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# AM Power Savings

## Using IBOC and MDCL together



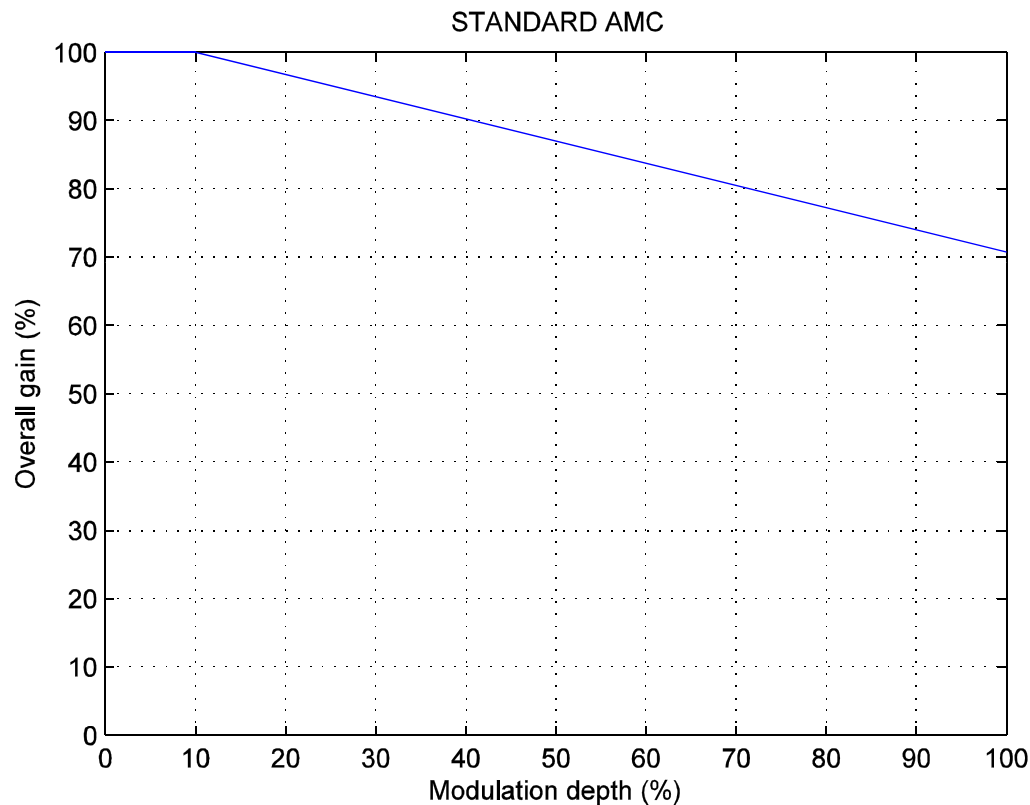
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# Presentation Overview

- Common types of MDCL
  - Amplitude Modulation Comanding (AMC)
  - Dynamic Amplitude Modulation (DAM)
- Implementation on NX (and older products)
- What are the implications?
  - Typical power reduction
  - Spectral mask concerns
  - Will your listeners notice?
- Recommendations and conclusions

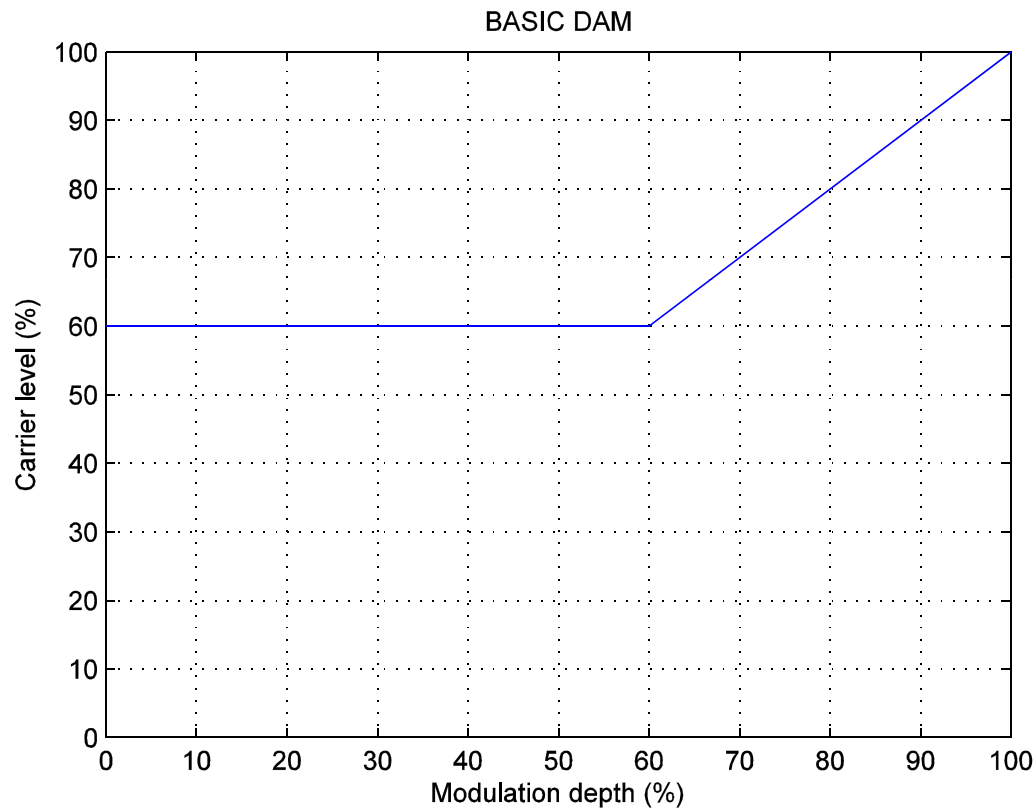


# Amplitude Modulation Compressing (AMC)



- Reduces overall gain on envelope signal at high mod
- Relatively inaudible to the listener
- Tends to maintain high SNR on received signal

# Dynamic Amplitude Modulation (DAM)



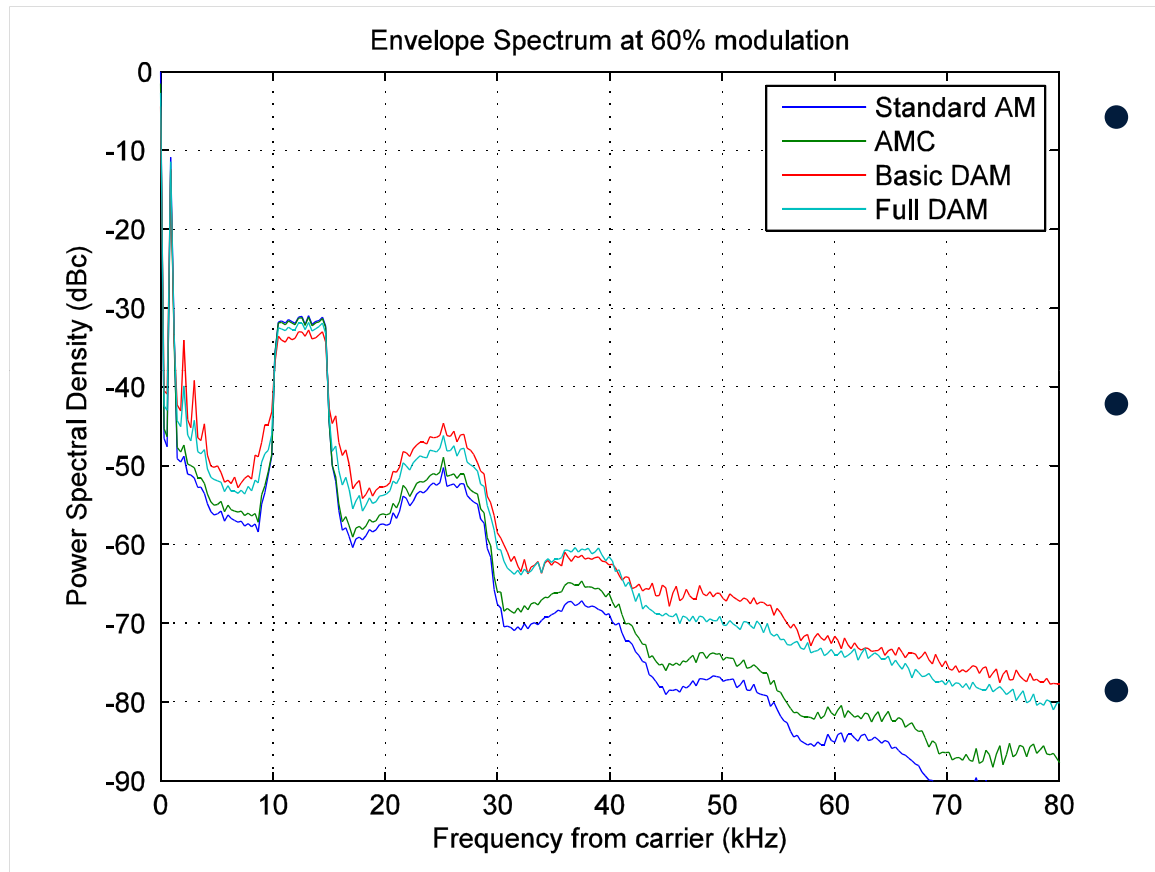
- Reduces carrier only at low mod – sidebands are unchanged
- Boosts received audio at low mod
- Can result in higher savings if less processed audio is used

# NX MDCL Implementation

- MDCL techniques are implemented digitally in the NX exciter
  - Precise peak control
  - Allows adjustable compression and different curves
- The MDCL-modified signal from the NX exciter is used to replace the carrier from the Engine
  - Any technique can be used without requiring Iqivity software support
  - Added benefit of removing the reliance of the analog AM on the IBOC equipment



# What does adding HD do to the AM?



- Envelope bandwidth is increased
- To an AM receiver, looks like additional noise
- Effect is worse with DAM

# Typical power reductions

MDCL	Carrier	Mod	IBOC	Total	Savings
AM	50	2.62	2.84	55.46	0%
AMC	32.81	1.72	2.84	36.39	34.4%
Basic DAM	30.18	2.62	2.84	35.64	35.7%
Full DAM	40.04	2.62	2.84	45.50	18.0%

- Savings of 20-30% can be realized

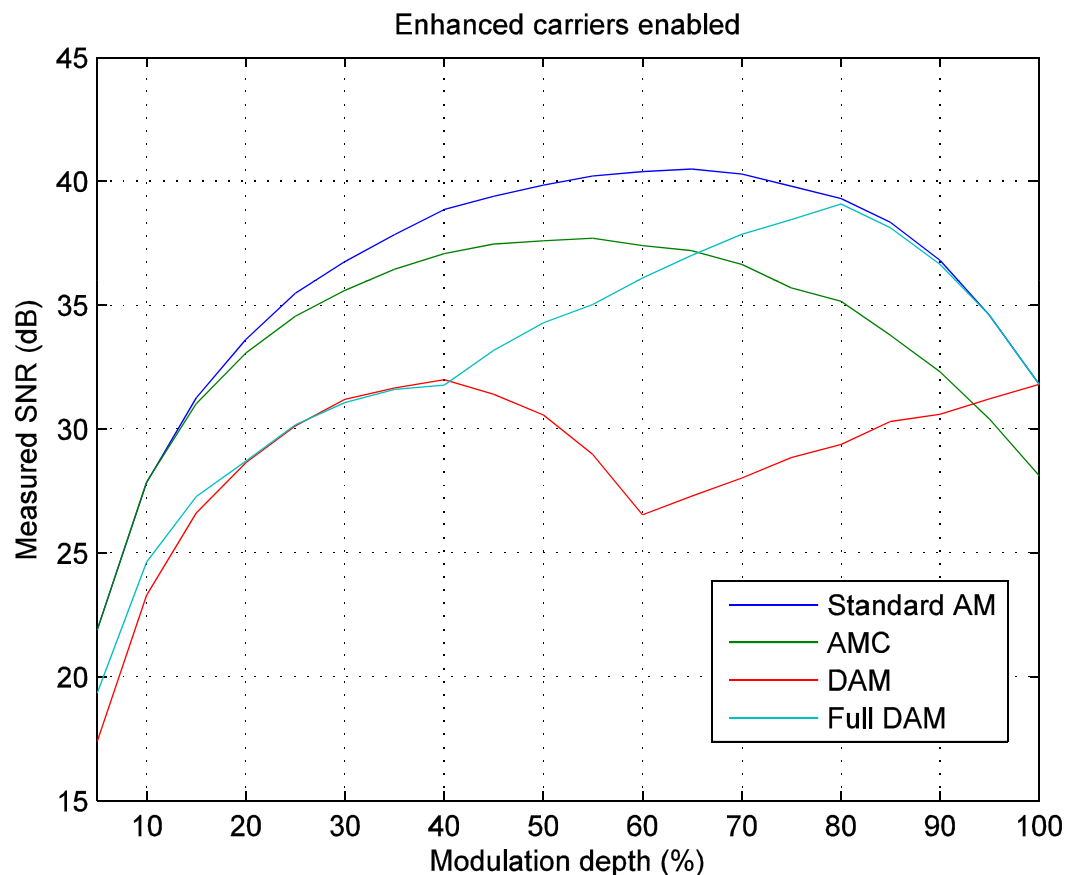


# Spectral mask compliance

- Decreasing the carrier is effectively the same as elevating the carriers to the transmitter
- This effect is worse for DAM
  - AMC decreases the gain on the envelope signal during peaks and troughs
  - DAM decreases the carrier when at lower mod depths, effectively increasing mod depth
  - The majority of spectral regrowth energy occurs due to distortion in the troughs

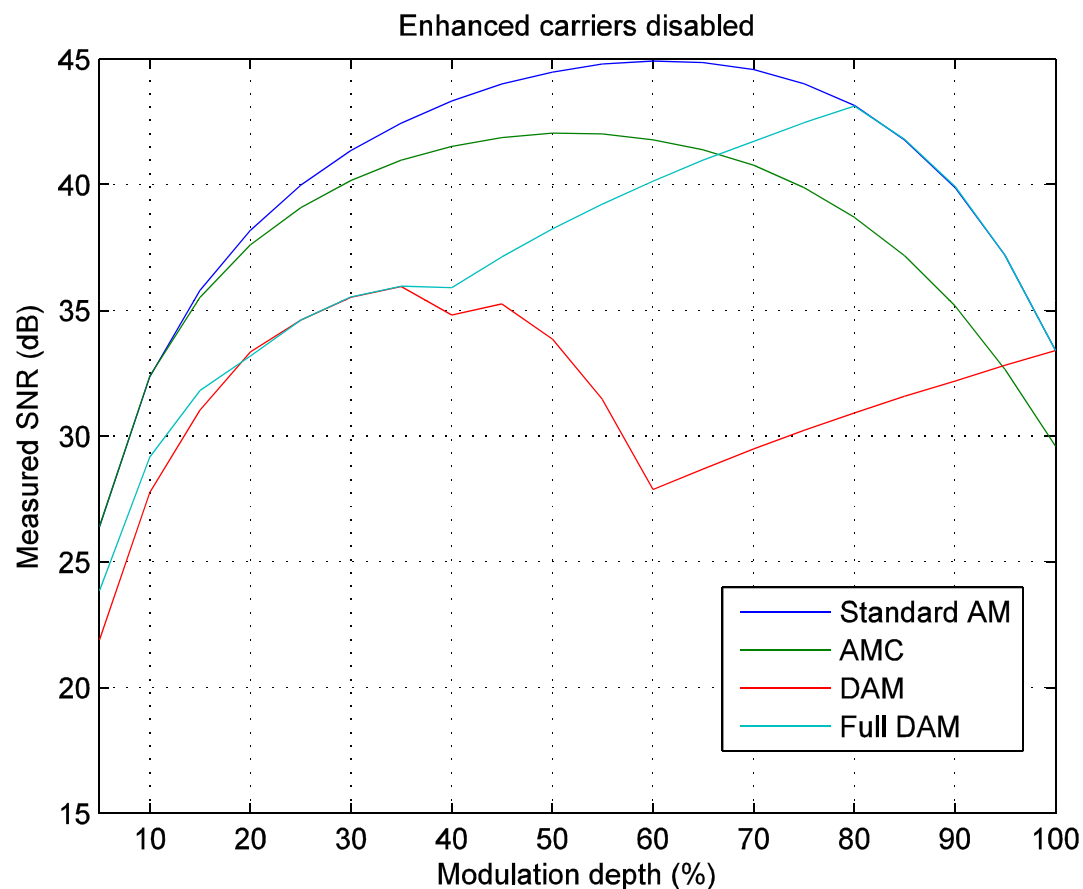


# Audio quality measurements: enhanced carriers on



- Standard AM is the best, as expected, but AMC is close
- SNR is worst at high and low mod depths
- DAM emphasizes peaks and troughs, resulting in more audible artifacts

# Audio quality measurements: enhanced carriers off



- Boosts the received SNR by 4-5 dB
- Makes up for the lost SNR from MDCL
- Reduces audible impact of IBOC

# Conclusions

- AMC offers the most benefit when used with IBOC
- If turning on MDCL:
  - Spectral compliance must be rechecked
  - Audio quality should be reevaluated
  - If possible, enhanced carriers should be disabled
- Significant power savings of 20-30% are possible

NXSeries **MW**

**25kW – 2.0MW**



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# Thank You



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