XGS-PON Technology

1.What is XGS-PON?

XGS-PON (10-Gigabit Symmetric Passive Optical Network) is a next-generation PON technology And standardized by ITU-T (G.9807.1). it's a symmetrical technology, meaning the upload and download speeds(10Gbps)are the same, which is crucial for applications requiring high upstream bandwidth, like cloud computing, video conferencing, and online gaming.

2.What different with XGS-PON vs XG PON vs GPON?

XGS-PON offers significantly higher speeds than GPON (2.5 Gbps downstream, 1.25 Gbps upstream)
XGS-PON provides symmetrical 10 Gbps speeds, while XG-PON is limited to 2.5 Gbps upstream.

Form2-1.Comparison with other PON technologies:

Feature	GPON	XG-PON	XGS-PON
ITU Standard	G.984	G.987	**G.9807.1**
Downstream Rate	2.5 Gbps	**10 Gbps**	**10 Gbps**
Upstream Rate	1.25 Gbps	2.5 Gbps	**10 Gbps** (Symmetric)
Wavelength	↓1490nm / ↑1310nm	↓1577nm / ↑1270nm	↓1577nm / ↑1270nm
Max Split Ratio	1:128	1:256	1:256
Encapsulation Method	GEM	XGEM	XGEM
Typical Use Case	Home broadband Small Business	5G,IPTV and other high downlink scenarios	Enterprise/Symmetry-critical
Advantages	Cost-sensitive residential areas	5G fronthaul (low upstream needed)	Smart factories/8K broadcast
Limitations	Cannot support future 5G small cells	Asymmetry bottlenecks cloud services	Requires Cat6a/Cable infrastructure

3.How to Coexistence and Compatibility with other PON Technology?

Coexistence and Compatibility with XGS-PON vs XG PON vs GPON

ITU-T G.984 and G.988 respectively define the standards for GPON and XG PON/XGS PON, including provisions for coexistence. By adhering to these standards, G-PON compatibility via a wavelength plan,

blocking filters, loss budget for coexistence on a common ODN, and a combo OLT

Wavelength Compatibility:

ITU-T G.984 and G.988 define the standards for GPON and XG PON/XGS PON respectively, and include coexistence provisions. XG-PON and XGS-PON have a downstream wavelength of 1577nm and an upstream wavelength of 1270nm, so they naturally support mixed access without the need for additional wavelength isolation; however, GPON has different wavelengths (downstream 1490nm/upstream 1310nm), so wavelength division multiplexing (WDM) is required to work simultaneously on the same optical fiber without interfering with each other. To achieve coexistence.

Solution:

1. XG-PON and XGS-PON coexist

DS: Broadcast mode is adopted, and the optical splitter sends the signal to all ONUs at the same time. ONU receives its own data by filtering according to the protocol identifier

US: Dynamic allocation of time slots through TDMA time division multiple access:

OLT allocates time slots according to the ONU type (XG-PON or XGS-PON), XG-PON ONU transmits at 2.5Gbps in the time slot, and XGS-PON ONU transmits at 10Gbps

2. Coexistence with GPON: Combo three-mode solution

US: After the GPON (1310nm) and XG(S)-PON (1270nm) signals enter the XGS-PON Combo port, the GPON signal and the XGS-PON signal are filtered by wavelength through WDM, and then sent to the corresponding processing channel.

DS: The signals of GPON and XGS-PON are multiplexed through WDM, and the mixed signals are transmitted to the ONU through ODN. The ONU built-in filter selects reception by wavelength.

3. Tools:

1. Tri-mode Combo optical module: integrated with GPON, XG-PON, XGS-PON lasers/detectors and WDM combiners

2. WDM filter: separate or multiplex different wavelength signals

3. XGS-PON Combo OLT: supports GPON, XG-PON, XGS-PON three types of ONU access (Stavix MO-XS8280B)

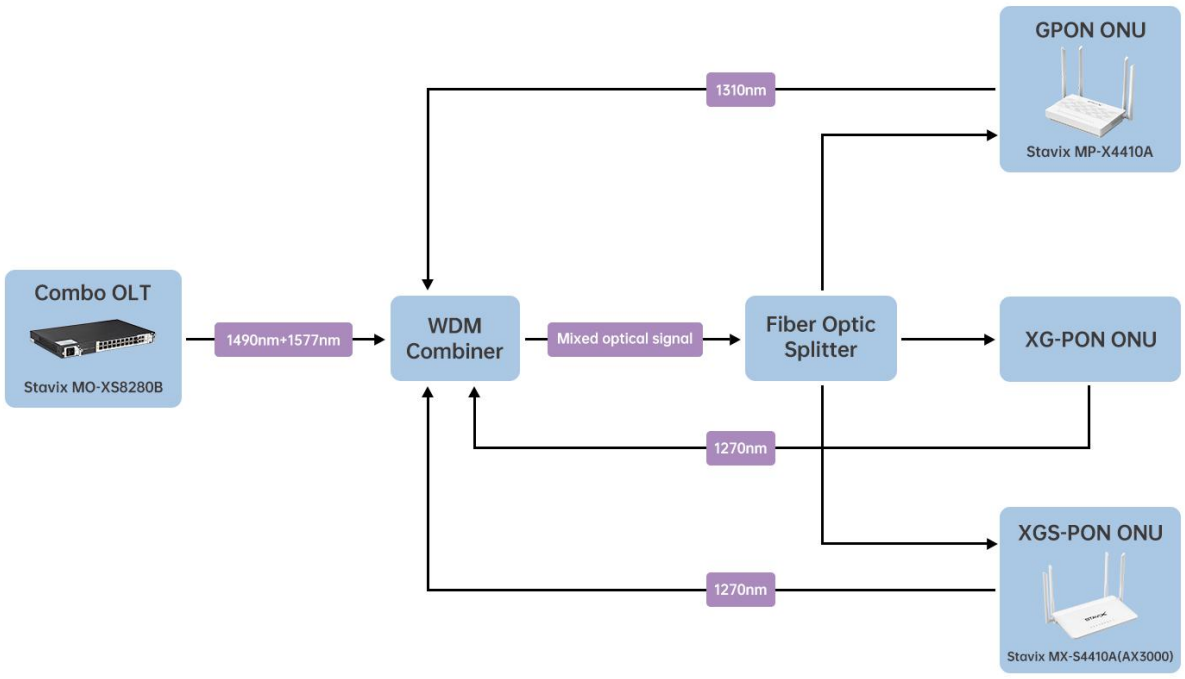

Figure 3-1.Combo PON Solution Architecture Diagram

4. XGS-PON Applications Scenarios

The optical section of a local access network system can be either active or passive and its architecture can be either point-to-point or point-to-multipointXGS-PON application scenarios can be divided into three parts: the antenna site、business、Residential.

A. FTTCell：For fibre to the cell-site (FTTCell) scenario, the ONU will be called a cell-site backhauling unit (CBU)

The fibre to the building (FTTB) scenario is divided into two scenarios,

B. FTTB for MDU-served residential users

- Asymmetric broadband services (e.g., IPTV, digital broadcast services, VoD, file download, etc.).
- Symmetric broadband services (e.g., content broadcast, e-mail, file exchange, distance learning, online-games, etc.).
- Plain old telephone service (POTS)

C. FTTB for MTU-served business users

- Symmetric broadband services (e.g., group software, content broadcast, e-mail, etc.).
- POTS – The access network must be able to provide, in a flexible way, narrow-band telephone services using either emulation (complete replication of a legacy service) or Simulation.

D. FTTO ：Fibre to the office (FTTO) addresses business ONU dedicated to a small business customer. Within this scenario, the following service categories have been considered:

- Symmetric broadband services (e.g., content broadcast, e-mail, file exchange, etc.).
- POTS – The access network must be able to provide, in a flexible way, narrow-band telephone services using either emulation (complete replication of a legacy service) or simulation
- Private line – The access network must be able to provide, in a flexible way, private line services at several rates.

E. FTTH/dp

F. For fibre to the home (FTTH) scenario, the following service categories have been considered:

FTTcurb/FTTCab;For fibre to the curb (FTTC) and fibre to the cabinet (FTTCab) scenarios, the following service categories have been considered:

- Asymmetric broadband services (e.g., IPTV, digital broadcast services, VoD, file download, online-games, etc.).
- Symmetric broadband services (e.g., content broadcast, e-mail, file exchange, distance learning, telemedicine, etc.).
- POTS – The access network must be able to provide, in a flexible way, narrow-band telephone services using either emulation (complete replication of a legacy service) or simulation (providing a service that is almost the same as the legacy service). – xDSL backhaul.

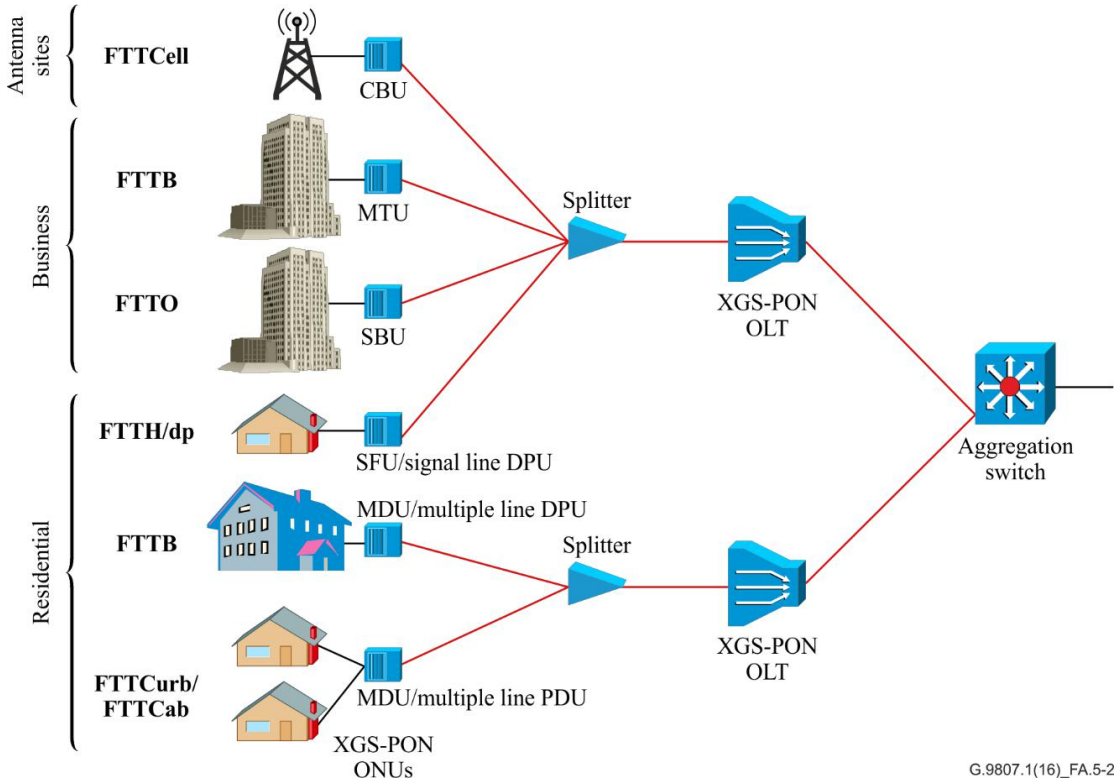

Figure 4-1 XGS-PON Application Scenarios (Excerpted from G.9807)

5..References

ITU-T G.987.2 (02/2023) 10-Gigabit-capable passive optical networks (XG-PON)

ITU-T G.9807.1 (02/2023)10-Gigabit-capable symmetric passive optical network (XGS-PON)

ITU-T Study Group 15 G.9807 10-Gigabit Symmetric Passive Optical Networks