

# Passive Optical Network (PON) Reference Guide

## PON Deployment Applications and AFL Solutions

### Fiber Installation

**Application:** Install cable, splice fibers, terminate with connectors

#### Recommended Products:

- Wrapping Tube Cable (WTC), with SpiderWeb Ribbon® (SWR®)
- FUSEConnect® splice-on connectors
- FASTConnect® mechanical connectors
- Fujikura 90R Fusion Splicer for ribbon splicing. Fujikura 90S+ Fusion Splicer for single-fiber core alignment splicing. Fujikura 41S Fusion Splicer for single-fiber cladding alignment splicing

### Fiber Installation Verification

**Application:** Verify installed cable plant insertion loss, return loss, splice loss, connector loss and reflectance, splitter loss and reflectance

#### Recommended Products:

- FlexScan® FS200-303/304 OTDR with OLS/OPM and VFL. SMLP-xx (1310/1550 nm OLS/OPM)
- FOCIS Flex, FOCIS Lightning® and SC/HOC One-Click® Cleaner and supplies

### PON Verification and Activation

**Application:** Verify PON downstream signal presence and levels; install ONT; verify PON upstream signal presence and levels

#### Recommended Products:

- FlowScout™ TPPM-XG PON Optical Power Meter (GPON, Video, XG/XGS/10GE PON downstream and upstream verification)
- FlexScan® TS100-60/70/75-P2 PON Troubleshooter with PON optical power meter (GPON and Video or XG/XGS/10GE PON downstream verification)

### PON Troubleshooting

**Application:** When downstream power levels absent or too low, test upstream to locate source(s) of excess loss and/or reflection. Alternatively, test downstream from splitter output ports to locate source(s) of excess loss and/or reflection

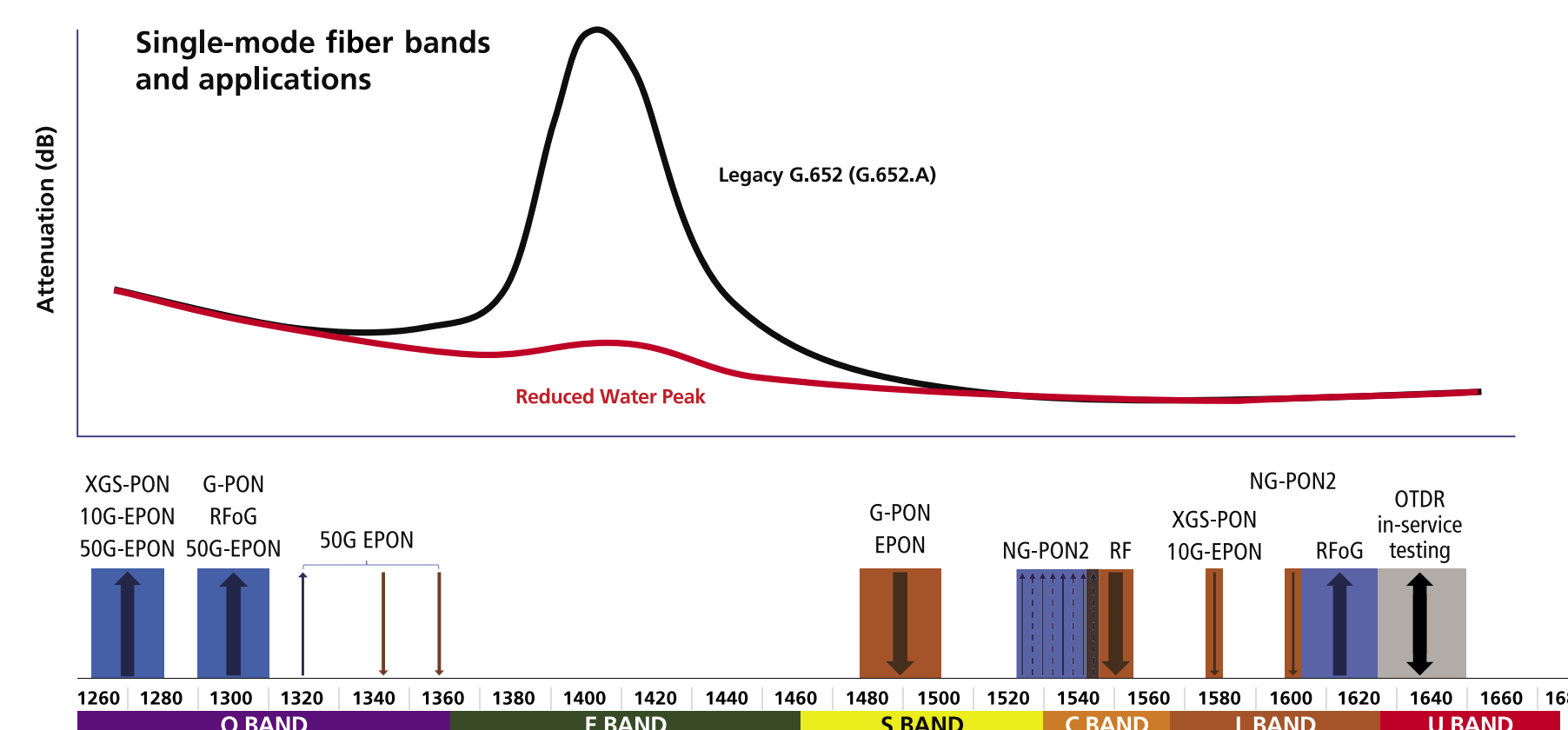
#### Recommended Products:

- FlexScan® TS100-60/70/75-P2 PON Troubleshooter w/ integrated PON optical power meter and VFL
- VFI4 Visual Fault Locator
- OFI-BIPM Optical Fiber Identifier with ONT detection

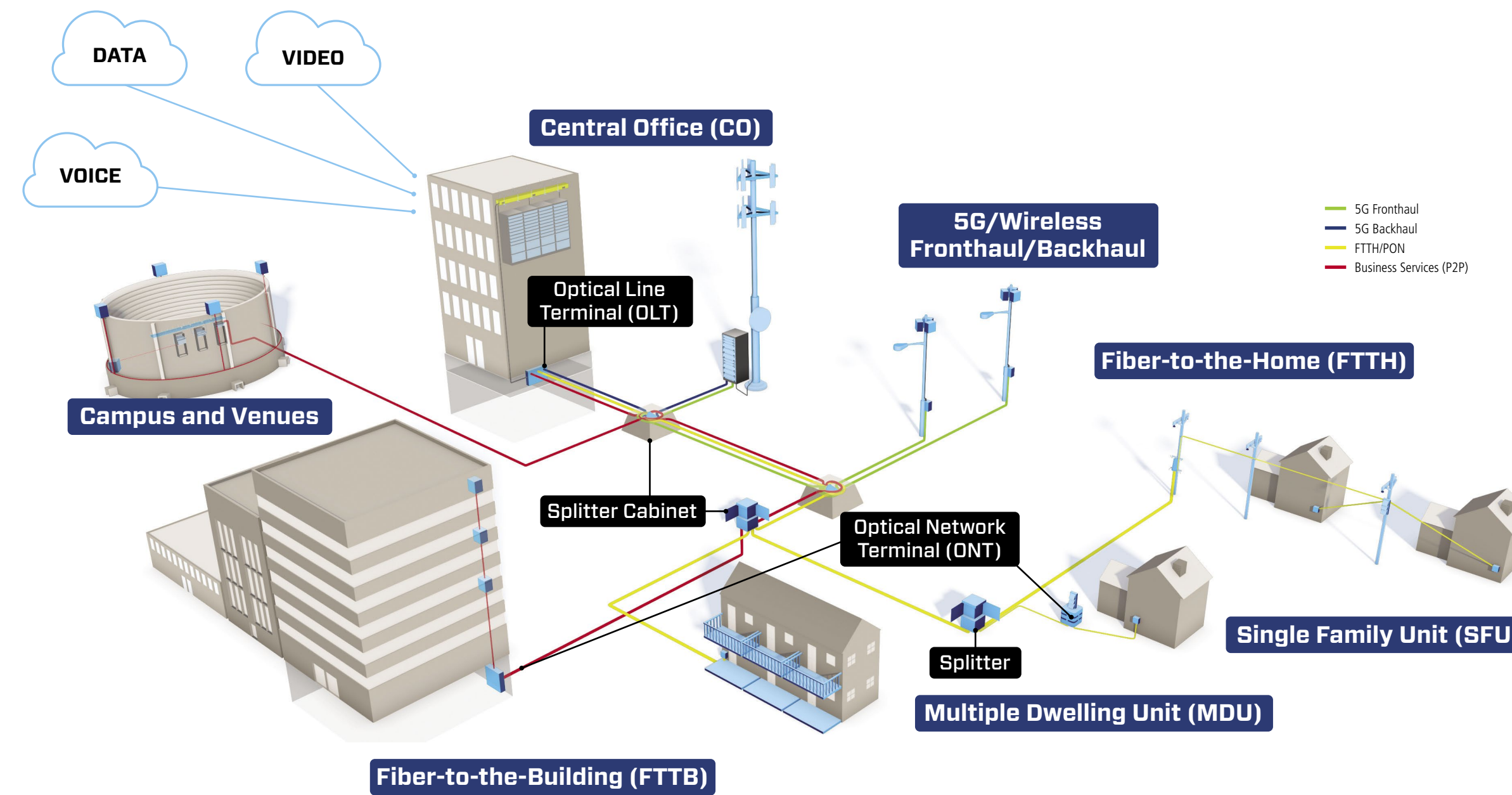
## Splitter Specifications

PARAMETER	UNIT	VALUE										
Product Type		1x2	1x3	1x4	1x6	1x8	1x12	1x16	1x24	1x32	1x64	1x128
Operational Wavelength	nm	1260~1650										
Insertion Loss	Typ.	3.6	6.0	7.0	9.2	10.3	12.2	13.6	15.8	16.6	20.1	24.5
	Max.	4.3	6.2	7.4	9.5	10.7	12.5	13.9	16.0	17.2	21.5	25.5
Return Loss	dB	≥ 55										
Directivity	dB	≥ 55										

## Single-mode Fiber Bands and Applications



## PON Network Architecture



## Product Matrix

Features	90S+ Fusion Splicer	41S Fusion Splicer	FASTConnect® and FUSEConnect®	FOCIS Flex	FOCIS Lightning®
Function	Fiber installation, fiber repair	Fiber installation, fiber repair	Fiber installation, fiber repair	Activation, OLT/ONT verification	Activation, OLT & fiber verification, troubleshooting
PON Power	N/A	N/A	N/A	N/A	N/A
Where Used	Splicing single fiber (active core alignment)	Splicing single fiber (cladding alignment)	At any connector	At any connector	At any connector
Results	Estimated splice loss	Estimated splice loss	N/A	Text display, mobile App; saves results as JPG or GIF files	Text display, mobile App; saves results as JPG or GIF files
Customer	Telco, MSO, Utilities, Municipalities	Telco, MSO, Utilities, Municipalities	Telco, MSO, Utilities, Municipalities	Telco, MSO, Utilities, Municipalities	Telco, MSO, Utilities, Municipalities

Features	SC/HOC One-Click® Cleaner and Supplies	FlexScan® FS200	FlowScout™	FlexScan® TS100	OFI-BPM
Function	Fiber installation, fiber repair	Fiber verification, troubleshooting	Activation, OLT/ONT verification	Activation, OLT & fiber verification, troubleshooting	Fiber installation, fiber repair
PON Power	N/A	Downstream only (single λ, GPON or XGS-PON)	Upstream & downstream (GPON, Video, XGS-PON)	Downstream only (GPON & Video or XGS-PON)	N/A
Where Used	At any connector	At OLT, ONT, or any connector access point	At ONT or between ONT and splitter	At ONT or between ONT and splitter	On any accessible fiber
Results	N/A	LinkMap, event table, trace; saves results as .SOR files	Text display, QR code; saves results as .ATD files	LinkMap & event table; saves results as .SOR files	Text display
Customer	Telco, MSO, Utilities, Municipalities	Telco, MSO, Utilities, Municipalities	Telco, MSO, Utilities, Municipalities	Telco, MSO, Utilities, Municipalities	Telco, MSO, Utilities, Municipalities

## PON Standards ITU-T and IEEE 802.3

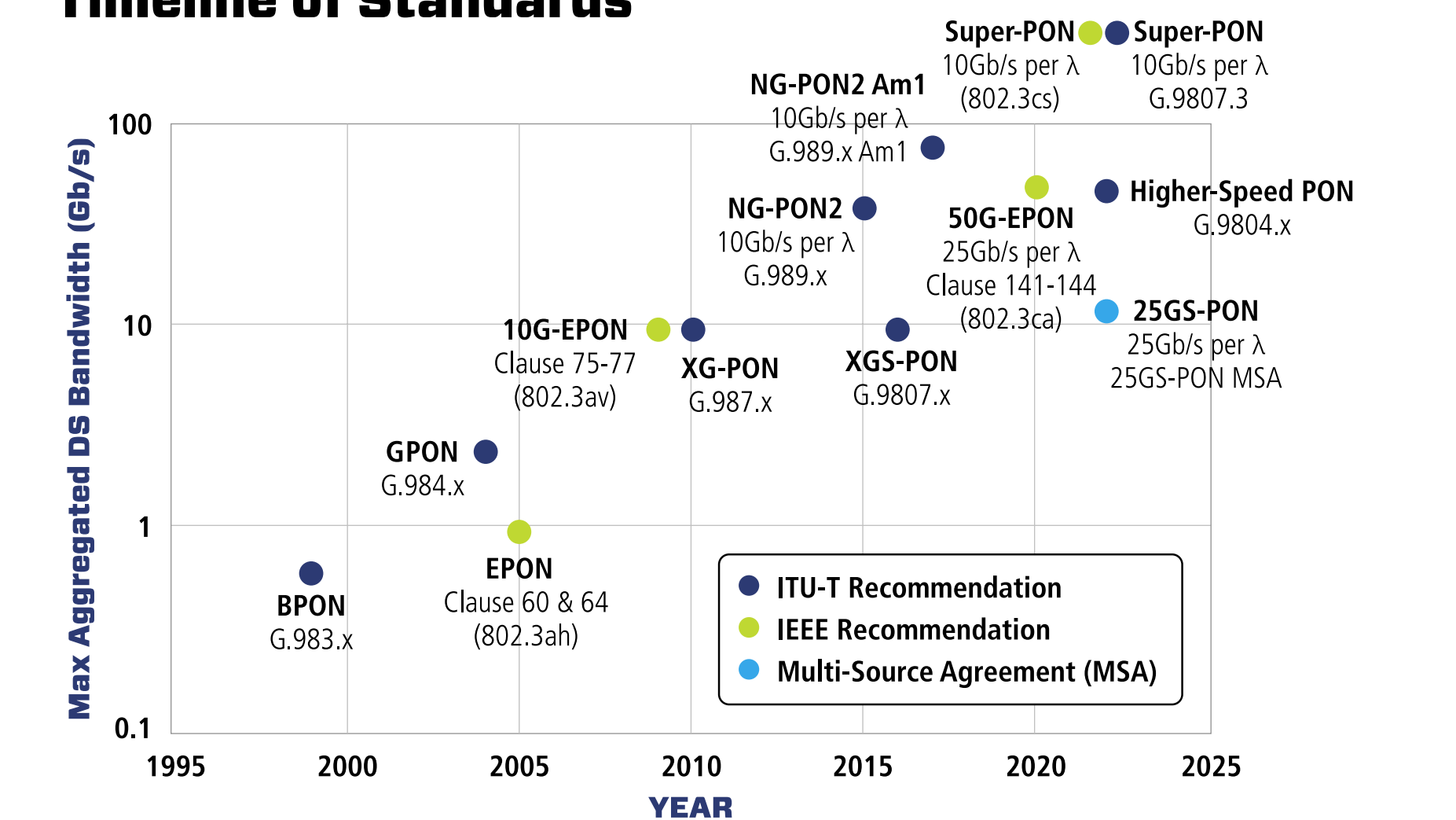
Standard		ITU-T Standards				MSA Standard 25G5-PON 25G5-PON MSA	IEEE Ethernet Standards		
		GPON ITU-T G.984	XG-PON ITU-T G.987.x	XGS-PON ITU-T G.9087.x	NG-PON2 ITU-T G.989		EPON IEEE 802.3ah	10G-EPON IEEE 802.3av	50G-EPON IEEE 802.3ca
Downstream	Rate	2.5G	10G	10G	N x 10G (N = 1-4)	25G	1.25G	10G	25G/50G
	λ (nm)	1480-1500	1575-1580	1575-1580	1596-1603	DS0: 1358 +/-2 DS1: 1342 +/-2	1480-1500	1575-1580	DS0: 1358 +/-2 DS1: 1342 +/-2
Upstream	Rate	1.25G	2.5G	10G	N x 10G (N = 1-4)	10 or 25G	1.25G	10G	25G/50G
	λ (nm)	1290-1310	1260-1280	1260-1280	1524-1544	US0-B: 1260-1280 US0-A: 1290-1310 US1: 1284-1288	1290-1310	1260-1280	US0-B: 1260-1280 US0-A: 1290-1310 US1: 1320 +/-2
Maximum Split		1:128	1:128	1:256	1:256	1:128	1:64	1:64	1:256
Maximum Loss (dB)		32	32	35	35	29	29	29	35

## Test & Inspection FTTx Solutions



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## Timeline of Standards



## PON Glossary

### ELEMENTS OF PON ARCHITECTURE

- CO - Central Office
- FAT - Fiber Access Terminal
- FDH - Fiber Distribution Hub
- FDT - Fiber Distribution Terminal
- MDU - Multi-Dwelling Unit (e.g. an apartment building)
- MTU - Multi-Tenant Unit (e.g. a building housing multiple business tenants)
- NTE - Network Termination Equipment
- ODN - Optical Distribution Network
- OLT - Optical Line Terminal
- ONT - Optical Network Terminal
- ONU - Optical Network Unit
- SBU - Single Business Unit
- SFU - Single Family Unit

### PON TECHNOLOGIES

- 10GEPON - 10G Ethernet PON (IEEE)
- 10GPON - Generically refers to any of XG/XGS/10GE PON
- 25G/50GEPON - 25 / 50 Gb/s Ethernet PON (IEEE)
- 25GS-PON - 25G Symmetric PON (MSA)
- BPON - Broadband PON (ITU-T)
- EPON - Ethernet PON (IEEE)
- GPON - Gigabit PON (ITU-T)
- NG-PON2 - Next Gen PON (4 x 10G) (ITU-T)
- XG-PON - Asymmetric 10G PON (ITU-T)
- XGS-PON - Symmetric 10G PON (ITU-T)