ADAPTIVE MODULATION

Benefits and Challenges

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- Scott Nelson – Alcatel-Lucent
- Scott Sweetland – Ceragon Networks, Inc.
- Peter Staxen – Ericsson
- Jim Wolfson – X-Dot, Inc.

Background 1

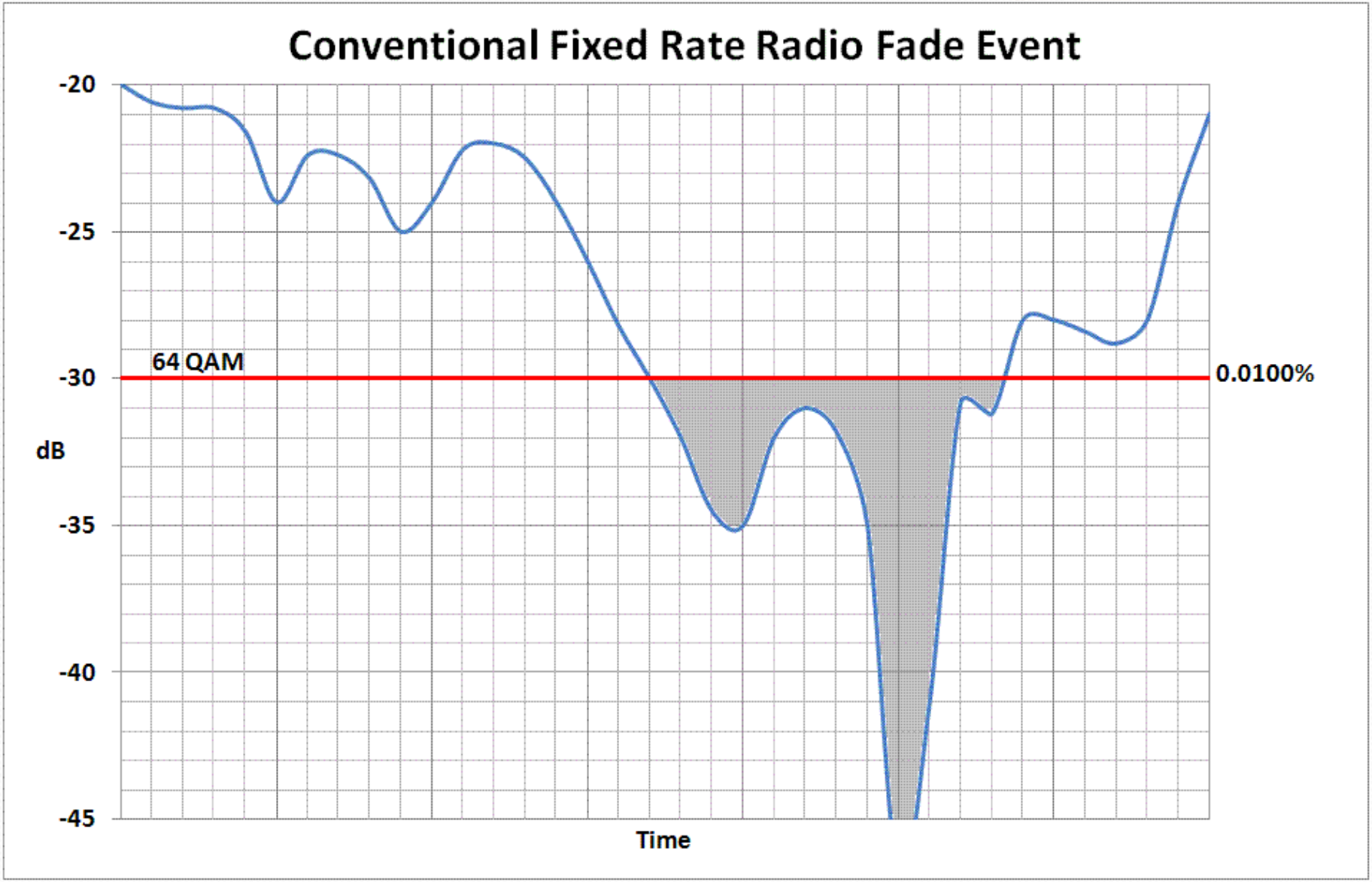
- Conventional radio modulation is determined by required throughput and RF channel bandwidth.
- New IP packet radios do not have a fixed required throughput.
- Packet radios can trade throughput for link budget with adaptive modulation using the same channel bandwidth.
- Packet radios with adaptive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

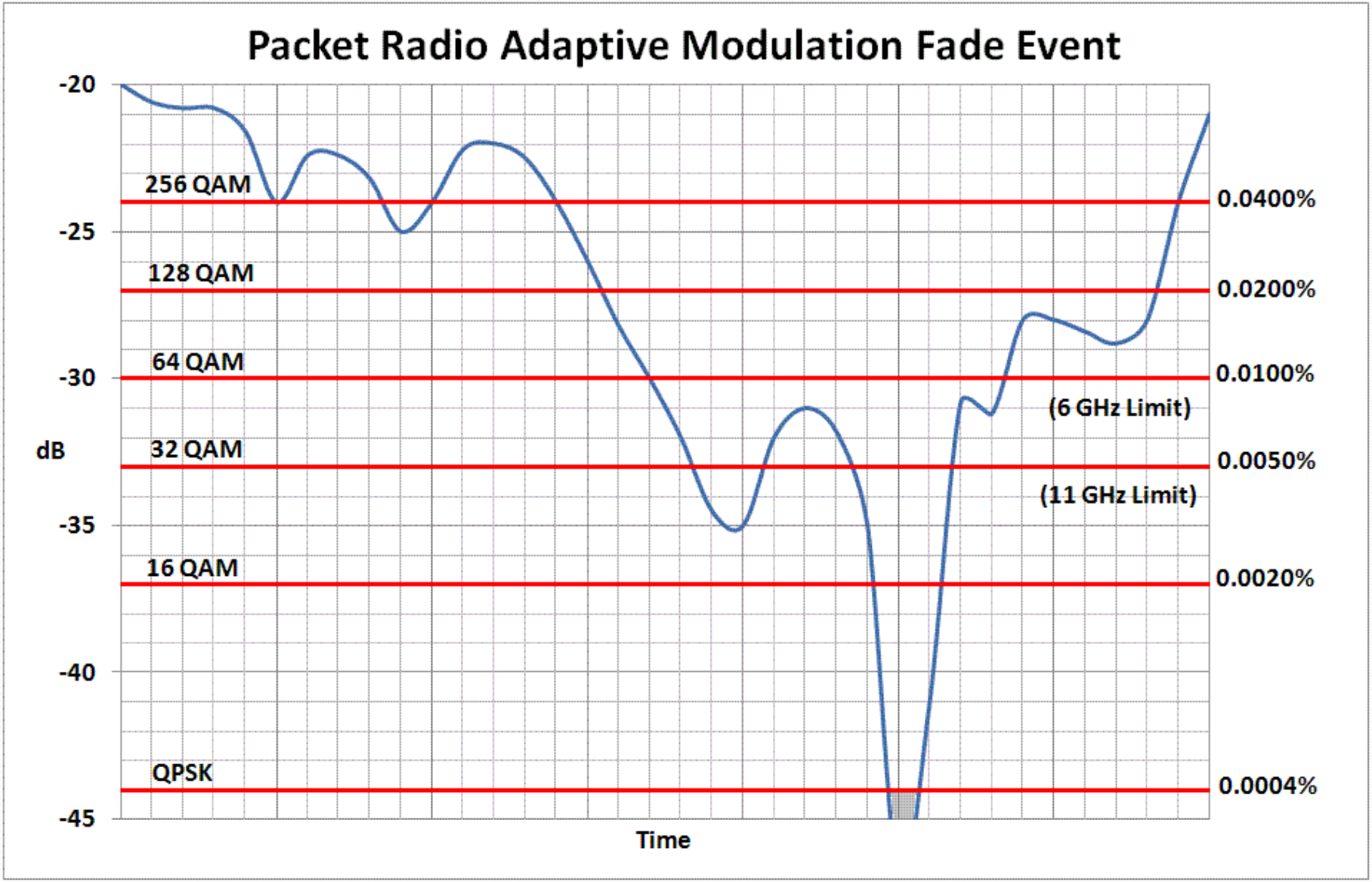
Background 2

- 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
-20
-25
-30
-35
-40
-45
dB
64 QAM
0.0100%
Time


Packet Radio Adaptive Modulation Fade Event
-20
-25
-30
-35
-40
-45
dB
256 QAM
128 QAM
64 QAM
32 QAM
16 QAM
QPSK
0.0400%
0.0200%
0.0100%
0.0050%
0.0020%
0.0004%
(6 GHz Limit)
(11 GHz Limit)
Time

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)