

# Upstream Burst Delimiter and Sync Pattern Assignment

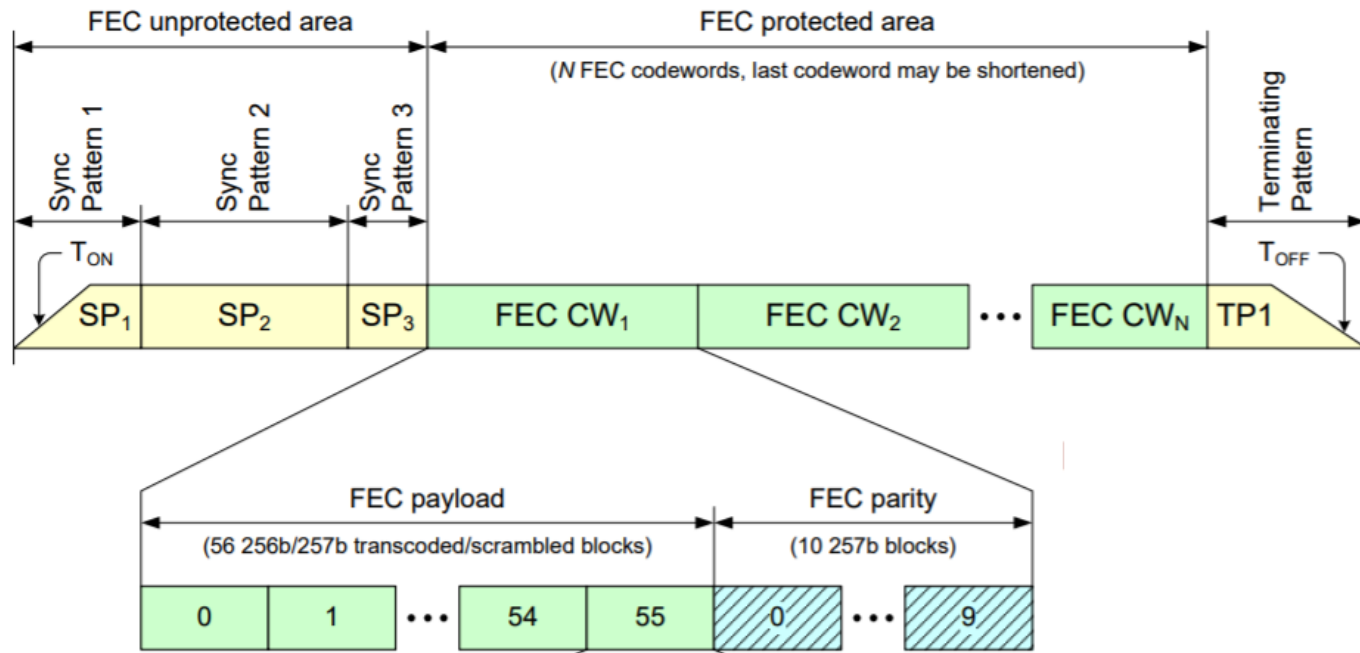
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- ❑ In January 2018, contributions on upstream burst delimiter selection were revised ([kramer\\_3ca\\_2\\_0118.pdf](#), [effenberger\\_3ca\\_1\\_0118.pdf](#), and [hajduczenia\\_3ca\\_1\\_0118.pdf](#)). There was agreement that different OLT Rx implementations may need different Sync Pattern (SP) and Start of Burst Delimiter (SBD) delimiter patterns to optimize burst reception process
- ❑ Irrespective of actual SP and SBD values, as long as sufficient Hamming distance is guaranteed, MTT for false burst lock and burst loss can be guaranteed.
- ❑ New MPCPDU(s) needed to broadcast SP and SBD pattern values to all ONUs on PON

- ❑ OLT announces SP and SBD pattern values to ONUs during initial MPCP Discovery process to be used in the upstream direction.
- ❑ ONU always uses SP/SBD values announced by OLT during Discovery.
- ❑ OLT uses default SP/SBD values unless different values are specified by the vendor. Default values (see next slide for SP1/2/3 definitions):
  - SP1 (AGC): TBD
  - SP2 (CGD): TBD
  - SP3 (SBD): TBD

# Burst structure

Image source: [kramer\\_3ca\\_2\\_0318.pdf#6](#)



- ❑ Three separate portions of FEC unprotected area: SP<sub>1</sub> (for AGC), SP<sub>2</sub> (for CDR), and SP<sub>3</sub> (SBD = Start Burst Delimiter)
- ❑ SP<sub>1</sub>, SP<sub>2</sub>, and SP<sub>3</sub> value may be different, as elected by OLT, to optimize given function (AGC, CDR, SBD)
- ❑ Each block length is multiple of 257 bits (block quanta)
- ❑ End Burst Delimiter (EBD) is not variable (defined in spec)

# Parameters Needed

- ❑ OLT announces values for SP1, SP2, and SP3 = three independent parameters. Each parameter is announced once, before the Discovery GATE, with value lengths in multiples of 257-blocks.
- ❑ OLT may announce different SP1/2/3 field length for discovery (longer) and regular (shorter) operation to optimize discovery and regular granting
- ❑ SBD needs to support minimum Hamming distance of X (e.g., 110 for 257-bit SBD pattern)
- ❑ New MPCPDU needed to carry each value separately
  - Single MPCPDU has 40-octet payload available (see Figure 144–4 in D1.0). Details on mapping SP pattern on next slides
- ❑ EBD uses 1 x 257-bit block of all zeros (similar to 10G-EPON)

# SYNC\_PATTERN MPCPDU / 1

- ❑ Used to announce the value of Synchronization Pattern (SP) to all ONUs on PON
  - Opcode 0x0018 (next available)
  - Bits 1 through 256 (they are scrambled and encoded together) of Sync Pattern saved into 32-octets wide data field *Sync Pattern*, right adjusted. Bit 0 of Sync Pattern saved into *SP Info* field (see next slide for details).
  - This arrangement saves on bit-level operations on MPCPDU and separates scrambled and encoded portion of pattern from bit 0 (pass-through)
  - Same encoding used for SP1, SP2, and SP3 fields

Octet	Value (binary)
0	SP<8:1>
...	...
30	SP<248:241>
31	SP<256:249>

# SYNC\_PATTERN MPCPDU / 2

- ❑ *SP Info* carries information on SP pattern in this MPCPDU:
  - Bit 0-1: SP Index (value 1, 2, 3), indicating which SP period is carried in this SYNC\_PATTERN message (SP1/2/3)
  - Bit 3-4: SP Count (value 2 or 3), indicating how many SYNC\_PATTERN messages are expected in announcement sequence
  - Bit 7: SP Balanced: 1 = balanced, 0 = unbalanced (see slide 8)
  - Bit 15: SP bit 0 (first bit of the SP sequence)
  - Other bits reserved / set to 0 on transmit
- ❑ *Discovery Repeat* indicates how many times the given 257-bit SP field is transmitted during Discovery Window transmission. Max  $2^{16}-1 = 65535$
- ❑ *Granting Repeat* indicates how many times the given the given 257-bit SP field is transmitted during regular granting operation. Max  $2^{16}-1 = 65535$

## SYNC\_PATTERN MPCPDU

Destination Address	6
Source Address	6
Length/Type = 0x8808	2
Opcode = 0x0018	2
Timestamp	4
SP Info	2
Sync Pattern (SP)	33
Discovery Repeat	2
Granting Repeat	2
Padding	1
FCS	4

# SYNC\_PATTERN MPCPDU /3

- ❑ Separate **Discovery Repeat** and **Granting Repeat** fields allow for different burst preamble lengths during discovery and regular operation.
- ❑ Balanced bit sequence may be more suitable for some OLT Rx implementations. But 257-bit pattern cannot be perfectly balanced. When the **SP Balanced** bit is set to one, rather than repeating SP+SP...SP N times, the ONU shall alternate SP and its inverted value  $\overline{SP}$  N times (SP+ $\overline{SP}$ +SP+ $\overline{SP}$ ...).



- ❑ OLT announces SP values using SYNC\_PATTERN MPCPDU before issuing DISCOVERY GATE MPCPDU
- ❑ SYNC\_PATTERN MPCPDUs are sent on broadcast PLID.
- ❑ Each SP value is announced using a separate SYNC\_PATTERN MPCPDU.
- ❑ The OLT may announce 2 or 3 SP values (as indicated by SP Count field):
  - **SP Count = 3**: SP1 for AGC, SP2 for CDR, and SP3 for SBD
  - **SP Count = 2**: SP1 for AGC+CDR, SP2 for SBD.
- ❑ OLT may announce different SP values (or even different counts of SP values) for different discovery attempts.

- ❑ Unregistered ONUs always process and store the last-announced SP values (SP values may change from one discovery attempt to another).
- ❑ ONUs do not validate the SP values or acknowledge the SYNC\_PATTERN MPCPDUs received from the OLT.
- ❑ An unregistered ONU shall not respond to a DISCOVERY GATE MPCPDU until a full set the SP values (as indicated by SP Count field) is received from the OLT.
- ❑ Once registered, ONU stops listening and acting on SYNC\_PATTERN MPCPDUs. The registered ONUs continue to use SP values that they stored at the registration time.