

# ADAPTIVE MODULATION

## Benefits and Challenges

- Thomas Willis – AT&T Labs (Moderator)
- Scott Nelson – Alcatel-Lucent
- Scott Sweetland – Ceragon Networks, Inc.
- Peter Staxen – Ericsson
- Jim Wolfson – X-Dot, Inc.

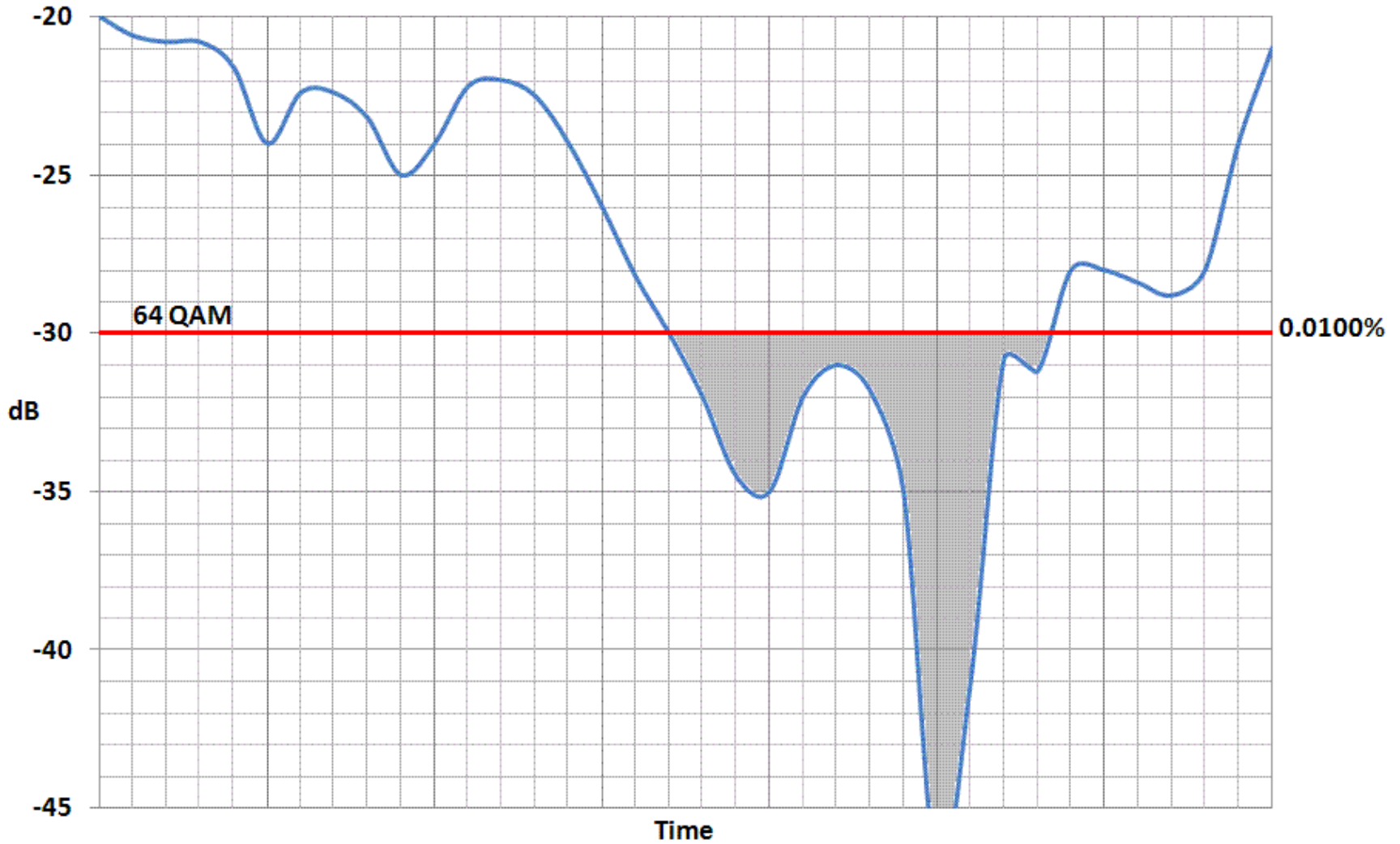
# Background 1

- Conventional radio modulation is determined by required throughput and RF channel bandwidth.
- New IP packet radios do not have a fixed required throughput.
- Packet radios can trade throughput for link budget with adaptive modulation using the same channel bandwidth.
- Packet radios with adaptive modulation have a variable link budget and variable spectral efficiency.

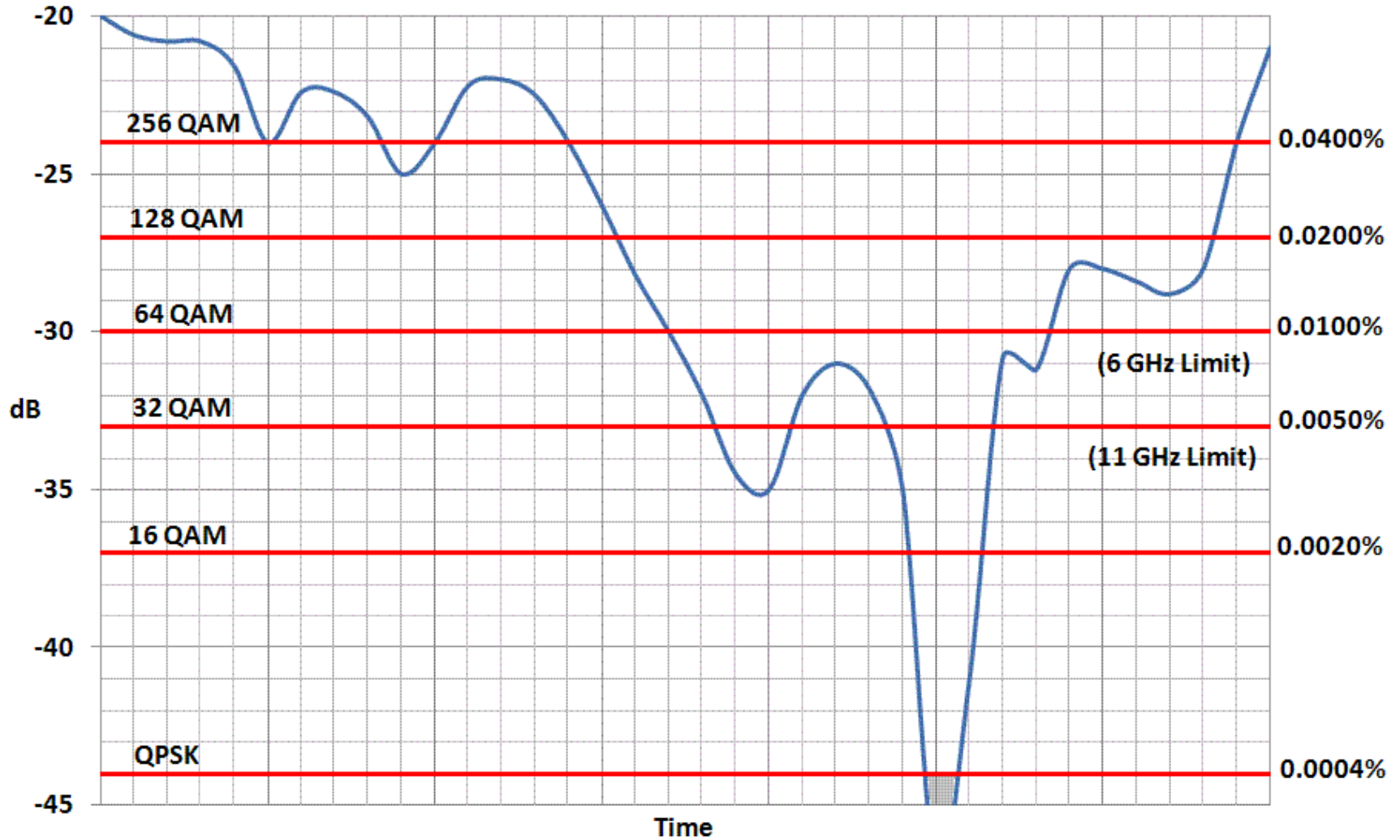
## Background 2

- Link budget can be improved with lower order modulation because:
  1. Required received S/N is lower thus improving receiver sensitivity
  2. Relaxed linearity requirements on the transmitter can allow for increased transmit power
- The improved link budget comes at the cost of throughput and spectral efficiency however.

## Conventional Fixed Rate Radio Fade Event



## Packet Radio Adaptive Modulation Fade Event



# Summary

- Adaptive Modulation is a useful tool.
- How should spectral efficiency concerns be addressed with this technology?
- What about potential interference from increased transmit power at low order modulation?
- NSMA WG-3 is actively examining these issues.  
(next meeting will be held here tomorrow morning)

