# Guard Band Requirements

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# How to Size the Guard Band?

- **The guard band is composed of multiple parts:**
  - Clock drift allowance + Path change allowance (thermal drift) – 16nSec resolution
  - Max(Laser on, Laser off)
  - Receiver AGC delay
  - Frequency & phase lock
  - Comma detect – 48nSec
  - Protocol clock resolution – 16nSec

- **What is the dominant contribution?**
  - PMD/PMA performance

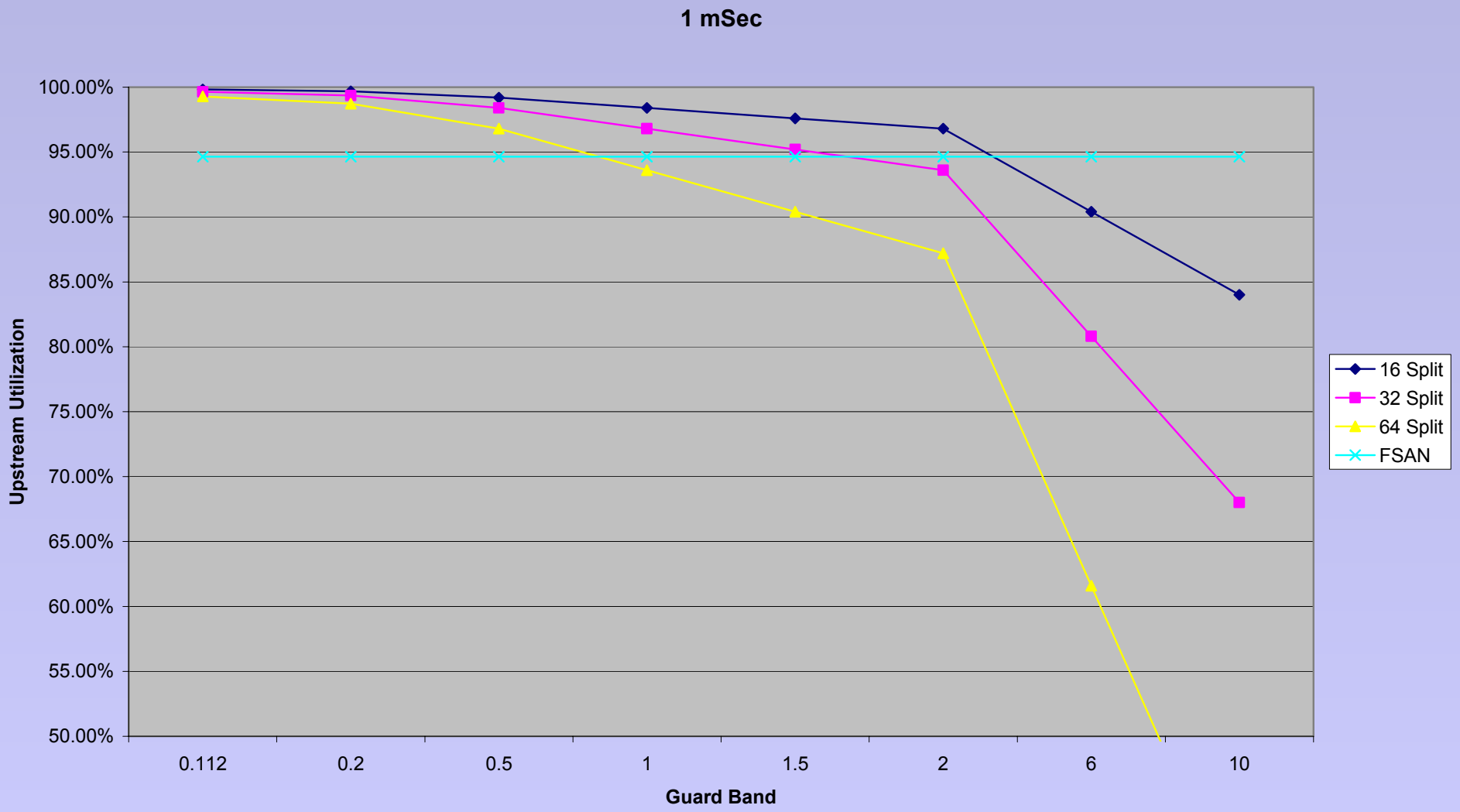
# Reaching the Target Requirement

- **What is the requirement?**
  - Low end-to-end delay
    - Dominant requirement set by TDM services
  - High upstream utilization
    - High for FTTH
    - Very high for FTTB
- **What is good enough?**

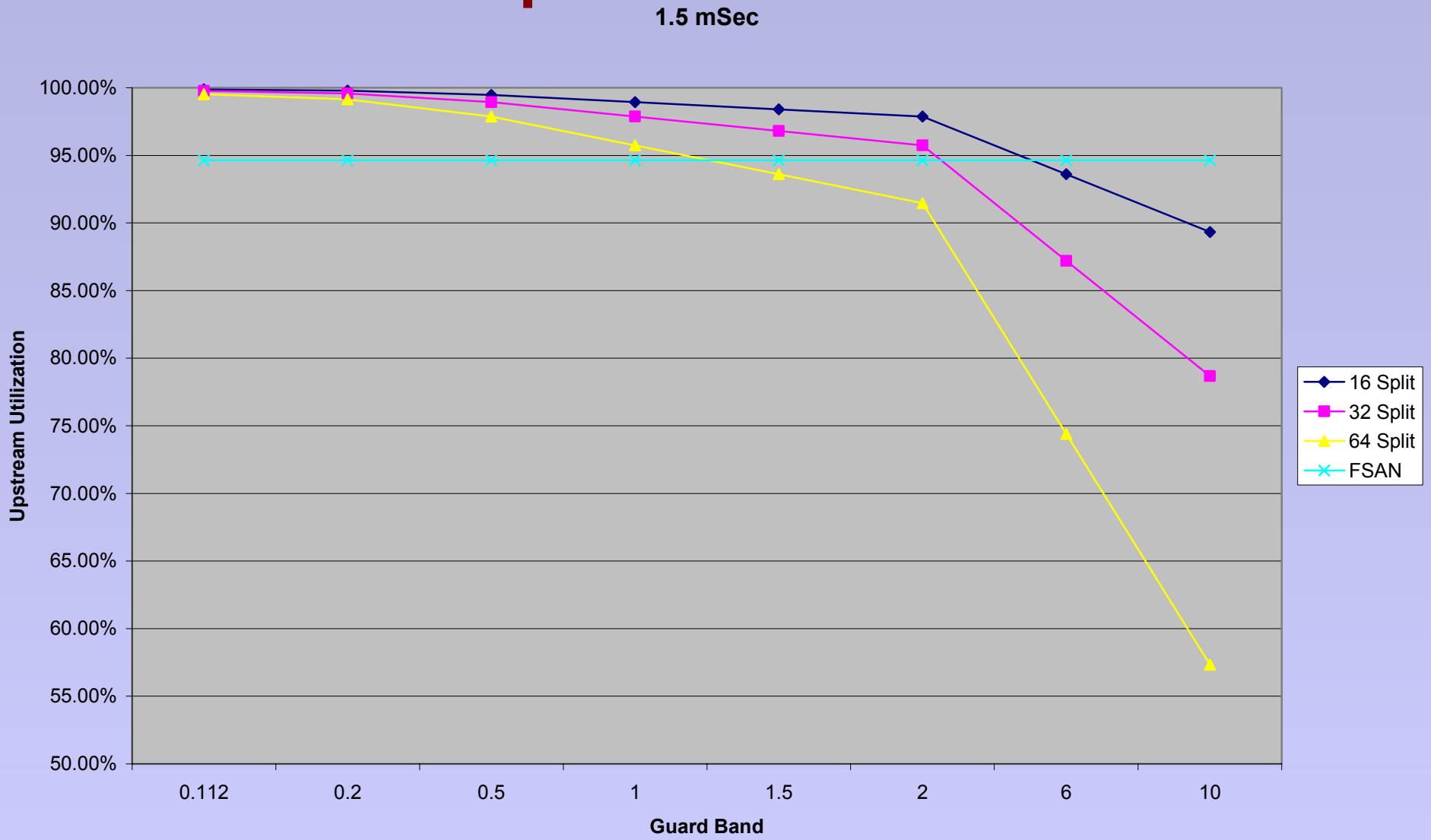
# Utilization

$$Utilization \geq 1 - \frac{GuardBand * N_{ONU}}{AccessCycle}$$

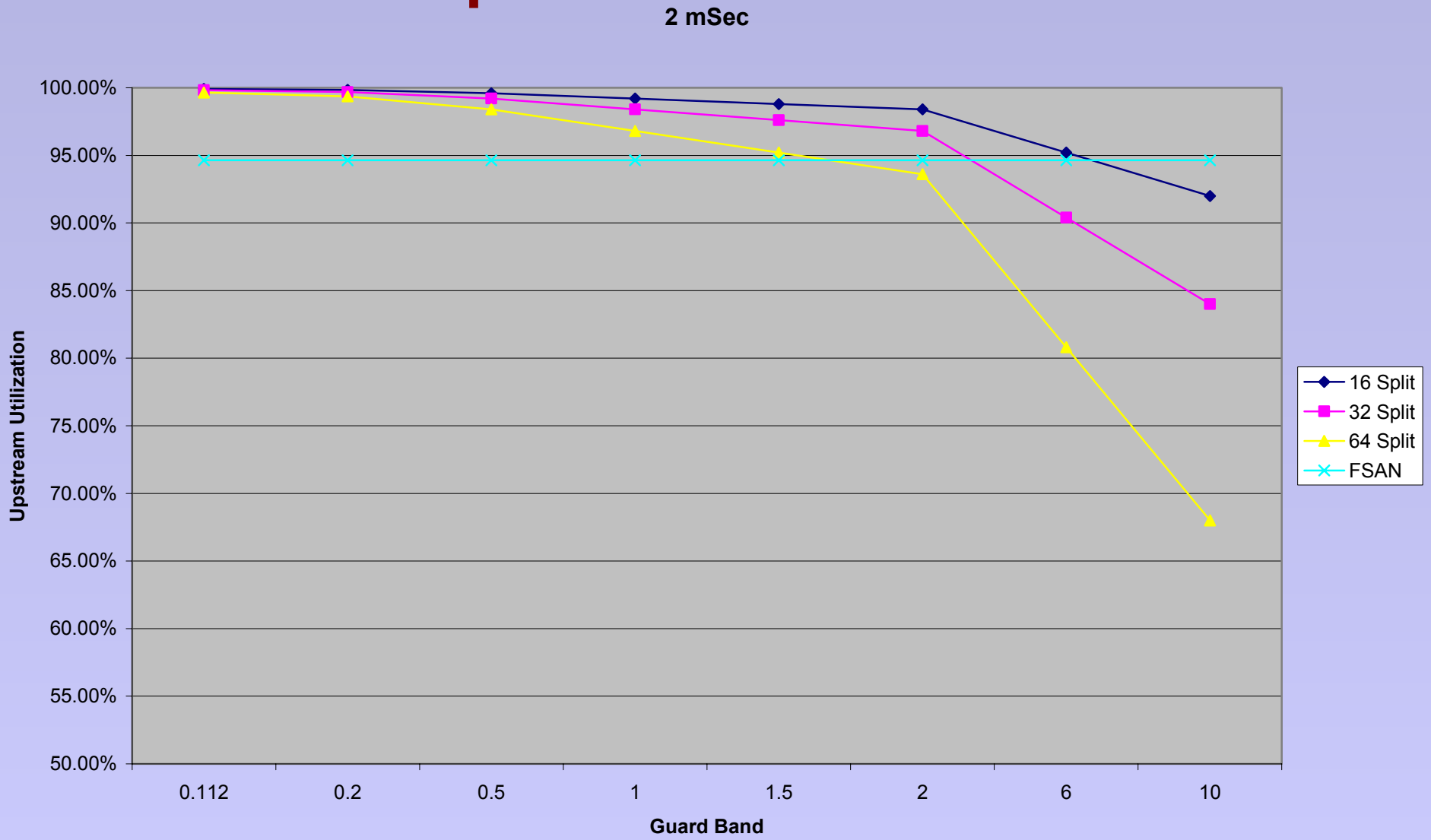
# 1mSec RT Requirement



# 1.5mSec RT Requirement



# 2mSec RT Requirement



# What is Good Enough?

- FSAN gives us 94.6% upstream utilization (prior to cell-tax)
- 1uSec Guard Band is as good or better except in 64 split case
- At least 80nSec imposed by protocol layer

# Two Orders of Magnitude!?

- **900nSec→16nSec change in laser on/off time is two orders of magnitude**
- **Justification: "Physically possible"**

- **Example:**
  - Analysis based on utilization (1mSec RT 1uSec→112nSec):

98.4%→99.82% improvement for 16 split case

96.8%→99.64% improvement for 32 split case

93.6%→99.28% improvement for 64 split case

# Conclusion

- 1uSec guard band gives better performance than FSAN up to 32 splits
- Guard band should be standardized on 1.5uSec to match FSAN
- Decreasing guard band does not improve performance in any significant parameter
- Utilization good enough to unify FTTH with FTTB
- Cost can only go up