Baseline proposal for Burst Markers in EPoC

100.2.4.x Introduction:

Burst markers are used 1) to indicate the start or end of a burst and 2) to indicate the bit loading profile of the burst. Burst marker is a predefined sequence of elements called *burst marker elements*. There are three types of *burst marker elements*, 1's, -1's and 0's. Where +1's and -1's represent BPSK modulated symbols, and 0's represent nulls (i.e. no energy being transmitted). A burst marker sequence may be defined either using any two or all three types of elements. Each *burst marker element* is transmitted in one resource *element.* Where a *resource element* represents one sub-carrier of an OFDM symbol. For "0" *burst marker element,* the resource element does not transmit anything (zero energy). There are *N* unique burst marker sequences, one for each of the *N* bitloading profiles.

Power boosting for Burst Marker sequences:

The power of the burst marker sequences may be boosted with respect to the average power of the data. If *marker_power* = 0/1/2 then the average transmit power of the burst marker will be 0/3/6 dB higher than the average transmit power of the data.

Burst marker sequence inclusion options:

The parameter *marker_incl* determine the number of burst markers transmitted with each burst. If the parameter *marker_incl* is set to "0" then the transmitter does not use any burst markers at all. If the parameter *marker_incl* is set to "1" then the transmitter uses burst marker at the beginning of each burst. If the parameter *marker_incl* is set to "2" then the transmitter uses burst marker at the end of each burst. If the parameter *marker_incl* is set to "3" then the transmitter uses the same burst marker twice per burst, once at the beginning of the burst and once at the end of the same burst. *Marker_incl* can only be set to zero if there is one and only one profile in use in the EPoC network.

Length of Burst Marker sequences:

The length of the burst marker sequence is the number of *burst marker elements* in the sequence. The length of the burst marker sequence shall be configurable to be 16/24/32/40/48/56/64. The parameter *marker_length* shall specify the length,*L* , of the burst maker sequence. The values 0/1/2/3/4/5/6 shall correspond to lengths *L* = 16/24/32/40/48/56/64 respectively.

Burst Marker mapping:

The burst marker shall be mapped row wise across time axis and from top to bottom across frequency (sub-carrier) axis. Interleaving Burst Marker sequence with data and/or pilots spreads the burst marker sequence across more sub-carriers. This provides immunity for the burst marker sequence against narrow band ingress. Figure: 2 shows mapping of the interleaved burst markers. The 1^{st}, 3^{rd}, 5^{th},…. resource elements are mapped with the burst marker sequence and the 2^{nd}, 4^{th}, 6^{th},… resource elements are mapped with the data and/or pilots. Where the 1^{st} resource element corresponds to the beginning of the first resource block of the burst.

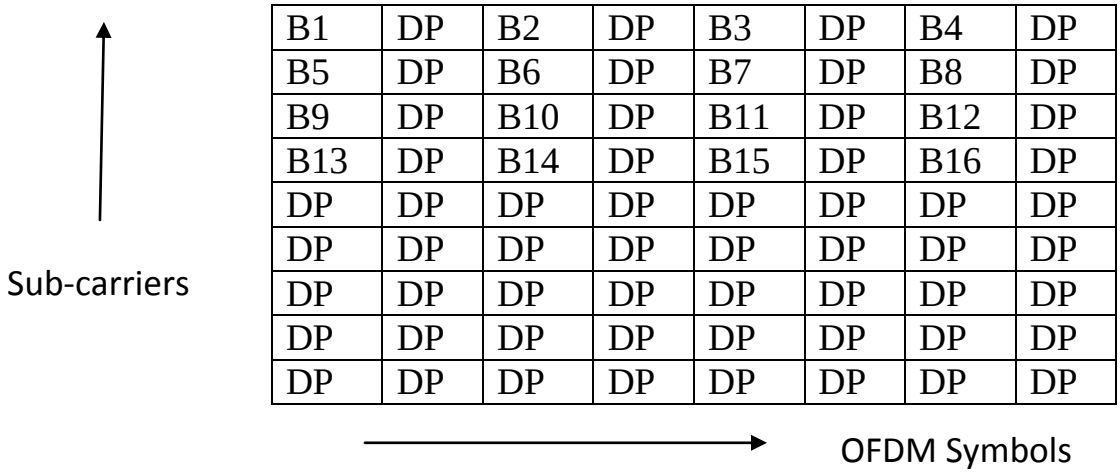

Figure: 1 mapping of interleaved burst marker sequence. B1,B2,…,B16 are the elements of burst marker sequence. DP is either data or pilot element.

Burst Marker sequences:

Burst marker sequences are generated from Gold Sequence generator. $Z^7 + Z^3 + 1$ is used as the generator polynomial for the first preferred polynomial and $Z^7 + Z^3 + Z^2 + Z + 1$ is used as the generator polynomial for the second preferred polynomial. The initial condition for the first PN sequence generator is [0 0 0 0 0 0 1]. The initial condition for the second PN sequence generator is [0 0 0 0 0 0 1]. Using the above generator polynomials, initial conditions and gold sequence generator index of 5,6,7 and 8 , four distinct burst marker sequences were generated for Profile1, Profile2, Profile3, and Profile4 respectively. Table: 1 gives the four distinct binary burst marker sequences for each of the four profiles. Table: 2 gives the four distinct ternary burst marker sequences for each of the four profiles. If the parameter *marker_type* is set to "1", then the transmitter uses the binary burst marker sequences from Table: 1. If the parameter *marker_type* is set to "0", then the transmitter uses the ternary burst marker sequences from Table:2. If the specified marker length,L is less than 64, then the transmitter shall select the first 'L' entries (starting from the top) of the burst marker sequences defined in tables 1&2.

Profile:1	Profile:2	Profile:3	Profile:4
1	1	-1	1
-1	1	-1	-1
1	-1	-1	-1
-1	-1	-1	1
-1	-1	1	1
-1	1	1	1
1	1	1	1
-1	-1	-1	-1
1	1	1	-1
1	1	-1	1
1	-1	1	-1
1	-1	1	1
1	-1	-1	1
-1	-1	1	1
1	-1	-1	1
-1	-1	1	-1
1	-1	1	-1
-1	1	-1	-1
1	-1	-1	-1
1	1	1	-1
-1	-1	1	-1
1	-1	1	-1
-1	1	-1	-1
1	-1	-1	-1
1	1	1	1
-1	-1	-1	1
1	1	-1	1
-1	1	-1	-1
1	-1	-1	1
1	1	-1	1
-1	1	-1	-1
1	-1	-1	-1
1	1	1	-1
1	1	-1	1
1	-1	1	1
-1	1	1	1
1	1	1	1
-1	-1	-1	-1
-1	-1	-1	-1
1	1	1	1
1	1	1	-1
-1	-1	1	1
-1	1	1	1
-1	-1	-1	-1
1	1	1	-1
-1	-1	1	-1
1	-1	1	-1
1	-1	1	-1
-1	1	-1	1
-1	1	-1	-1
1	-1	-1	1
-1	-1	1	1
1	-1	-1	-1
-1	-1	-1	1
1	1	-1	1
1	-1	1	1
-1	1	1	-1
1	1	-1	-1
-1	1	1	1
-1	-1	-1	-1

Table: 1 Binary Burst marker sequence

Profile:1	Profile:2	Profile:3	Profile:4
0	1	-1	1
1	0	-1	-1
-1	1	0	-1
0	-1	-1	1
1	-1	-1	0
-1	-1	0	1
-1	1	1	0
-1	0	1	1
1	1	1	0
0	-1	-1	1
-1	1	1	0
1	0	-1	-1
1	1	0	-1
0	-1	1	1
1	0	1	-1
1	-1	0	1
1	-1	-1	0
-1	-1	0	1
0	-1	1	1
0	-1	-1	1
1	-1	0	-1
-1	0	1	-1
1	1	1	0
-1	0	-1	-1
1	-1	-1	0
1	1	0	-1
-1	-1	1	0
0	-1	1	-1
1	0	1	-1
0	1	-1	-1
-1	-1	0	-1
1	0	-1	-1
1	1	1	0
-1	0	-1	1
1	-1	0	1
-1	0	-1	1
0	1	-1	-1
1	1	0	1
1	-1	-1	0
0	1	-1	1
-1	1	-1	0
0	-1	-1	-1
1	0	1	-1
1	1	0	-1
1	0	-1	1
0	1	1	1
1	-1	1	0
-1	1	0	1
1	1	1	0
-1	0	-1	1
-1	-1	0	-1
0	-1	-1	-1
1	1	0	1
1	0	1	-1
0	1	1	1
-1	-1	1	0
-1	0	1	1
-1	1	0	-1
1	0	-1	-1
-1	-1	1	0
1	1	0	-1
0	-1	1	-1
1	-1	1	0
0	-1	1	-1

Table: 2 Ternary Burst Marker Sequence