BER Monitor

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Background

1. 10GBASE-R (ie. optical point-to-point) includes a *BER Monitor* process, which monitors the quality on the received link and sets the MDIO flag *"High BER"* when high bit error rate is detected. The MDIO flags are reset when "normal" error rate is restored.

2. MDIO flag "Receive link Status" is set to 0 when a *"High BER"* condition is present.

3. In 10GBASE-R, BER is estimated by counting occurences of valid and invalid 2-bit sync headers. The *"High BER"* flag is set when estimated BER is > 10^{-4} over a period of 125 usec.

4. At the Atlanta meeting, BER Monitor for 10GEPON was identified as an outstanding PCS issue.

Background: MDIO Registers

Table 45–73—10GBASE-R PCS status 1 register bit definitions

Bit(s)	Name	Description	R/W[a]
3.32.15:13	Reserved	Ignore when read	RO
3.32.12	10GBASE-R receive link status	1 = 10GBASE-R PCS receive link up 0 = 10GBASE-R PCS receive link down	RO
3.32.11:3	Reserved	Ignore when read	RO
3.32.2	PRBS31 pattern testing ability	1 = PCS is able to support PRBS31 pattern testing 0 = PCS is not able to support PRBS31 pattern testing	RO
3.32.1	10GBASE-R PCS high BER	1 = 10GBASE-R PCS reporting a high BER 0 = 10GBASE-R PCS not reporting a high BER	RO
3.32.0	10GBASE-R PCS block lock	1 = 10GBASE-R PCS locked to received blocks 0 = 10GBASE-R PCS not locked to received blocks	RO

[a]RO = Read Only

BER Monitor as a complement to FEC statistics

1. The 10GEPON FEC decoder provides statistics on corrected symbols and corrected bits (cf. clause 30.5.1.1.15)

2. An ONU or OLT management application can use these to get a good estimate of *pre-correction* BER.

   - The higher the BER => less accurate the estimate
     - due to uncorrectable FEC codewords
     - But this is not a problem

3. In contrast: the “High BER” flag relates to *post-correction* BER and operates on a short time scale (125 usec) -> so it provides a more timely type of information to management

Applicability for 10GEPON ONUs and OLTs

1. Management awareness of transitory high-error receiver conditions seems desirable for 10GEPON ONUs

2. Much less useful in the case of an OLT - due to frequent losses of burst mode lock and switching of ONU transmitters

Whether or not to standardize

1. BER Monitor only impacts MDIO registers

2. Most EPON devices implement MAC and PHY together – consequently MDIO might not be utilized much.

    - Instead, vendors just provide the interface to the management application as they see fit

3. On the other hand, 802.3ah did specify various MDIO management registers nonetheless

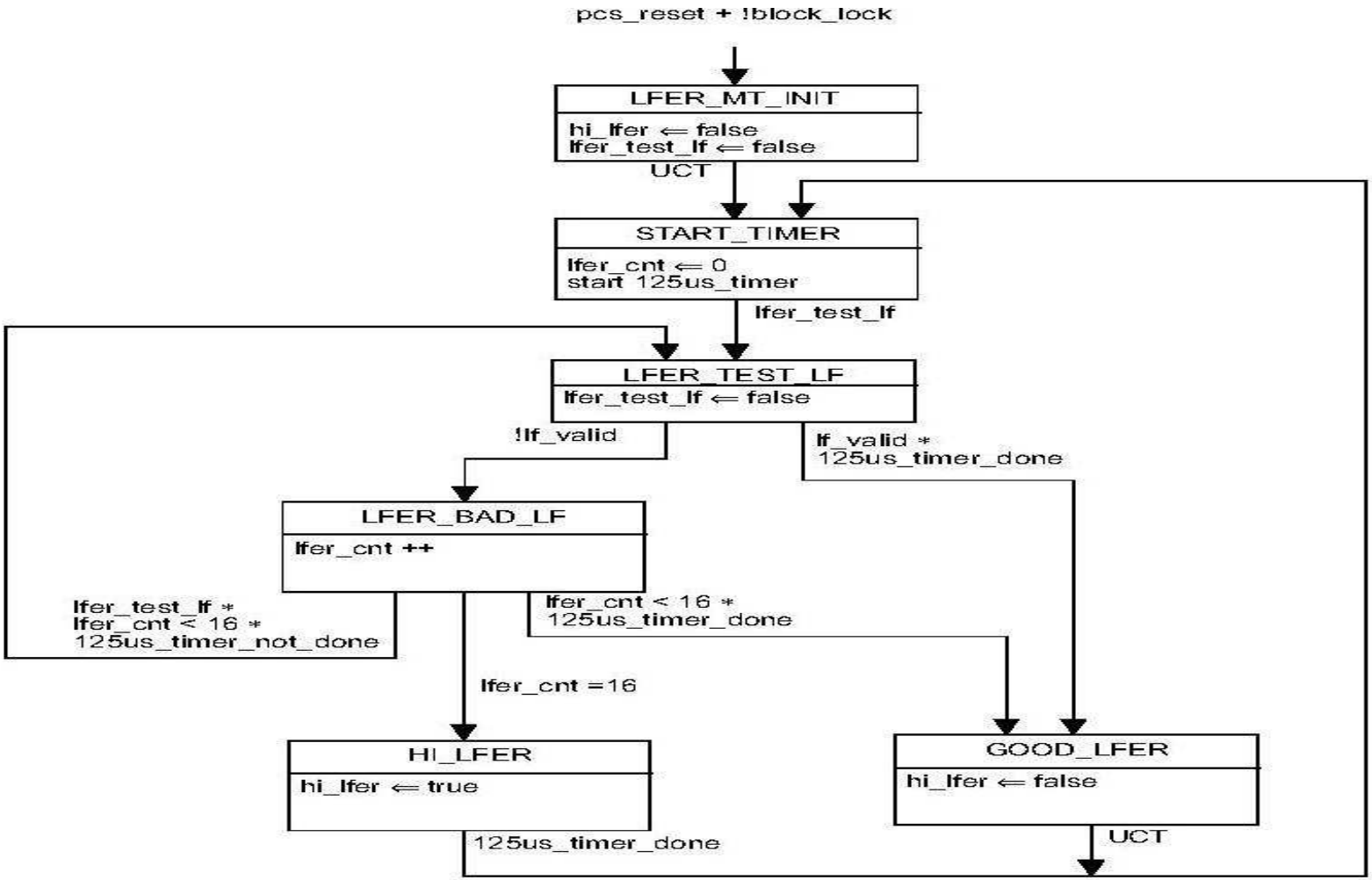
Outline of a BER Monitor Process for 10GEPON ONUs

1. Adapt 10GBASE-R/10GBASE-T status registers in Table 45–73**:**
   - Upon high BER condition, MDIO register *3.32.1* becomes high and *3.32.12* becomes low

2. Monitor for uncorrectable FEC codewords (as in 10GBASE-T state diagram shown in next slide) rather than erroneous sync headers (10GBASE-R approach).

3. 16 uncorrectable FEC codewords within 125 usec is deemed to be “high BER”

BER Monitor State Diagram (10GBASE-T)



Note: 10GEPON "FEC Codeword Error" corresponds exactly to 10GBASE-T "LDPC Frame Error"

Straw Poll

_____ 10GEPON specification should include High BER MDIO registers and BER monitor process for ONU.

_____ 10GEPON specification need not include BER monitor process. FEC statistics and vendor-specific mechanisms are sufficient.

_____ No opinion