

Optical Link Budget Calculation Worksheet - Official Technical Overview & Hardware Datasheet

EXECUTIVE SUMMARY

This document serves as the definitive technical reference for the Optical Link Budget Calculation Worksheet, a precision-engineered software tool and hardware-agnostic reference platform designed for carrier-grade optical network planning. The worksheet provides network engineers and systems integrators with a mathematically rigorous framework for computing end-to-end optical power losses, dispersion penalties, and receiver sensitivity margins across a diverse array of fiber-optic transmission systems. By integrating industry-standard ITU-T G.957 and G.984 recommendations with real-world attenuation coefficients, this solution enables deterministic link performance prediction, ensuring first-pass-successful deployments in both metro and long-haul infrastructures. The toolset is packaged as a standalone, rack-mountable computation appliance (1RU form factor) featuring a hardened Linux-based real-time operating system, a 10.1-inch capacitive touch display for field operations, and dual Gigabit Ethernet management ports for remote orchestration via SNMPv3 or RESTful APIs. This datasheet details the hardware architecture, environmental tolerances, compliance certifications, and ordering logistics for the Optical Link Budget Calculation Worksheet platform.



ARCHITECTURE & CHASSIS DESIGN

The Optical Link Budget Calculation Worksheet is built upon a modular, fanless chassis architecture optimized for silent operation in central office environments or outdoor cabinets with extended temperature ratings. The chassis measures 440 mm (W) x 300 mm (D) x 44.5 mm (H) (1RU), constructed from galvanized steel with a corrosion-resistant powder coat finish. Internal cooling is achieved via a passive heat-sink array coupled with two variable-speed 40 mm exhaust fans that activate only under sustained processing loads exceeding 70% CPU utilization, ensuring an acoustic noise floor below 25 dBA under typical operating conditions. The front panel hosts a 10.1-inch, 1280 x 800 pixel capacitive touchscreen with anti-glare coating and an ambient light sensor for automatic brightness adjustment, enabling direct data entry and real-time graphical display of link loss budgets. Rear-panel

interfaces include dual 10/100/1000BASE-T management ports, one RS-232 console port (RJ-45), two USB 3.0 Type-A ports for external storage or keyboard/mouse support, and a dedicated 100BASE-FX SFP slot for out-of-band optical monitoring. The motherboard integrates a quad-core ARM Cortex-A72 processor running at 2.2 GHz, with 8 GB of DDR4 ECC RAM and 32 GB of onboard eMMC flash storage for the operating system and worksheet application. An optional 2.5-inch SATA SSD bay (user-accessible) is available for logging link calculation histories and exporting PDF/CSV reports.

HARDWARE FEATURES

The Optical Link Budget Calculation Worksheet distinguishes itself through a suite of hardware-accelerated features that bridge computational precision with practical field utility. Key capabilities include:

1. **MULTI-PARAMETER OPTICAL ENGINE:** The onboard FPGA co-processor executes iterative loss calculations across up to 128 optical spans simultaneously, incorporating wavelength-dependent attenuation coefficients (0.20 dB/km @ 1550 nm, 0.35 dB/km @ 1310 nm), connector losses (0.5 dB per mated pair), splice losses (0.1 dB per fusion splice), and chromatic dispersion penalties (≤ 18 ps/nm/km for G.652 fibers). The engine supports both unidirectional and bidirectional link analyses with polarization mode dispersion

(PMD) statistical modeling.

2. DATABASE OF TRANSCEIVER PROFILES: Preloaded with over 1,500 OEM-verified optical transceiver profiles (SFP, SFP+, QSFP, CFP variants), the worksheet automatically retrieves transmitter output power, receiver sensitivity, and optical modulation amplitude (OMA) values for pluggable modules. Users may upload custom profiles via XML or JSON import.

3. REAL-TIME ENVIRONMENTAL COMPENSATION: An integrated temperature sensor and barometer allow dynamic adjustment of fiber attenuation coefficients based on ambient conditions, providing ± 0.02 dB/km correction accuracy for temperature variations between -10°C and $+65^{\circ}\text{C}$.

4. REDUNDANT POWER SUPPLIES: Dual hot-swappable power supply modules (PSUs) are housed in the rear compartment, supporting either AC (100-240 V, 50/60 Hz) or DC (-48 V) input with automatic failover and load sharing. Each PSU delivers 150 W maximum output, with an efficiency rating of 89% at 50% load.

5. NETWORK SYNCHRONIZATION: The management ports support IEEE 1588v2 Precision Time Protocol (PTP) and Network Time Protocol (NTP) for timestamp synchronization of calculation logs, facilitating correlation with optical

time-domain reflectometer (OTDR) traces during troubleshooting.

COMPLIANCE & STANDARDS

The Optical Link Budget Calculation Worksheet has been certified to meet or exceed the following regulatory and industry standards:

- ITU-T G.957 (Optical interfaces for equipment and systems relating to SDH)
- ITU-T G.984 (Gigabit-capable passive optical networks - GPON)
- ITU-T G.652 (Characteristics of a single-mode optical fiber and cable)
- Telcordia GR-1089-CORE (EMC, electrostatic discharge, and electrical safety for telecom equipment)
- Telcordia GR-63-CORE (NEBS Level 3 physical protection)
- IEC 60825-1 (Safety of laser products - Class 1 compliant for all optical ports)
- UL 60950-1 / IEC 60950-1 (Information technology equipment safety)
- FCC Part 15 Subpart B (Class A digital device)
- EN 55032 (Electromagnetic compatibility of multimedia equipment)
- RoHS 3 (Restriction of Hazardous Substances Directive 2015/863)

Additionally, the device is compliant with the OpenConfig operational data models for telemetry streaming, allowing integration with third-party network management systems (NMS) via gRPC.

TECHNICAL SPECIFICATIONS

Parameter	Specification
Form Factor	1RU Rack-Mountable Chassis (440 x 300 x 44.5 mm)
Processor	Quad-Core ARM Cortex-A72 @ 2.2 GHz with FPGA Co-Processor
Memory	8 GB / 16 GB (Optional) DDR4 ECC RAM
Storage	32 GB / 128 GB eMMC + Optional 2.5-inch SATA SSD
Display	10.1-inch Capacitive Touchscreen (1280 x 800, Anti-Glare)
Management Ports	Dual 10/100/1000BASE-T (RJ-45), RS-232 Console, USB 3.0 x2
Optical Monitoring	1 x 100BASE-FX SFP Slot (Dedicated Out-of-Band)
Power Supply	150 W AC (100-240 V) or DC (-48 V), 1+1 Redundant Option
Switching / Compute Capacity	Up to 128 Simultaneous Span Calculations

Supported Fiber Standards	ITU-T G.652, G.653, G.655 (With Dispersion Modeling)
Transceiver Profile Library	1,500+ Standard (Up to 5,000+ Optional)
Environmental Temperature	Operating: -10 °C to +65 °C; Storage: -40°C to +85°C
Humidity	5% to 95% (Non-Condensing) at +40° C
Altitude	Up to 4,000 m Operating
Acoustic Noise	≤ 25 dBA (Typical, Passive Mode); ≤ 35 dBA (Active Cooling)
MTBF (Telcordia SR-332)	350,000 Hours at +25°C
Weight	4.2 kg (Full Configuration with Dual PSUs)

ORDERING OPTIONS

The Optical Link Budget Calculation Worksheet is offered in three distinct product configurations to match diverse deployment requirements:

1. STANDARD EDITION (Part Number: OLB-1000-S): Includes base chassis with

ARM processor, 8 GB RAM, 32 GB eMMC, one AC PSU (150 W), and the worksheet application license. No SSD or optical transceiver profiles beyond the base library.

2. ADVANCED EDITION (Part Number: OLB-2000-A): Upgraded to 16 GB ECC RAM, 128 GB eMMC, dual AC PSUs (1+1 redundancy), preloaded extended transceiver database (5,000+ profiles), and enhanced FPGA logic for dispersion-limited link calculations (up to 200 km spans).

3. CARRIER EDITION (Part Number: OLB-3000-C): All features of Advanced Edition, plus dual DC PSUs (-48 V), 1 TB 2.5-inch SATA SSD (logging enabled), IEEE 1588v2 hardware timestamping, and a 5-year extended warranty with advanced replacement SLA (4-hour response).

All orders include a quick-start guide, console cable, and rack-mount ear kit. Software updates for the worksheet application are delivered via a secure HTTPS repository with digital signature verification for the first 3 years post-purchase. Optional accessories include a portable carrying case (Part Number: ACC-CASE-OLB), an external GPS antenna for PTP grandmaster sync (ACC-GPS-ANT), and a magnetic-mount temperature probe for external environmental monitoring (ACC-TEMP-PROBE).

