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How to adjust the signal of an AGC dual-channel optical receiver



Overview

A 2.5-Gb/s CMOS optical receiver with wide dynamic range using dual. In this paper, a new 2.5 Gb/s optical receiver adopting dual automatic gain controls.

Key Takeaways

To adjust a dual-channel AGC optical receiver, coordinate the gain control of each channel's variable gain amplifier to maintain a stable output while preventing overload and optimizing SNR.Understanding the AGC Structure

A dual-channel optical receiver typically uses Variable Gain Amplifiers (VGAs) in each channel, with a detector comparing the output to a setpoint voltage to generate an error signal. This error signal is integrated to produce a gain control voltage applied to the VGAs, forming a feedback loop that stabilizes the output signal level despite variations in input power . There are two common VGA types:

• Input VGA (IVGA): Passive attenuator followed by a fixed-gain amplifier; preferred for AGC because output level is relatively independent of gain setting .

• Output VGA (OVGA): Fixed-gain amplifier followed by a passive attenuator; less suitable for AGC due to reduced output handling at low gain .
Steps to Adjust the AGC
• Set the Target Output Level: Determine the desired output voltage or power for each channel. This is the reference for the AGC loop.

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• Configure the Gain Range: Ensure the AGC can cover the full dynamic range of input signals. For example, if the input varies by 120 dB and the ADC has 72 dB dynamic range, the AGC should provide at least 48 dB of gain control, with additional margin for temperature and component variations .

• Distribute Gain Across Stages:
• Use a coarse front-end attenuator or LNA bypass to handle large input variations.

• Apply fine gain control at the IF stage near the ADC for precise adjustment.

• Optionally, implement digital AGC in DSP for slow, steady-state fine-tuning .

• Coordinate Dual-Channel Control:
• If two VGAs are cascaded, hand off gain control from the second stage to the first only when the first stage approaches overload.

• Alternatively, drive both VGAs in parallel, optionally offsetting control signals to reduce ripple effects .

• Adjust AGC Response Time:
• The AGC loop must be fast enough to track slow signal variations but slow enough to avoid modulating the desired signal.

• Typical loop bandwidths: 1–10 kHz for steady-state tracking, 100 kHz–1 MHz for initial acquisition .

• Monitor and Fine-Tune:
• Use a scope or signal analyzer to observe output levels.

• Adjust step size, maximum gain, and loop filter parameters to optimize stability and SNR .

Additional Considerations
• Temperature Compensation: Ensure the detector stage compensates for diode voltage variations with temperature to maintain accurate AGC operation .

• Noise Management: The AGC should respond primarily to the desired signal, minimizing the effect of noise .

• Dual-Channel Synchronization: For optical receivers, ensure both channels maintain similar gain dynamics to prevent imbalance in differential or stereo signals. By carefully setting the target output, gain range, loop response, and coordination between channels, the AGC dual-channel optical receiver can maintain stable signal levels, prevent overload, and optimize signal-to-noise performance across varying input conditions.

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Article Content

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What is AGC (Automatic gain control)□

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AGC is crucial in optical networks, especially in EDFAs within DWDM systems. By fixing the gain of the amplifier, it

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Automatic Gain Control in Broadcasting Systems

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Learn the basics of Automatic Gain Control (AGC), an algorithm that monitors the received signal and automatically controls the gain

David Finch AGC Whitepaper

This AGC solution employs a feedback architecture. In contrast with a feed-forward design, the feedback architecture significantly

Mastering Automatic Gain Control

Definition and Purpose of AGC in RF Systems AGC is a feedback control system that adjusts the gain of a receiver or

AGC

When signal is above the minimum signal level (AGC_MIN_AUDIO), the signal level can be adjusted to approach a desired level by

How Does the Automatic Gain Control (AGC) Function in SmartSDR

A Description of the SmartSDR AGC Automatic Gain Control (AGC) is a feature that automatically adjusts the slice receiver''s audio

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Design and Operation of Automatic Gain Control Loops for Receivers

This article is intended to provide insight into the effective operation of variable gain amplifiers (VGA) in automatic gain

How Automatic Gain Control (AGC) Works

Consequently, a time-varying signal amplitude produces a loop with time-varying loop bandwidth and hence a

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Understand automatic gain control in receivers — how AGC detects signal level, controls IF gain, and uses attack and decay timing.

Automatic Gain Control (agc)

The agc object contains internal squelch control to allow the receiver the ability to disable signal processing when the signal level is

Automatic Gain Control Methods

Automatic Gain Control (AGC) Figure 2: automatic gain control block diagram Gain control is necessary to adjust the receiver

Comprehensive explanation of Automatic Gain Control (AGC) for

Automatic Gain Control is typically used to describe a receiver gain adjust function, while Output Power Control is

A simple way to add AGC to your communications

Since the early days of vacuum tube radios, circuits were needed to automatically adjust a

Usage of the Automatic Gain Control Circuit (AGC)

2 AGC Active Mode In the active mode, the Receiver Signal Strength Indicator (RSSI) voltage is compared with a

AN-1451 LM4935 Automatic Gain Control (AGC) Guide

In a given frame, the AGC''s peak detector determines the peak value of the incoming microphone audio signal level and compares

Auto Gain Control in Electronic Systems

Applications of AGC AGC (Auto Gain Control) is widely used in various electronic systems. It is commonly used in

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