# Test Pattern Generators and checkers.

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# Introduction

- Multiple Test Pattern Generators and checkers are defined for use in 802.3dj. In Draft 1.4 there is ambiguity about which ones are mandatory, which ones are optional, and potentially some errors in the descriptions of how these are used.
- This Presentation attempts to clarify the situation and make the draft consistent for the electrical and IMDD clauses. It provides two options for how to document this and the CRG should choose which option to use.

# Draft 1.4 Section 176.7.4 has issues.

**176.7.4 PMA test patterns**

Where the lanes of the PMA are connected to a physically instantiated interface xAUI-n, Inner FEC, or a PMD service interface, the PMA may optionally generate and detect test patterns. These test patterns are used to test adjacent layer interfaces for an individual PMA sublayer or to perform testing between a physically instantiated interface of a PMA and external testing equipment.

**176.7.4.1 PRBS31 test pattern**

A PMA shall include a PRBS31 pattern generator and checker as specified in 120.5.11.1.1.

**176.7.4.2 PRBS31Q test pattern**

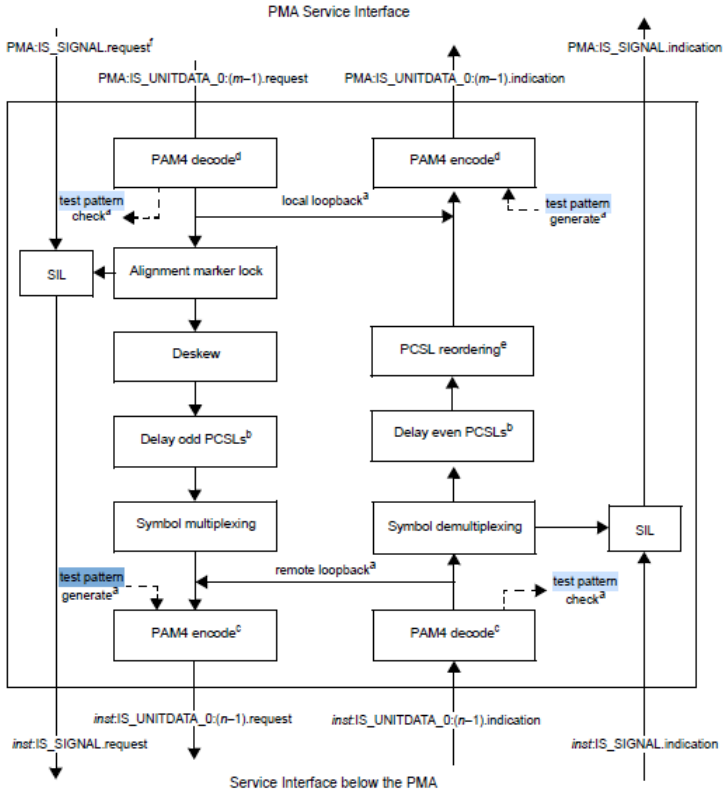
A PMA shall include a PRBS31Q pattern generator and checker as specified in 120.5.11.2.2.

- There is ambiguity whether the test patterns are optional or required.
- It is never necessary to have the PRBS31 and PRBS31Q test patterns simultaneously.
- The PRBS31 is used for the Inner FEC, but not needed for xAUI-n or PMD's which use the PRBS31Q

# PRBS31Q versus PRBS31.

- PRBS31 is defined in 120.5.11.1.1 as an NRZ signal defined in 49.2.8
- PRBS31Q is defined in 120.5.11.2.2 as formed by Gray coding pairs of bits from two repetitions of the PRBS31 pattern defined in 49.2.8 into PAM4 signals as described in 120.5.7.1. i.e. This is the PAM4 encoded PRBS31 pattern. ((Note Clause 176 uses the same Gray coding defined in 120.5.7.1) so PRBS31Q is identical to PAM4 encoded PRBS31 .
- We never need both patterns at the same time and can document the PRBS31Q pattern either as a separate pattern (Proposal A) or as PAM4 encoded PRBS31 (Proposal B)

# Injection point of test pattern Generator is before PAM4 encode and the checker is after PAM4 decode




*inst*: PMA or PMD or FEC or AUI
SIL: Signal indication logic

[a] Optional
[b] If 200GBASE-R, 400GBASE-R or 800GBASE-R
[c] If the sublayer below the PMA is an AUI or PMD
[d] If the sublayer above the PMA is a 1.6TAUI-16
[e] If the sublayer above the PMA is an 800GBASE-R BM-PMA
[f] PMA:IS_SIGNAL.request is not present when the sublayer above the PMA is a PCS or DTE XS

*m* = 8 (200GBASE-R), 16 (400GBASE-R), 32 (800GBASE-R), or 16 (1.6TBASE-R)
*n* = 1 (200GBASE-R), 2 (400GBASE-R), 4 (800GBASE-R), or 8 (1.6TBASE-R)

**Figure 176–2—200GBASE-R 8:1, 400GBASE-R 16:2, 800GBASE-R 32:4, 1.6TBASE-R 16:8 PMAs functional block diagram**

- Figure 176-2 shows the test pattern injection point. (Figure 173-3 is similar as are Figures 176-12 and 176-13)
- Injecting PRBS31Q at this point and further Gray coding it isn't what is intended. However the use of the optional pre-coder within the PAM4 encode process should be documented.
- Footnote a saying the test pattern generate and check are optional is not correct.

# Proposal A (If PRBS 31Q is considered separate).

- Change the text in 176.7.4 to

"Where the lanes of the PMA are connected to a physically instantiated interface xAUI-n, Inner FEC, or a PMD service interface, the PMA generates and detects test patterns. These test patterns are used to test adjacent layer interfaces for an individual PMA sublayer or to perform testing between a physically instantiated interface of a PMA and external testing equipment.

- Change the text in 176.7.4 .1 to

"A PMA connected to an Inner FEC shall include a PRBS31 pattern generator and checker as specified in 120.5.11.1.1. "

- Change the text in 176.7.4.2 to

"A PMA connected to an xAUI-n or PMD service interface shall include a PRBS31Q pattern generator and checker as specified in 120.5.11.2.2."

- In Figures 176-2, 173-3, 176-12 and 176-13 remove the footnote saying "optional" on the test pattern generators and checkers. Relabel the existing injection points PRBS31 test pattern generate and PRBS31 test pattern check. Split the PAM4 encode and decode into "Gray mapping" and "Precoding". Add "test pattern generate (except PRBS31)" and "test pattern check (except PRBS31)" injection points between the "Gray mapping" and "Precoding".
- Change 176.7.4.7 (PMA clock error detection and counters) from "Each PRBS31Q test pattern checker shall include block error detection ….." to "Each PRBS31Q test pattern checker and PRBS31 test pattern checker shall include block error detection……."
- Add Management variables and MDIO registers for the PRBS31 generator, checker and counters.

# Proposal B (If PRBS 31Q is combined with PRBS31).

- Change the text in 176.7.4 to

"Where the lanes of the PMA are connected to a physically instantiated interface xAUI-n, Inner FEC, or a PMD service interface, the PMA generates and detects test patterns. These test patterns are used to test adjacent layer interfaces for an individual PMA sublayer or to perform testing between a physically instantiated interface of a PMA and external testing equipment.

- Change the text in 176.7.4 .1 to

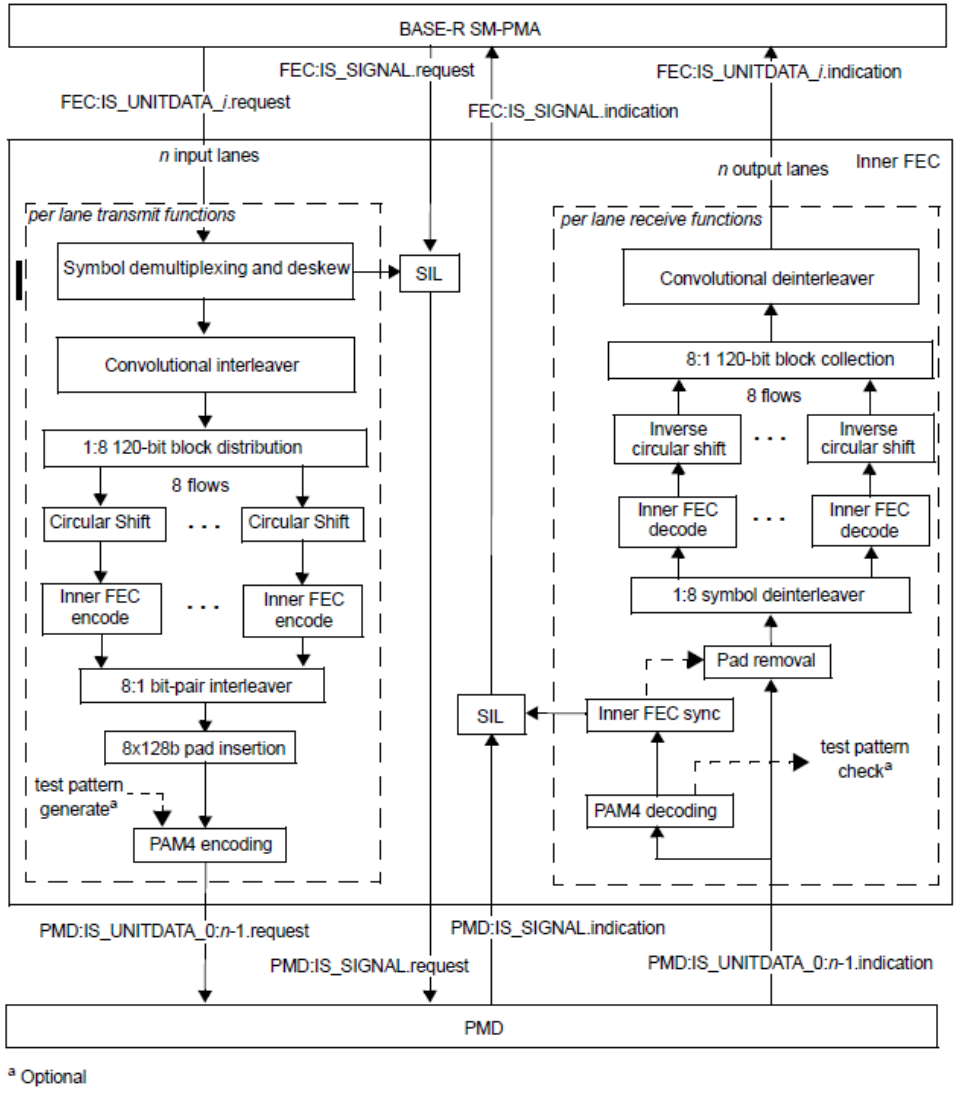
"A PMA shall include a PRBS31 pattern generator and checker as specified in 120.5.11.1.1. "

- Change the text in 176.7.4.2 to

"The PRBS31Q test pattern generator and checker are the PRBS31 test pattern generator and checker as defined in 176.7.4.1 Gray encoded by the Gray mapping defined in 176.7.1.1."

- In Figures 176-2, 173-3, 176-12 and 176-13 remove the footnote saying "optional" on the test pattern generators and checkers. Relabel the existing injection points PRBS31 test pattern generate and PRBS31 test pattern check. Split the PAM4 encode and decode into "Gray mapping" and "Precoding". Add "test pattern generate (except PRBS31)" and "test pattern check (except PRBS31)" injection points between the "Gray mapping" and "Precoding".
- Change 176.7.4.7 (PMA clock error detection and counters) from "Each PRBS31Q test pattern checker shall include block error detection ….." to "Each PRBS31 test pattern checker checker shall include block error detection……."
- Change the Management variables and MDIO registers to PRBS31 instead of PRBS31Q.

# Clause 177




[a] Optional

**Figure 177–2—Functional block diagram**

- Figure 177-2 shows the test pattern injection point. Injecting the test patterns at this point and further Gray coding them isn't what is intended. However the use of the optional pre-coder within the PAM4 encode process should be documented.

**Proposal**

Split the PAM4 encode and decode into "Gray mapping" and "Precoding". Move the "test pattern generate and "test pattern check" injection points between the "Gray mapping" and "Precoding".