PCS Diagnostic Modes

Review and Next Steps

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Review of PCS Diagnostic Mode Discussion

1. Modes for conformance testing

   a) Square-wave mode (3av_0711_mandin_2.pdf)
      - For measurement (by test equipment) of transmitter optical properties (ER etc.)
      - Alternating runs of 1 and 0.
        - Run length configured to run between 4 and 11

   b) PRBS31 mode (3av_0711_mandin_2.pdf)
      - For transmitter tests, as well as *stressed receiver* test

   c) Pseudorandom mode (3av_0711_mandin_1.pdf)
      - Generates/validates legal PCS codewords
      - mFor transmitter tests, as well as *stressed receiver* test

2. Further study was requested to select modes for 10GEPON

3. Modes for Real-time Diagnosis

   - Interest was expressed in investigating application or augmentation of the diagnostic modes for employment in a provider/customer troubleshooting environment

PRBS31 Test Pattern mode

1. PRBS31 support was optional in 10GBASE-R

2. Currently:
   - PRBS31 is commonly supported by test equipment
   - UNH test suites accept it both for transmitter and stressed receiver tests
   - Duplication of scrambler functionality is no longer much of a concern

3. *Recommendation*: Make PRBS31 mode *mandatory* for 10GEPON

4. *Issue:* What should be the configurable run length range?

Pseudorandom test pattern mode

1. Pseudorandom test pattern involves components of the PCS: ie. de/scrambler, FEC Encode/Decode, and 66b block build

   - No MAC or 64b/66b code
   - Whereas PRBS31 – in contrast - only involves the analog and optical path

2. Consequently: Pseudo-random test pattern can be used in the lab or by an operator to confirm/troubleshoot logical connectivity between two peers up to the FEC layer.

3. Minimal implementation burden

4. *Recommendation*: Make Pseudorandom test pattern mode mandatory for 10GEPON

Real-time diagnostics?

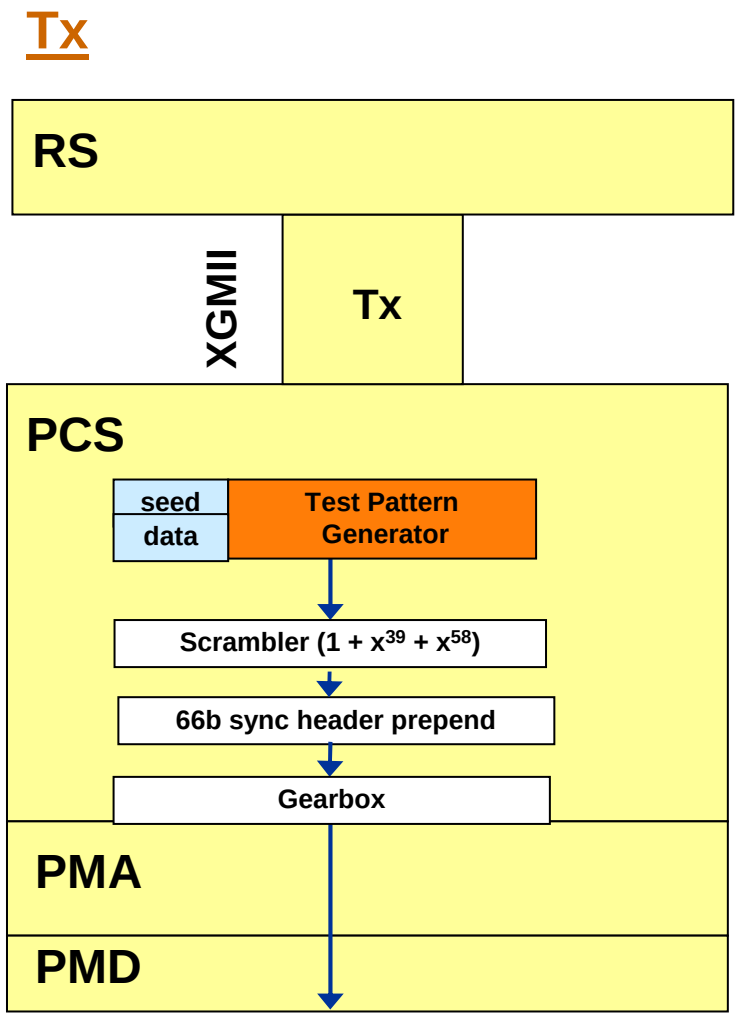
1. Original intent of PCS Diagnostic modes is conformance testing:
   - Optical signal characteristics
   - CDR
2. With pseudorandom mode, we include peer connectivity testing
3. What would be required to extend diagnostics to a realtime PON environment?
   a) Would need to be a digital pattern limited to a particular ONU's upstream or downstream timeslot
   b) On the downstream, it would need to not disrupt the synchronization on other ONUs
   c) Would need to provide more information than simple data transmission
4. Does not appear particularly promising

Next steps?

Backup:

Summary of Pseudorandom Mode

Pseudo-random Test Pattern Mode (Transmit Direction)

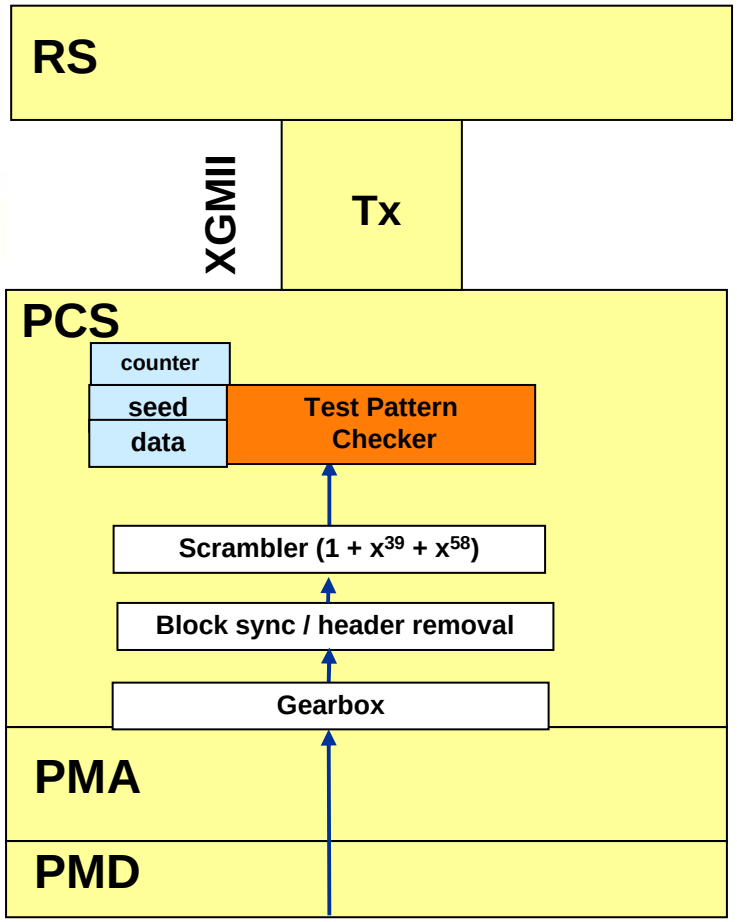


The test patterns are generated by utilizing the regular scrambler and framing mechanisms of 10G:

- Particular scrambler seeds are configured via MDIO
- The input data (either “all 0s” or “Local Fault” and configured via MDIO) is generated locally within the Tx PCS for the duration of Pseudo-random test pattern mode
- Scrambler output (ie. the pseudo-random pattern data) is carried in 66b blocks (with regular sync headers)

Pseudo-random Test Pattern Mode (Receive Direction)

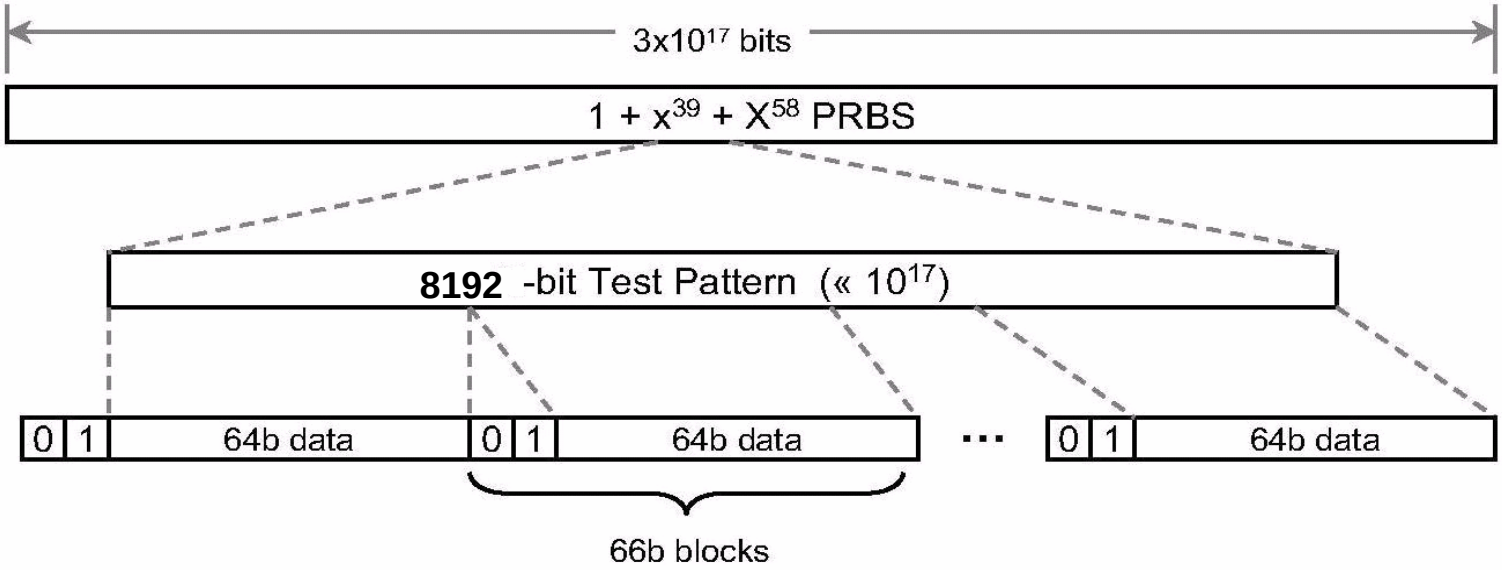
Rx



The test pattern data is received by the *Checker* function via the regular synchronization, framing, and scrambler mechanisms of Serial 10G:

- Scrambler seeds and data are configured via MDIO to match those of the transmitting equipment
- 66bit block alignment is obtained with the usual header-based state machine.
- The received descrambled data is compared to the result expected according to the configured seeds
- Counter records the number of erroneous data blocks and is typically read via MDIO by a test application

Pseudo-random test pattern – data stream



Adjustments for 10GEPON: Parity blocks / burst mode

1. The 10GEPON pseudo-random test pattern should include FEC parity blocks (inserted by the FEC layer beneath the tx scrambler as with regular data)

   a) In the case where the ONU is the receiver, the ONU's PCS performs block synchronization using the regular 10GEPON sync state machine

   b) Though parity blocks arrive at the ONU or OLT receiver, while in test pattern mode the 66b blocks are by default not corrected.
      - So that the test pattern checker can determine the raw BER as required in "stressed receiver"-type tests.
      - MDIO configuration register activates FEC correction

2. The pseudo-random test pattern received on the upstream by the OLT must begin with the 10GEPON burst preamble and 66b delimiter.

   For flexibility, the ONU PCS should be configurable (by MDIO register) to transmit the burst preamble/delimiter at the beginning of the cyclic pseudo-random test pattern transmission.