Update on Burst Marker Detection in EPoC

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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 Pseudo Random Sequence as pilots, and use correlation based method to detect the sequence.

Proposed burst marker scheme

- In the proposed scheme, a burst marker is formed by combining a fixed pattern of pilot resource elements ‘P’, and null (silent) resource elements, ’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:

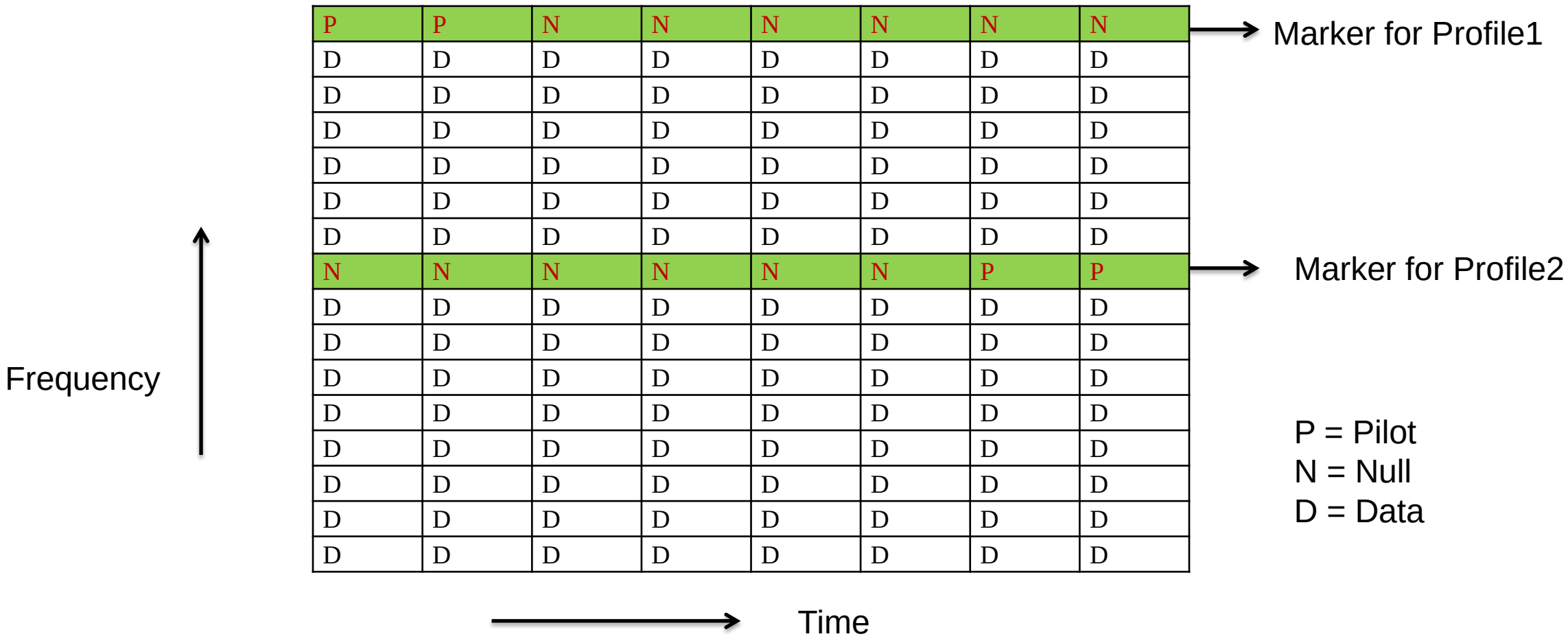
  Burst marker sequence #1 = P, P, N, N, N, N, N, N

  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 resource element is ‘x’ dB higher than the power of a null resource element.
- This difference in power level between the pilot resource element and the null resource element is exploited by the receiver for detection of the correct burst marker sequence.

Burst marker detector

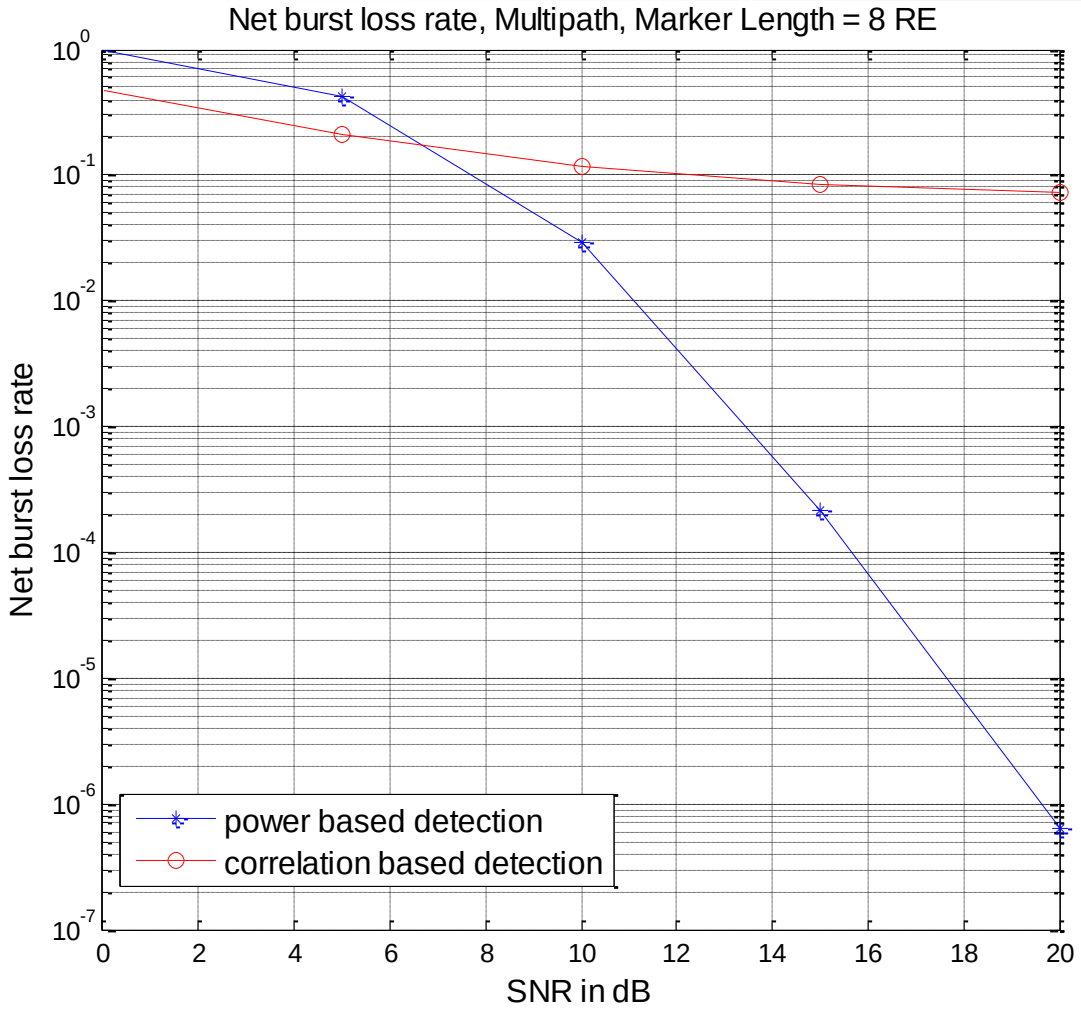
- For the case of 4 profiles, the detector computes 4 power ratios, one for each hypothesis.
- The numerator of the power ratio is the sum of powers of resource elements at the locations of the pilots.
- The denominator of the power ratio is the sum of powers of the resource elements, at the location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

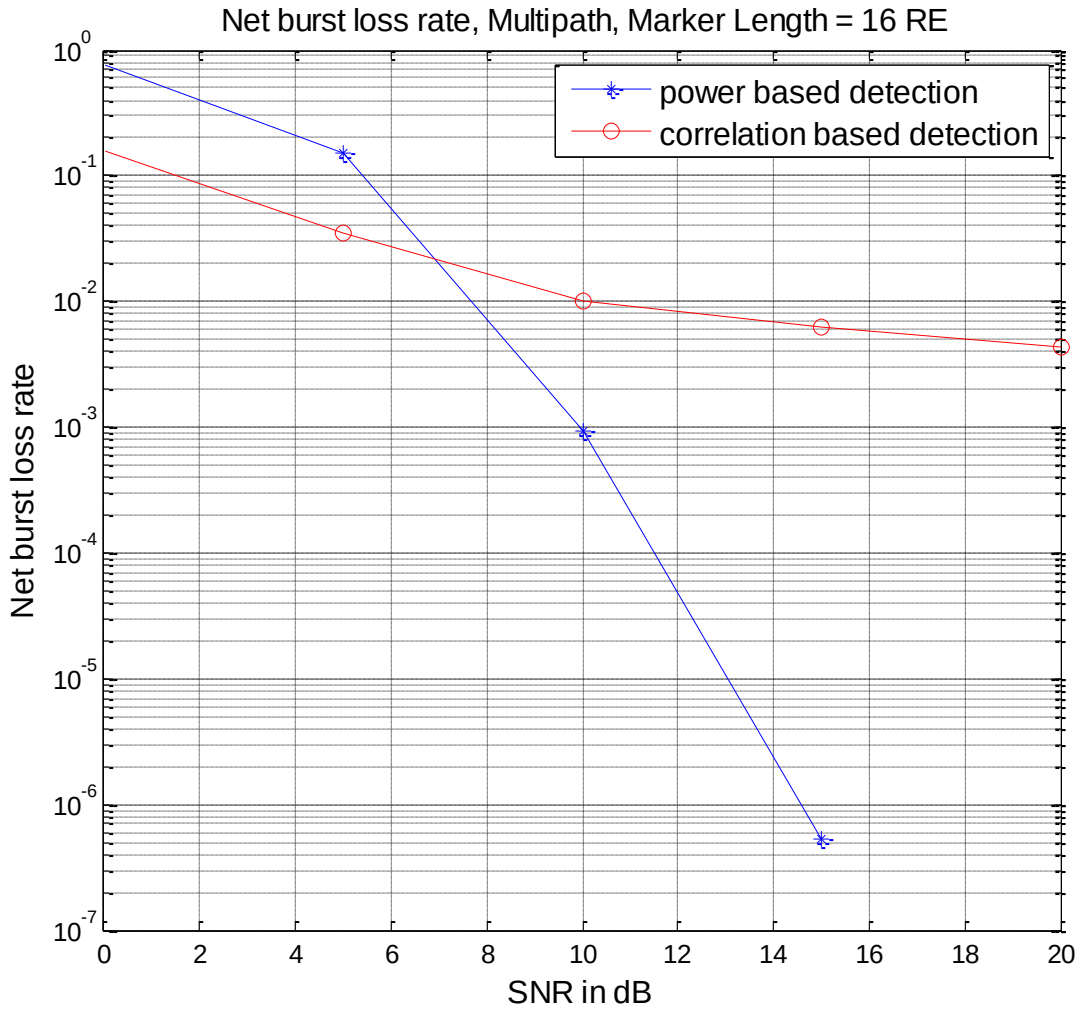
Simulation Results:

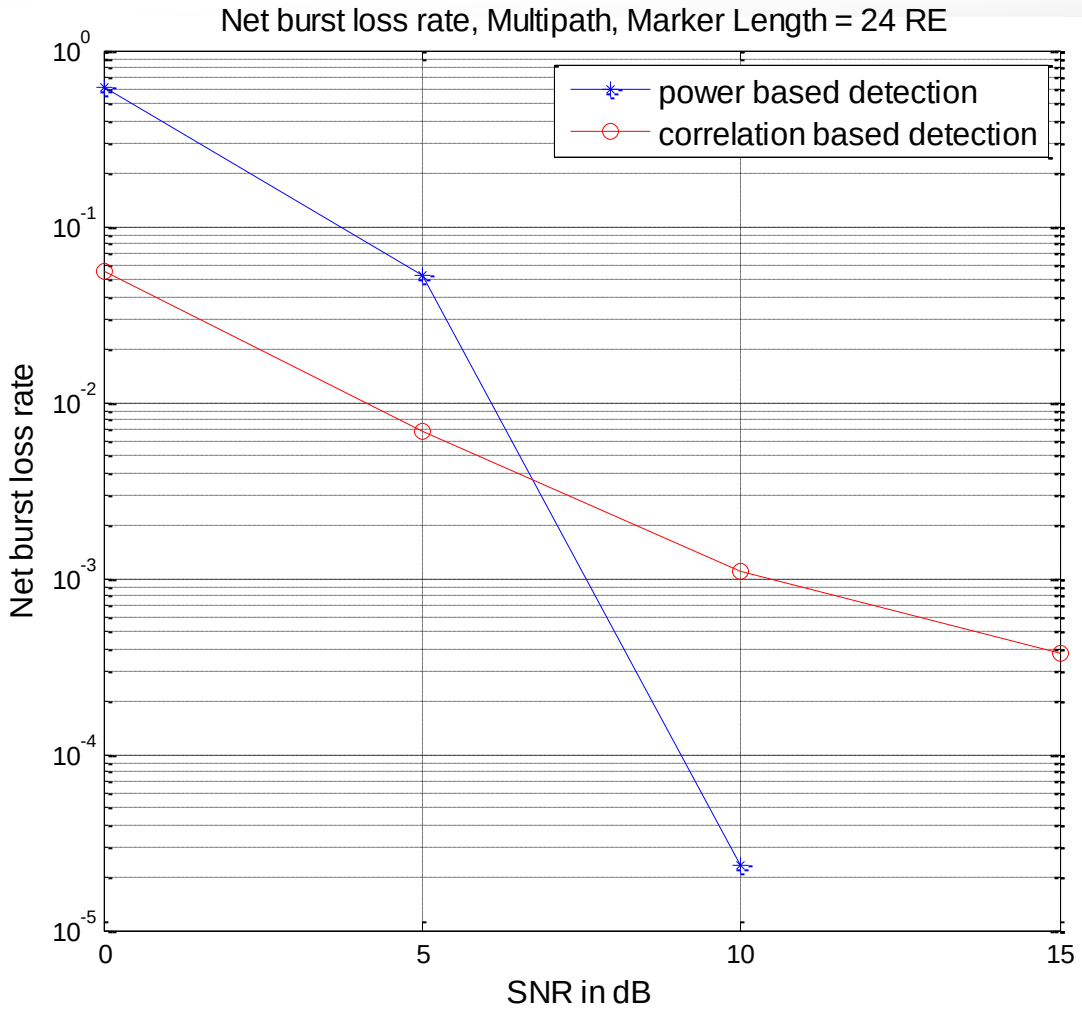
- AWGN
- DOCSIS Multipath profile (Valid 97% of the time):

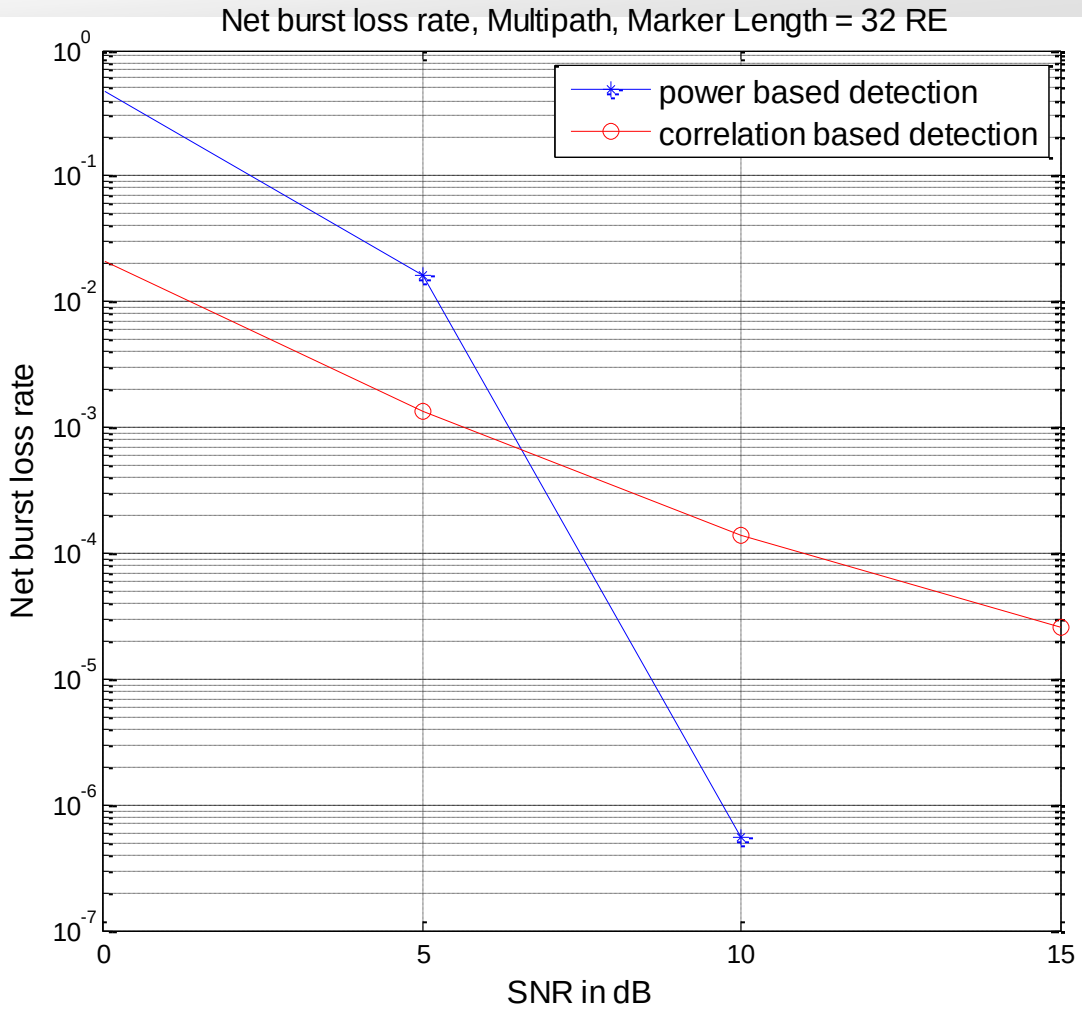
  delay = [0.5 1 1.5 2 3 4.5]*1e-6;

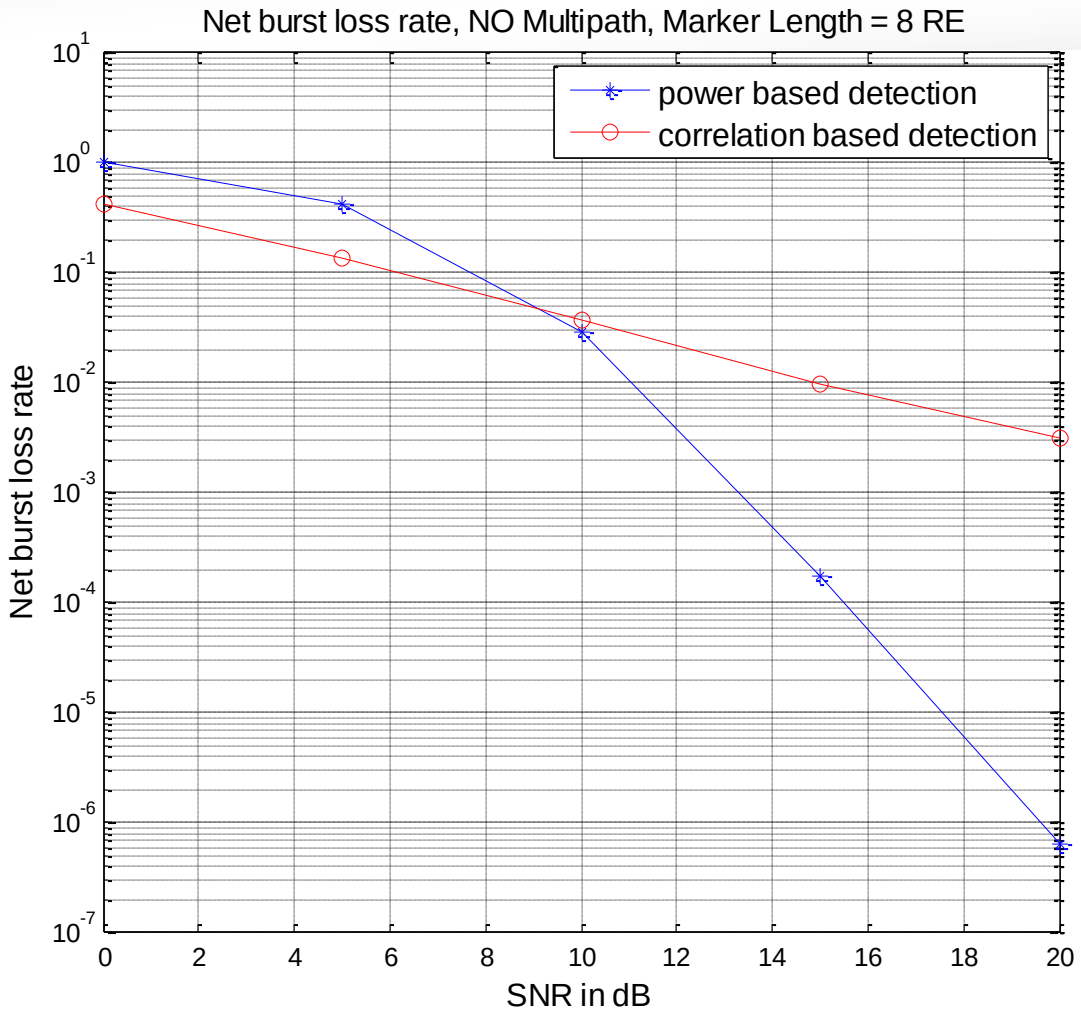
  pwr_db = [-16 -22 -29 -35 -42 -51];
- Carrier frequency offset = 25 Hz
- In the plots a missing data point indicates 100% detection.
- 4 Profiles are used in the simulations.
- Net burst loss rate = Burst loss rate due to missing a valid burst + Burst loss rate due to false detection of an invalid burst.
- 8 symbols in a frame.

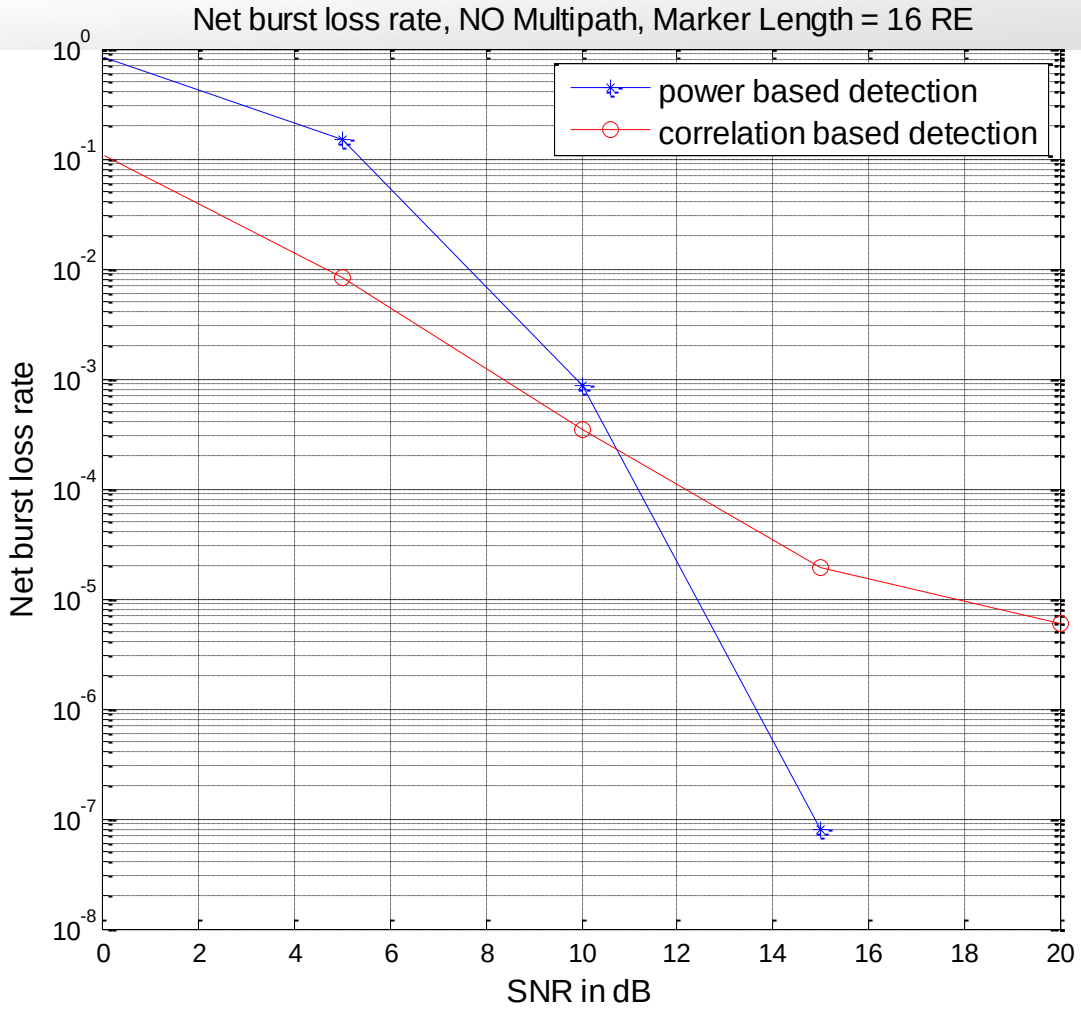

Net burst loss rate, Multipath, Marker Length = 8 RE
Net burst loss rate
SNR in dB
power based detection
correlation based detection


Net burst loss rate, Multipath, Marker Length = 16 RE
Net burst loss rate
SNR in dB
power based detection
correlation based detection


Net burst loss rate, Multipath, Marker Length = 24 RE
power based detection
correlation based detection
Net burst loss rate
SNR in dB
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
0
5
10
15


Net burst loss rate, Multipath, Marker Length = 32 RE
power based detection
correlation based detection
Net burst loss rate
SNR in dB
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
0
5
10
15


Net burst loss rate, NO Multipath, Marker Length = 8 RE
power based detection
correlation based detection
Net burst loss rate
SNR in dB
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
0
2
4
6
8
10
12
14
16
18
20


Net burst loss rate, NO Multipath, Marker Length = 16 RE
power based detection
correlation based detection
Net burst loss rate
SNR in dB
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-8
0
2
4
6
8
10
12
14
16
18
20

Summary

- The Power based detection scheme is superior to the correlation based detection scheme for SNR > 10 dB.
- For SNR < 10 dB and Marker length < 32 Resource Elements, both the schemes do not meet the performance requirement of better than 1E-6 Net burst loss rate.

Thank you

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