Burst Markers in EPoC

Syed Rahman

Introduction

- Burst markers are used to indicate the start and end of each burst
- The burst marker can be a sequence of known pilots.
- To indicate the profile of a burst, a different sequence can be used for each profile.
- One scheme is to use a random sequence as pilots, and use correlation method to detect the sequence.

Introduction

- Packet loss in EPoC will be due to two factors:
  1. Packet loss due to 1E-8 BER requirement
  2. Packet loss due to burst detection error.
- Two sources of burst detection error.
  1. Missing to detect a burst.
  2. False detection of burst. This causes dropping of the existing burst.
- Burst loss rate should include both the false detection and missing detection.
- EPoC target packet loss rate is 1E-5 for US and 1E-6 for DS.
- Cable labs have similar requirements.
- Since a burst has multiple packets, the burst loss rate should be much smaller than packet loss rate.

Proposed burst marker scheme

- In the proposed scheme, a burst marker is formed by combining a fixed pattern of pilot sub-carriers ‘P’, and null (silent) sub-carriers, ’N’, interlaced with each other.
- Locations of P are mutually orthogonal in all burst marker sequences.
- Example of 4 burst marker sequence to represent 4 profiles:

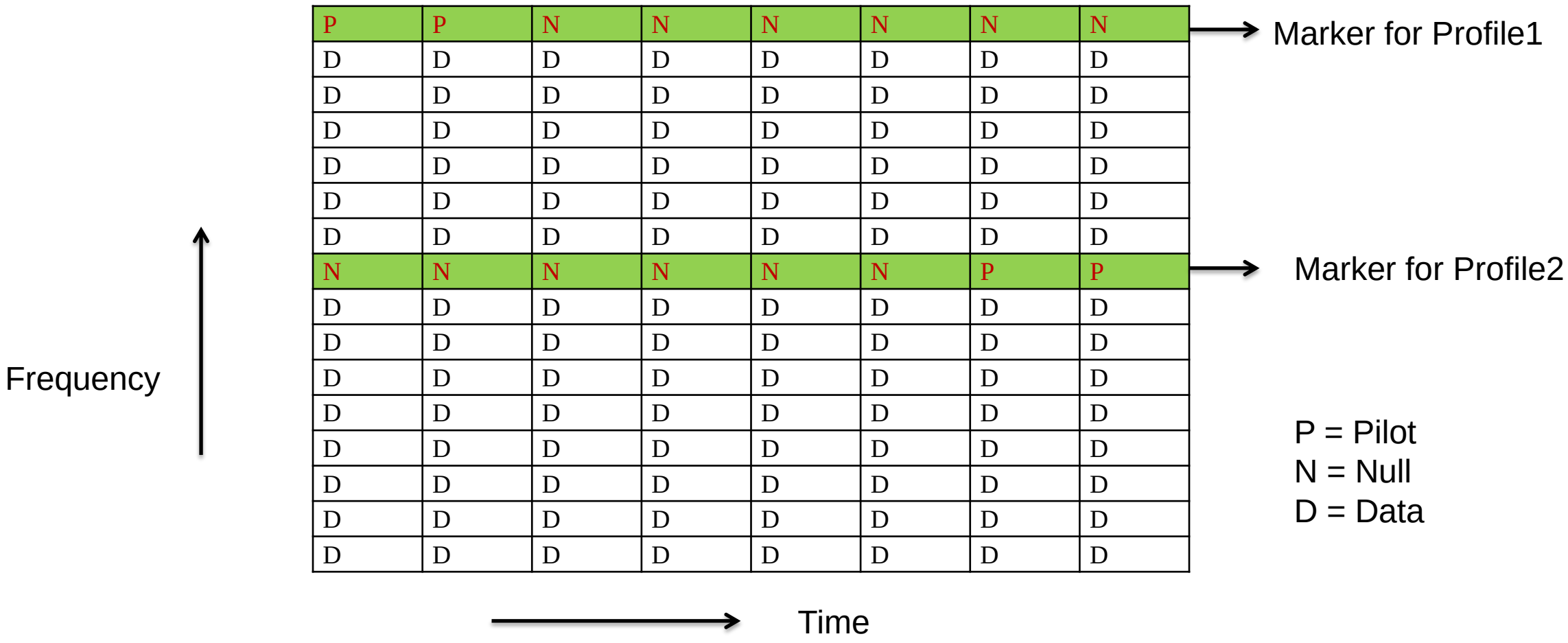
  Burst marker sequence #1 = P, P, N, N, N, N, N, N

  Burst marker sequence#2 = N, N, P, P, N, N, N, N

  Burst marker sequence#3 = N, N, N, N, P, P, N, N

  Burst marker sequence#4 = N, N, N, N, N, N, P, P

Proposed burst marker scheme example



Burst marker detector

- In case of ‘x’ dB signal to noise ratio, the power of a pilot sub-carrier is ‘x’ dB higher than the power of a null sub-carrier.
- This difference in power levels between the pilot symbols and the null symbols is exploited by the receiver for detection of the correct burst marker sequence.

Burst marker detector

- For the case of 4 profiles, the detector computes 4 power ratios, one for each hypothesis.
- The numerator of the power ratio is the sum of powers of two sub-carriers at the locations of the pilots.
- The denominator of the power ratio is the sum of powers of the 4 sub-carriers, at the location of the nulls.

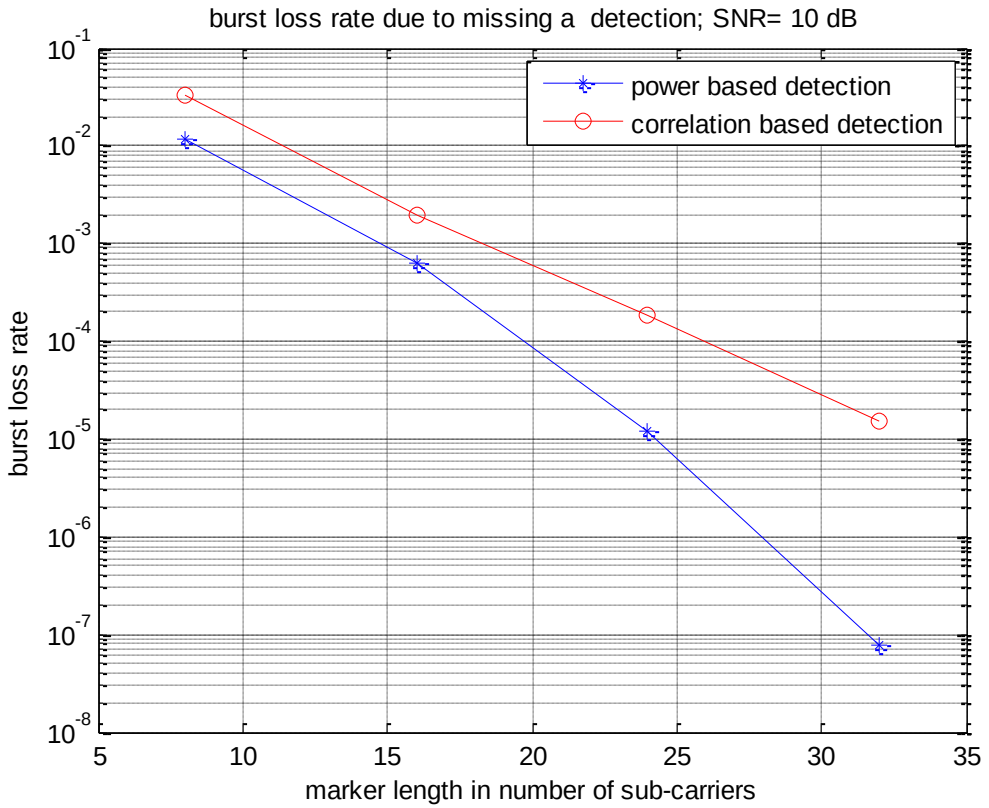
Simulation Results:

- AWGN
- DOCSIS Multipath profile (Valid 97% of the time):

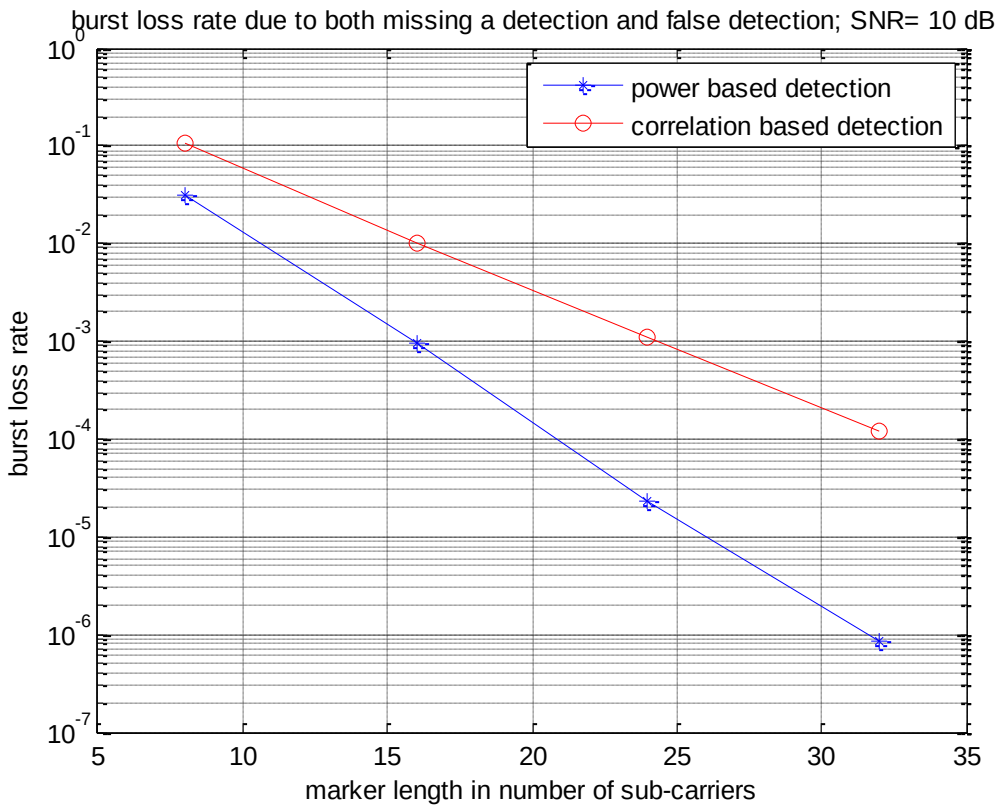
delay = [0.5 1 1.5 2 3 4.5]*1e-6;

pwr_db = [-16 -22 -29 -35 -42 -51];

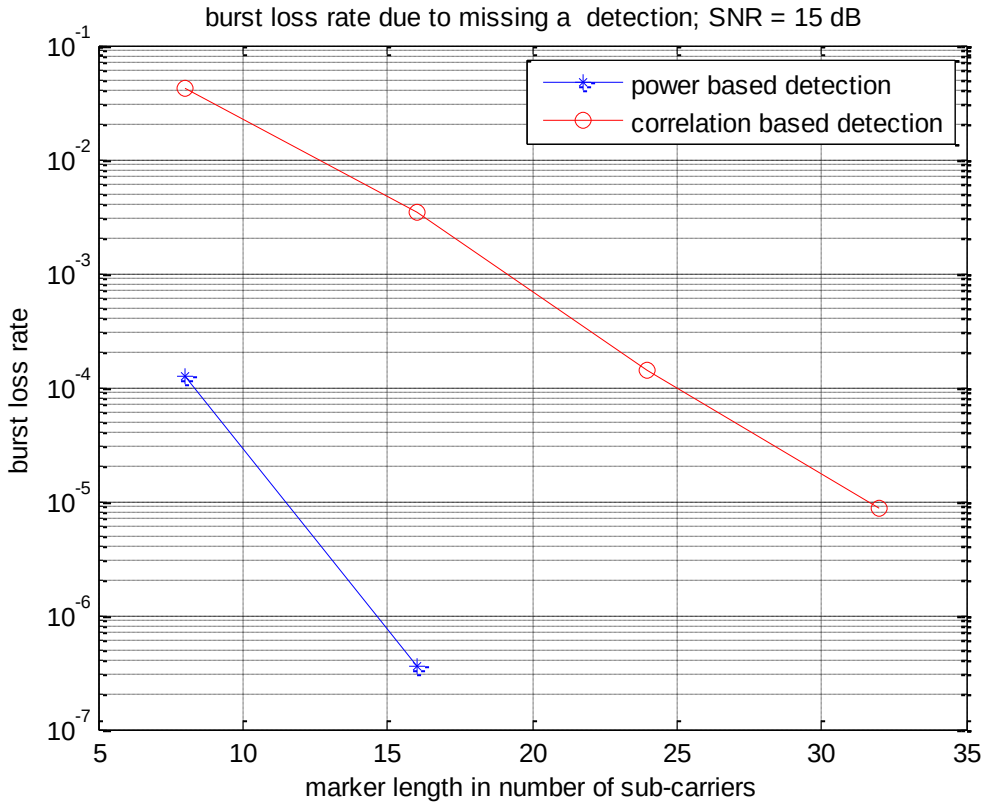
- Carrier frequency offset = 25 Hz
- In the plots a missing data point indicates 100% detection.



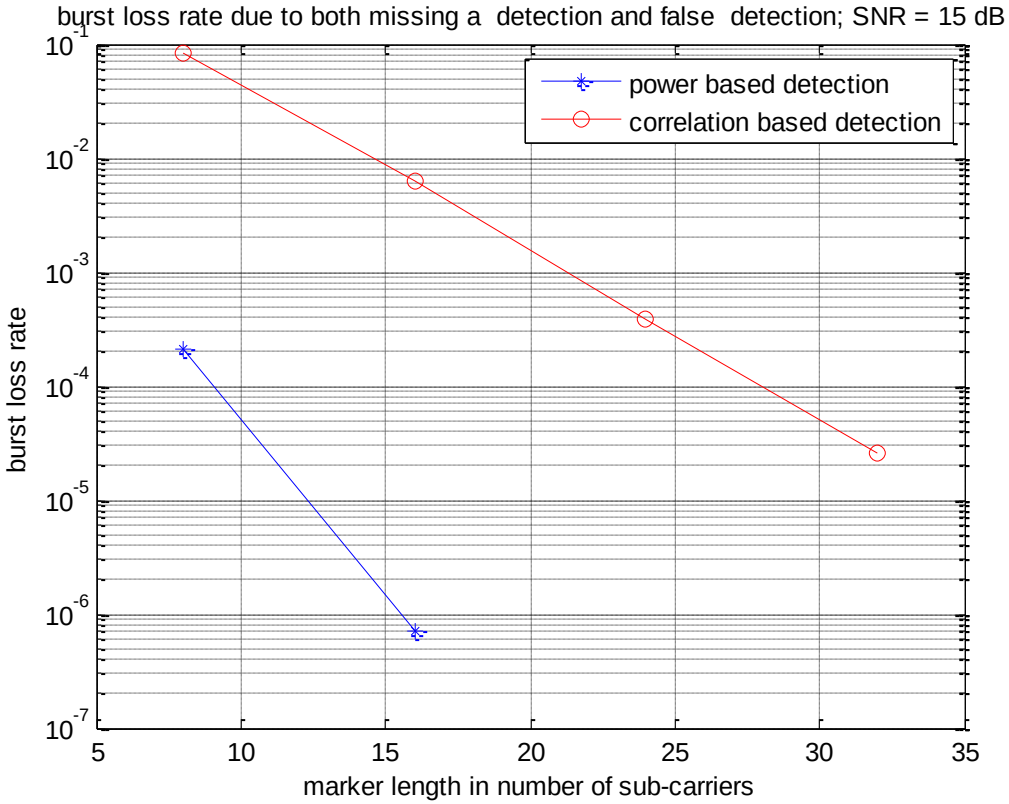
Plot 1A



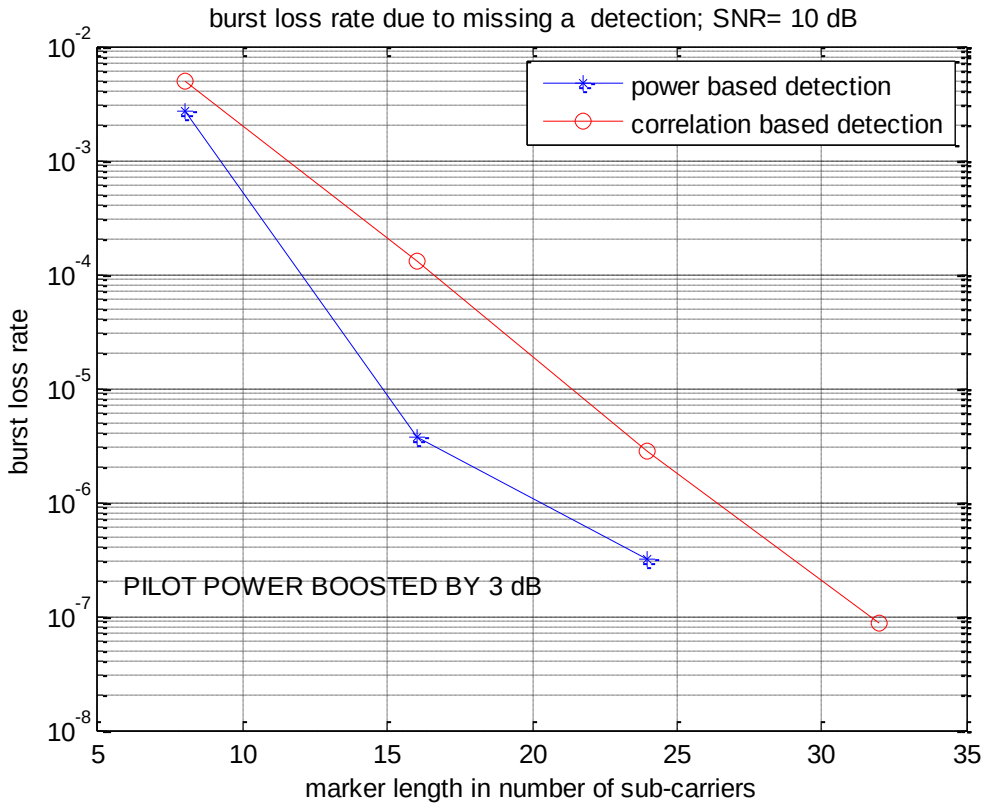
Plot 1B



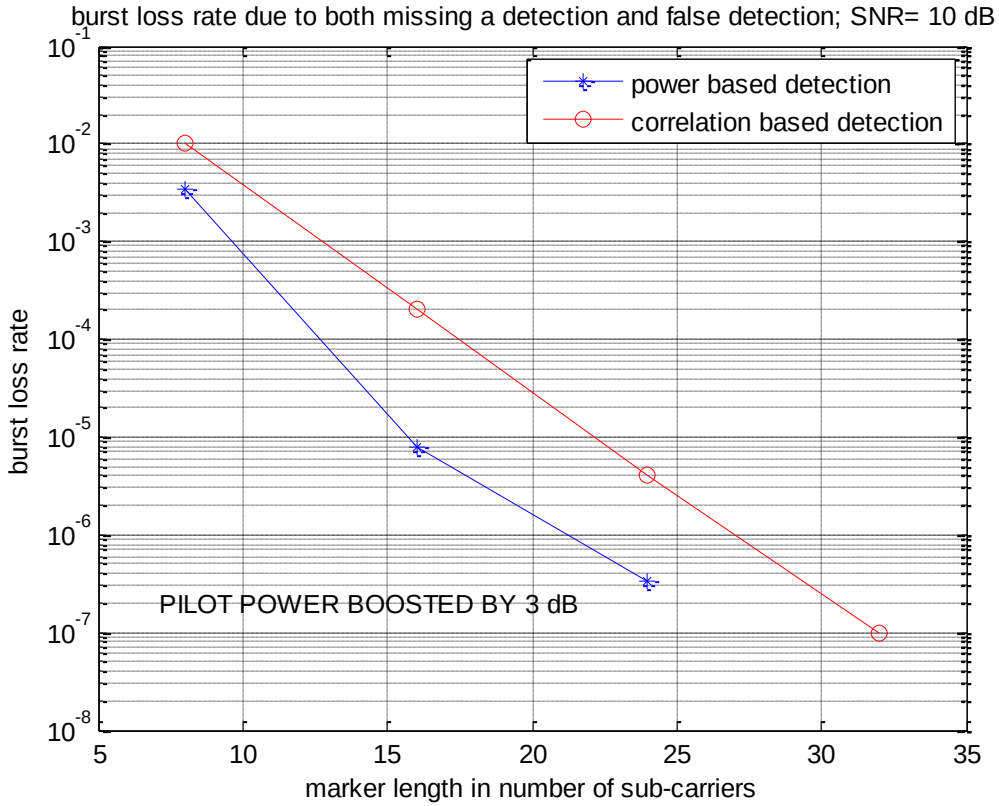
Plot 2A



Plot 2B



Plot 3A



Plot 3B

Conclusion

- Simulation results indicate that the proposed burst marker scheme is superior to the correlation method based burst marker scheme, in all the simulated cases.
- Boosting the power of the pilots by 3 dB, improves the performance by an order of magnitude.

Thank you

www.huawei.com