

FIBER TO THE HOME (FTTH) GUIDE

Version 3.0

PART I: FTTH SYSTEMS AND ARCHITECTURE

FIBER TO THE X (FTTx)

FTTx is the generic term which is widely used for various fiber optic access infrastructure. The telecommunications industry uses distinct FTTH and FTTX configurations. The terms in most widespread use today are

- **FTTN (fiber-to-the-node)**

Fiber Cable is terminated in a street cabinet, possibly miles away from the customer premises, with the final connections possibly being copper.

- **FTTC / FTTK (fiber-to-the-curb, -closet, or -cabinet)**

This is very similar to FTTN, but the street cabinet or pole is closer to the user's premises, typically within 1,000 feet (300 m)

- **FTTP (fiber-to-the-premises)**

This telecom term is used for both FTTH and FTTB, or where the fiber network includes both homes and small businesses.

- **FTTB (fiber-to-the-building, or business, or -basement)**

Fiber Optic Cable reaches the boundary of the building- or the MPOE- Minimum Point Of Entry-such as the basement in a multi-dwelling unit, with the final connection to the individual living space being made via alternative means, similar to the curb or pole termination technologies.

- **FTTH (fiber-to-the-home)**

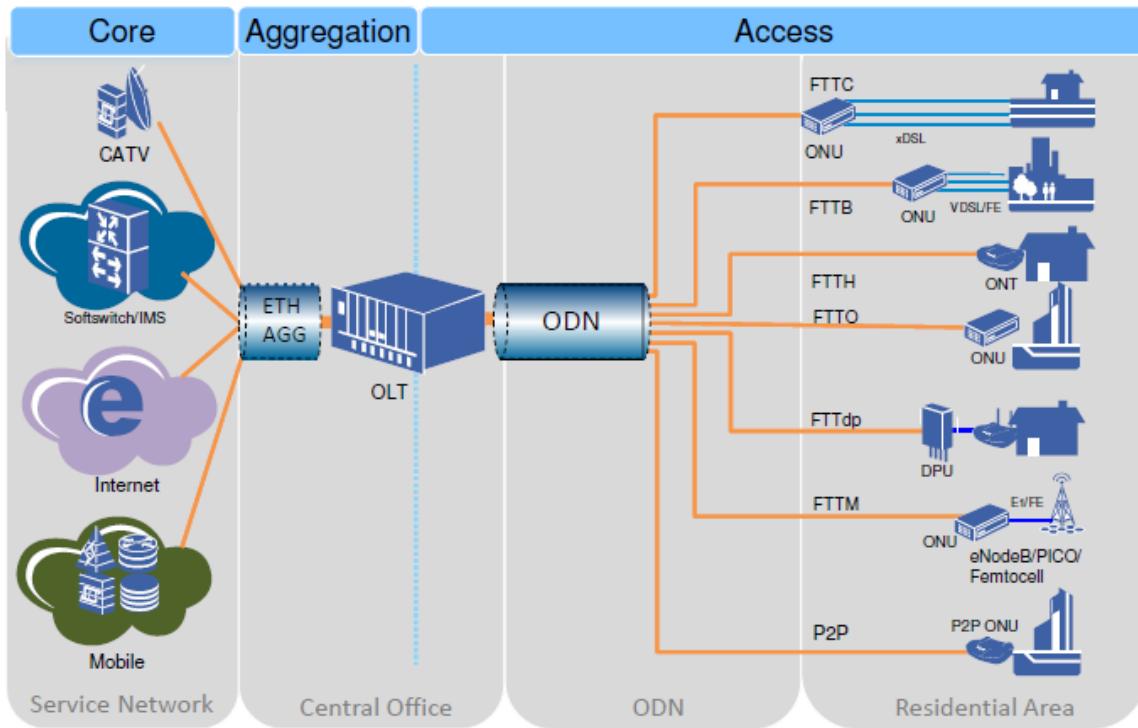
Fiber reaches the boundary of the living space, such as a box on the outside wall of a home. Passive optical networks (GPON) and point-to-point Ethernet are architectures that deliver triple-play services over FTTH networks directly from an operator's central office.

- **FTTD (fiber-to-the-desktop)**

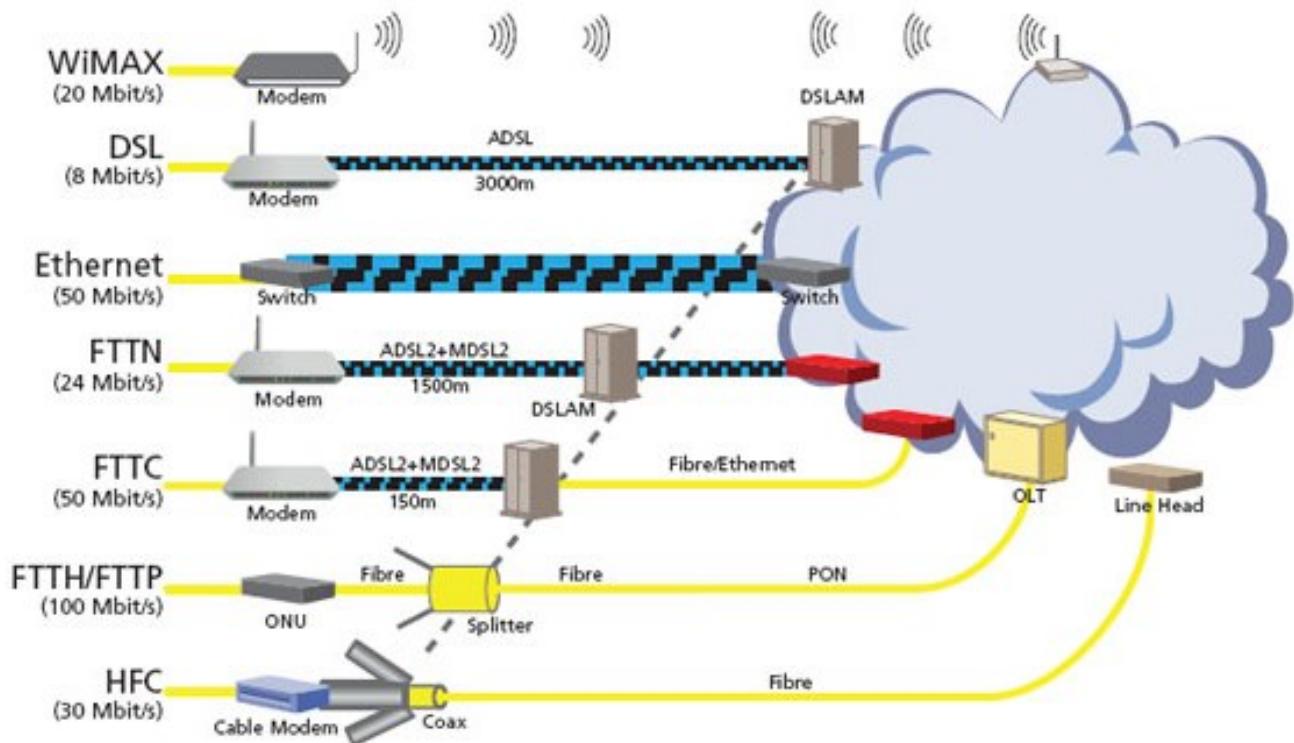
Fiber Optic Cable connections are installed from the main computer room to a terminal or fiber media converter near the user's desk.

- **FTTA/FTTR (Fiber-to-the-Antenna /Radio)**

FTTA is a broadband network architecture in which optical fiber is used to connect the remote radio head (RRH) to the base station in new antennas, or retrofitted in existing ones, to replace all or part of the coax local loop. One advantage of fiber-optic cable is that it is easier to install because it is lighter than coax cable.

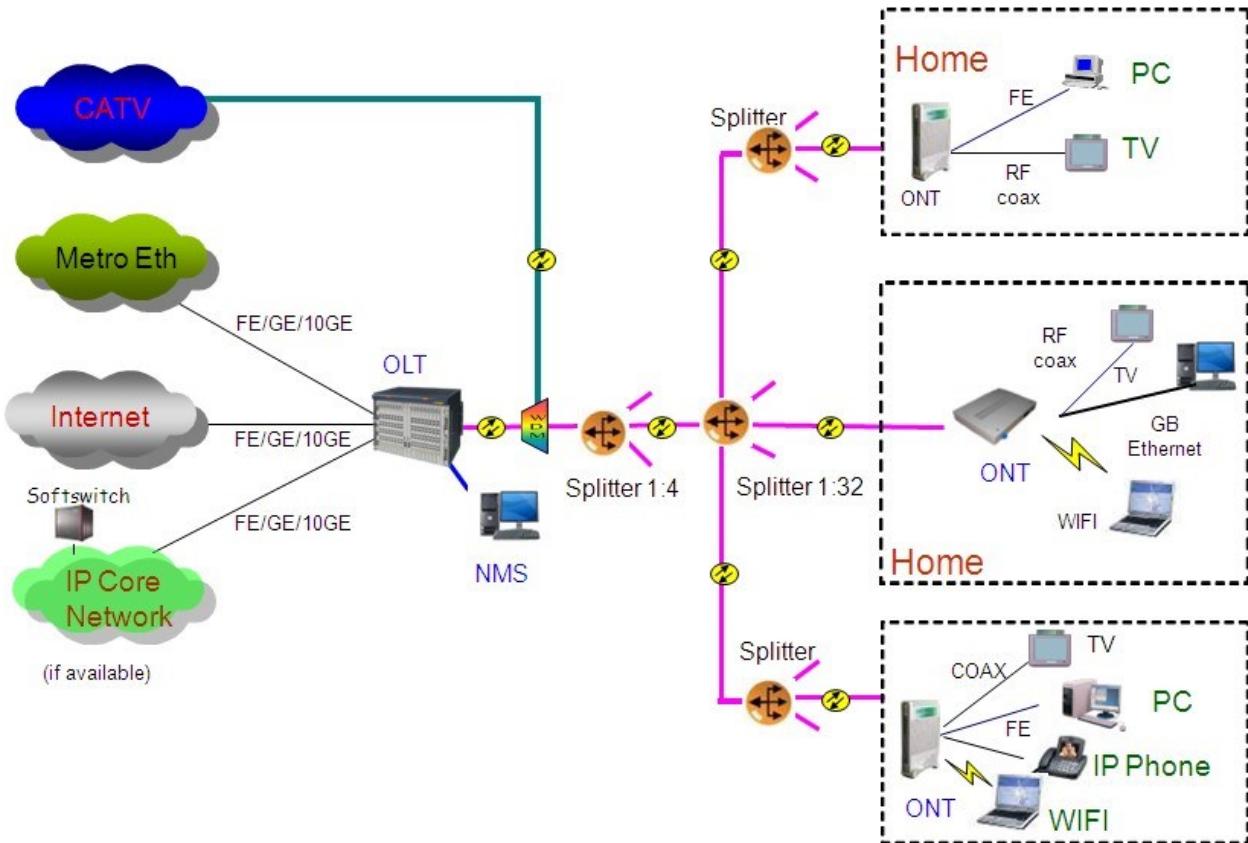


COMPARISON OF TECHNOLOGIES



FIBER TO THE HOME (FTTH)

Fiber to the home (FTTH) is the delivery of a communications signal over optical fiber from the operator's switching equipment all the way to a home or business, thereby replacing existing copper infrastructure such as telephone wires and coaxial cable. Fiber to the home is a relatively new and fast growing method of providing vastly higher bandwidth to consumers and businesses, and thereby enabling more robust video, internet and voice services



PASSIVE OPTICAL NETWORK (PON)

	TDM PONs						WDM PON
	BPON	EPON	GPON	10G EPON	XG-PON1	XG-PON2	
Standards	ITU G.983	IEEE 802.3ah	ITU G.984	IEEE P802.3av (draft)	FSAN	FSAN	None
Framing	ATM	Ethernet	GEM	Ethernet	GEM	GEM	Protocol Independent
Maximum Bandwidth	622 Mb/s	1.25Gb/s	2.5 Gb/s 1.25Gb/s	10.3125Gb/s	10Gb/s 2.5Gb/s	10Gb/s	1 – 10 Gb/s per channel
User per PON	16 - 32	16 - 32	32 - 64	≥ 64	≥ 64	≥ 64	16 - 32
Bandwidth per user	20 – 40Mb/s	30 – 60Mb/s	40 – 80 Mb/s	≥ 100 Mb/s	≥ 100 Mb/s	≥ 100 Mb/s	1 – 10 Gb/s
Video	RF/IP	RF/IP	RF/IP	RF/IP	RF/IP	RF/IP	
Cost	Low	Low	Medium	High	High	High	Very high

Current Generation **Next Generation** **Future**

Figure 3- PON Comparison

APON

Though it is rarely appear in our current fiber network project, APON (ATM PON) is the first PON system that achieved significant commercial deployment with an electrical layer built on Asynchronous Transfer Mode (ATM).

BPON

As we know, BPON (Broadband PON) is the enhanced subsequence of APON, with the transmission speed up to 622Mb/s. At the same time, it added the dynamic bandwidth distribution, protection and other functions. APON/BPON systems typically have downstream capacity of 155 Mbps or 622 Mbps, with the latter now the most common.

GPON / 10GPON

As one of the most competitive “The Best Last Mile Solution”, GPON (Gigabit PON) is based on the TU-TG.984.x standard for the new generations of broadband passive optical access. Compared with the other PON standards, GPON provides the unprecedented high bandwidth downlink rate of up to 2.5 Gbit/s, the asymmetric features better adapt to the broadband data services market. It provides the QoS full business protection, at the same time carries ATM cells and (or) GEM frame, the good service level, the ability to support QoS assurance and service access. Carrying GEM frame, TDM traffic can be mapped to the GEM frame, 8kHz using a standard frame able to support TDM services. As a carrier-grade technology standards, GPON also provides access network level protection mechanism and full OAM functions. GPON is widely deployed in FTTH networks. It can develop into two directions which is 10 GPON and WDM-PON.

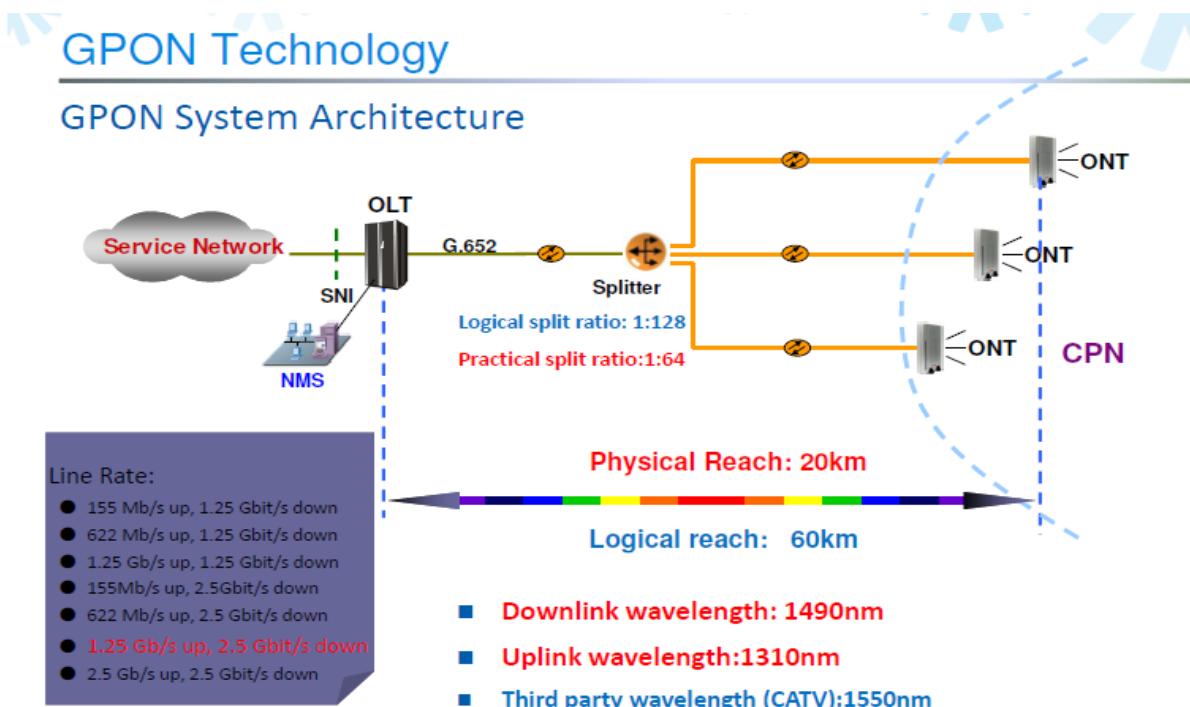
EPON / 10G-EPON

Like the super heroes of the Hollywood movies, EPON (Ethernet PON) is the rival activity to GPON which uses Ethernet packets instead of ATM cells. EPON/GEPON uses 1 gigabit per second upstream and downstream rates. It is a fast Ethernet over PONs which are point to multipoint to the premises (FTTP) or FTTH architecture in which single optical fiber is used to serve multiple premises or users. EPON is an emerging broadband access technology, through a single fiber-optic access system, to access the data, voice and video service, and it has a good economy.

WDM-PON

WDM-PON uses multiple optical wavelengths to increase the upstream and/or downstream bandwidth available to end users. WDM-PON uses wavelength division multiplexing technology to access to the passive optical network. It has four programs as following:

1. Each ONU is assigned with a pair of wavelength, for uplink and downlink transmission, thereby providing the OLT to each ONU fixed virtual point-to-point bidirectional connections.
2. ONU uses tunable lasers, according to the needs of the ONU to dynamically allocate the wavelength, and each ONU can be shared the wavelength, the network are reconfigurable.
3. Using colorless ONUs, the ONU are independent from the wavelength.
4. Using a combination of TDM and WDM technology, Composite PON (CPON). CPON uses WDM technology in the downstream, and TDMA technology in the upstream.



ODN (Optical Distribution Network)

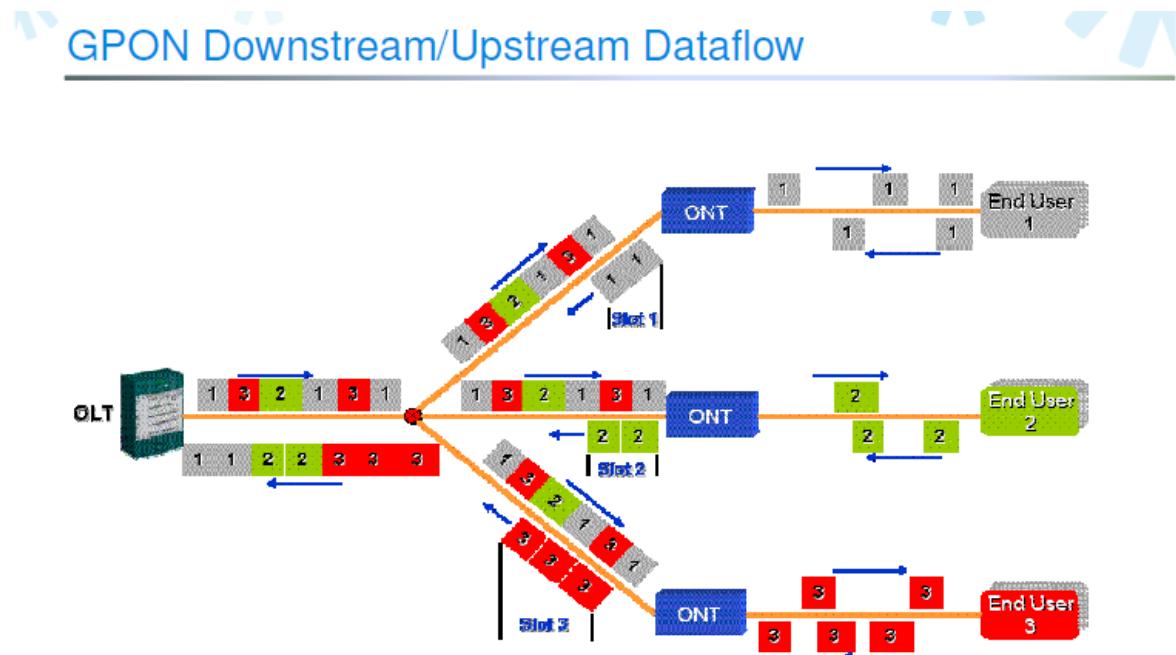
ODN is a FTTH fiber optic cable network based on PON equipment. Its role is to provide optical transmission channel between the OLT and ONU. According to the function, ODN from the central office to the client can be divided into four parts: feeder fiber optic subsystems, cable wiring subsystem, home line of fiber optic subsystems and fiber terminal subsystems. The main components in ODN include optical fibers, optical connectors, optical splitters and corresponding equipment's for installing them.

OLT (Optical line terminal)

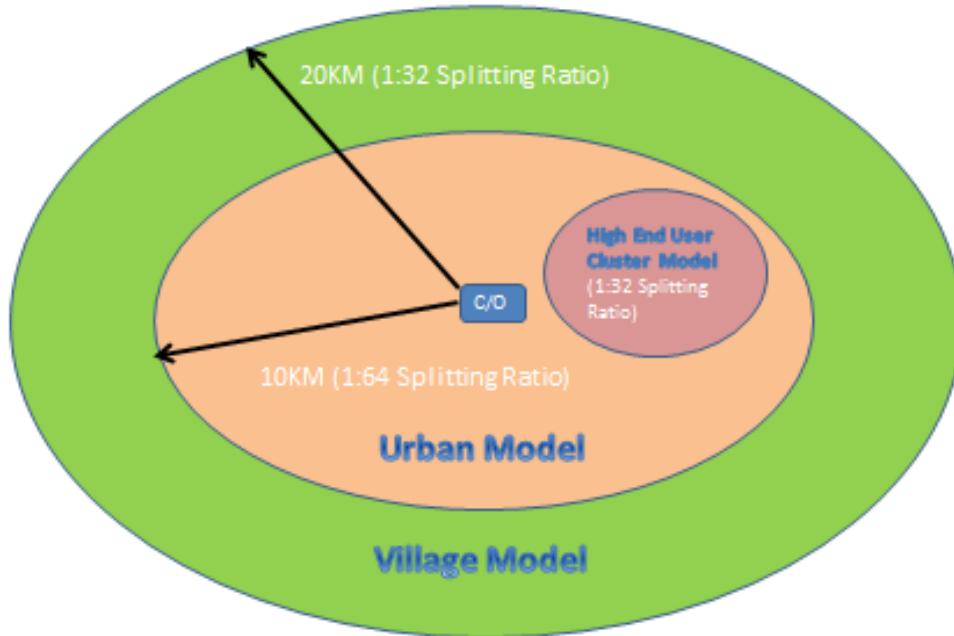
OLT is terminal equipment connected to the fiber backbone. It sends Ethernet data to the ONU, initiates and controls the ranging process, and records the ranging information. OLT allocates bandwidth to the ONU and controls the starting time and the transmission window size of the ONU transmission data.

ONU/ONT (Optical network unit/Optical network Terminal)

ONU is a generic term denoting a device that terminates any one of the endpoints of a fiber to the premises network, implements a passive optical network (PON) protocol, and adapts PON PDUs to subscriber service interfaces. In some contexts, ONU implies a multiple subscriber device. Optical Network Terminal (ONT) is a special case of ONU that serves a single subscriber.



FTTH MODELS

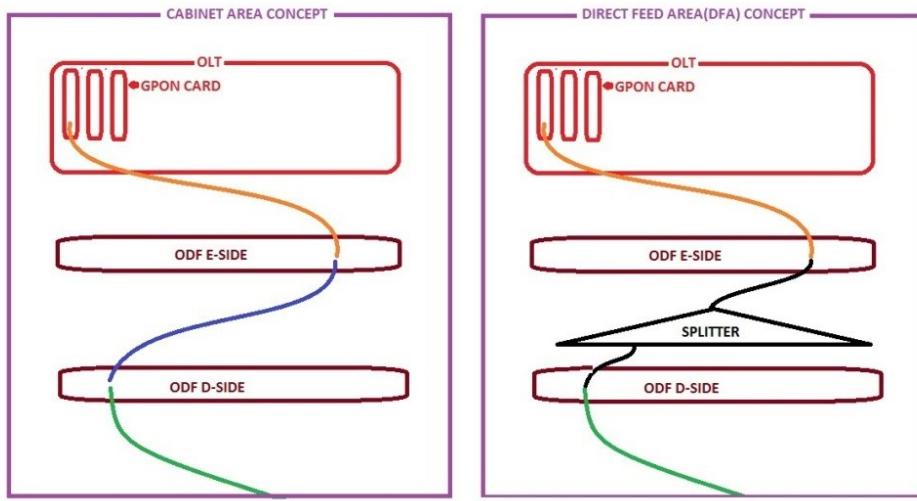


URBAN MODEL – Which is only cover the distance maximum up to 10KM from C/O , Maximum 64 Customers can be connected through single OLT port to get the optimum bandwidth for each customers, if all customers connected simultaneously 40Mbps is the maximum bandwidth per customer

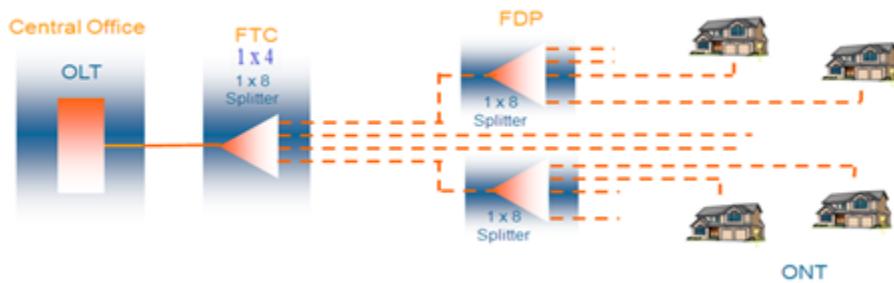
VILLAGE MODEL- Which is only cover the distance maximum up to 20 KM from C/O , Maximum 32 Customers can be connected through single OLT port to get the optimum bandwidth for each customers, if all customers connected simultaneously 80Mbps is the maximum bandwidth per customer

HIGH END USER CLUSTER MODEL – which is cluster located inside the 10KM radios from C/O and maximum 32 customers can be connected , if all customers connected simultaneously 80 Mbps is the maximum bandwidth per customer

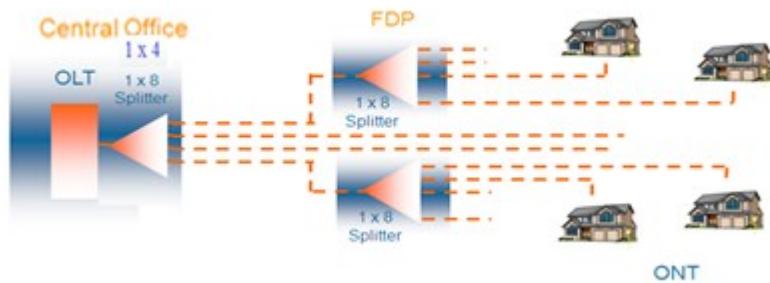
FTTH CONCEPTS



CABINET AREA CONCEPT : This is the model where the first level splitter accommodated inside a cabinet , the cabinet is located outside the central office (C/O) , Cabinet can be a pole mounted or Ground mounted



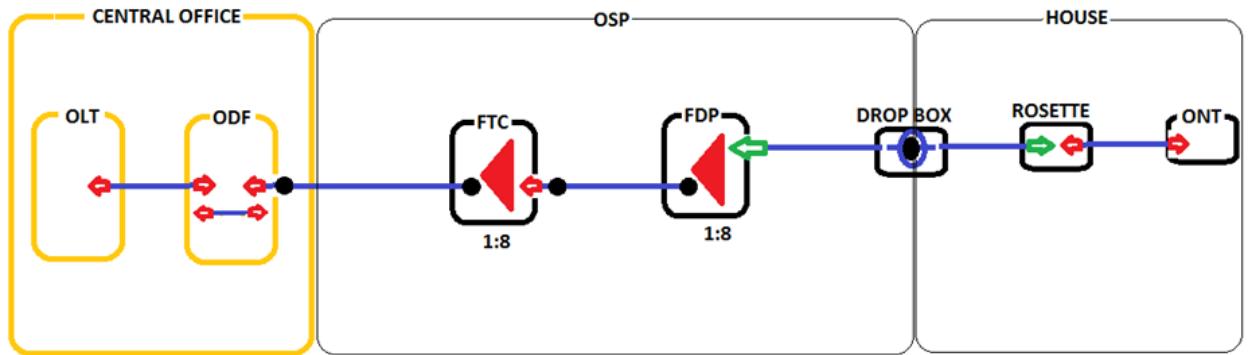
DIRECT FEED AREA(DFA) CONCEPT : This is the model where the first level splitter accommodated inside the ODF , ODF is located inside the central office (C/O)



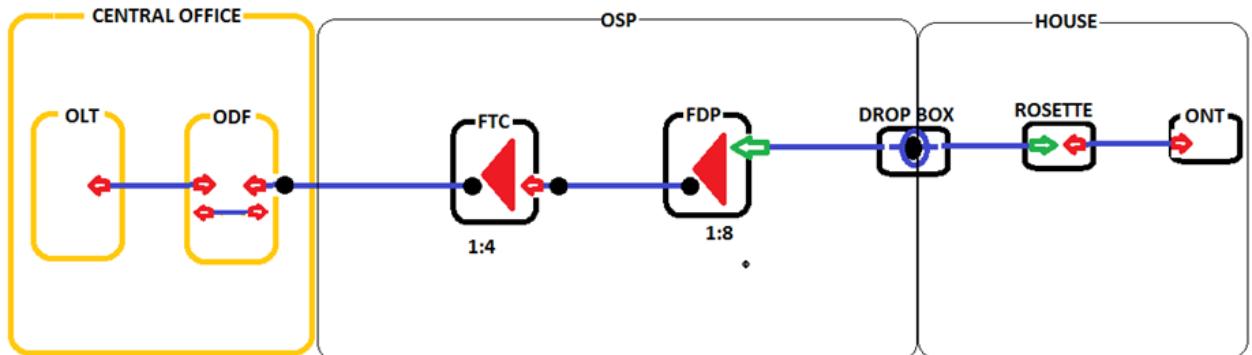
ARCHITECTURES

Based on the Models and Concepts , SLT FTTH network and clusters implementations are being carried out , there are four types of network architecture available in the SLT FTTH network

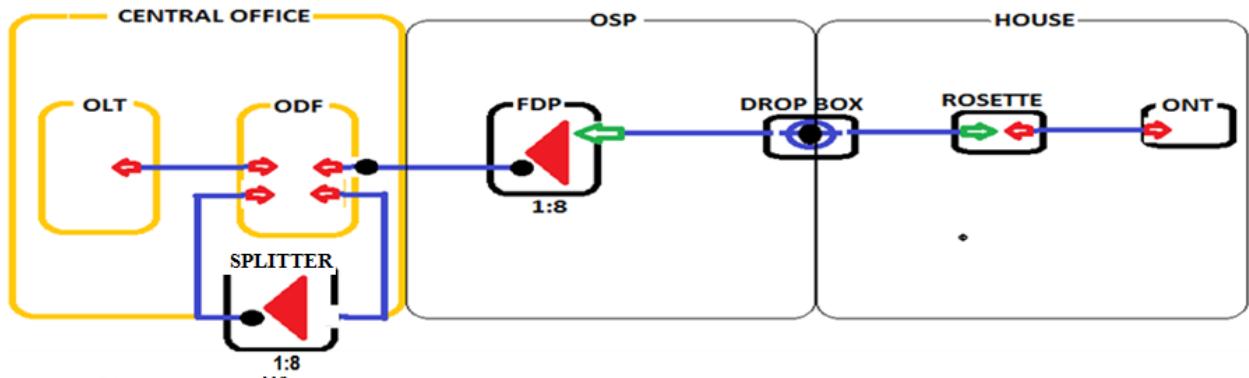
1. **CABINET AREA – URBAN MODEL** : Single OLT port can be connected to 64 customers and the first level splitting inside the cabinet , cabinet is part of OSP network



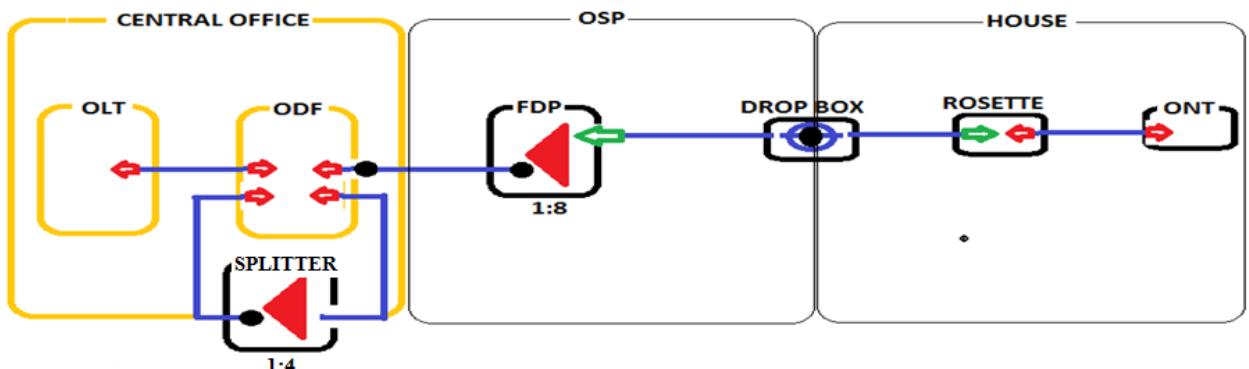
2. **CABINET AREA – VILLAGE MODEL & HIGH END USER MODEL** : Single OLT port can be connected to 32 customers and the first level splitting inside the cabinet , cabinet is part of OSP network



3. **DFA– URBAN MODEL** : Single OLT port can be connected to 64 customers and the first level splitting inside the ODF



4. **DFA– VILLAGE MODEL & HIGH END USER MODEL** : Single OLT port can be connected to 32 customers and the first level splitting inside the ODF



PART II : FTTH COMPONENTS AND INSTALLATION STANDARDS

OPTICAL LINE TERMINAL (OLT)

OLT is terminal equipment connected to the fiber backbone. It sends Ethernet data to the ONU, initiates and controls the ranging process, and records the ranging information. OLT allocates bandwidth to the ONU and controls the starting time and the transmission window size of the ONU transmission data.

ZTE - ZXIA10 C300M/ C350M



HUAWEI - MA5600T/MA5603T



GTGO - 8-port GPON interface

GTGH - 16-port GPON interface



GPFD -16–port GPON interface



SMALL FORM-FACTOR PLUGGABLE (SFP)

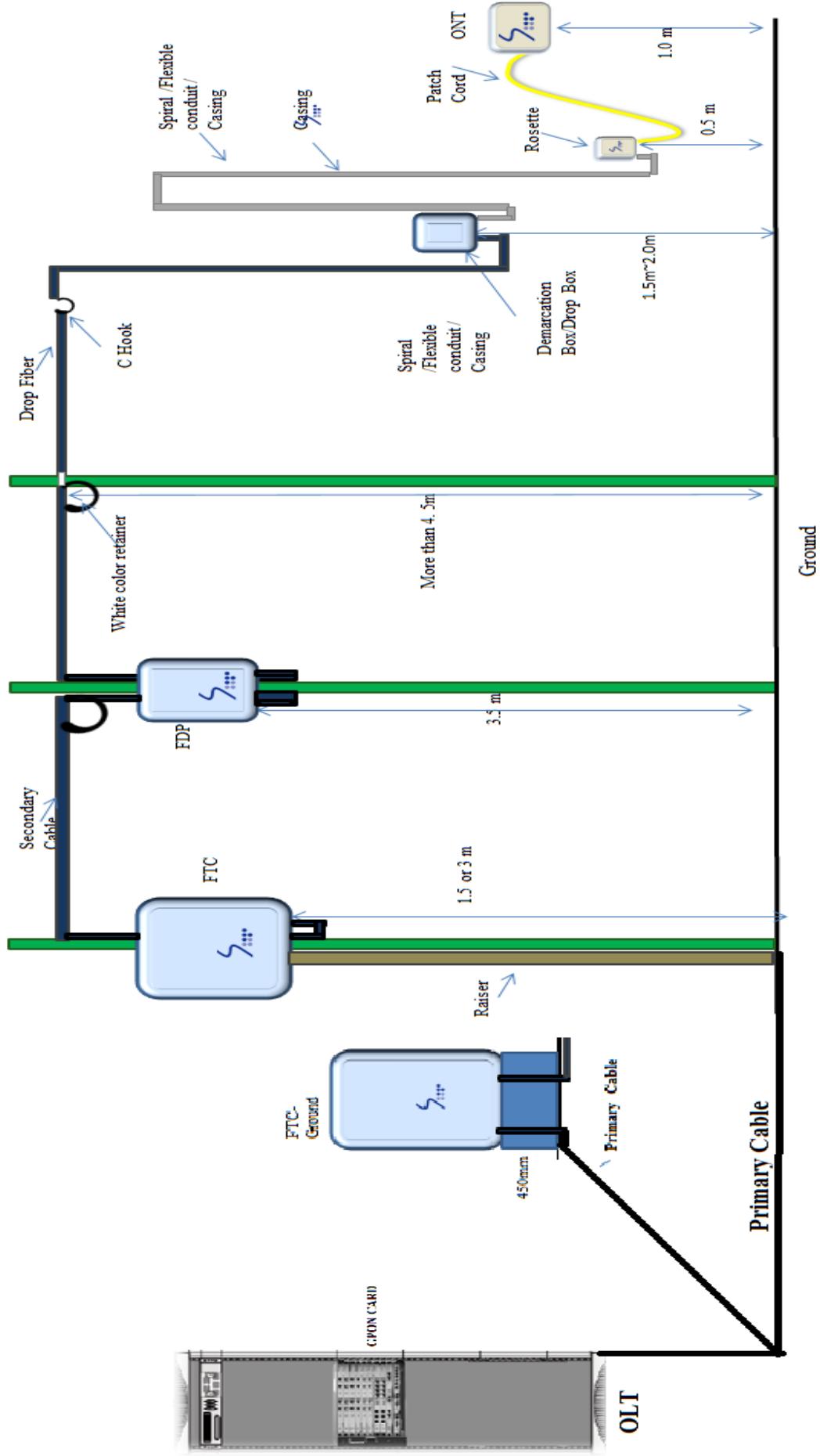
The small form-factor pluggable (SFP) is a compact, hot-pluggable transceiver used for both telecommunication and data communications applications.

An optical transceiver chip is an integrated circuit (IC) that transmits and receives data using optical fiber rather than electrical wire. Optical fiber, also called fiber optic, refers to the technology associated with the transfer of information in light beams or pulses along solid transparent fibers or cables.

The Key Differences Between GPON SFP Class B+ and Class C+:

	B+ Module	C+ Module
Type	One-fiber bi-directional optical module, class B+	One-fiber bi-directional optical module, class C+
Operating Wavelength	Tx: 1490 nm Rx: 1310 nm	Tx: 1490 nm Rx: 1310 nm
Encapsulation Type	SFP	SFP
Port Rate	Tx: 2.49 Gbit/s Rx: 1.24 Gbit/s	Tx: 2.49 Gbit/s Rx: 1.24 Gbit/s
Minimum Output Optical Power	1.50 dBm	3.00 dBm
Maximum Output Optical Power	5.00 dBm	7.00 dBm
Maximum Receiver Sensitivity	-28.00 dBm	-32.00 dBm
Optical Connector Type	SC/PC	SC/PC
Optical Fiber Type	Single-mode	Single-mode
Reach	20.00 km	20.00 km
Overload Optical Power	-8.0 dBm	-12.0 dBm
Extinction Ratio	8.2 dB	8.2 dB





FTC –GROUND INSTALLATION (3OPP)



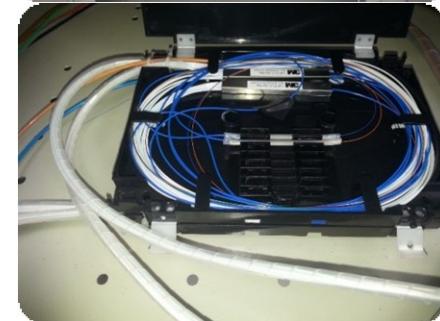
1. Fix primary (incoming UG) cable to the gland which is located at the bottom of the cabinet.



2. Route primary (incoming) fiber tubes into relevant fiber panels through fiber tube guiding tray.



3. Connect the Fiber to the SC/UPC adapter According to the network requirement. Take Fiber through the cable management part.



4. Connect the fibers by splicing and coil the cable in the Cable management part.



5. Place the spliced fiber with sleeve at the Splicing tray.



6. Install the splitter inside the splitter tray



7. Take the secondary fiber cable through outlet from the cabinet and take it through the riser (for UG cable) or to the pole.(Ariel cable)



8. Connect the earth wire to the earthling Point Of the cabinet
9. Earth measurement must be less than 50 ohm



10. The height of the base shall be at least 450mm above the exiting ground level.

FTC –GROUND INSTALLATION (ZTT)



1. Fix primary (incoming UG) cable to the gland which is located at the bottom of the cabinet.



2. Splice the primary cable with pigtails inside the tray



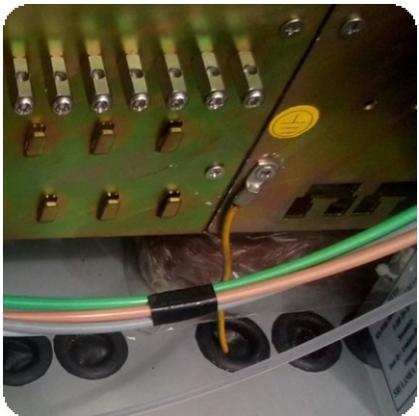
3. Take the secondary fiber cable through outlet from the cabinet and take it through the riser (for UG cable) or to the pole.(Ariel cable)



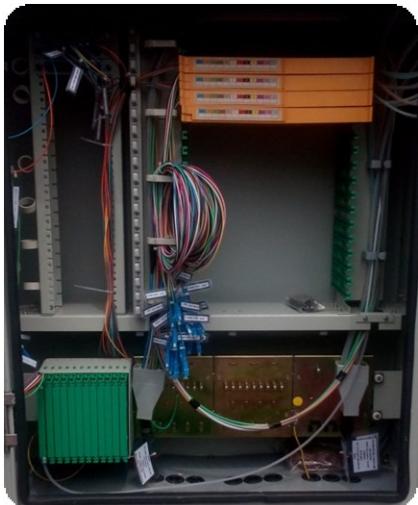
4. Splice the secondary cable with pigtails inside the tray



5. Install the splitter inside the splitter tray and connect the primary and secondary terminated pigtails



6. Connect the earth wire to the earthing Point Of the Cabinet
7. Earth measurement must be less than 50 ohms



8. Route primary and secondary fiber tubes into relevant fiber panels through fiber tube guiding tray & Do the labeling as per SLT standard



9. The height of the base shall be at least 450mm above the exiting ground level.

10. Keep 5m coil inside the MH

FTC – POLE MOUNT INSTALLATION



1. Mount the FTC in 8m SLT standard pole
FTC should mount at the height of 3.0m from ground or 1.5m from ground depending on the site situation)



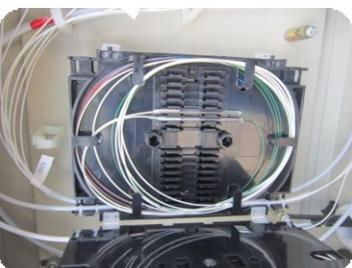
2. Keep the 7.5 m primary cable coil at pole or nearest MH



3. Fix and route the primary (incoming) cable and Secondary (outgoing) cables to the gland Which is located at the bottom of the cabinet.



4. Install the splitter inside the splitter tray
Incoming fiber to be terminated with Splitter input by splicing
And coil the cable in the trays



5. Splitter output pigtails should connected to E-Side of the patch panel with SC/UPC adapters



6. Terminate the secondary cable by Splicing with pigtails inside the splicing tray

7. Pigtails (Secondary cable) to be connected with D-Side of the Patch panel with SC/UPC adapter



8. Do the cable arrangement in proper way using cable management and labeling



9. Connect the earth wire to the earthing Point Of the cabinet
 10. Earth measurement must be 50 Ohms for FTC

FTC TYPE AND ACCESSORIES

M-1	FTC/Small -Outdoor /Pole, Wall Mounted 4X1:4,2X1:8 Splitter To be fixable to standard SLT-8m Pole	FTC-Enclosure, Splice trays, More than 20 Sleave holders, Patch pannel with 20 adopters 16 FDP – Secondary output
M-2	FTC/ Medium-Outdoor /Pole,Wall Mounted 6X1:4,3X1:8 Splitter To be fixable to standard SLT-8m Pole	FTC-Enclosure, Splice trays, More than 30 Sleave holders, Patch pannel with 30 adopters 24 FDP –Secondary output
M-3	FTC/ Large -Outdoor /Pole,Wall Mounted 12X1:4,6X1:8 Splitter To be fixable to standard SLT-8m Pole	FTC-Enclosure,Splice trays, More than 60 Sleave holders, Patch pannel with 60 adopters 48 FDP -Secondary output
M-4	FTC/ Extra Large -Outdoor /pole, Wall Mounted 18X1:4,9X1:8 Splitter To be fixable to standard SLT-8m Pole	FTC-Enclosure , Splice trays More than 90 Sleave holders Patch pannel with 90 adopters 72 FDP - Secondary output
M-5	FTC/Small -Outdoor /Ground Mounted 18X1:4,9X1:8 Splitter To be fixable onto appropriate concrete base	FTC-Enclosure, Splice trays, More than 90 Sleave holders, Patch pannel with 90 adopters 72 FDP - Secondary output
M-6	FTC/Medium -Outdoor /Ground Mounted 36X1:4,18X1:8 Splitter To be fixable onto appropriate concrete base	FTC-Enclosure, Splice trays More than 180 Sleave holders, Patch pannel with 180 adopters 144 FDP –Secondary output
M-7	FTC/Large -Outdoor /Ground Mounted 72X1:4,36X1:8 Splitter To be fixable onto appropriate concrete base	FTC-Enclosure,Splice trays, More than 360 Sleave holders, Patch pannel with 360 adopters 288 FDP –Secondary output

TERMINATING SECONDARY CABLES IN FTC:

- All secondary cables (as in the approved plan) to be terminated in FTC in the inner side of cable tray
- If an alternative cable (larger in size) is used at implementation instead of the designed cable type, only the number of cores in the approved design to be terminated in FTC (Eg; due to unavailability of required cable type)
- Fiber cores to be terminated in the core order and all the cores which are not connected to FDPs to be considered as stumps
- A FDP Number to be allocated and reserved for all of such stumps

TERMINATING PRIMARY CABLES IN FTC

- In the case of primary cables
 - Only required number of cores are released at FTC (as per approved design) and the rest is passed through(Case a)
 - Or, a cable tail tapped from an existing steam ends up at FTC(Case b)
- Fiber cores are arranged within FTC as follows
 - In the case-a, only the required cores are spliced to Splitter inputs (as per the approved design) and the balance reserved cores (in the same tube) remain not spliced or not terminated within management tray of FTC; the rest of the tubes to be passed through
 - In the case-b, only the required cores are spliced to Splitter inputs (as per the approved design) and the balance cores remain not spliced or not terminated within management tray of FTC

EARTH SHEATH (ALUMINUM FOIL) OF AERIAL/CONDUIT CABLE

- Earth Sheath of Conduit/Aerial cable to be grounded only at the following locations
 - At ODF (cables beginning at ODF D side)
 - At Local ODF of FTC (cables ending at ODF E side and cables beginning at ODF D side)
- Earth Sheath of Conduit/Aerial cable not to be continued/bonded at any joint or FDP
 - Earth Sheath not to be continued/bonded within aerial/underground Joint Closure
 - Earth Sheath not to be continued/bonded within FDP

FDP INSTALLATION



1. FDP should mount 3.5m from ground level (reference bottom of FDP)
2. Fiber Coil length at Mid - FDPs total 15m at both sides 7.5m (enabling to lower the areal cable to ground)
3. Fiber coil length at stump is 18m
4. At the End- FDP keep secondary cable coil length of 7.5m
5. Route and fix the secondary (incoming) cable to the gland which is located at the bottom of the FDP
6. Install the splitter inside the splitter tray
7. Incoming fiber to be terminated with Splitter input by Splicing and coil the cable in the trays
8. Splitter output connected to SC /UPC Adapters
9. Fiber Drop Wire must be terminated with FAC connector (SC/UPC)
10. Adequate Drop Wire coil must be keep into FDP
11. Route and fix the Drop Wire (outgoing) cable to the gland this is located at the bottom of the FDP
12. Do Labeling as per SLT standard

SPLITTER



Planar Light Circuit (PLC) Splitters

2.0m, 0.9mm SC/UPC pigtauls for input and Output – 8(D side) or 9(Both Side) pigtauls, Case Dimension (LXWXH) should be 60x7x4 mm



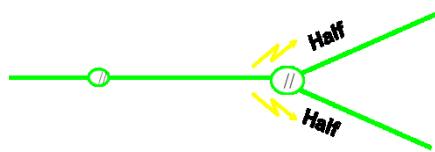
Cassette type Splitter

2.0 m, 2.0mm, SC/UPC pigtauls connected for input and output – 9 pigtauls



Blade type Splitter

0.5 m, 0.9mm SC/UPC pigtauls connected for input and output, with 1 input and 8 output ports



1:2 Splitters

Every time the signal is split two ways, half the power goes one way and half goes the other. So each direction gets half the power, or the signal is reduced by,

$$10 \log_{10}(1/N) \rightarrow 10 \log_{10}(1/2) = 3.0 \text{ dB}$$

Parameters	1x2	1x4	1x8	1x16	1x32	2x2	2x4	2x8	2x16	2x32
Insertion loss (dB)	3.5	7.2	10.5	13.5	16.5	3.9	7.5	10.8	14.1	17.4

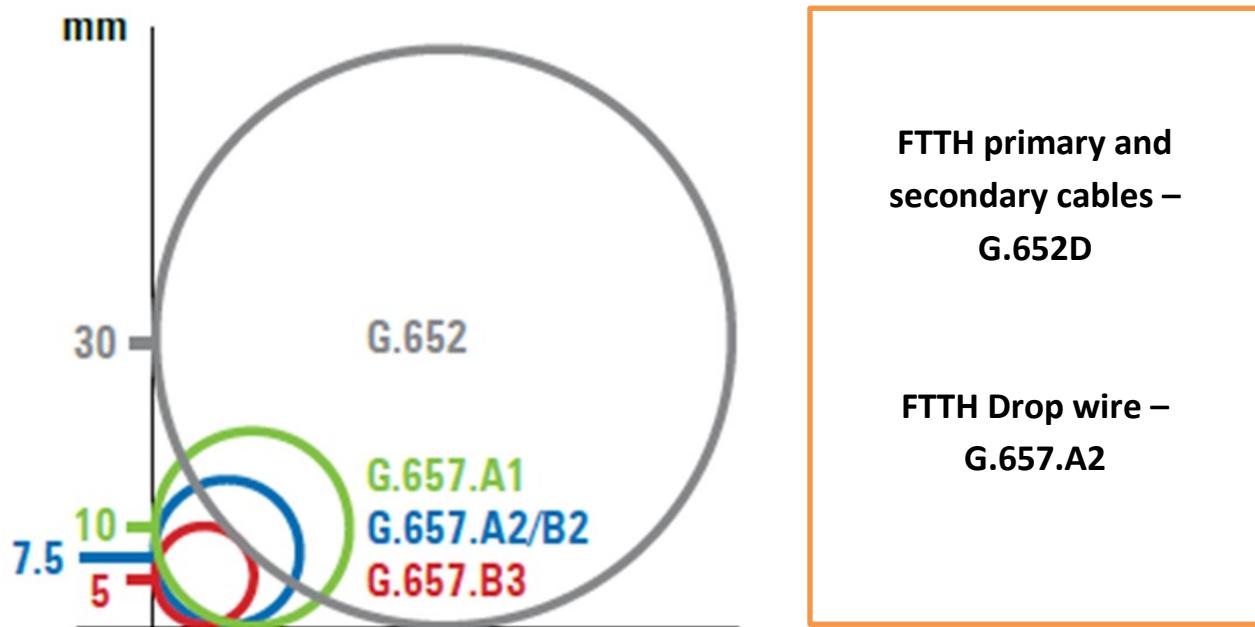
Operating wavelength will be 1260 ~ 1360 nm & 1450 ~ 1650 nm

Insertion loss should be less than 0.3 dB for SC/UPC connectors (Pigtails)

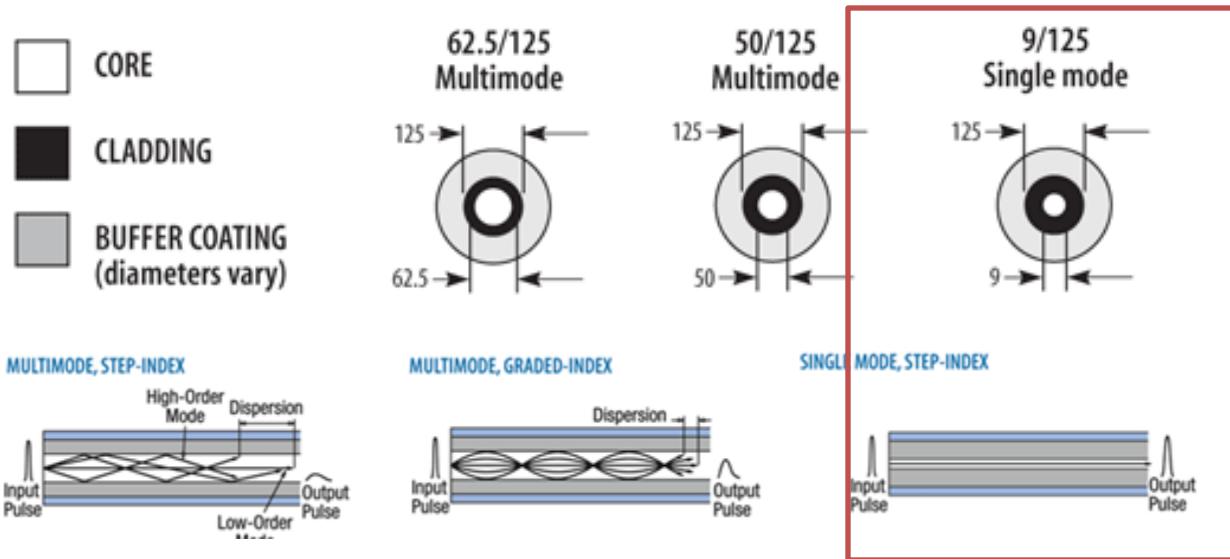
FIBER OPTIC CABLES

International Standard for optical fiber

- **ITU-T G.651**
Multimode fiber standard
- **ITU-T G.652**
ITU-Standard Single mode fiber. 4 different categories (A, B, C, D) differ in the water peak attenuation around the 1383nm window Equivalent standards : Telcordia GR-20, IEC 60793-2, TIA/EIA-492CAAB
- **ITU-T G.653**
Zero Dispersion Shifted Fiber (ZDSF), having zero dispersion around the 1550nm window
- **ITU-T G.654**
Cutoff shifted and low attenuation fiber, designed mainly for submarine applications
- **ITU-T G.655**
Non-zero Dispersion Shifted Fiber (NZDSF), having low dispersion in the 1550nm and 1625nm windows, the DWDM region. Suited for long-haul and backbone applications. Categories A, B, C, D, E differ in PMD and dispersion values
- **ITU-T G.656**
Medium Dispersion Fiber (MDF), designed for local access and long haul fiber
- **ITU-T G.657**
Latest standard (from 2008 Jan) for FTTH application. Designed to bend at small radius of down to 10mm radius and 7.5mm radius



SINGLE MODE VS MULTIMODE - FTTH ONLY SINGLE MODE



Absorption Loss:

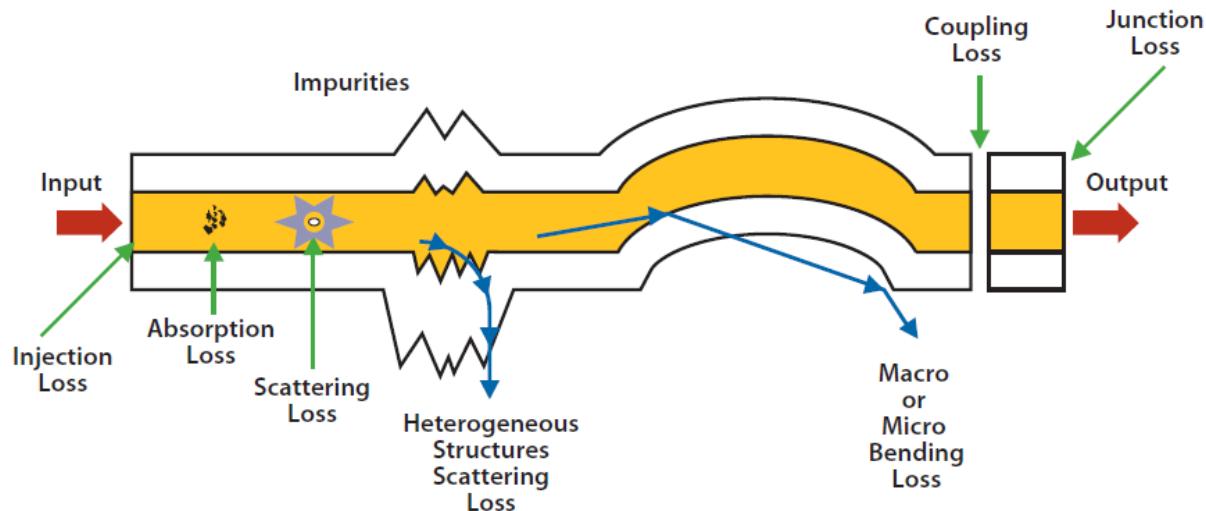
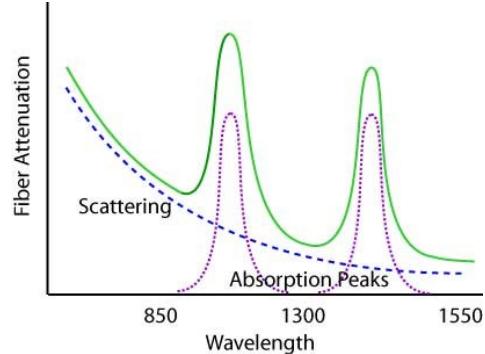
Caused by the fibre itself or by impurities in the fiber, such as water and metals.

Scattering Loss:

Arise from microscopic variations in the material density, from compositional fluctuations and from structural defects occurring during fiber manufacture.

Bending loss:

Loss induced by physical stress on the fibre.



Link loss mechanisms

DEMARCATION BOX (DROP BOX)



1. Should be firmly mounted onto the outer wall at 1.5m~2.0m
2. External Fiber Wires to and from Demarcation Box neatly Installed within a protective casing/with an appropriate Protection on the outer wall
3. Outdoor (G.652D) and Indoor (G.657A2) fiber wires properly Spliced and arranged within Demarcation Box – two type cable
4. Same Outdoor fiber wire (G.657A2) used as Indoor fiber wire and properly passed through Demarcation Box without splicing
5. 2m-3m coil must be kept inside the Demarcation box
6. FAC connectors, SC/UPC adaptors to be accommodated inside Demarcation Box

ROSETTE BOX



1. Fiber Rosette properly fixed onto the inner wall at the appropriate place (where sufficient safety available and easily reachable) at 0.5m height from floor level
2. FAC properly connected to fiber wire within Fiber Rosette
3. Fiber wire properly arranged within Fiber Rosette, keep 1m fiber coil kept within Fiber Rosette
4. SC/UPC Adaptor must be placed within fiber Rosette
5. No splicing to be accommodated inside Rosette

INTERNAL WIRING -INSIDE CUSTOMER PREMISES

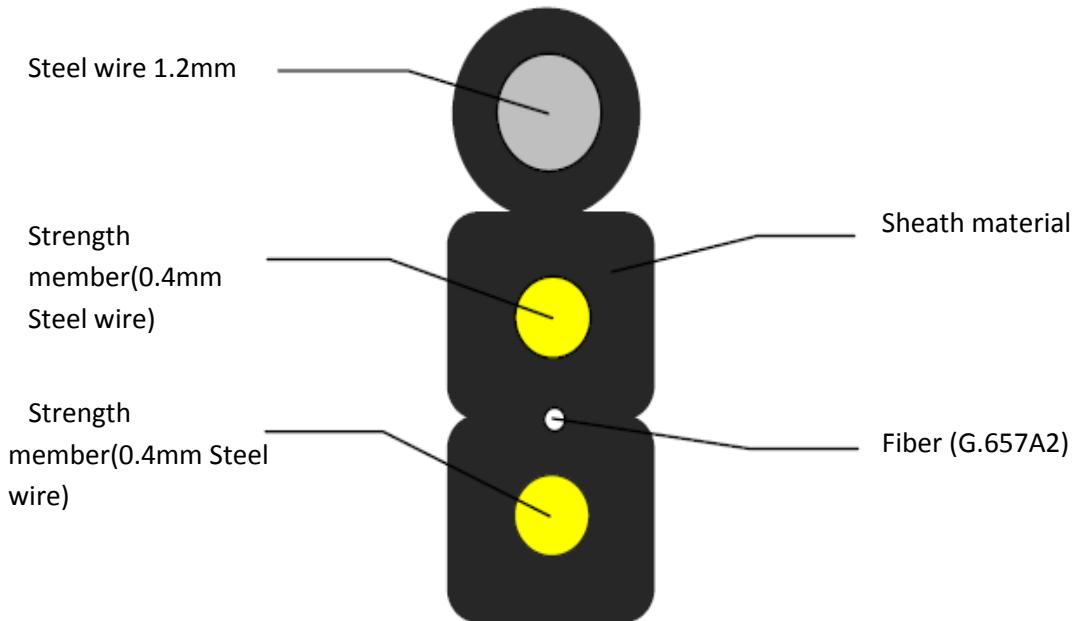


1. Fiber wire properly taken from outside to inside of house over the wall within a protective casing/conduit
2. Internal Wiring neatly done inside house within a protective casing/with an appropriate protection/using a self-adhesive



3. Internal wire must comply with G.657.A2 standard
4. Appropriate Spiral or flexible conduit must use for cover the Bends

SINGLE CORE DROP CABLE



ITU.T G.657.A2

POLE ERECTION AND DROP WIRE DRAWING

- Construction of poles with struts and stays where ever those required
- Buried depth of the pole: 1/5th of the actual height of pole
- Buried depth to be measured using the pole Height Measuring Instrument
- Permissible Drop wire Clearance (Along the Road – 4.5m and at Road Crossings – 5.0m & ensure Properly Tensioned Power)
- Crossing as indicated below <600V – 60cm, 600 - 700V, 120cm & 7000V – 15000V,200cm
- Sag of Drop wire not to exceed 0.4m for 40m or less pole span, sag of 0.7m between 40-50m pole span.
- There shouldn't be fiber Drop wire joint between FDP & Drop box
- White colored Retainers must be used and properly fixed into L-Hooks
- C-hook to be fixed firmly at suitable place and drop wire to be covered by flexible conduit or spiral
- Drop wire clearance from foliage must be not less than 1m
- Drop wire bends should comply with G.657A2 / G.652.D
- For each MH cable length of 5m must keep
- If the pole contains closure joints total 20m cable coil must be keep , both side 10m cable coil

RETAINERS TO BE USED FOR PON AREAL APPLICATIONS

- White color retainers (pure white) between FDP and Customer house
- Black color retainers (pure black) between FTC and FDP

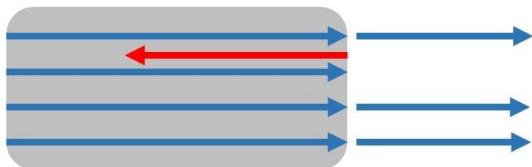
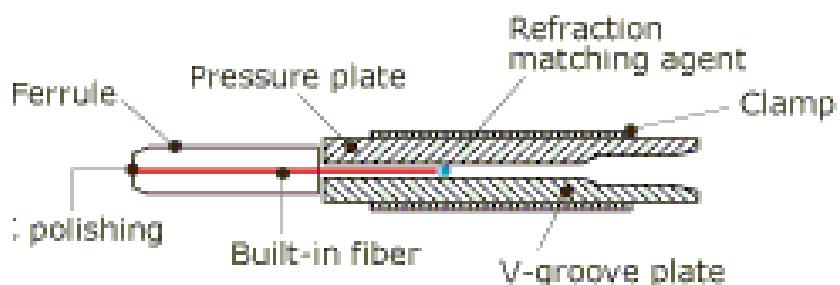
GUARD WIRE OF AERIAL CABLE-DROP WIRE

- Guard wire of aerial drop wire (going to customer's house) not to be grounded at anywhere
- Therefore, guard wire of aerial drop wire not to be bonded to guard wire of aerial cable at FDP
- Consequently, guard wire of aerial cable not to be grounded at each FDP
- Aerial cable guard wire to be grounded only at the following locations
 - At the beginning of aerial cable
 - At the end of aerial cable
 - If an aerial cable is branched, the guard wires of each branch to be grounded at their ends.
- Guard wire of aerial cable to be continued by bonding
 - Guard wires to be bonded to ensure electrical continuity throughout at each cable jointing/breaking points

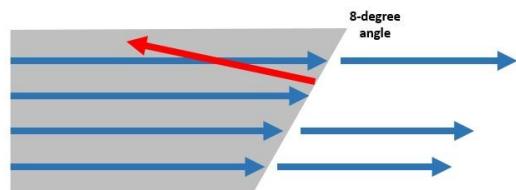
FAC CONNECTOR



1. SC/UPC connector must be used.
2. Connector /Adapter must be Blue in Color.
3. Fiber insertion loss < 0.5dB
4. FAC connector used inside the FDP to terminate the Outdoor drop wire
5. FAC connector used inside the Rosette to terminate Indoor drop wire
6. Should follow the instruction manual, proper tools provided by manufacturer



UPC



APC



ADAPTER



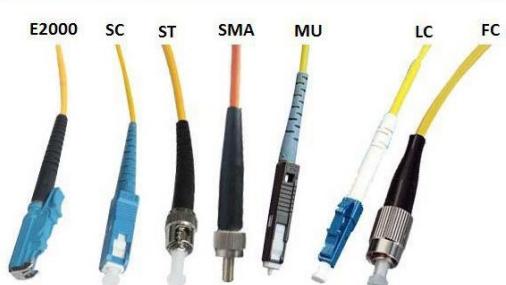
1. SC/UPC connector must be used.
2. Connector /Adapter must be Blue in Color.
3. Fiber insertion loss < 0.3dB
4. FAC connector used inside the FTC , FDP, Rosette

PIGTAIL



1. SC/UPC pigtails must be used.
2. Connector /Adapter must be Blue in Color.
3. Fiber insertion loss < 0.3dB
4. Pigtails used to connect primary and secondary cable to FTC

PATCHCORD



1. SC- FC patch cord used to connect GPON card to ODF
2. SC- SC patch cord used to connect ONT to Rosette

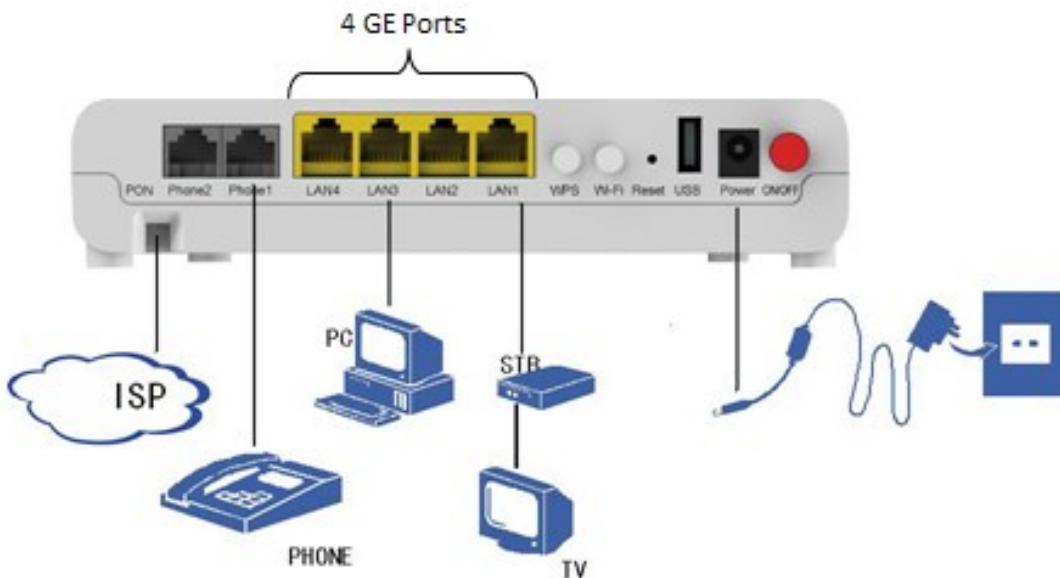
According to connector styles, it is divided into FC, SC, ST, LC, MTRJ, MU, E2000, DIN patch cord

Generally, single-mode fiber cable color is yellow, its connector and protective sleeve are blue. Its transmission distance is longer. Multi-mode fiber cable color is orange or grey, its connector and protective sleeve are red or black. Its transmission distance is shorter

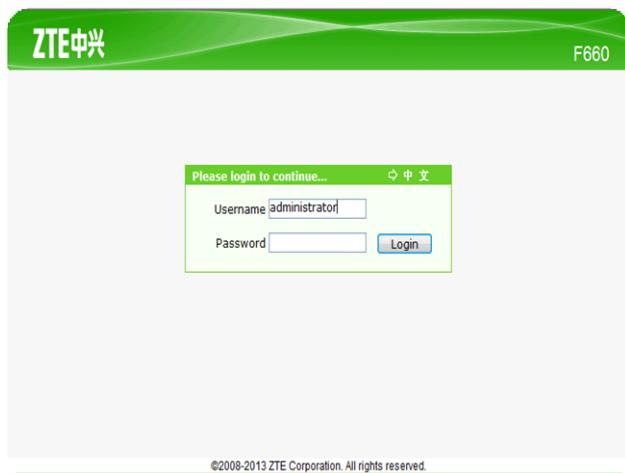
OPTICAL NETWORK TERMINAL (ONT)



1. ONT must be placed in a proper location where connectivity for the instruments can obtained easily and less interference from other Wi-Fi signals.
2. ONT must be fixed in a way where the ports of the ONT headed downwards
3. ONT must be fixed 1m from ground level
4. Use the SC/APC (Green) side of patch code to connect the ONT
5. Use the SC/UPC (Blue) side of patch code to connect the rosette
6. Patch code neatly arranged and protected.



ONT CONFIGURATION –ZTE F660



1. Login as Administration to bind the ONT with network

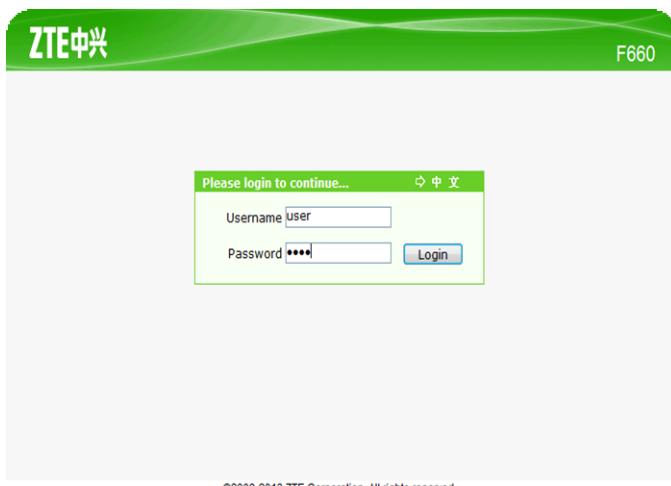
Type 192.168.1.1 in browser
Enter administrator password → Login

A screenshot of the ZTE F660 web interface showing device information. The header says "ZTE 中兴" and "F660". The left sidebar shows a menu with "Status", "Device Information" (selected), "Network Interface", "User Interface", "VoIP Status", "Network" (selected), "Security", "Application", "Administration", and "Help". The main content area shows device details for Model F660, including Serial Number (EC8A4C-ZTEEMDWEAA02571), Hardware Version (V5.2), Software Version (V5.2.10P2T4), Boot Loader Version (V5.2.10), PON Serial Number (ZTEGc08466b6), Password (GC08466B6), and Batch Number (07dfP2T40078). The footer includes a copyright notice: "©2008-2013 ZTE Corporation. All rights reserved.".

2. Network → PON → SN

A screenshot of the ZTE F660 web interface for configuring Network-PON-SN. The header says "ZTE 中兴" and "F660". The left sidebar shows a menu with "Status", "Network" (selected), "WAN", "WLAN", "LAN", "PON" (selected), "LOID", "SN" (selected), "Routing(IPv4)", "Routing(IPv6)", "Port Locating", "Security", "Application", "Administration", and "Help". The main content area shows a warning message: "Configure password take effect after rebooting the device." It has fields for "SN" (ZTEGc08466b6) and "Password" (0112424743). At the bottom are "Submit" and "Cancel" buttons. The footer includes a copyright notice: "©2008-2013 ZTE Corporation. All rights reserved.".

3. 10 digit phone number entered as password



4. Login as user - Username: user , Password: user
IP: 192.168.1.1



5. Configure internet using BB Username & Password

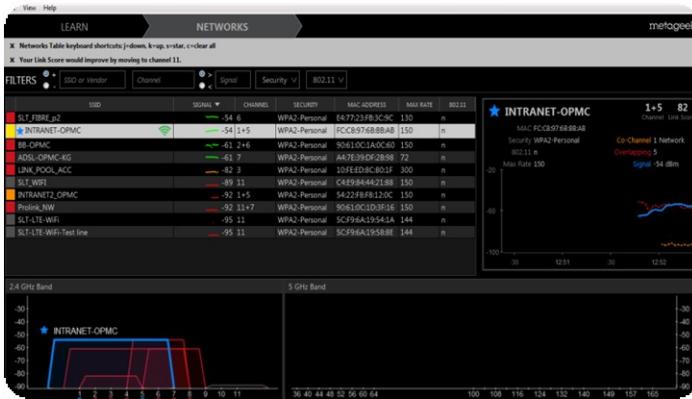
Goto 'quick Setup'
Add PPPoE username and password

Go to 'Next'



6. Configure Wi-Fi SSID and Password

Enable SSID → Enter SSID (Wi-Fi U/N)
Enter pre shared key (Wi-Fi P/W) → save → Detail Setup



7. Run “InSSIDer Home” software application

Monitor the proper Wi-Fi channel to reduce the interference

The screenshot shows the 'Basic' settings page under 'WLAN' in the ZTE F660 network configuration. It includes fields for Wireless RF Mode (Enabled), Enable Isolation (unchecked), Mode (Mixed(802.11b+802.11g+802.11r)), Country/Region (United Kingdom), Band Width (Auto), Channel (6), External Channel (Auto), SGI Enable (3), Beacon Interval (4), Transmitting Power (6), QoS Type (8), RTS Threshold (10), and DTIM Interval (12). A tip message at the top says: 'Tip: Wireless RF mode from disabled to scheduled take a minute or so, please refresh.'

8. Network→WLAN→Basic

Channel→Select Channel manually→Submit

The screenshot shows the 'PON information' page under 'Network Interface' in the ZTE F660 network configuration. It displays GPON State (GPON) and Init State (Init). Detailed parameters include Optical Module Input Power(dBm) (--), Optical Module Output Power(dBm) (--), Optical Module Supply Voltage(uV) (3262000), Optical Transmitter Bias Current (uA) (7156), and Operating Temperature of the Optical Module(°C) (52).

9. Check the ONT power receiving level and make sure > -28dB

Status Network Interface→PON information

ONT CONFIGURATION –HUAWEI HG8254H



1. Login as Administration to bind the ONT with network

Type 192.168.1.1 in browser
Enter administrator password → Login

System Tools > ONT Authentication

On this page, you can change ONT authentication parameters to ensure that it can be authenticated on the OLT.

Password Mode: ASCII string

Password: Hide (a string of 10 characters at most)

SN: 4857544395E0372C * (16 hex digits, or 12 hex digits that end with 8 hex digits)

Apply Cancel

2. System tools → ONT authentication
→ password (use 10 digit telephone number of the user) and click <Apply>



3. Login as user - Username: user, Password: user IP: 192.168.1.1

HG8245H

Quick Setup Detail Setup Logout

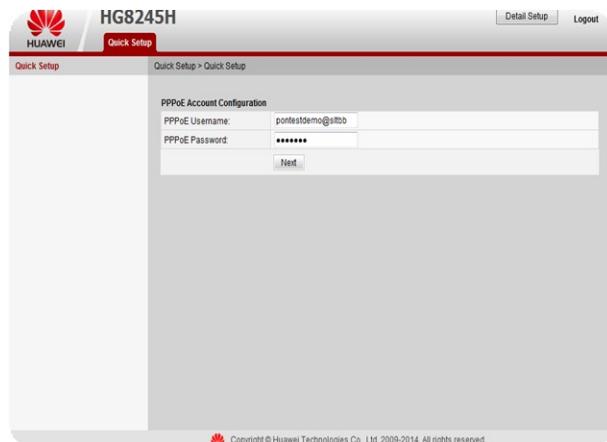
Quick Setup > Quick Setup

PPPoE Account Configuration

PPPoE Username: pontestdemo@stbbs
PPPoE Password: *****

Next

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4. Quick Setup → Type internet user name and password and click <Next>

HG8245H

Quick Setup Detail Setup Logout

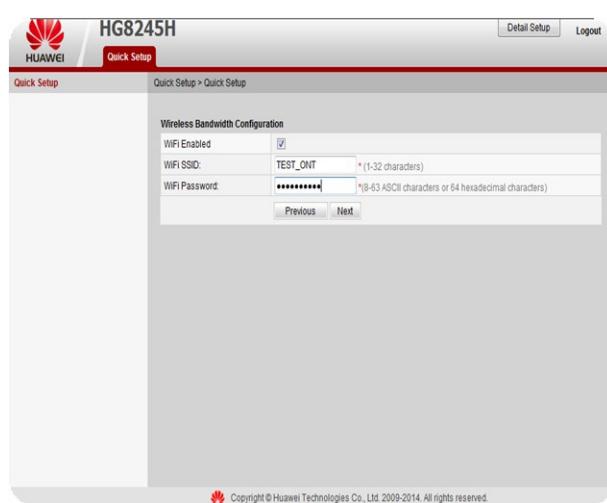
Quick Setup > Quick Setup

Wireless Bandwidth Configuration

WiFi Enabled:
WiFi SSID: TEST_ONT *(1-32 characters)
WiFi Password: ***** *(8-63 ASCII characters or 64 hexadecimal characters)

Previous Next

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5. Quick Setup → Configure WiFi SSID and WiFi password and click <Next>

HG8245H

Quick Setup Detail Setup Logout

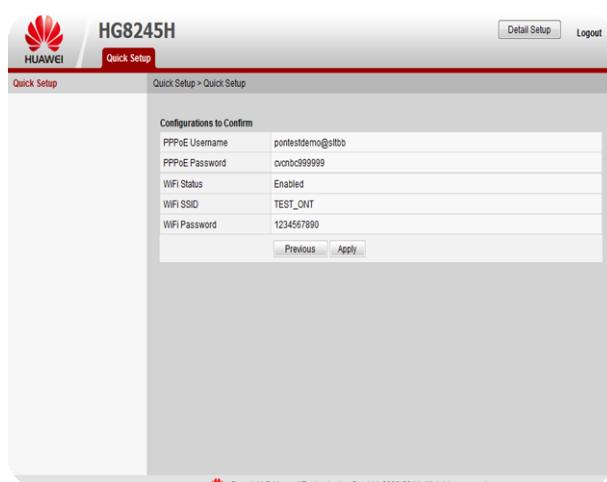
Quick Setup > Quick Setup

Configurations to Confirm

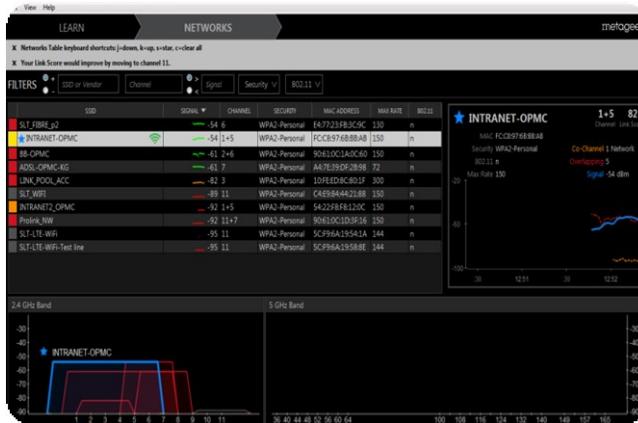
PPPoE Username	pontestdemo@stbbs
PPPoE Password	ovnbc999999
WiFi Status	Enabled
WiFi SSID	TEST_ONT
WiFi Password	1234567890

Previous Apply

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6. Apply



7. Run “InSSIDer Home” software application

Monitor the proper Wi-Fi channel to reduce the interference

This screenshot shows the "WLAN Basic Configuration" screen with the "WLAN Advance Configuration" tab selected. It displays a form for advanced parameters like TX Power (100%), Regulatory Domain (China), and Channel (Automatic). A note states: "On this page, you can set advanced WLAN parameters. When the WLAN function is disabled, this page is blank."

8. To change Wi-Fi Channel manually

WLAN → **WLAN Advance Configuration** → **Channel**

Select channel Manually

This screenshot shows the "Status" screen of the Huawei HG8245H device. Under the "Optical Information" section, it displays optical signal sending status, TX and RX optical power, working voltage, bias current, and working temperature. The TX optical power is listed as -27 dBm, which is above the required threshold of -27 dBm.

9. Check the ONT power receiving level and make sure > -27dB

Go to: **Status** → **Optical Information**

PART III : FTTH TOOLS AND FUNCTIONS

POWER METER AND POWER SOURCE



Power Meter

Used to measure the received optical power and it is a standard tester in a typical FO technician's toolkit.

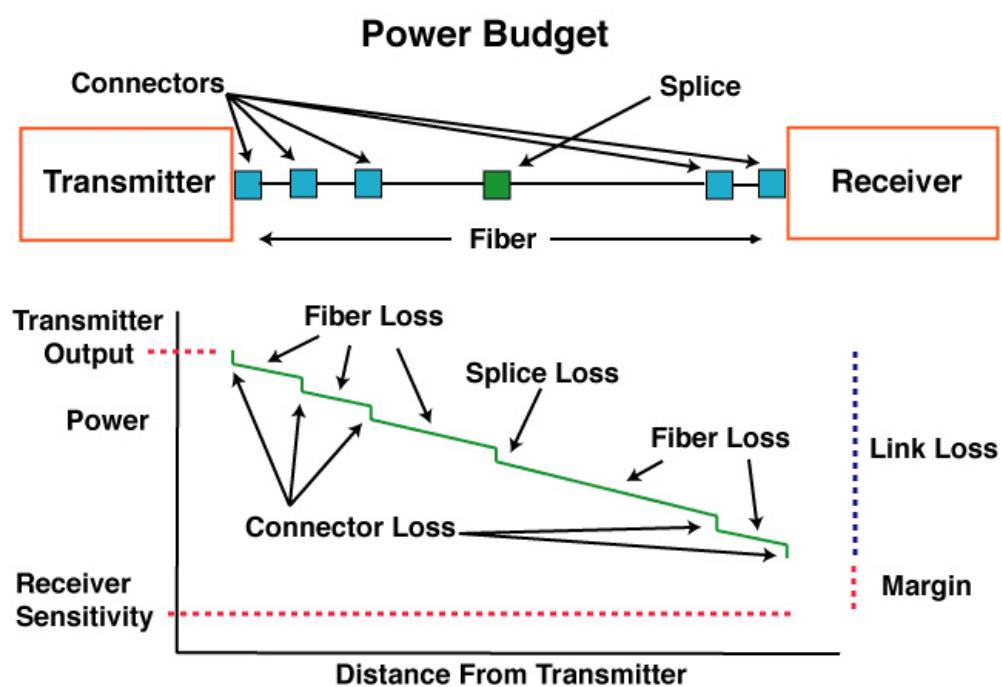
FTTH using 1490nm wavelength



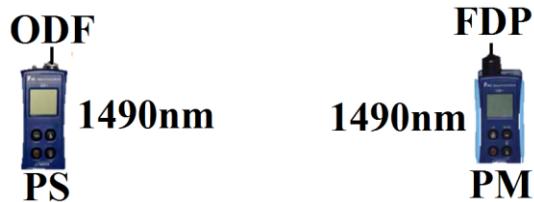
Power Source

Provides continuous wave and stable source of energy for attenuation measurements, fiber tracing and macro bend identifying. **FTTH using 1490nm wavelength**

Each power source has the output power value - user must know the power output value before start the testing

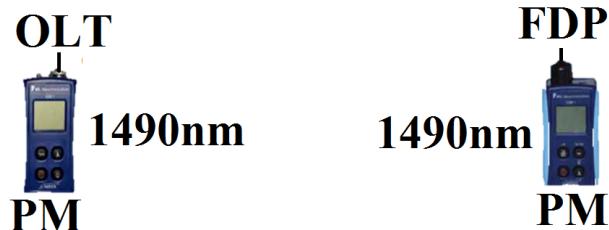


ACTUAL POWER LOSS – PON (USING POWER METER & POWER SOURCE)-NETWORK not connected to OLT



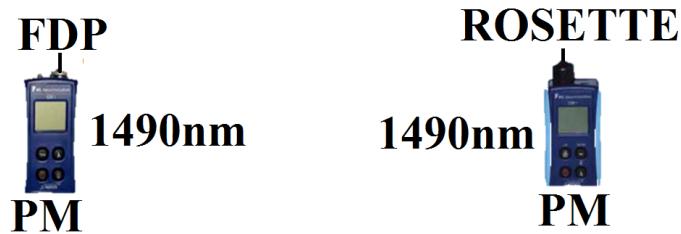
1. Calibrate the power source and gets the output power reading (R1) – Set Power source to 1490nm
2. Connect the power source to Primary cable end in ODF
3. Get the reading (R2) from the FDP port - Set Power Meter to 1490nm
4. Different between the readings (R1- R2) will be the Actual power loss

ACTUAL POWER LOSS – PON (USING POWER METER) - NETWORK connected to OLT



1. Set Power Meter to 1490nm
2. Connect the power meter to OLT and get reading (R1)
3. Get the reading (R2) from the FDP port - Set Power Meter to 1490nm
4. Different between the readings (R1- R2) will be the Actual power loss

ACTUAL POWER LOSS – NEW CONNECTION (USING POWER METER)



1. Assume that network connected to OLT
2. Get the reading (R1) from the relevant port at FDP – Set Power Meter to 1490nm
3. Get the reading (R2) from the Rosette - Set Power Meter to 1490nm
4. Different between the readings (R1- R2) will be the actual power loss of new connection (FDP-Rosette)

POWER LOSS CALCULATION -THEORETICAL

Power loss values

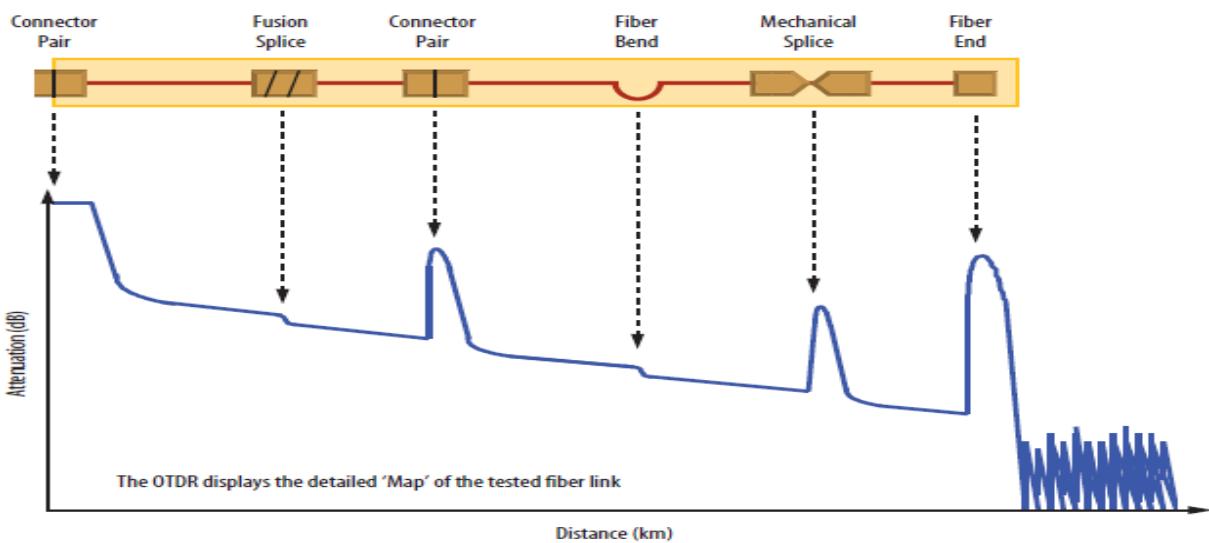
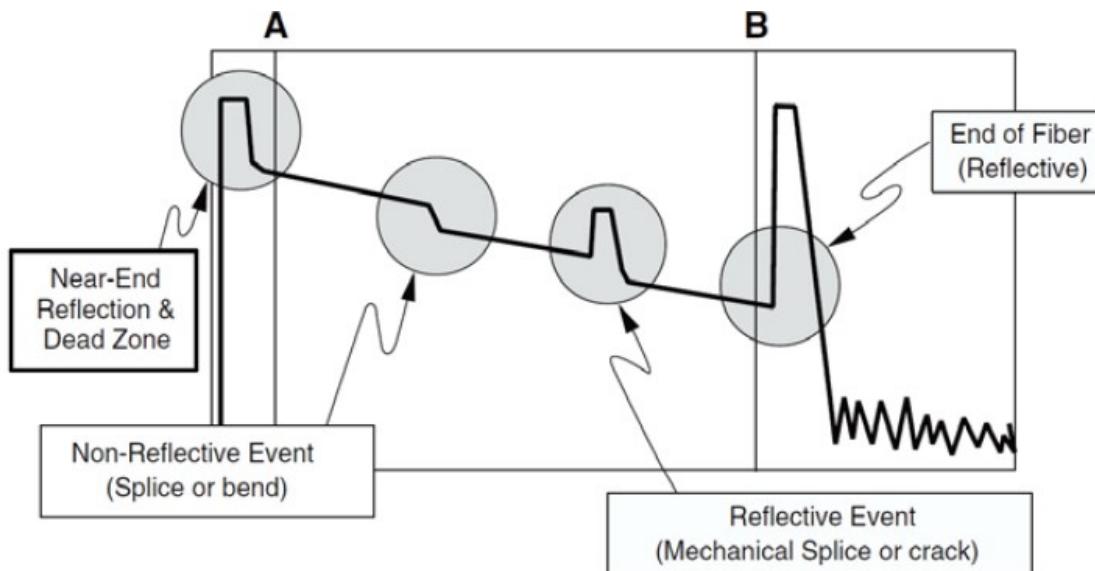
- Splitter 1:8 – 10.5 dB
- Splitter 1:4 – 7 dB
- Splicing – 0.1 dB
- Adapter – 0.3 dB
- Pigtail – 0.3 dB
- Patch cord – 0.7 dB
- Fiber cable – 0.24 dB /Km (1490nm)
- SFP Power value range +1.5 dBm to +5.0 dBm (Test wavelength: 1490nm) –average 3.5 dBm

1. Using these values theoretical loss must be calculated and compare with actual power loss
2. Theoretical loss must be approximately equals to Actual loss
3. Should consider some Margin loss also based on Path condition and Aging of Fiber and equipment
4. Link loss = Attenuation + Splice Loss + Connector/Adapter Loss + Splitter loss + Margin (Margin is not considerable for new network and new equipment)

OPTICAL TIME DOMAIN REFLECTOMETER (OTDR)



OTDR provides various applications such as normal (point-to-point) fibre cable construction testing and fault location, splice verification, quickly locate breaks or measure fibre length as well as measure optical power (1310, 1490 & 1550 ,1625 wavelengths) or fibre loss , **GPON OTDR** is suitable for FTTH



FUSION SPLICING TOOL KIT



Splicing Machine

Fiber holder
Fiber Cleaver
Fiber protection sleeves
Fiber Cleaning kit

- Faber cleaning fluid
- Lint free fiber wipes
- Cable ringing/stripping tool.
- Scissors
- Loose tube cutters
- Miller Tri-hole strippers
- Lint free miniature cotton buds.



Splicing Table

WARNING: Always wear eye protection when handling optical fibers. Dispose of any cut or cleaved ends properly.

MECHANICAL SPLICING TOOL KIT



	Pros	Cons
Mechanical	Fast installation Low tooling cost Easy to use	Higher part cost Slightly higher loss No field testing
Fusion	Low insertion loss and reflection Low material cost	High equipment cost Requires power Higher skill level required

FIELD ASSEMBLY CONNECTOR TOOL KIT



- Cleaver
- Assembly Tool
- Cable Clamps
- Fiber Stripper
- Kevlar Scissors
- Fiber Preparation Fluid
- Lint-free Cloth Wipes
- Installation Instructions
- Strip Length Template

WARNING: Always wear eye protection when handling optical fibers. Dispose of any cut or cleaved ends properly.

FIBER INSPECTION SCOPE

To ensure that the connector installed are clean and passed



Inspection procedure

1. Connect the probe to the device
2. Power on and connect the connector to test to the probe
3. Rotate the probe until a clear view of the connector end face is showing

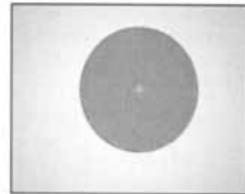
Clean connector

- alcohol residue
- dirt
- skin oil is present.

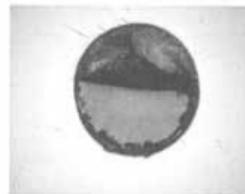
Replace connector

- signs of cracks
- pits, scratches
- over polished

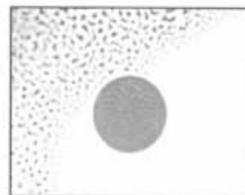
Good



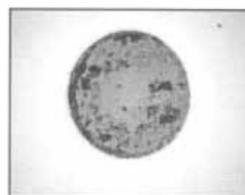
Replace



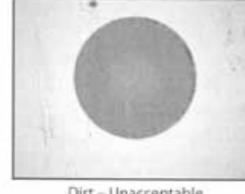
Clean



Replace

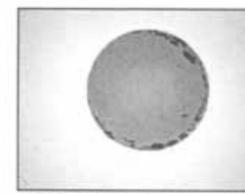
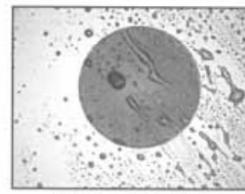


Clean



Replace

Clean



Replace

PEN-STYLE FIBER CLEANER



CASSETTE / REEL FIBER CLEANER



VISUAL FAULT LOCATER (VFL)

Provides continuous wave and stable source of energy for attenuation measurements, fiber tracing and macro bend identifying.



- This type of test is used to verify if the cable is damaged
 - physical stress
 - mishandling
 - not following the guidelines and procedures during the installation process.
- In this case you will determine if there are some faulty cables that may require replacements
- Connect one cable end to the visual Fault locator , and then switch it on
- On the other end of the cable, check if the light is visible or not. If light is not visible, check the cable for bends and replace cable if necessary

FIBER DROP CABLE STRIPPER



Universal Stripper for 3.1x2.0mm FTTH drop cables with steel wire or FRP strength member. Made of zinc alloy steel with PVC non-slip handle. Improve cable splicing, more efficient and easy to use.

BUFFER TUBE CUTTER



It is ideal for cutting different buffer tubes of the loose tube cable, and without nicking the enclosed fiber. Stripping and cutting tool for buffer tube, for tube diameters up to 1/8 in.(3.2mm), cutting depth adjustable, replaceable blade.

ROUND CABLE SLITTER



Designed for fast, safe, and precise jacket removal of PE, PVC, rubber, and other jackets. Stripping round cable from 4.5mm to 25mm in diameter. The adjustable blade allows cutting depth up to 4.5mm , even strong protective outer jacket can simply be stripped off.

LIVE FIBER DETECTOR



Detect the live fiber

MID –SPANING TOOLS



Quickly and easily access fibers in 2, 2.5 and 3mm buffer tubes in a mid-span location without fiber damage



Allows easy mid-span access to optical fibers in loose buffer tubes

PART IV: FTTH LABELING

LABELING METHOD

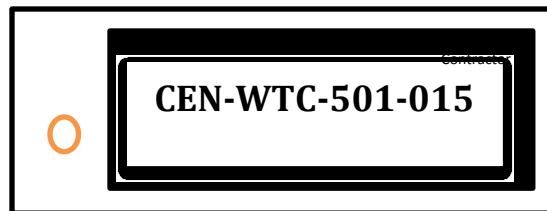
1. Font : **Cambria**
2. Font size : **14**
3. Make the text **BOLD**
4. All text : **Capital**
5. Text colour : **Black**
6. Background of label : **White**
7. Text should be **left aligned**
8. Create inner box : **Each side 5mm from text**
9. Maximum length of inner box : **6cm**

CEN-WTC- XYZ - 501-015

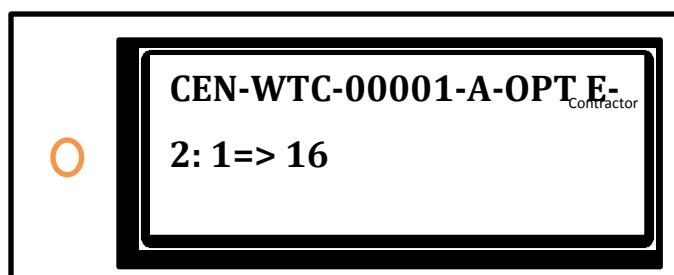
10. Create outer box : **Each side 3~4 mm from inner box**
11. Between inner and outer box space colour : **black**

CEN-WTC-501-015

12. Label should laminate - 1.0 cm length to have from left side of outer box



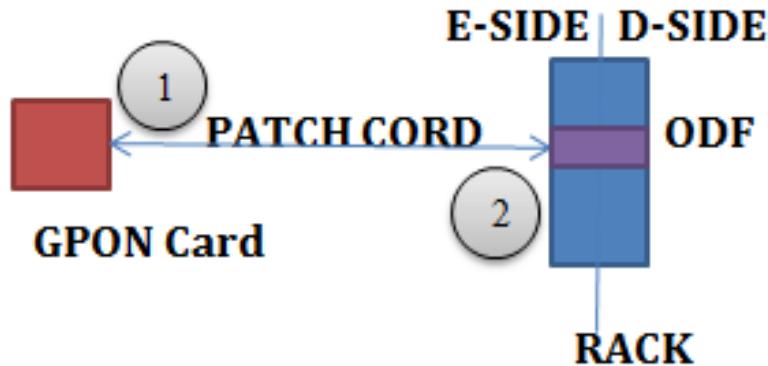
13. Width of the inner box may vary based on number of lines
14. **Line space 1.5** for multi-line label



15. Tie the Label with cable using tie rope

Note: Some location not possible to tie the label in laminated format, please use the reliable sticker for labeling

GPON –ODF RACK



1 PATCH CORD COMING FROM GPON CARD

GPON Slot no /Port no – RACK N0/ODF No /ODF ports (total) /connected port – FTC No /Splitter No

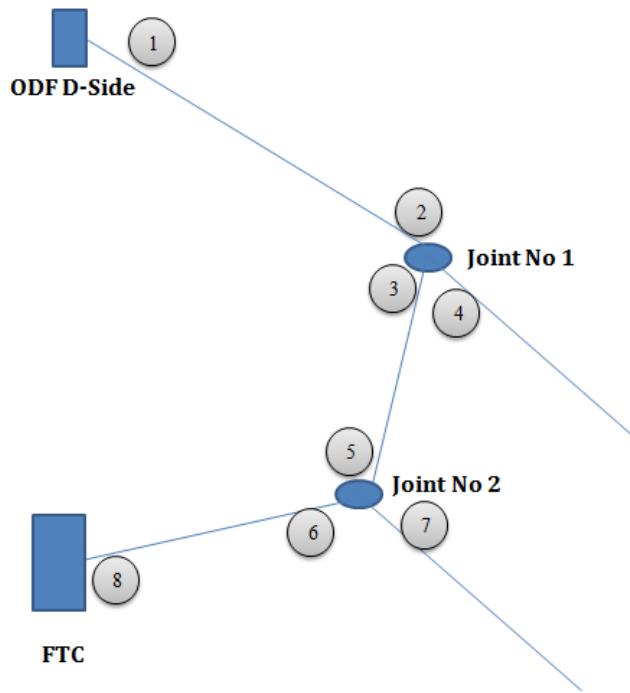
GPON 01 /08 -RACK 01 /0DF 02/32/28 - FTC-0501/S01

2 PATCH CORD TERMINATED AT ODF

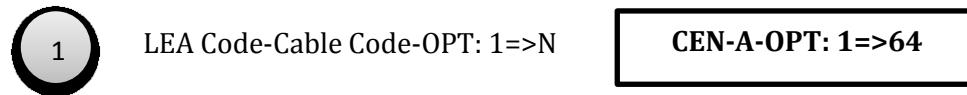
GPON Slot no /Port no – RACK N0/ODF No /ODF ports(total) /connected port – FTC No /Splitter No

GPON 01 /08 -RACK 01 /0DF 02/32/28 - FTC-0501/S01

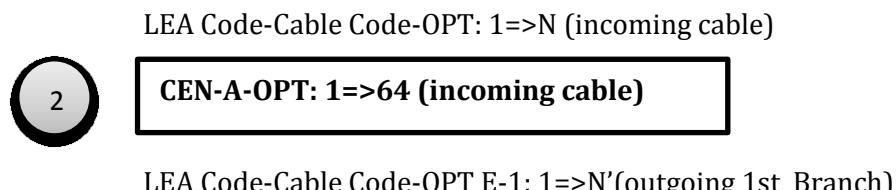
PRIMARY CABLE LABELING



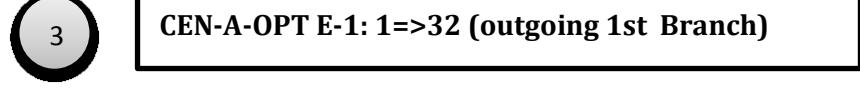
PRIMARY CABLE COMING FROM ODF



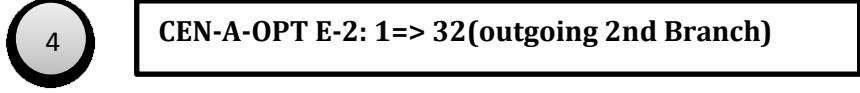
PRIMARY CABLE BRANCHING AT THE 1ST JOINT



LEA Code-Cable Code-OPT E-1: 1=>N' (outgoing 1st Branch)



LEA Code-Cable Code-OPT E-2: 1=>N" (outgoing 2nd Branch)



PRIMARY EXTENDED CABLE BRANCHING AT THE 2ND JOINT

LEA Code-Cable Code-OPT E-1: 1=>N' (incoming cable)



CEN-A-OPT E-1: 1=>32 (incoming cable)



LEA Code-Cable Code-OPT E-1-1: 1=>N'''(outgoing 1st Branch)

CEN-A-OPT E-1-1: 1=>16 (outgoing 1st Branch)



LEA Code-Cable Code-OPT E-1-2: 1=>N''''(outgoing 2nd Branch)

CEN-A-OPT E-1-2: 1=>16 (outgoing 2nd Branch)

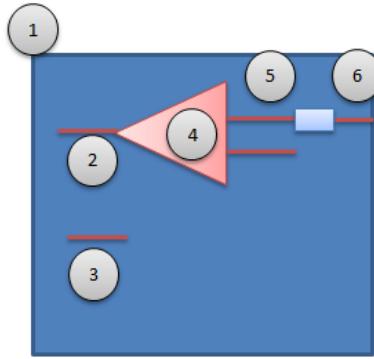
TERMINATE TO FTC



LEA Code-Cable Code-OPT E-1-2: 1=>N''''(outgoing 2nd Branch)

CEN-A-OPT E-1-2: 1=>16 (Primary Cable)

FIBER TERMINATION CABINET LABELING



FTC LABELING METHOD (FTC CODE)



LEA Code-Suburb Code-FTC No

CEN-WTC-0501

LABELING SPLITTER INPUT CORE IN FTC



ODF Rack No.-ODF No-ODF D side Port No/FTC Splitter No

ODF-01-D001/S01

LABELING SPARE INPUT CORES (USABLE) IN FTC



ODF-ODF No-ODF D side Port No

ODF-01-D004

LABELING SPARE INPUT CORES (UNUSABLE) IN FTC



ODF-ODF No-ODF D side Port No/N

ODF-01-D009/N

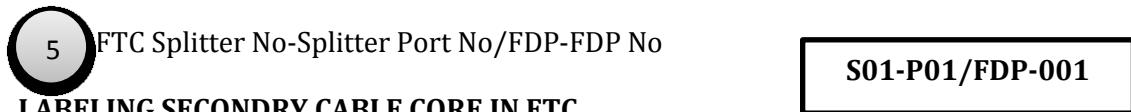
FTC-SPLITTER LABELING METHOD



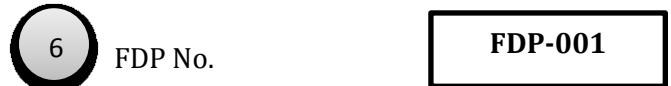
S(FTC Splitter No):1XN or 2XN (Splitting ratio as appropriated)

S01:1X4

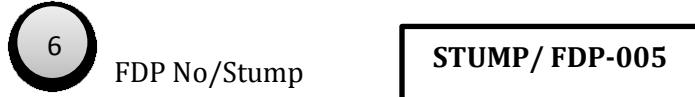
LABELING SPLITTER OUTPUT CORES IN FTC



LABELING SECONDARY CABLE CORE IN FTC



STUMP FDP



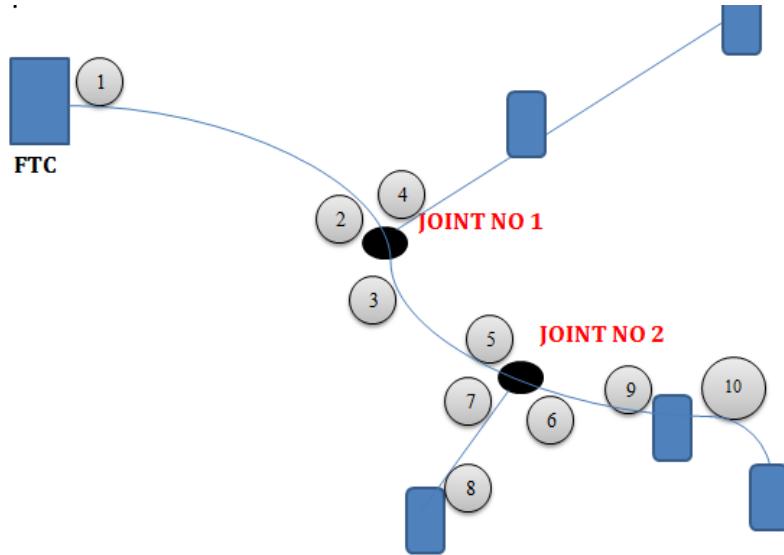
UNUSABLE SECONDARY CORES



FTC CARD

FTC Card		FTC Name:		FTC-GPS Reading		FTC Address		
Incoming Fibre No.	Splitter No.	Splitter Type	Outgoing Fibre No.	Power Loss (dB)	FDP Number	FDP-GPS Reading	FDP Address/Floor No	
1			1					
			2					
			3					
			4					
			5					
			6					
			7					
			8					
2			1					
			2					
			3					
			4					
			5					
			6					
			7					
			8					
3			1					
			2					
			3					
			4					
			5					
			6					
			7					
			8					
Contractor								
Other								

SECONDARY CABLE LABLING



SECONDARY CABLE COMING FROM FTC

LEA Code-Suburb Code-Location Code-Cable Code-OPT: 1=>N

1 **CEN-WTC-00001-A-OPT: 1=>32**

SECONDARY CABLE BRANCHING AT THE 1ST JOINT

LEA Code-Suburb Code-Location Code-Cable Code-OPT: 1=>N (incoming cable)/FTC No.

2 **CEN-WTC-00001-A-OPT: 1=>32(incoming cable)/501**

LEA Code-Suburb Code-Location Code-Cable Code-OPT E-1: 1=>N'(outgoing 1stBranch)/
FTC Number/(FDP Nos).

3 **CEN-WTC-00001-A-OPT E-1: 1=>16(outgoing 1st Branch)/501/(001,003)**

LEA Code-Suburb Code-Location Code-Cable Code-OPT E-2: 1=>N"(outgoing
2ndBranch)/ FTC Number/(FDP Nos)

4 **CEN-WTC-00001-A-OPT E-2: 1=> 16(outgoing 2nd Branch)/501/(005,006)**

SECONDARY EXTENDED CABLE BRANCHING AT THE 2ND JOINT

LEACode-SuburbCode-LocationCode-CableCode-OPT E-1: 1=>N' (incoming cable)



CEN-WTC-00001-A-OPT E-1: 1=>16 (incoming cable)

LEACode-SuburbCode-LocationCode-CableCode-OPT E-1-1: 1=>N'''(outgoing 1st Branch)/ FTC Number/(FDP Nos)



CEN-WTC-00001-A-OPT E-1-1: 1=>8 (outgoing 1st Branch)/501/(006,010)

LEACodeCode-SuburbCode-Location Code-CableCode-OPT E-1-2: 1=>N''''(outgoing 2nd Branch)/ FTC Number/(FDP Nos)



CEN-WTC-00001-A-OPT E-1-2: 1=>8 (outgoing 2nd Branch)/501/(005 ,007,009)

SECONDARY CABLE TERMINATION AT FDP

LEACode-SuburbCode-LocationCode-CableCode-OPT E-1: 1=>N' (incoming cable)



CEN-WTC-00001-A-OPT E-1: 1=>16 (incoming cable)

SECONDARY CABLE TERMINATION AT FDP(using MIDSPANING)

LEACode-SuburbCode-LocationCode-CableCode-OPT E-1: 1=>N' (incoming cable)



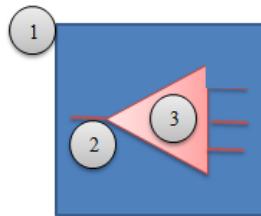
CEN-WTC-00001-A-OPT E-1: 1=>16 (incoming cable)

LEACode-SuburbCode-LocationCode-CableCode-OPT E-1: 1=>N' (outgoing cable)



CEN-WTC-00001-A-OPT E-1: 1=>16 (outgoing cable)

FIBER DISTRIBUTION POINT (FDP) LABLING



FDP LABELING METHOD (FDP CODE)

1

LEA Code-Suburb Code -FTC No -FDP No

CEN-WTC-0501-015

FDP-SPLITTER INPUT CORE

2

FTC Splitter No-Splitter Port No

S01-P01

FDP-SPLITTER LABELING METHOD

3

S (FDP No):1XN or 2XN (Splitting ratio as appropriated)

S015:1X8

FDP CARD

FDP Card		FDP Name		FDP-GPS Reading		FDP Address	
Splitter port	Power Loss (dB)	Home Address				PSTN No	Other Contacts
		Room/ House No	Floor No/ Street Name	Block No/ Suburb Area	Apartment / City		
1							
2							
3							
4							
5							
6							
7							
8							
1							
2							
3							
4							
5							
6							
7							
8							
Contractor							
Other							

OTHER

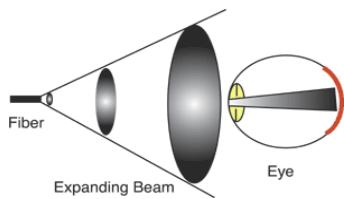
1. Area code = LEA code – Suburb code
2. Only for ongoing FTTH Pilot Project sites-in buildings, labeling to be done as follows
In ascending order from first floor FDP to top most floor FDP
From shortest distance to highest distance from cable channel.
3. For FTTH Main Project Sites-in external plants and indoor plants, Labeling to be done as follows
In ascending order from the far most FDP to the nearest FDP
From higher distance to shortest distance from cable channel (in buildings)
4. Splitters/Fiber Trays to be labeled from bottom to top /from left to right
5. Splitters to be labeled from bottom to top /from left to right
6. D side Port No. and E side Port No. in Patch Panel of FTC to be labeled from top to bottom/left to right.
7. D side Port No. (and E side Port No. if available) to be labeled in Patch Panel of FDP from top to bottom/left to right.
8. If multiple splitters possible within FDP:
S(FDP No)-Splitter Port No

S015-P04
9. If only one splitter possible within FDP:
Not specially required; Original labeling may exist (such as 1,2,3,...8)
Splitter Port No

P02

ANNEXURE: SAFETY RULES –WORKING WITH FIBER OPTIC CABLES

EYE SAFETY



The light that exits an optical fiber is also spreading out in a cone

It should have infrared filters to reduce the danger of invisible infrared light

BARE FIBER SAFETY



Broken ends of fibers

scraps of fiber
termination
splicing

Be careful when handling fibers to not stick the broken ends into your fingers. Dispose of all scraps properly.



Keep a piece of double stick tape on the bench to stick fiber scraps onto

We can use a dedicated container for all fiber scraps.

MATERIALS SAFETY



Fiber optic splicing and termination use various chemical cleaners

Always work in well-ventilated areas.

Avoid skin contact as much as possible

Normal handling procedures for these substances should be observed. If you are not certain of how to deal with them, ask the manufacturer.

FIRE SAFETY



Note that fusion splicers use an electric arc to make splices,

No flammable gasses are contained in the space where fusion splicing is done.

Splicing is never done in manholes where gasses can accumulate.

The cables are brought up to the surface into a splicing trailer where all fiber work is done.

Splicing trailer is temperature-controlled and kept spotlessly clean to insure good splicing.

ELECTRICAL SAFETY

Fiber cables are often installed around electrical cables.

Electricians are well-trained in electrical safety, but some fiber optic installers are not.

Even if the fiber is not conductive, fiber hardware can conduct electricity or the installer can come in contact with live electrical wires when working in proximity to AC power

FIBER OPTIC INSTALLATION SAFETY RULES.

1. Keep all food and beverages out of the work area. If fiber particles are ingested they can cause internal hemorrhaging.

2. Wear disposable aprons to minimize fiber particles on your clothing. Fiber particles on your clothing can later get into food, drinks, and/or be ingested by other means.



3. Always wear safety glasses with side shields and protective gloves. Treat fiber optic splinters the same as you would treat glass splinters.



4. Never look directly into the end of fiber cables until you are positive that there is no light source at the other end. Use a fiber optic power meter to make certain the fiber is dark.

When using an optical tracer or continuity checker(Visual light source), look at the fiber from an angle at least 6 inches away from your eye to determine if the visible light is present.



5. Work on a black work surface as it helps to find fiber scraps.

6. Only work in well ventilated areas

7. Avoid setting up fiber optic cable splicing and terminating work areas directly under or near heating or air conditioning outlets, as dust or dirt on connectors is a major cause of scratches on polished connectors that can cause high loss measurements.



8. Contact lens wearers must not handle their lenses until they have thoroughly washed their hands.



9. Do not touch your eyes while working with fiber optic systems until your hands have been thoroughly washed.



10. Keep all combustible materials safely away from the curing ovens.

11. Put all cut fiber pieces in a properly marked container for disposal.

12. Do not kneel on the floor or sit on benches in a fiber optic area.

13. Do not pick up shards of fiber with your fingers.

14. Do not brush up pieces of fiber with your hands. Use a small brush.



15. Thoroughly clean your work area when you are done.

16. Do not smoke while working with fiber optic systems.

17. Do not pick up shards of fiber with your fingers.

18. Keep dust caps on connectors, and patch panels.

19. Wash your hands before and after working with fiber optic cables.



References

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<http://www.ftthcouncil.org/p/cm/ld/fid=25>

<http://www.fiberoptictel.com/>

<http://www.usolutionbiz.com/>

<http://www.dasannetworksid.com>



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