Optical Access Architecture Reference Document: Huawei Type B and Type C PON Protection Switching Engineering Manual

TECHNOLOGY OVERVIEW

The Huawei Type B and Type C PON Protection Switching Engineering Manual defines the carrier-grade engineering principles, hardware topology, and operational procedures for deploying Type B and Type C protection switching in Huawei optical access networks. Type B protection provides a redundant feeder fiber and OLT PON port with a 2:N splitter architecture, enabling sub-50 ms recovery upon feeder fiber or OLT port failure. Type C protection extends redundancy to the full distribution segment, employing dual feeder fibers, dual OLT PON ports, and dual drop fibers to the ONT, achieving true end-to-end path protection. This manual is intended for network planners, field engineers, and operations teams responsible for high-availability FTTx deployments. The document covers protection switching triggers, protocol behavior, hardware prerequisites, and deployment verification procedures in strict accordance with ITU-T G.983.1, G.984.1, and G.987.1 recommendations.



OPTICAL TRANSCEIVER INTERFACES

Type B and Type C protection switching rely on paired PON ports on the OLT, each equipped with dedicated optical transceivers. The OLT supports pluggable SFP/SFP+ optical modules compliant with ITU-T G.984.2 (GPON) and G.987.2 (XG-PON) class B+ and class C+ optical budgets. Type B protection requires two PON ports per protected PON group, with optical power monitoring on both working and protection paths. Type C protection requires four PON ports per protected group to support dual feeder and dual distribution paths. Optical transceiver interfaces support hot-swappable modules, digital diagnostic monitoring (DDM), and automatic power shutoff (APS) for eye safety. Fiber routing must maintain path diversity, with working and protection fibers terminated on separate ODF frames and routed through physically disjoint cable ducts.

REDUNDANT SUBSYSTEMS

The protection switching architecture comprises four redundant subsystems: (1) OLT PON port redundancy, where the protection port remains in hot-standby and assumes traffic within the switching threshold; (2) feeder fiber redundancy, with Type B using a 2:N optical splitter and Type C using dual 1:N splitters with independent feeder paths; (3) distribution fiber redundancy, unique to Type C, providing dual drop fibers to a dual-homed ONT; and (4) control plane redundancy, with protection switching coordinated by the OLT control board and, optionally, an external protection switching controller. The switching mechanism supports revertive and non-revertive modes, configurable hold-off timers (0–10 s), and wait-to-restore timers (0–300 s). Loss-of-signal (LOS) and loss-of-frame (LOF) alarms on the working path trigger automatic switching; manual and forced switch commands are available for maintenance activities. The ONT supports Type B and Type C protection modes with dual optical interfaces and automatic path selection based on received optical power and signal quality.

CAPABILITY METRICS

Protection switching performance is characterized by switching time, recovery

time, and service interruption duration. Under ITU-T G.984.1 requirements, Type B protection switching completes within 50 ms for feeder fiber failures and within 50 ms for OLT PON port failures. Type C protection switching completes within 50 ms for any single fiber or port failure across the full path. The system supports up to 128 protected PON groups per OLT chassis, depending on the control board capacity and the number of service slots. Protection group configuration supports 1:1 and 1+1 protection architectures for Type B, and 1:1, 1+1, and dual-homing architectures for Type C. Optical power budget margins must be verified to ensure that the protection path meets the same class B+ or class C+ loss budget as the working path. The manual provides engineering worksheets for link budget calculation, splitter ratio selection, and fiber route diversity validation.

Parameter	Specification
Protection Architecture	Type B: 2:N splitter, dual OLT PON port, single feeder redundancy
Protection Architecture (cont.)	Type C: dual feeder, dual OLT PON port, dual drop fiber, end-to-end redundancy
Switching Time	≤ 50 ms per ITU-T G.984.1 / G.987.1
Switching Modes	Revertive / non-revertive, configurable hold-off 0–10 s, wait-to-restore 0–300

	s
OLT PON Ports per Protected Group	Type B: 2; Type C: 4
Optical Module Classes	GPON class B+ / C+; XG-PON class B+ / C+; SFP/SFP+ hot-swappable with DDM
Protected PON Groups per Chassis	Up to 128 (control board dependent)
Management Integration	Huawei U2000 / NCE bulk provisioning, alarm correlation, switching dashboard
Compliance Standards	ITU-T G.983.1, G.984.1, G.984.2, G.987.1, G.987.2; IEEE 802.3ah; GR-1089-CORE; IEC 60825-1

COMPLIANCE AUDIT

Deployments must comply with ITU-T G.983.1 for BPON, G.984.1 and G.984.2 for GPON, and G.987.1 and G.987.2 for XG-PON protection switching requirements. Additional compliance applies to IEEE 802.3ah for EPON deployments, Telcordia GR-1089-CORE for electromagnetic compatibility and electrical safety, and IEC 60825-1 for laser safety. Protection switching procedures must be audited against the operator's high-availability SLA, with

periodic failover drills, alarm correlation checks, and switching time verification. The manual includes a compliance checklist covering optical budget verification, fiber route diversity attestation, protection group configuration audit, switching time measurement, and restoration behavior validation. Records of all protection switching events, including trigger cause, switching duration, and recovery status, must be retained in the OLT alarm log for a minimum of 30 days.

SCALING STRATEGY

Protection switching scales horizontally by adding protected PON groups across additional service slots and vertically by upgrading OLT control board capacity. For large-scale deployments, the manual recommends a phased rollout: first deploy Type B protection on feeder segments serving high-density residential and business areas, then upgrade to Type C protection for critical enterprise and mobile backhaul services requiring full path redundancy. Splitter placement must account for future protection upgrades; Type B 2:N splitters should be installed in ODF frames with spare ports for Type C migration. Fiber management practices must preserve spare dark fibers along diverse routes. The manual provides capacity planning tables correlating protected PON groups, control board utilization, alarm processing load, and switching controller throughput. Network management integration via Huawei

U2000/NCE supports bulk protection group provisioning, automated compliance reporting, and real-time protection switching dashboards.

