What are the power supplies for high-frequency communication systems



Overview

For historical, practical, and technical reasons, telecom systems typically utilize a -48 V DC power supply.

Key Takeaways

High-frequency communication systems require highly efficient, stable, and compact power supplies capable of supporting both high-speed digital circuits and analog components, often using advanced AC/DC and DC/DC conversion topologies.

Key Design Considerations

Efficiency and Power Density: Modern communication systems, including 5G base stations and AI data centers, demand high-efficiency power supplies to minimize energy loss and heat generation.

High-density PS

Us, such as the 3. 3 kW and 8 kW high-frequency units, achieve peak efficiencies above 97% while maintaining compact form factors, enabling integration into space-constrained environments. Voltage Regulation and Multiple Outputs: Communication systems often require multiple tightly regulated low-voltage supplies for digital ASICs, FPGAs, and high-voltage analog circuits.

Distributed voltage bus architectures, such as the +12V Intermediate Bus Architecture (IBA), allow efficient conversion from a -48V telecom bus to multiple low-voltage outputs using point-of-load (POL) modules or hybrid isolated converters.

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C and DC Conversion: High-frequency AC power supplies, like the DF-CM series, provide stable, precise sine wave outputs over a wide frequency range (200 Hz to 2500 Hz), suitable for testing, calibration, and operation of high-frequency communication equipment.

On the D

C side, advanced topologies such as interleaved bridgeless totem-pole AC/DC converters and GaN half-bridge LLC DC/DC converters offer low total harmonic distortion (THD), isolation, and fast transient response. Redundancy and Reliability: Telecom power supplies must ensure uninterrupted operation. Designs often include N+1 redundancy, backup batteries, or generators.

Active-clamp forward converters (ACFC) are commonly used to convert -48V DC to positive voltages with soft switching, reducing EMI and switching losses while protecting primary switches. Integration and Compactness: Highly integrated power ASICs, such as LM5041 and LM5030, allow embedding isolated power supplies directly onto motherboards or line cards, reducing PCB area and component count while maintaining efficiency. This is critical for high-frequency systems where space and thermal management are constraints.

Practical ImplementationFront-End AC/DC Conversion: Provides power factor correction (PFC) and regulates intermediate bulk voltage. Interleaved or bridgeless topologies improve efficiency and reduce harmonic distortion.

Back-

End DC/DC Conversion: GaN-based half-bridge or full-bridge LLC converters provide isolated, regulated outputs for sensitive digital and analog loads.

Point-of-

Load Modules: Small, surface-mount POL converters supply multiple low-voltage rails efficiently, often in SIP or SMD packages.

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C Supplies: For laboratory or industrial testing, units like the DF-CM series offer adjustable voltage and frequency ranges with precise digital control and monitoring. SummaryHigh-frequency communication systems require power supplies that combine high efficiency, precise voltage regulation, high power density, and reliability. Advanced AC/DC and DC/DC topologies, high-frequency AC supplies, and integrated POL modules are essential to meet the demands of modern telecom infrastructure, including 5G networks, AI data centers, and high-speed digital communication equipment.

Article Content

Efficient Telecom Power Supplies | DigiKey

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Communications System Power Supply Designs

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To overcome the limitations of active clamp-on converters, a new generation of power supply technologies has emerged that offer higher efficiency, higher power density and simplified

Understanding the Role of Power Supplies in RF Systems

To achieve optimal RF stability and function, power supplies interconnect with RF energy system components like magnets, modulators, inductors, and transformers.

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