

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
 - Comma detect – 48nSec
 - Protocol clock resolution – 32nSec
 - Max(Laser on, Laser off)
 - Receiver AGC delay

- **What is the dominant contribution?**
 - PMD 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

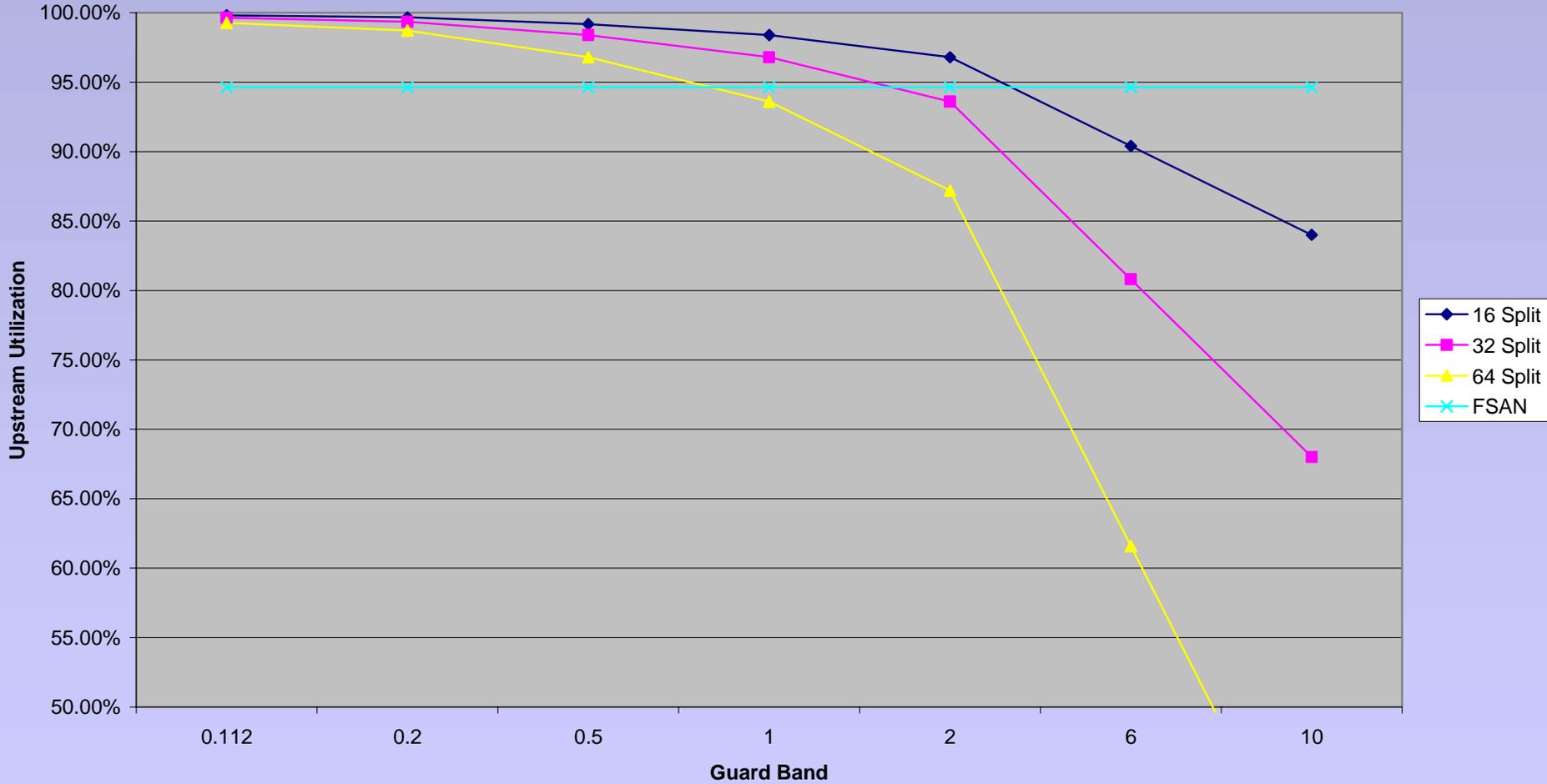
□ What is good enough?

Utilization

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

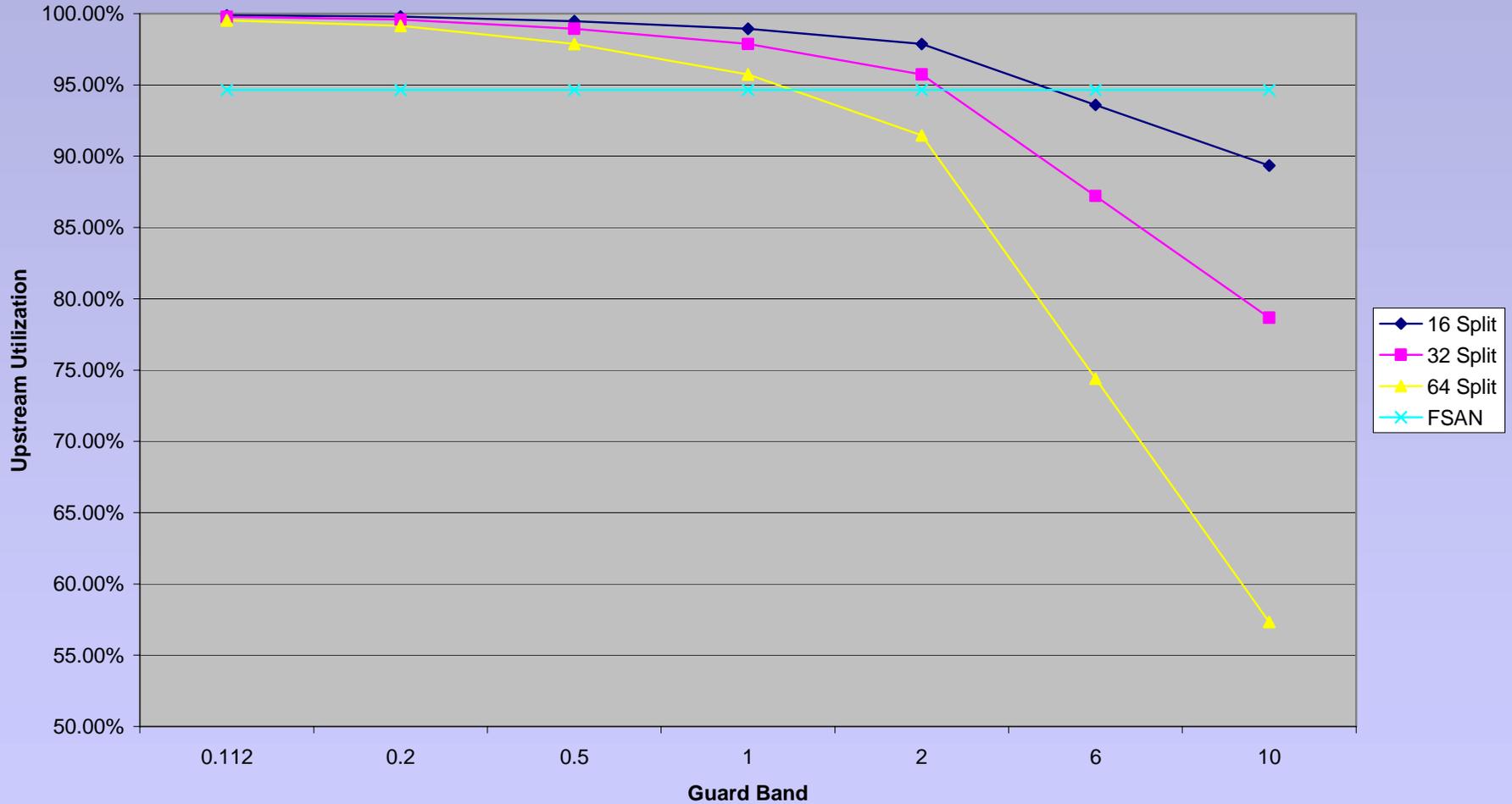
1mSec RT Requirement

1 mSec



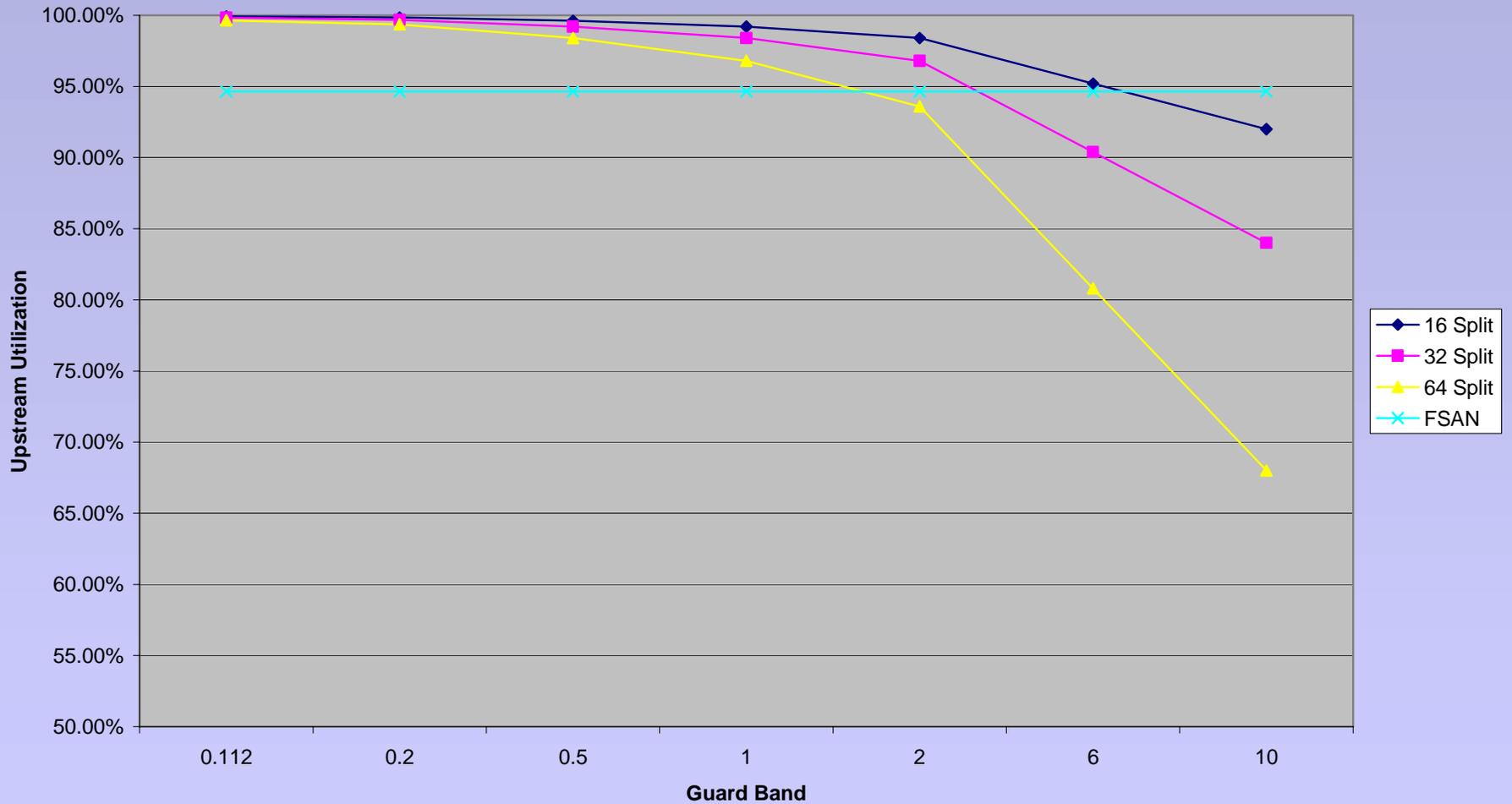
1.5mSec RT Requirement

1.5 mSec



2mSec RT Requirement

2 mSec



What is Good Enough?

- ❑ **FSAN gives us 94.6% upstream utilization**
- ❑ **1uSec Guard Band is as good or better except in 64 split case**
- ❑ **At least 96nSec imposed by protocol layer**

Two Orders of Magnitude!?

- **900nSec→8nSec change in laser on/off time is two orders of magnitude**
- **Justification: “Physically possible”**
- **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 0.5uSec to 1uSec
- ❑ Decreasing guard band does not improve performance in any significant parameter
- ❑ Utilization good enough to unify FTTH with FTTB
- ❑ Cost can only go up