OEM CATV Receiver RF Output Level Compatibility on Mixed-Signal ODN Networks - Official Technical Overview & Hardware Datasheet

EXECUTIVE SUMMARY

This document serves as the definitive technical reference for OEM CATV Receiver modules engineered for seamless RF output level compatibility within mixed-signal Optical Distribution Network (ODN) infrastructures. As network operators transition from legacy analog to hybrid fiber-coax (HFC) and passive optical networks (PON), maintaining consistent RF output levels across diverse signal domains becomes paramount. This datasheet outlines the hardware architecture, silicon-level processing, and RF conditioning logic that ensure carrier-grade performance, minimal signal degradation, and full interoperability with existing headend and edge termination equipment. The device family is designed to address the critical challenges of signal attenuation, thermal drift, and optical power variance, providing a robust, field-proven solution for multi-service operator (MSO) networks.



HARDWARE ARCHITECTURE & SILICON

The OEM CATV Receiver module is built upon a foundation of advanced mixed-signal processing, integrating a high-linearity RF amplifier stage, a precision optical-to-electrical (O/E) converter, and an intelligent automatic gain control (AGC) loop. The core silicon utilizes a gallium arsenide (GaAs) pseudomorphic high-electron-mobility transistor (pHEMT) technology for the low-noise amplifier (LNA), ensuring an exceptionally low noise figure (< 5 dB) while delivering a high output level capability of up to +45 dBmV. The onboard digital signal processor (DSP) continuously monitors the incoming optical power (ranging from -8 dBm to +2 dBm) and dynamically adjusts the RF gain to maintain a stable output level, compensating for fiber length variations and connector losses. This architecture guarantees an output level stability of ±0.5 dB over the entire operating temperature range (-40°C to +85°C), minimizing

the need for manual field adjustments and reducing operational expenditure (OPEX).

KEY FEATURES & ROUTING LOGIC

- Feature 1: Hybrid ODN Compatibility: Seamlessly integrates with both time-division multiplexing (TDM) and wavelength-division multiplexing (WDM) PON architectures, supporting downstream wavelengths of 1550 nm and 1310 nm for return path monitoring.

- Feature 2: Programmable RF Output Level: Offers a wide output level adjustment range of +20 dBmV to +45 dBmV in 0.5 dB steps, allowing precise matching to the specific requirements of the connected cable modem termination system (CMTS) or edge QAM (EQAM) device.

- Feature 3: Advanced Equalization & Tilt: On-chip equalization circuits compensate for cable slope and frequency response anomalies, featuring a fixed inter-stage tilt of +1.5 dB to +2.5 dB per 100 MHz to flatten the output spectrum across the 47 MHz to 1218 MHz frequency band.

- Feature 4: Ingress & Surge Protection: Robust surge protection up to 6 kV (IEC 61000-4-5) and ingress filtering to reject out-of-band interference, ensuring high signal integrity and reliability in harsh outside-plant (OSP) environments.

- Feature 5: Telemetry & Monitoring: Real-time optical power monitoring (OPM) and RF output level status reporting via a dedicated I2C/SPI management interface, enabling proactive network maintenance and fault detection from a

network operations center (NOC).

COMPLIANCE & STANDARDS

The device is fully compliant with the applicable industry specifications to ensure interoperability and regulatory acceptance. It meets the SCTE 40 2020 standard for digital cable network transmission, including the stringent requirements for carrier-to-noise (C/N), composite second-order (CSO), and composite triple-beat (CTB) distortion. Furthermore, it complies with the ANSI/SCTE 23-3 2019 standard for DOCSIS 3.1 radio frequency interface (RFI) specifications, ensuring it can deliver the high-quality signals necessary for multi-gigabit data services. The module also adheres to the EU RoHS Directive (2011/65/EU) and is designed to meet the Telcordia GR-1089-CORE and GR-63-CORE requirements for electromagnetic compatibility (EMC) and physical protection, respectively.

TECHNICAL SPECIFICATIONS

Frequency Range: 47 MHz to 1218 MHz (1.2 GHz)

Optical Input Wavelength: 1550 nm ± 10 nm (standard); 1310 nm return path (optional)

Optical Input Power: -8 dBm to +2 dBm (normal operation)

RF Output Impedance: 75 Ω (female F-type connector standard, BNC optional)

RF Output Level (Nominal): +40 dBmV (adjustable from +20 to +45 dBmV)

Gain (Optical to RF): 50 dB (typical at 1550 nm input)

Noise Figure (NF): < 5.0 dB (at 25°C, 1550 nm, 0 dBm input)

CSO / CTB Performance: < -65 dBc (with 80-channel NTSC loading)

Flatness: ±0.75 dB (over full frequency band)

Return Loss (RF Output): > 16 dB

Operating Temperature: -40°C to +85°C (industrial grade)

Power Supply: +5 VDC / +12 VDC (dual power input, internal polarity protected)

Power Consumption: < 15 W (typical)

Management Interface: I2C / SPI (400 kHz max) with onboard EEPROM for configuration storage

Dimensions (Module): 170 mm x 130 mm x 25 mm (L x W x H), pluggable SFP or dedicated board form factor available.

Parameter	**Specification**
Form Factor	Pluggable SFP+ / PCB Module (1RU Rackmount Capable)
Switching Capacity	N/A (Dedicated RF Amplifier / O/E Converter)
Power Supply	Dual Hot-Swappable Redundant DC: -48 VDC or +12 VDC

Optical Connector	SC/APC (Standard) / LC/UPC (Optional)
RF Connector	75 Ω F-type Female / BNC (Option)
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +125°C
MTBF	> 500,000 hours (Telcordia SR-332)

