

Upstream Wideband Probe

802.3bn

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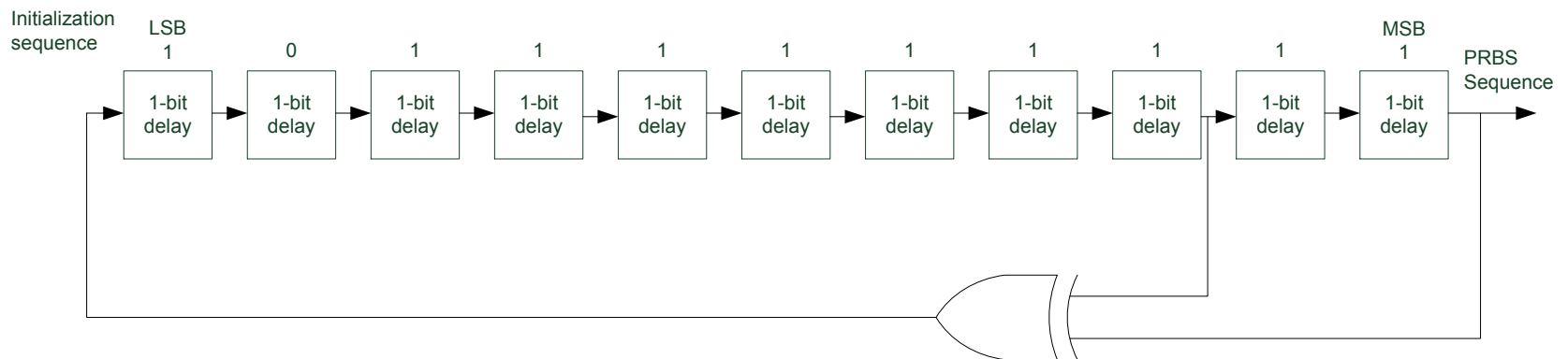
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Wideband Probe Purpose and Requirements

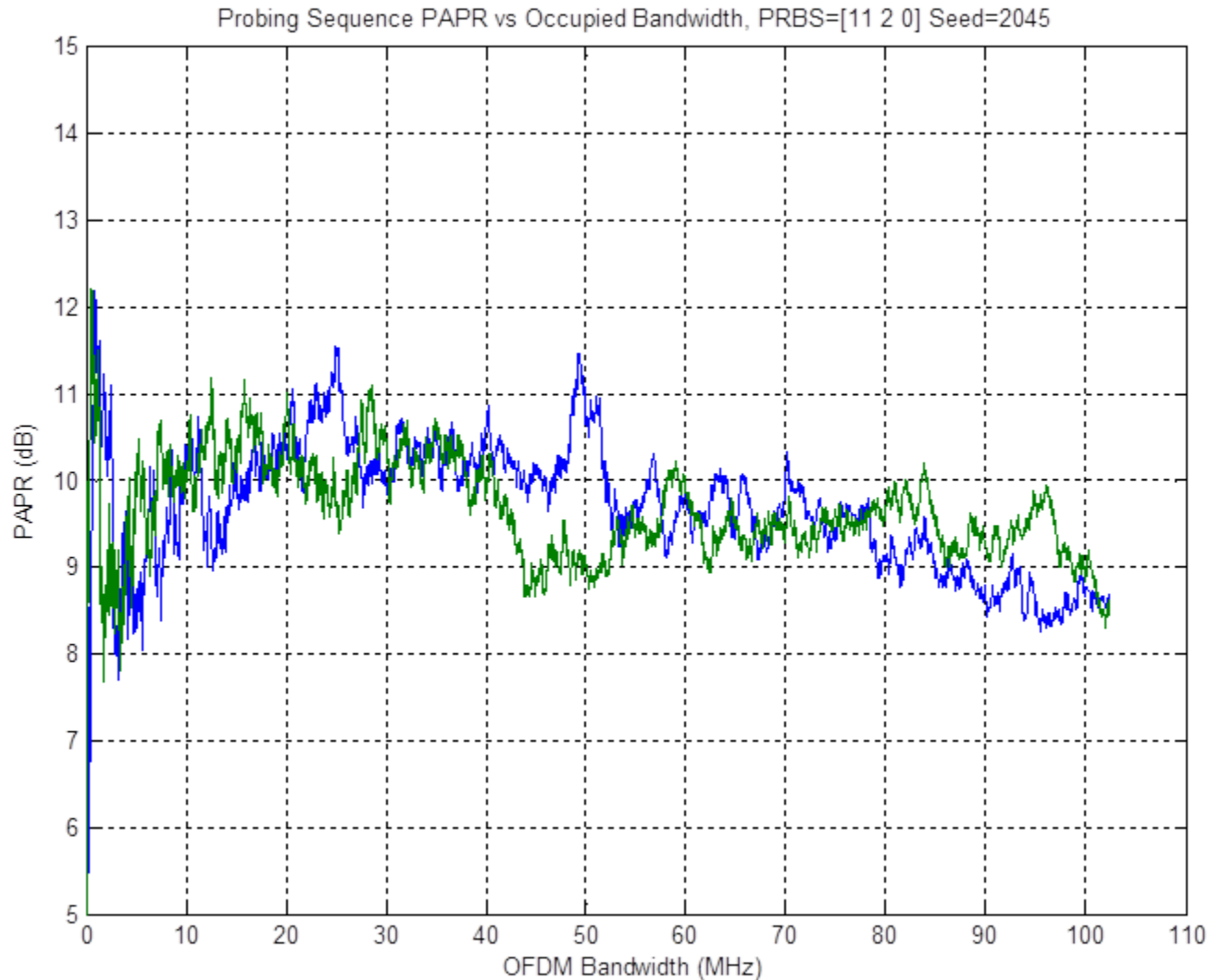
- Purpose:
 - Estimate channel frequency response between each CNU and CLT
 - pre-equalization of CNU transmission
 - fine ranging (by estimating the CE linear phase trend)
- Requirements:
 - Simple generation and detection
 - TX : same process as Pilot generation
 - RX : same process as Channel Estimate
 - PAPR does not change significantly with cyclic shift carrier assignment
 - Specified over all subcarriers. In exclusion band, replace the +1 or -1 by 0 in the sequence.
 - Wideband probe eliminate mag/phase discontinuities from stitching responses from multiple narrowband probes (from phase noise)
 - Low PAPR

Wideband Probe

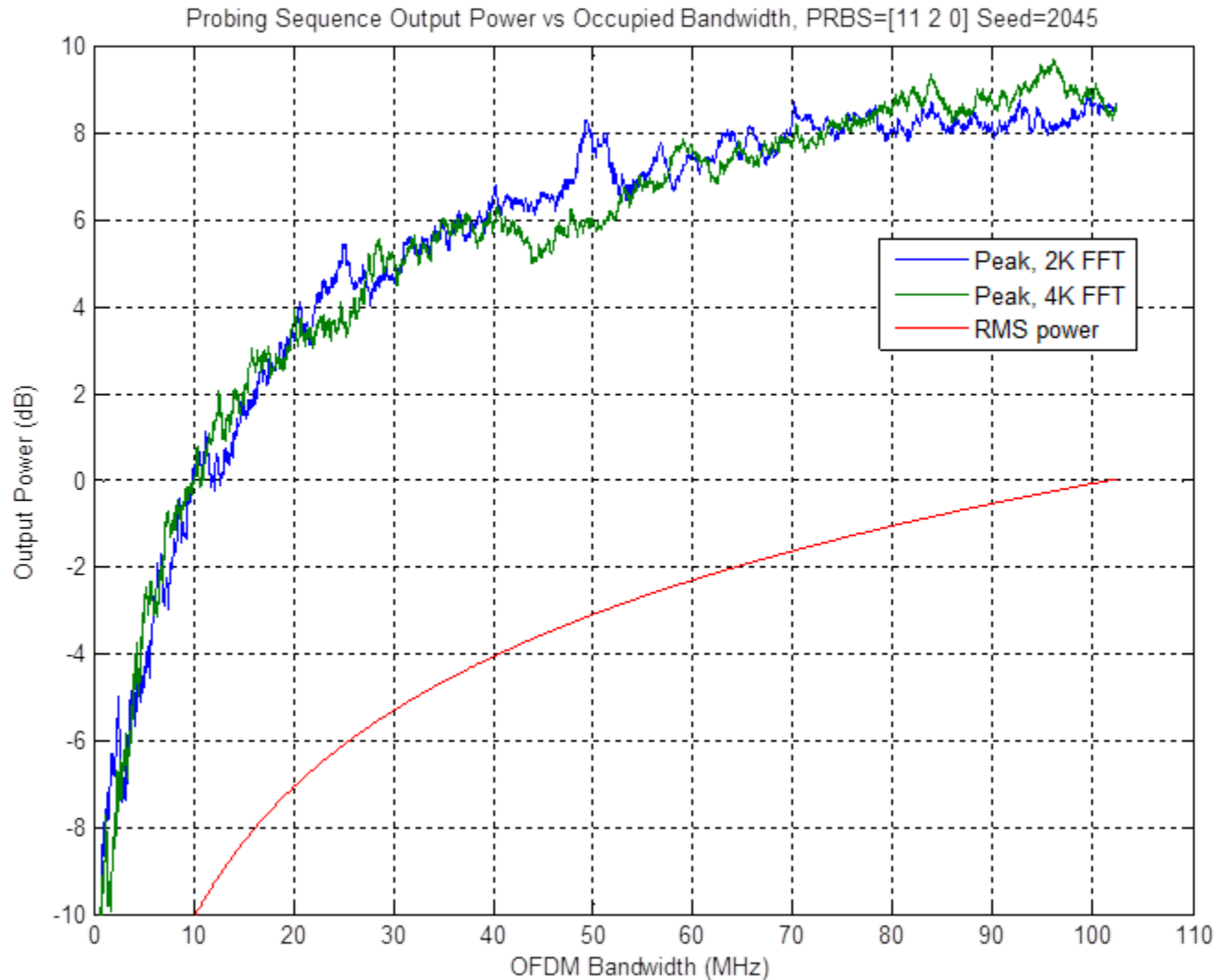
- Polynomial : $X^{11} + X^2 + 1$, Seed = 2045 decimal
- BPSK mapping: $0 \rightarrow 1, 1 \rightarrow -1$
- Sequence mapped to subcarriers in increase frequency order and wrap around to negative frequencies at $N_{\text{fft}}/2$. First bit on first subcarrier at 0 Hz (center frequency).
- 2K FFT sequence
1 1 1 1 1 1 1 1 1 0 1 1 ... 1 0 0 0 0 0 0 0 1 0 1
- 4K FFT sequence
1 1 1 1 1 1 1 1 1 0 1 1 ... 0 0 0 0 0 0 0 1 0 1 1



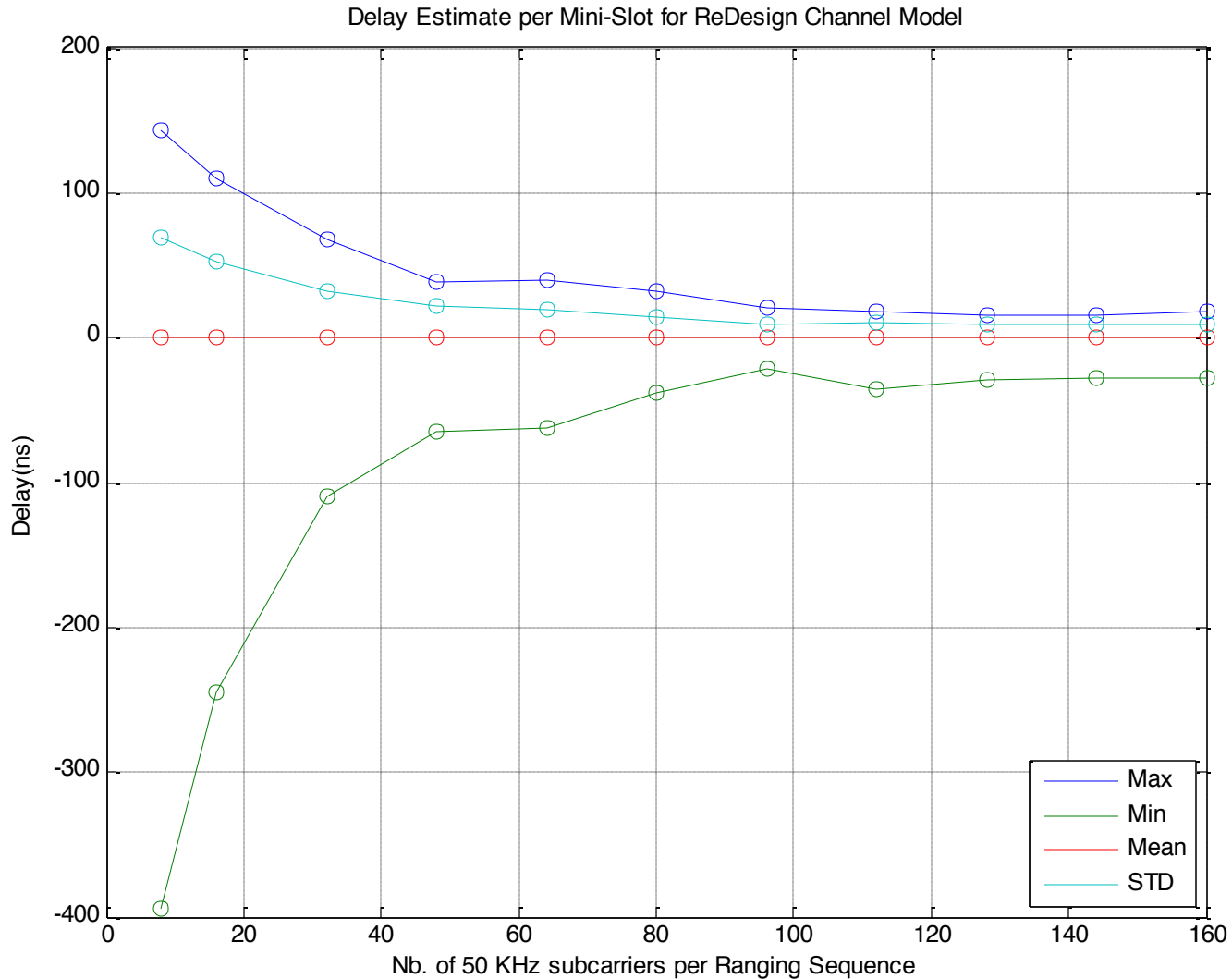
PAPR of 2K (blue) and 4K (green) Probe



Power of Probe vs. Bandwidth



Fine Ranging Estimate vs. Ranging Sequence Bandwidth



Conclusion

- Simple BPSK Ranging sequence for Upstream ranging is proposed:
 - Fine ranging of CLT
 - Power adjustment
 - Channel estimation for CNU pre-equalization
- Defined for 2K FFT and 4 K FFT
- Sequence exhibit low PAPR
- PAPR does not increase significantly with truncation from the exclusion bands
- Sequence can be extended to 8 K FFT by cyclic shift

QUESTIONS?