APPLICATION NOTE

Reducing RAN Running Costs with Advanced DC-DC Technologies

Introduction

Efficiency, reliability, and remote monitoring reduce energy and maintenance expenses for telecom.

The reliability issue is a significant pain point because a so-called “truck roll” (a visit by a service technician to the base station to repair or replace a component, circuit board, or other assembly) is a costly last resort that service providers want to avoid. Unplanned downtime and maintenance costs can mount very quickly, reaching many hundreds of times the cost of any specific part or system that has failed.

DC-DC Converter Efficiency and Reliability

Efficiency and reliability are key criteria for system architects and telecommunication (telecom) operators who design and deploy small cell wireless transmitters and receivers for 5G and future telecom infrastructure. Both criteria impact operating expenditure (OpEx). Higher efficiencies mean lower energy costs (both for powering the active cell components and any systems needed to cool components and sub-assemblies), while reliability reduces unplanned downtime and maintenance costs.

There is an increased focus on the DC-DC converters that are essential to powering the RFPA systems in wireless bases stations and related telecom equipment. Demand for full-load efficiencies of 95% or more is common, in addition to service reliability Mean Time Between Failure (MTBF) requirements that are calculated in millions of hours.

Remote radio heads (RRHs) in a cell are particularly inefficient, typically ranging between 35 to 45% power-in to power-out. Most of that inefficiency resides in the radio frequency power amplifier (RFPA). Sophisticated linearization techniques and newer design and component technology enable higher output power capabilities. However, next-generation “massive MIMO” active antenna unit (AAU) radios need multiple lower-power amplifiers. Linearizing each of these small amplifiers is costly and marginally effective since the additional circuitry itself consumes much of the power that it is designed to save.

Thermally optimized for Ingress Protection (IP) sealed, contact-cooled designs such as RRH equipment, the ADH1300-48S28 provides a 28 V output, operates at nearly 96% efficiency at full load, and features current limit characteristics and transient load performance optimized for RFPA applications. A wide range of output voltage adjustment (50 to 118%) improves power amplifier efficiency, reducing the dissipated heat and improving thermal management design.

This new DC-DC converter is rated for an MTBF that exceeds 1.5 million hours (calculated according to Telcordia SR-332-2006), supporting extended, reliable operation in the outdoor conditions typically associated with small cell hardware. In addition, ADH1300-48S28 units help operators keep maintenance costs down by providing digital monitoring and control functionality via an integrated PMBus interface. This interface allows engineers to digitally configure, control, and monitor the converter, minimizing the need for a truck roll should there be a problem with the power supply. What's more, as fluctuations in power supply parameters can often be a warning of problems in the RFPA itself, this functionality also supports preventative maintenance regimes that further reduce costly downtime.

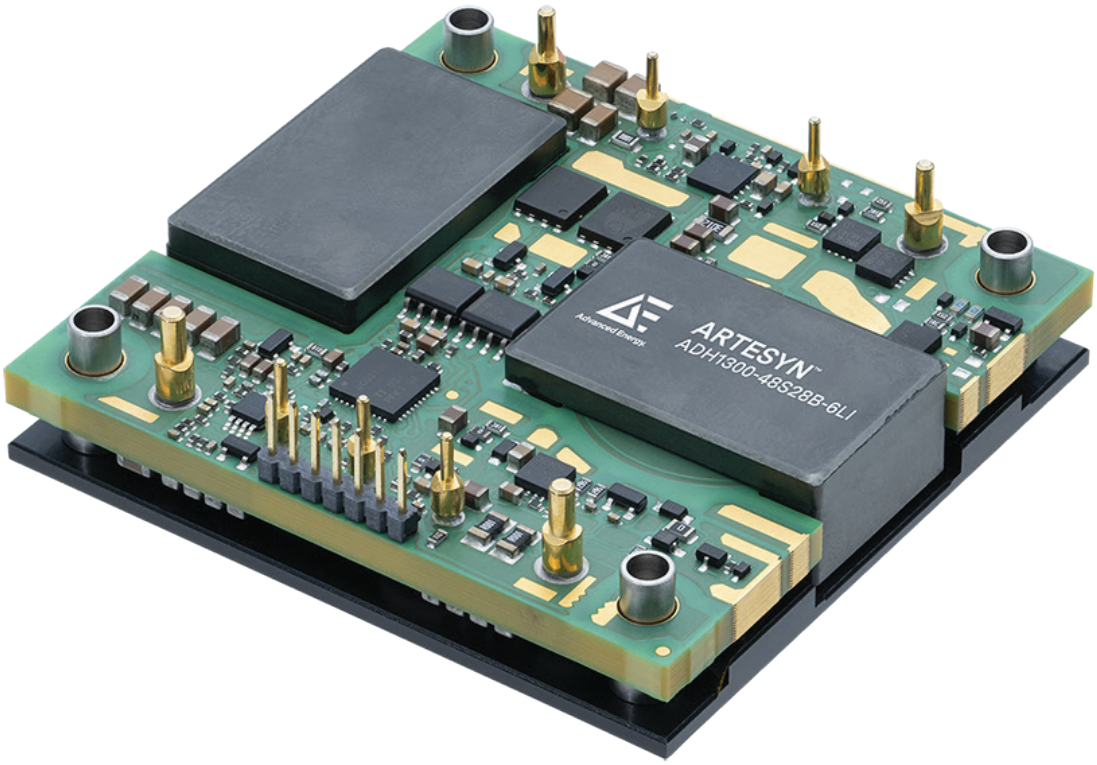

Figure 1: Advanced Energy's Artesyn ADH1300-48S28 1300 W half-brick DC-DC converter

Summary

- **Efficiency:** This is crucial for system architects and telecom operators when designing and deploying small cell wireless transmitters and receivers for 5G. Higher efficiency reduces energy costs.
- **Reliability:** This is also crucial because it minimizes unplanned downtime and maintenance costs. For example, a “truck roll” (service technician visit), can be extremely costly, often many times the cost of the failed component.
- **DC-DC Converter Efficiency and Reliability:** Designers focus on DC-DC converters for powering RFPA systems. High efficiency (95% or more) and high reliability (MTBF in millions of hours) are essential. Reliability is a core philosophy of all of our RFPA products.
- **Advanced Energy’s Solution:** The Advanced Energy Artesyn® ADH1300-48S28 DC-DC converter offers 1300 W power in a half-brick form factor, nearly 96% efficiency at full load, and a wide range of output voltage adjustment. It is thermally optimized for RRH equipment and supports extended reliable operation with an MTBF exceeding 1.5 million hours.
- **Digital Monitoring and Control:** The ADH1300-48S28 includes a PMBus interface for digital configuration, control, and monitoring, which helps reduce maintenance costs and supports preventative maintenance by detecting power supply parameter fluctuations.

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than four decades to perfecting power for its global customers. We design and manufacture highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

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