

AM Energy Saving Technologies FAQ

Q: I've been hearing about ways that AM stations can save a lot on power. What is this all about?

Since the early 1980s, technology has existed to help reduce the energy costs of AM transmitters. These technologies emerged in the late 1970s and 1980s in the United Kingdom, Germany and Switzerland and refer to specific systems developed by both transmitter manufacturers and broadcast agencies. They all have a similar goal of reducing the average transmitted power in AM broadcasts and thus electrical energy use, while minimizing the negative effects on the received signal quality. These systems have been deployed in many high power sites around the world and are used today by major international broadcasters but never legally permitted in the US by FCC rules.

Q. What has changed?

As of September 13, 2011 the FCC Media Bureau has decided it will allow U.S. AM stations to use technologies that reduce transmitter power consumption - techniques that have been available to broadcasters elsewhere for years. The public notice is available here:

http://transition.fcc.gov/Daily_Releases/Daily_Business/2011/db0913/DA-11-1535A1.pdf

Q. What kind of savings can I expect?

Power savings of up to 30% or more may be realized. Consider the following example. The current average residential rate in the US is close to 10 cents per kilowatt hour and some regions exceed 25 cents. An older tube type 50 kW transmitter might operate with an electrical efficiency factor (RF power output divided by AC power input) of around 70%. Assuming an additional 10 kW of radiated sideband power, this transmitter will consume nearly 86 kW. The daytime yearly energy usage of this station (assuming a 12 hour day) would be 377,000 kilowatt hours per year for an average cost of \$38,000. Depending on the night time status, this station could use up to \$76,000 annually.

Using technologies like Dynamic Carrier Control or Amplitude Modulation Comanding, one can realize power reductions of 30% (or more) for annual savings of \$22,000 for a full time station. For customers with modern solid state transmitters, for example Nautel's up to 90% efficient NX transmitters, savings will be slightly less dramatic but still significant in the order of \$18,000 or more. Stations that reduce power at night will see fewer saving while those in parts of the country where power is more expensive will see more dramatic savings.



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Q. Which algorithms are supported?

All of the standard forms of DCC are supported including DCC, AMC, DAM each in several variations. If other algorithms are desired Nautel may implement them based on customer requirements. Plus, customers may choose a given algorithm and customize it, perhaps starting out more gradually and increasing it over time, monitoring the received signal.

Q. OK, that's a lot of jargon, how about a glossary?

MDCL: Modulation Dependent Carrier Level - General name for this set of technologies that allow AM stations to reduce transmitter power consumption.

DAM: Dynamic Amplitude Modulation - This power saving technique reduces the carrier amplitude at lower modulation depths where the full amplitude is not required to prevent negative peak distortion. The audio level is not adjusted, so this has the side effect of increasing audio volume at low modulation depths out of the receiver. There is also a corresponding decrease in signal to noise ratio at low modulation depths.

DCC: Dynamic Carrier Control - This term is sometimes used to refer to the family of power reduction approaches but is actually a specific variation of the DAM described above. Like DAM it also can introduce audible effects during low modulation.

AMC: Amplitude Modulation Companding - In this approach both the carrier and audio are reduced together at high modulation depths. Since the signal to noise ratio is already relatively high during full modulation, the carrier and audio can both be reduced with very little impact in receivability. This technique results in minimal audible impact and therefore is a preferred method of power reduction.

Q. Won't this diminish my coverage area?

Because these systems do reduce the power in the carrier, there may be slight impairments in the received signal quality in the fringes however these problems tend to be slight and are masked by the higher level of modulation. Different algorithms may have different impact on fringe coverage or be more favorable to talk or musical formats.

Q. How does all of this work?

Generally these techniques take advantage of the fact that the majority of the energy in an AM transmission is in the carrier, which contains no information. By dynamically reducing the carrier power depending on the state of the modulation, power savings of up to 30% or more may be realized.

Please refer to Tim Hardy's 2009 paper or view Nautel's Oct 26, 2011 webinar.

Paper: http://www.nautel.com/Resources/Docs/Presentations/NAB2009/BECR07_Tim_Hardy_Energy_Conservation_in_AM_Transmitters.ppt

Webinar Link: www.nautel.com/webinars



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Q. Which algorithm should I use?

Any of the mentioned algorithms can provide significant power savings but Nautel recommends AMC due to its minimal audible impact.

Q. Can this power saving technique be applied to HD Radio transmissions or just analog?

It is possible that power savings could also be achieved for transmitters with HD Radio and Nautel hopes to do some testing in the future.

Q. Do I need an FCC approval?

Stations will need a waiver of rules to proceed, but the bureau has set up procedures to seek the waiver, and it indicated it would approve requests that use Nautel and Harris options, as described in the FCC public notice:

“AM licensees who wish to implement MDCL technology shall file with the Audio Division a letter requesting waiver of Section 73.1560(a) of the Rules, addressed to:

*MDCL Waivers
Federal Communications Commission
Audio Division, Media Bureau
445 12th Street SW, Room 2-B450
Washington, DC 20554*

A copy of the request, preferably in .pdf format, shall be sent by e-mail to ann.Gallagher@fcc.gov. The letter shall specify the technology the licensee plans to use and discuss its implementation at the licensee’s station. Upon favorable consideration of the letter request, the Audio Division will issue a modified station license indicating that a waiver has been granted to permit use of a specific MDCL technology, resulting in the variation of transmitter power to levels below 90 percent of the station’s nominal licensed power.⁸ We will require, however, that the transmitter achieve full licensed power at some audio input level, or when the MDCL is temporarily disabled.”

Please refer to the public notice for full details. The public notice is available here:

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Q. What algorithm does Nautel support?

AMC, DCC and DAM.

Q. I own a Nautel transmitter, what will I need to do to deploy this technology?

NX transmitters include free power savings technologies as standard. Implementing Amplitude Modulation Companding or Dynamic Carrier Control on a Nautel NX transmitter simply involves selecting the appropriate option on the NX front panel, instructing the built-in DSP based exciter to run the modified carrier algorithm.

Nautel has also developed products for installation with older transmitters that do not have internal signal processing capability. The latest product utilizes an NX series DSP exciter card in a 1U chassis. Modified carrier and audio signals are sent to the host transmitter allowing it to benefit from this technology. Contact Nautel's Customer Service department to learn how to implement this technology on older series transmitters.

Q. My transmitter is not a Nautel, what can I do?

For other manufacturers please contact your vendor to determine what solutions are available or planned.

Q. What has been Nautel's role promoting these power saving techniques?

- Implemented energy saving technologies as a free capability in its NX Series transmitters.
- Tim Hardy presented paper on the subject at the 2009 NAB show.
- Supported successful trials by Chuck Lakaytis in Alaska resulting in a waiver for Alaska broadcasters.
- Petitioned the FCC for broader approval.

Q. What else can I do to reduce my energy costs for AM broadcasting?

Nautel's NX Series offer exceptional energy efficiency and can provide substantial savings compared to older transmitters. For example if your transmitter is 70% efficient then combining both the NX's built-in efficiencies and DCC technology could provide yearly savings of \$40,000 or more for a 50 kW station. Cost savings of this magnitude can repay the capital investment for a new transmitter in just a few years. Over the life of a 50 kW transmitter cost savings easily amount to \$500,000 or more.

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