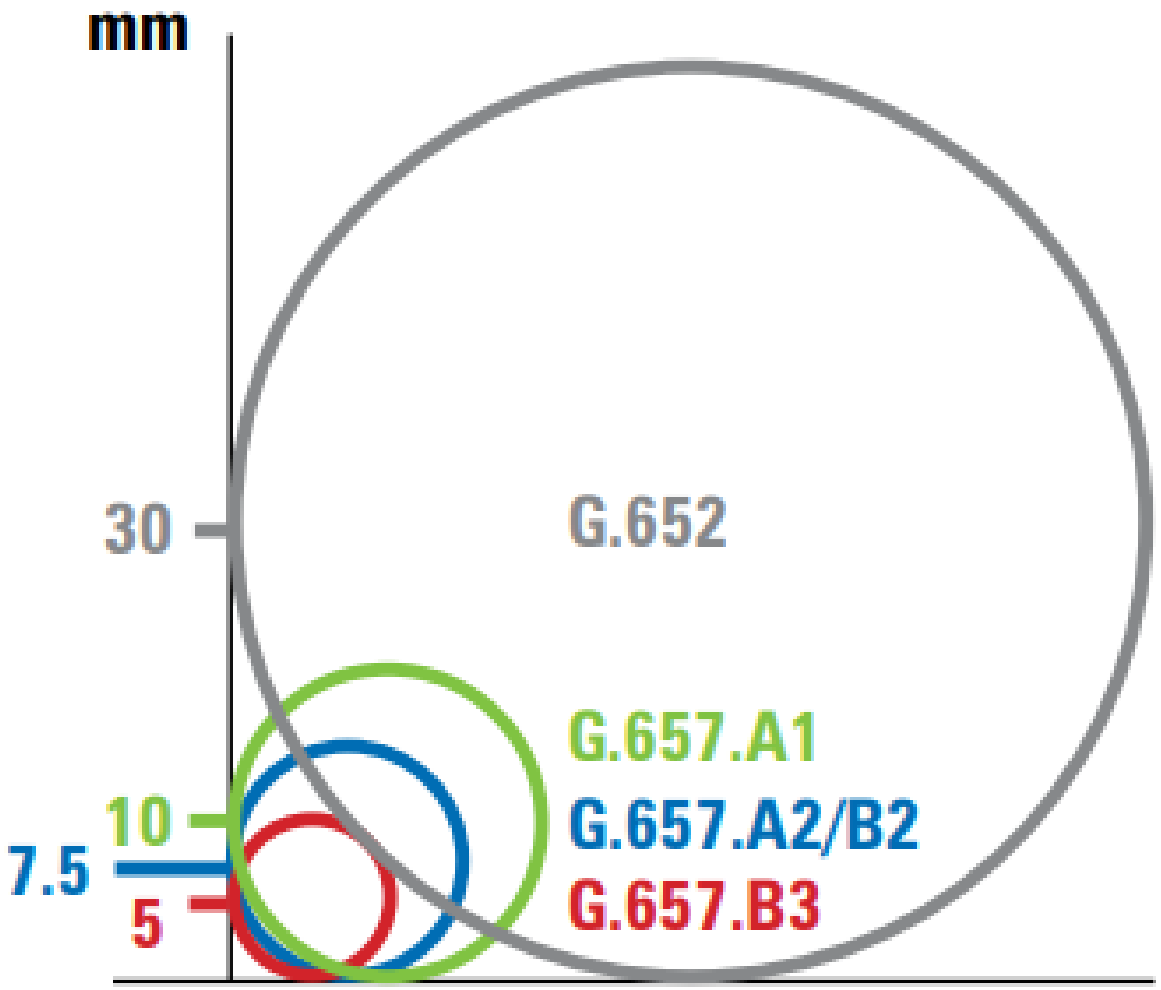
ITU STANDARD

- G.651 (multi-mode fiber)
- G.652 (single-mode fiber)
- G.653 (dispersion-shifted, single-mode fiber)
- G.655 (non-zero dispersion-shifted, single-mode fiber)
- G.657 (bending-loss insensitive single-mode fiber)

Name	Other Names	Specified Wavelength (nm)	Applications
G.652	Zero-Dispersion/Non-dispersion-shifted fiber, or standard SMF.	1310, 1550, 1625 (C and D excluded)	LAN, MAN, access networks and CWDM transmission.
G.653	Dispersion-shifted optical fiber	1310 to 1550	Long-haul single-mode transmission systems using erbium-doped fiber amplifiers (EDFA).
G.654	Cut-off shifted optical fiber	1550	Higher bandwidth submarine systems and back haul systems.
G.655	Non-zero dispersion-shifted optical fiber (NZDSF)	1550 to 1625	Long-haul systems that use Dense WDM (DWDM) transmission.
G.656	Non-Zero dispersion for Wideband Optical Transport fiber	1460 to 1625	Long-haul systems that use CWDM and DWDM transmission over the specified wavelength range
G.657	Bending loss insensitive optical fiber for access networks	1260 to 1625	Fiber-to-the-home (FTTH) networks.

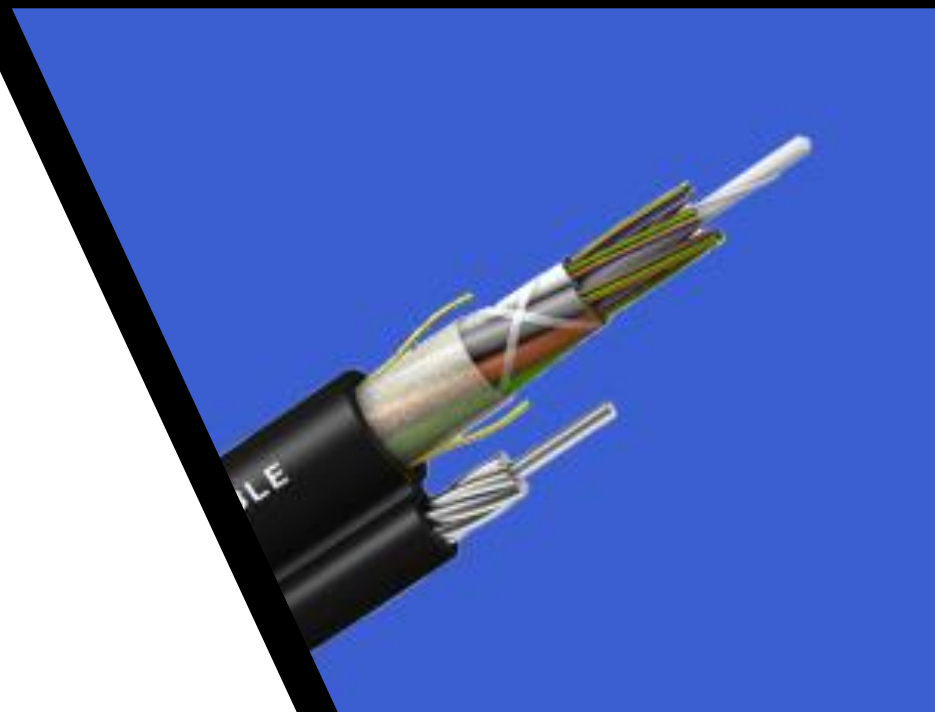

1383nm
Legacy SMF
Low Water Peak SMF
Zero Water Peak
Attenuation (dB/km)
0.6
0.5
0.4
0.3
0.2
0.1
0
O-Band
E-Band
S-Band
C-Band
L-Band
1250
1300
1350
1400
1450
1500
1550
1600
Wavelength (nm)


25
20
15
10
5
0
-5
-10
-15
Dispersion (ps/nm/km)
1250
1300
1350
1400
1450
1500
1550
1600
1650
Wavelength (nm)
EDFA
G.652
(-D) NZDSF
(+D) NZDSF


mm
30
10
7.5
5
G.652
G.657.A1
G.657.A2/B2
G.657.B3

FIBER CABLE

- Figure 8 cable (aerial cable)
- UG cable



FIBER COLOR CODE

- TIA-598
- S12
- Standear Type E

TIA-598 Fibers	1	2	3	4	5	6	7	8	9	10	11	12
	Blue	Orange	Green	Brown	Grey	White	Red	Black	Yellow	Violet	Pink	Turquoise
	13	14	15	16	17	18	19	20	21	22	23	24
	Blue —	Orange —	Green —	Brown —	Grey —	White —	Red —	Clear —	Yellow —	Violet —	Pink —	Turquoise —

TIA-598 Tubes	1	2	3	4	5	6	7	8	9	10	11	12
	Blue	Orange	Green	Brown	Grey	White	Red	Black	Yellow	Violet	Pink	Turquoise

S12 Fibers	1	2	3	4	5	6	7	8	9	10	11	12
	Red	Blue	White	Green	Yellow	Grey	Brown	Black	Violet	Orange	Turquoise	Pink
	13	14	15	16	17	18	19	20	21	22	23	24
	Red —	Blue —	White —	Green —	Yellow —	Grey —	Brown —	Clear —	Violet —	Orange —	Turquoise —	Pink —

S12 -Alt. 1 Tubes	1	2	3-16
	Red	Blue	White

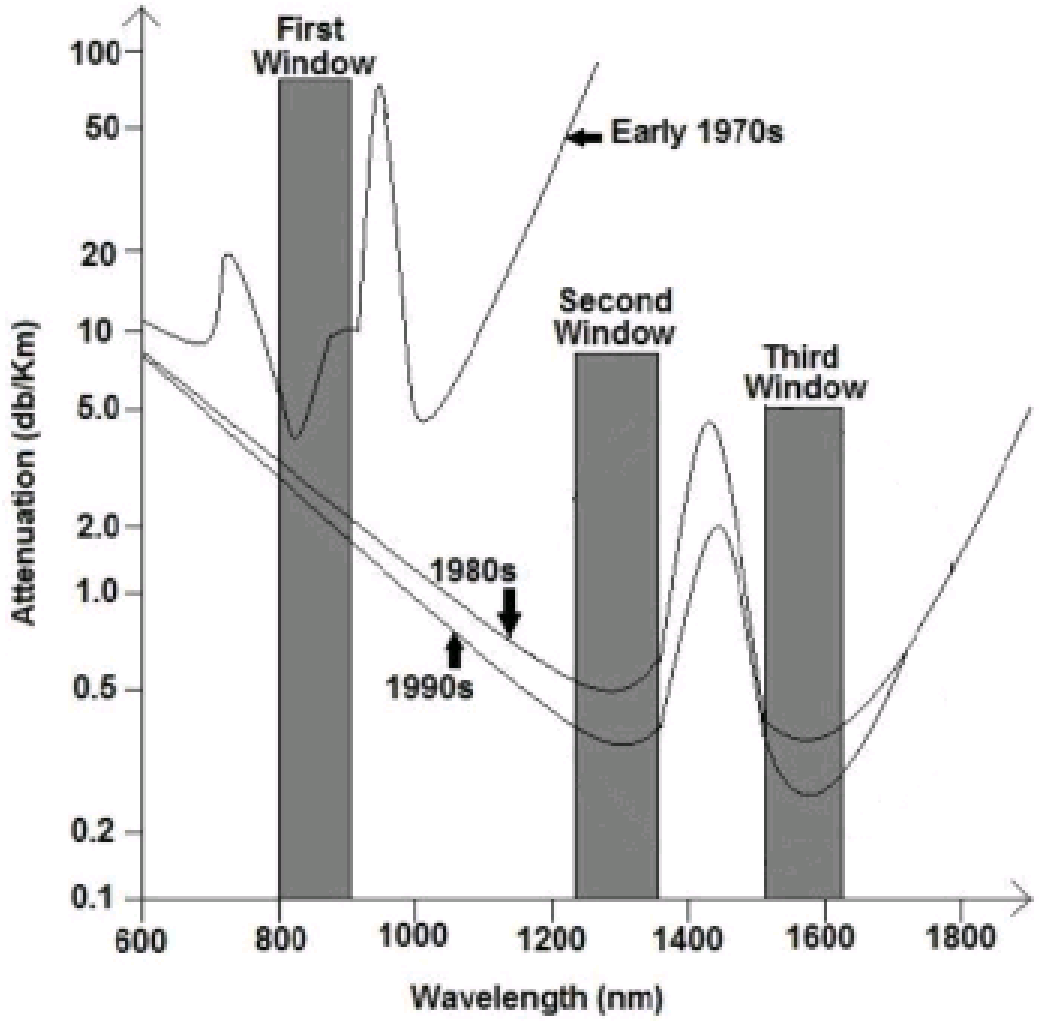
S12 - Alt. 2 Tubes	1	2	3	4	5	6	7	8	9	10	11	12
	Red	Blue	White	Green	Yellow	Grey	Brown	Black	Violet	Orange	Turquoise	Pink

Standard Type E Fibers	1	2	3	4	5	6	7	8	9	10	11	12
	Red	Blue	White	Green	Yellow	Grey	Brown	Black	Orange	Violet	Pink	Turquoise
	13	14	15	16	17	18	19	20	21	22	23	24
	Red —	Blue —	White —	Green —	Yellow —	Grey —	Brown —	Clear —	Orange —	Violet —	Pink —	Turquoise —

Standard Type E Tubes	1	2	3-6	7	8-16
	Red	Blue	White	Blue	White

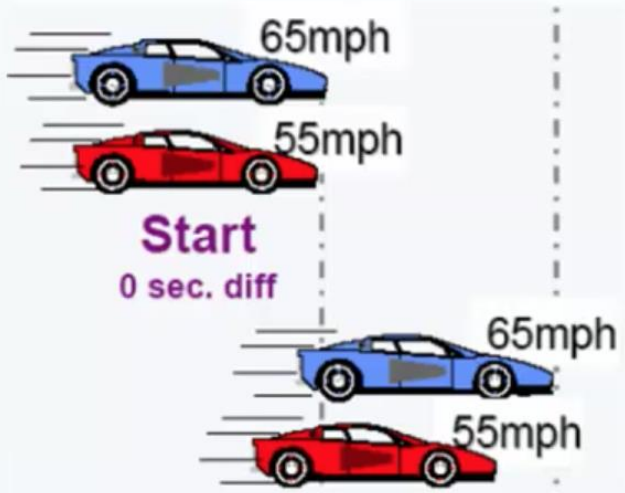
TUBE (OR FIBER) NUMBER	COLOR
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Pink (Rose)
12	Aqua

3 WINDOWS


First Window
Second Window
Third Window
Early 1970s
1980s
1990s
Attenuation (db/Km)
100
50
20
10
5.0
2.0
1.0
0.5
0.2
0.1
600
800
1000
1200
1400
1600
1800
Wavelength (nm)

DISPERSION

What is Chromatic Dispersion



The difference in *speed* between the two cars (or two components of light) causes them to arrive at the end at different times.

The longer the distance - the more time difference between them.

Effect of Chromatic Dispersion

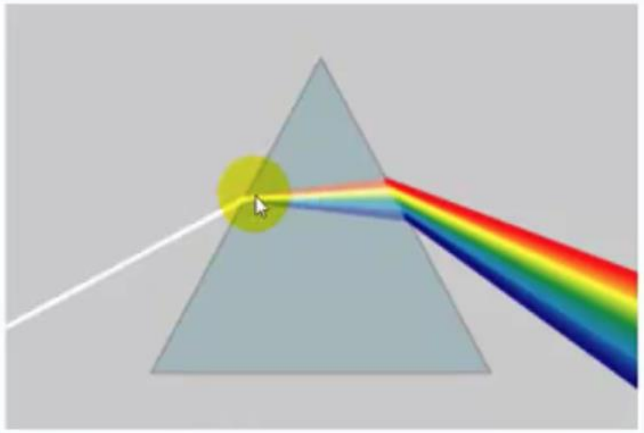
Dispersion is the time domain spreading or broadening of the transmission signal light pulses - as they travel through the fibre

Chromatic Dispersion Causes

1. Pulse Broadening
2. Bit Error

Chromatic Dispersion Types (1)

- Material Dispersion

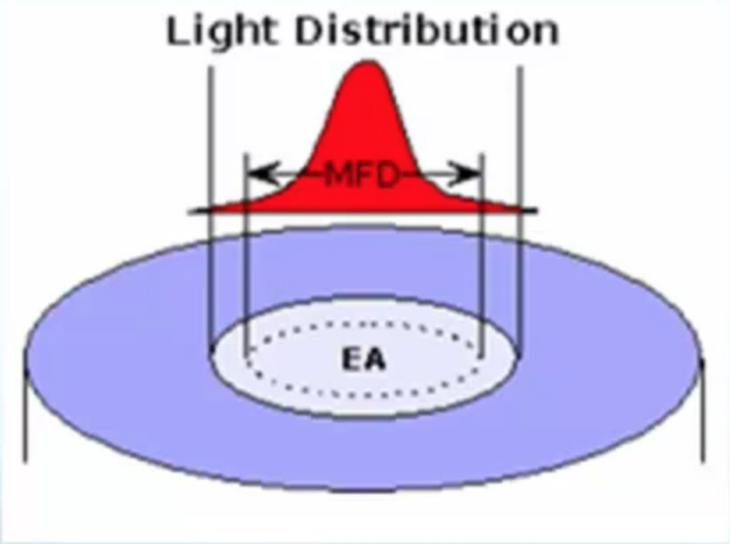


The refractive index of silica is wavelength dependent. Different wavelength has different refractive index. This is called Material Dispersion.

We cannot change material dispersion since it only depends on the material Itself.

Chromatic Dispersion Types (2)

- Waveguide Dispersion

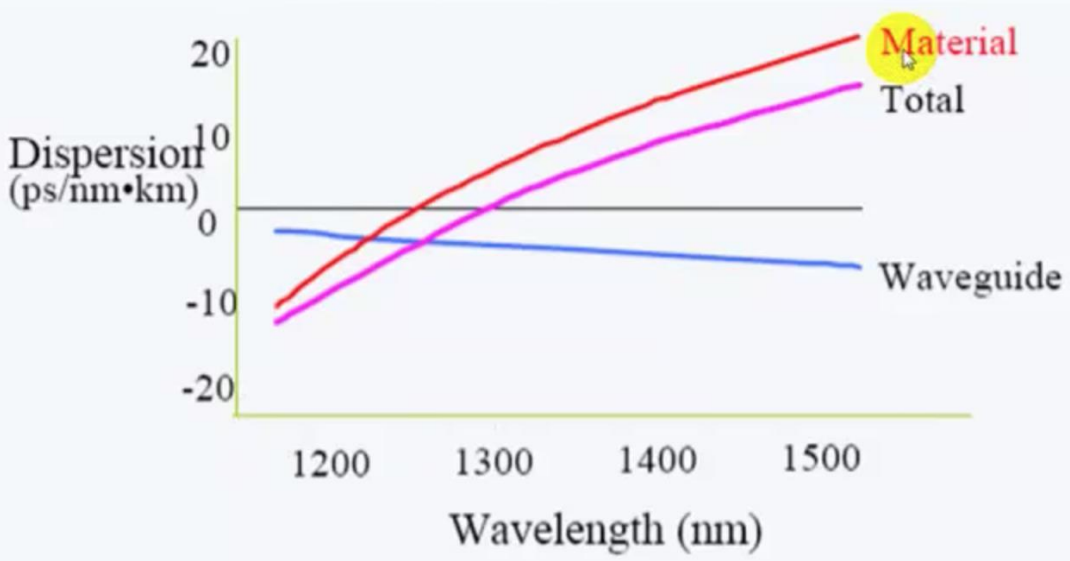


Waveguide dispersion is cause by power distribution in the fiber's core and cladding, which is wavelength dependent.

Light travels faster in the core and slower In the cladding.

Different power distribution causes different wavelength travels at different speed.

Total Chromatic Dispersion



By changing the Waveguide dispersion (i.e., altering the fibre design) and balancing it against the Material dispersion (fixed), the dispersion characteristics of the fibre can be engineered to required values over the preferred operating window

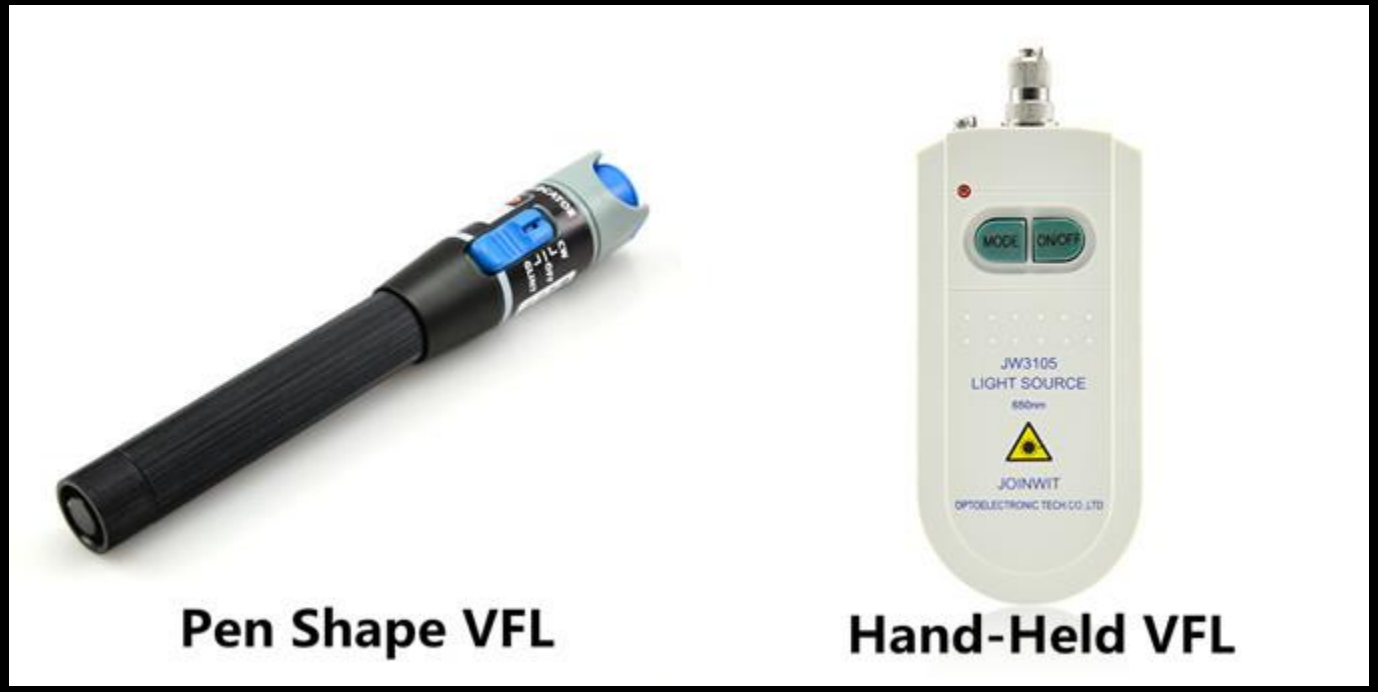
Total Chromatic Dispersion =

Material Dispersion +
Waveguide Disperion

TOOLS AND ACCESSORIES

- VFL (virtual Fault Locator
- Power Meter & light Source
- OTDR

VFL


MODE
ON/OFF
JW3105
LIGHT SOURCE
650nm
JOINWIT
OPTOELECTRONIC TECH CO.,LTD
Pen Shape VFL
Hand-Held VFL

VFL

LIGHT SOURCE AND POWER METER

OTDR

WHAT IS FTTH?

WHAT IS FTTH ?

FTTH means Fiber To The Home

- Best one cable system
- Use PON(Passive Optical Network) technologies
- Support three different type of services (Internet , VoIP and IPTV) via a single fiber cable

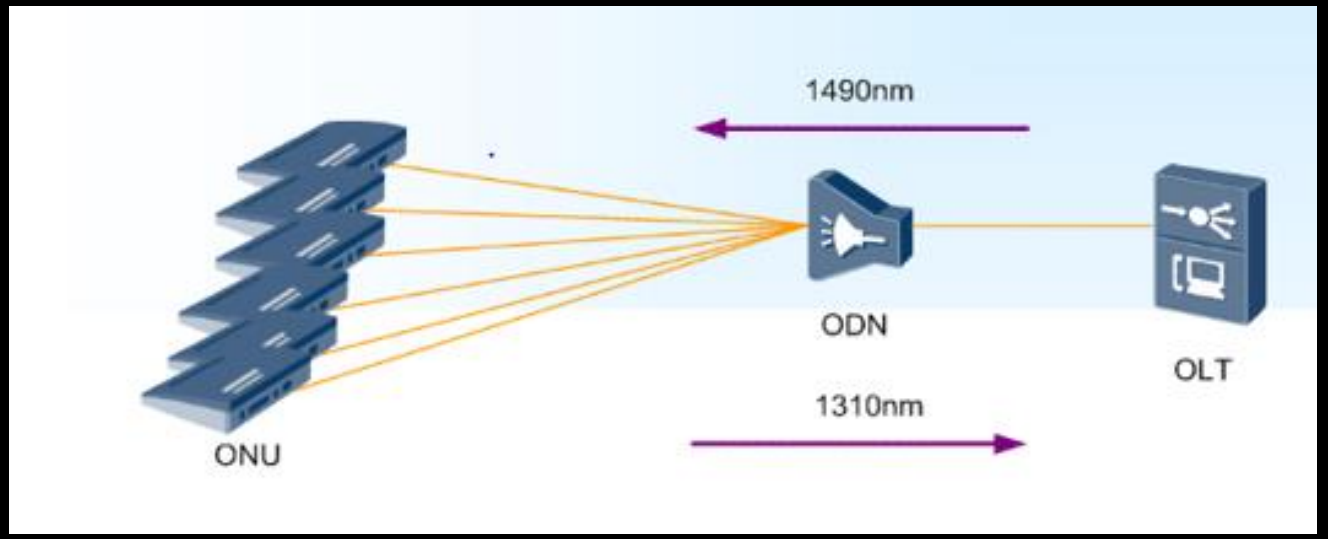
FEATURE

FTTH means Fiber To The Home

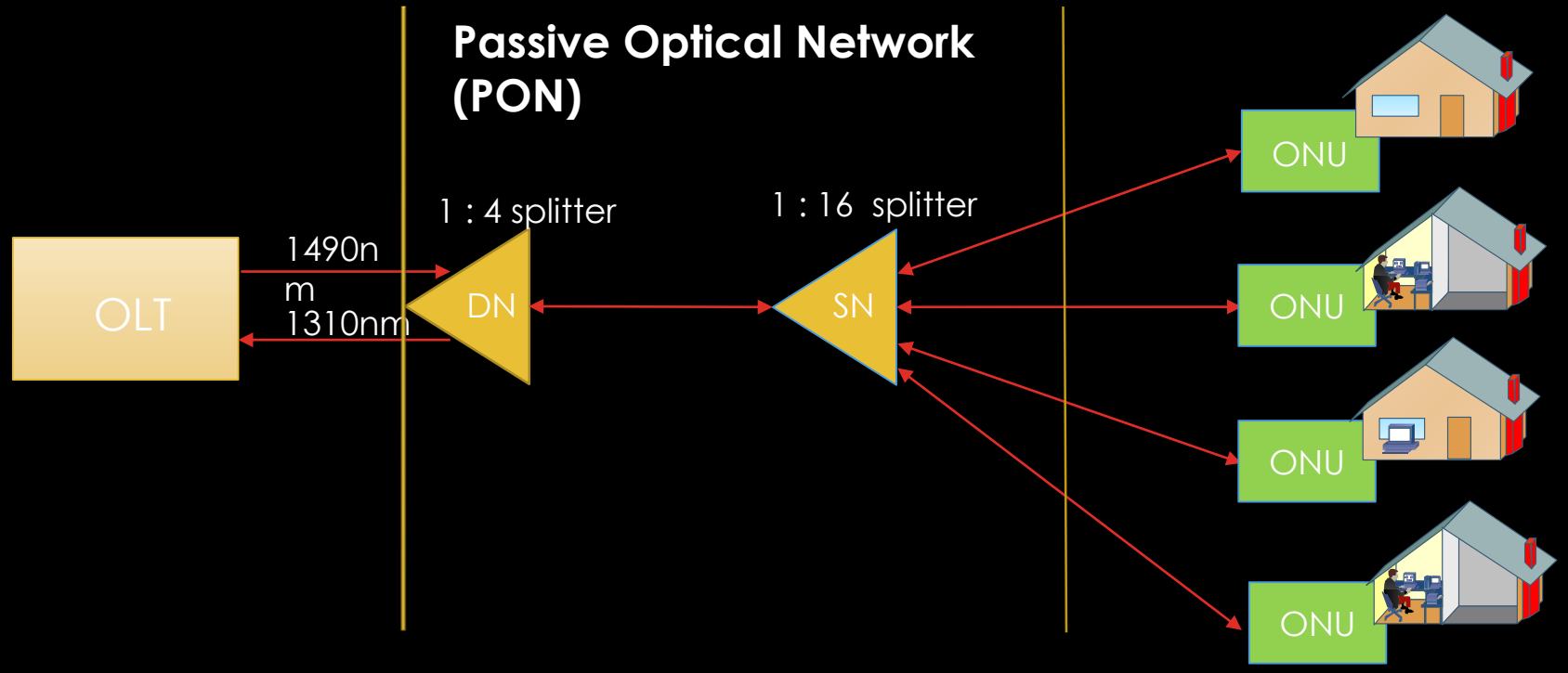
- Downstream rate : 2.488 Gb/s, Upstream rate : 1.244 Gb/s
- Wavelength：downstream 1490 nm; upstream 1310 nm/1550 nm.
- Maximum distance：20 Km
- Maximum Splitting ratio : 1:32 ,1:64 and 1:128

GPON WORKING PRINCIPLE

- Point-to-Multipoint access network
- Use wavelength division multiplexing (WDM) technology



FTTH SERVICE SYSTEM DESIGN



Optional Wavelength

- -Downstream 1490nm
- -Upstream 1310nm

THANKS

ANY ?