



Power Protection for Broadcast: The Power behind DTV Conversion

Application Note



The challenge

Guarantee maximum uptime as station managers design and implement a digital TV system that meets the FCC deadline

The solution

A power protection and management solution to eliminate power-related risks to system availability

Why a Powerware UPS?

- Proven technology used for the most business-, life- and mission-critical applications for 40 years
- Expertise in maximizing uptime at broadcast facilities throughout the world
- Technology specifically designed to protect transmitters

Key business benefits

- Cost savings due to efficient system operation
- Improved customer relationships resulting in zero downtime
- Ability to tailor a solution to a specific facility's needs
- Ability to design a power system that enables you to "pay as you go" without penalty

As you prepare for the February 17, 2009 FCC-mandated deadline for DTV conversion, there are many factors that can have an impact on whether the transition is smooth and effective. In designing your conversion plans, you must not only determine the need for translators, digital production equipment, and the size and power of the digital transmitters, but you must also ensure the uninterrupted operation of these systems.

The risks of power

The needs and expectations of the public audience are growing, and the ever-increasing demand for information, coupled with a rising viewer reliance on TV, makes service interruptions especially unacceptable. Anything that poses a risk to any of your critical applications must be dealt with proactively, with a system designed to prevent potential risks to uptime. An integral part to any

business continuity plan is power protection and management. The station today is more sensitive to power disturbances like surges, sags, noise and outages as the equipment migrates to PC-based digital services. These power disturbances can cause damage to transmitters and production equipment, loss of digital data and video feeds, and ultimately can cause the station to go off the air. This can result in losing viewers to com-

peting stations and a negative viewer perception of service reliability. If your power fails, the transmission shuts down and television screens go blank. It only takes minutes of downtime to have a significant impact on the effective operation of your broadcast facility. Downtime can quickly escalate into a financial crisis due to lost ad revenue, idle employees and frustrated viewers.

The right power solution depends on a variety of details, including transmitter size and power, transmission consolidation, and whether the upgrade includes master control, digital encoders and decoders, and what level of protection each part requires. You consider several issues when selecting a power solution, including a single point of failure that establishes the potential for system downtime by creating one place in the system that, if it fails, brings the entire power system down and causes a loss of the critical load. There can be multiple points of failure in a poorly designed system; the optimal solution is a well thought-out system that has no single point upon which the entire system relies. The key points to remember about a single point of failure are:

- Redundancy of both modules and key components is critical to protecting against a single point of failure bringing a system down
- Many redundant UPSs introduce a new system-level single point of failure, such as communication wiring and common controls for load sharing and selective tripping, which can defeat the purpose of having a redundant system in the first place (This means that if the communications or com-

mon controls are compromised in any way, the entire system goes down, dropping the critical load)

- The most reliable system is a redundant one in which there is no system-level single point of failure, and in which the UPS modules have redundancy of key components, such as fans and power supplies (It is imperative to closely examine any redundant design for shared functions that can be the Achilles heel of the system)
- Efficiency is a factor in the overall cost of ownership of a UPS and ancillary equipment, and it is always a balancing act between reliability and efficiency (It is a good rule of thumb to look for a double-conversion online UPS with an efficiency of >94%)
- Upgradeability is another factor in both cost-savings and convenience, as many station managers plan for station growth and want to be able to add power capability as their needs change—many transformers have an upgrade path and the UPS should be able to mirror that growth without risking the initial investment

The right power management solution must be able to handle all of these events without any interruption of transmitter and production facility operation.

Eliminating risks from power anomalies

The best way to successfully mitigate the damaging effects of power anomalies is with the right UPS, plus any ancillary power train products. UPSs come in a wide range of designs and topologies. How do you know which is right for your needs? Given the critical nature of a broadcast application, and



the need for maximum transition uptime, the following are some fundamental features to look for when designing the power infrastructure of your DTV conversion:

- Double-conversion design to ensure perfect power for sensitive digital equipment
- Redundant UPSs that do not introduce a system-level single point of failure
- High power density (high kVA per square foot) to save on premium facility space
- Additional power train equipment, including generators, static transfer switches, TVSS, and power distribution, that integrates with your UPS and is managed from a single interface
- Efficient UPS operation for cost savings
- Remote management and monitoring capability

The DTV challenge

With the conversion to DTV, you are facing a much more complex challenge than just selecting a transmitter and sending out a signal. You are responsible for managing assets, signals and systems that converge with

telecommunication and computing technologies, protocols and standards. Myriad systems, both legacy analog applications and new digital ones, must integrate into a cohesive solution that delivers:

- Reliable transmission to prevent blank screens
- Encoding and decoding for the smooth transmission of audio and video signals throughout the facility
- Networking for real-time delivery of broadcast-quality content over private or public networks
- Monitoring/testing to ensure integrity of signal
- Centralization of multi-channel enterprises to realize economies of scale and to leverage resources
- Integration of analog and legacy systems
- Management of all broadcast facilities and networks for failure prevention

During the changeover, both legacy and digital systems must be managed.

Powering the broadcast facility

The conversion to DTV presents an opportunity to analyze not only the power needs at the transmitter, but the power requirements throughout the production facility as well. Over the years, the digitization of broadcast equipment has changed the way in which power is utilized, often meaning that pristine, nonstop power is essential. There are many pieces of equipment that must be operating for a broadcast to proceed in an uninterrupted manner, including:

- Master control switcher
- Microwave transmitter gear
- Video cameras
- Microphones
- Distribution amplifiers
- Editors
- Servers

A typical broadcast production facility will require between 100 and 500 kVA of power. Depending on the setup of the facility, you can opt for either a centralized UPS for a single point of control, or distributed UPSs protecting each piece of equipment. There are benefits and drawbacks to each option. If you opt for the centralized solution, your UPS must be the most reliable design available, including redundant components within the unit. To further ensure system availability, you should consider redundant UPS modules to guarantee availability in the event that one of the UPSs goes offline. Using a distributed solution means you have more units to manage and monitor, so it is imperative that you have an intelligent power management software program to ensure that your critical equipment is always protected.

Eaton's solution for broadcast facilities

Eaton's solutions for broadcast facilities address the fundamental issues of constant uptime, low cost of ownership and growth without penalty. By offering a consistent level of quality and reliability across power ranges, Eaton delivers:

- Solutions sized to meet the needs of any transmission site, studio or other critical operations
- Optional heavy-duty static switch operation specifically designed to eliminate risks from crowbar events and other transmitter-specific power problems, mitigating the need to oversize the UPS
- Ability to upgrade the UPS to support additional equipment and/or a larger transmitter
- Local, remote and network monitoring capabilities
- Redundancy with Powerware® Hot Sync®, our patented technology which eliminates a system-level single point of failure
- Redundant components within the UPS modules to reduce potential for module failure
- World-class, around-the-clock service by Eaton personnel with the broadest coverage available in the industry
- 40 years of experience in maximizing uptime for critical systems, from 300 VA to >1100 kVA

Eaton offers a wide range of power solutions for a variety of critical applications, including the industrial, healthcare, IT, government and pharmaceutical industries.

Crowbar event

"Crowbar events" happen inside of the inductive output tubes (IOTs) housed in the transmitter. These sensitive, fragile tubes are very expensive, often costing up to \$25,000 each. They draw excessive current for operation, which can create a short inside the tube. To protect the tube from being damaged, they have a crowbar circuit to discharge the current in the form of a short.

The transmitter's crowbar circuit immediately switches off AC power to that amplifier's high-voltage DC power supply when it is fired. At the same time, it places a short circuit (2000–3000A) on the DC supply to instantly discharge the high-voltage filter capacitors.

Typically, there will be crowbar firings during transmitter checkout and initial operation right after installation, and when the IOT is failing at the end of its life cycle. It has been reported that some IOTs have triggered repetitive crowbar firings until the IOT has "settled in" on new installations. Therefore, it is necessary to consider the duty cycle of a crowbar event, which is approximately three seconds between the time the crowbar fires and the amplifier cabinet's logic circuit resets and turns the HV supply on again.

IOTs require 480V, three-phase input and typically require about 100 kVA of power per tube. A UPS protecting IOTs must be able to switch to bypass fast enough to avoid the 3000A short and then to bring itself back online once the slow blow fuses between the UPS and the IOT have dissipated the short.

Heavy-duty static switch

Eaton has developed a heavy-duty static switch specifically to handle the crowbar events that frequently occur in digital broadcast transmitters. This protects the UPS from being damaged by the high-voltage short, enabling it to continually operate, regardless of IOT crowbar firings.

UNITED STATES
8609 Six Forks Road
Raleigh, NC 27615 U.S.A.
Toll Free: 1.800.356.5794
or 919.872.3020

www.powerware.com

CANADA
Ontario: 416.798.0112
Toll Free: 1.800.461.9166

LATIN AMERICA
Argentina: 54.11.4343.6323
Brazil: 55.11.3616.8500
México: 52.55.9000.5252
Portugal: 55.11.3616.8500

EUROPE/MIDDLE EAST/AFRICA
Denmark: 45.3686.7910
Finland: 358.94.52.661
France: 33.1.6012.7400
Germany: 49.0.7841.604.0
Italy: 39.02.66.04.05.40
Norway: 47.23.03.65.50
Sweden: 46.8.598.940.00
United Kingdom: 44.1753.608.700



PowerChain
Management®

ASIA PACIFIC
Australia: 61.2.9693.9366
New Zealand: 64.0.3.343.3314
China: 86.21.6361.5599
HK/Korea/Taiwan: 852.2745.6682
India: 91.11.2649.9414 to 18
Singapore/SEA: 65.6825.1668

Eaton, Powerware, Powerware Hot Sync and PowerChain Management are trade names, trademarks, and/or service marks of Eaton Corporation or its subsidiaries and affiliates.

© 2008 Eaton Corporation
All Rights Reserved
Printed in USA
COR04AN
August 2008

EAT•N

Powerware