Proposal for a Signal Quality Indicator

Rubén Pérez-Aranda
(rubenpda@kdpof.com)

IEEE 802.3bv Task Force - May 2015

Background and objectives

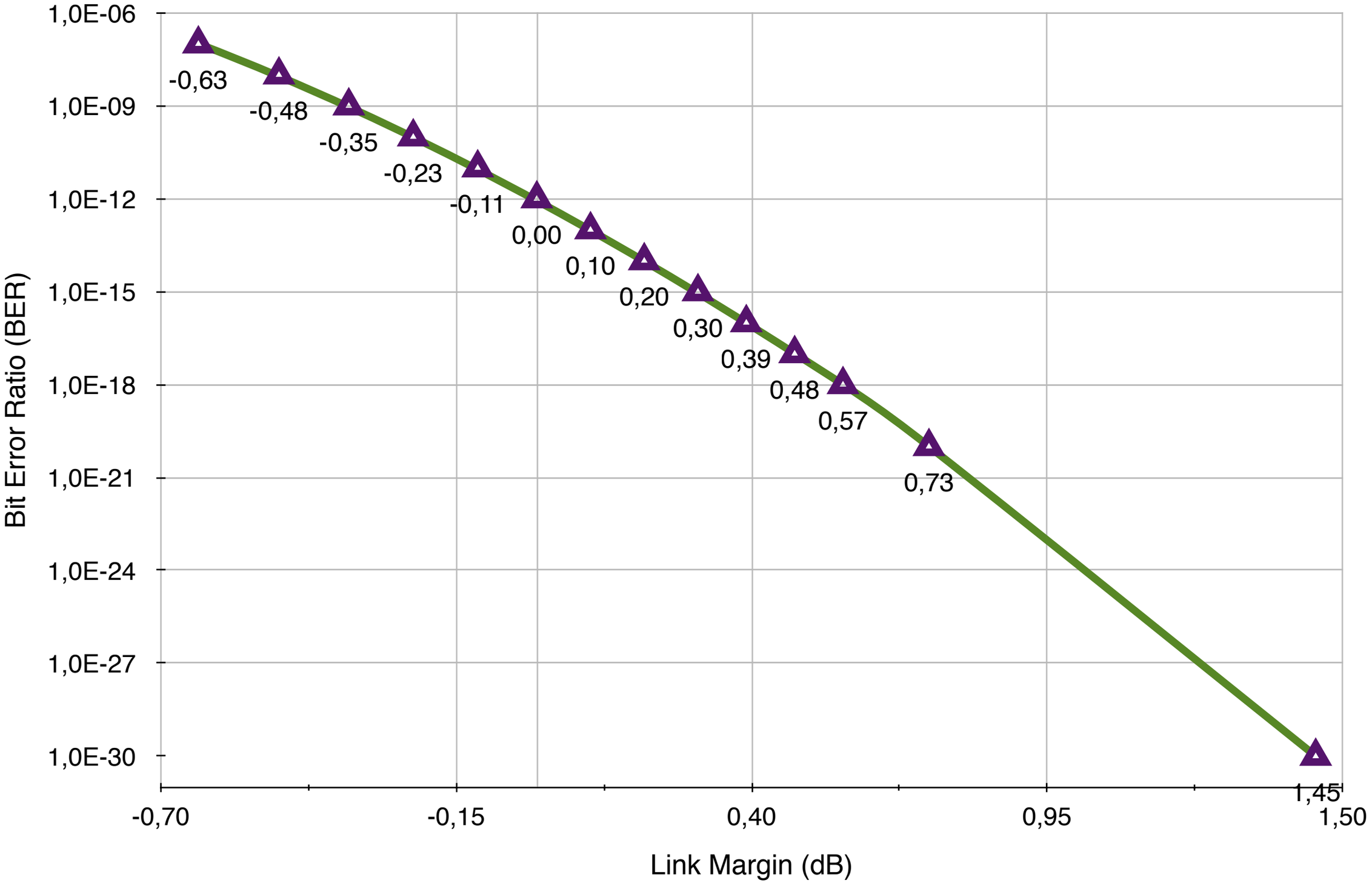
- PHY Quality Monitor state diagram is included in D1.0, sub-clause 1143.2.3. This state diagram is in charge to determine the value of state variable loc_rcvr_status, used to establish bidirectional link by Link Monitor state diagram.
- The PHY Quality Monitor is based on Link Margin estimation (LM)
- LM is continuously reported by the local PHY to the partner by using PHD, as defined in Figure 114-41
- Comment #100 attach a proposed text for Clause 45, where registers are defined to report local and remote LM

- Here, Signal Quality Indicator (SQI) is proposed based on LM that may be used by a Management Entity attached to a 1000BASE-H PHY to know the health of the link and then carry out dependability tasks
- The SQI discretizes the LM indicator according to several performance criteria (BER, MTTFPA, MTBE, etc)
- The local and remote SQIs should be included in Clause 45

SQI proposal - performance vs. Link Margin

BER <=	SNRe (dB)	LM (dB)	Signal Quality Indicator (SQI)	Receiver Status	OAM Channel Status	MTBE >=	MTFPA PHY >= (years)	MTFPA PHY +FCS >= (years)	MTBE > 8000h	MTTFPA PHY > Age of Universe	MTTFPA PHY + FCS > Age of Universe
1,00E-07	24,38	-0,63	*DOWN*	NOT_OK	UP	0,35 s	1,10E+07	4,70E+16			
1,00E-08	24,53	-0,48	*DOWN*	NOT_OK	UP	3 s	6,30E+07	2,70E+17			
1,00E-09	24,66	-0,35	*DOWN*	NOT_OK	UP	35 s	3,30E+08	1,40E+18			
1,00E-10	24,78	-0,23	*DOWN*	NOT_OK	UP	5m:49s	1,60E+09	6,90E+18			
1,00E-11	24,90	-0,11	*DOWN*	NOT_OK	UP	58m:13s	7,50E+09	3,20E+19			
1,00E-12	25,01	0,00	*MARGINAL*	OK	UP	9h:42m	3,30E+10	1,40E+20			
1,00E-13	25,11	0,10	*MARGINAL*	OK	UP	4d:1h	1,40E+11	6,00E+20			
1,00E-14	25,21	0,20	*MARGINAL*	OK	UP	40d:9h	5,80E+11	2,50E+21			
1,00E-15	25,31	0,30	*MARGINAL*	OK	UP	1y:43d	2,30E+12	1,00E+22			
1,00E-16	25,40	0,39	*GOOD*	OK	UP	11y:71d	9,10E+12	3,90E+22			
1,00E-17	25,49	0,48	*GOOD*	OK	UP	111y:331d	3,50E+13	1,50E+23			
1,00E-18	25,58	0,57	*GOOD*	OK	UP	1,1e3 y	1,30E+14	5,70E+23			
1,00E-20	25,74	0,73	*GOOD*	OK	UP	1.1e5 y	1,80E+15	7,90E+24			
1,00E-30	26,46	1,45	*GOOD*	OK	UP	1,1e15 y	5,40E+20	2,30E+30			

SQI proposal - BER vs. Link Margin



SQI proposal - levels

- Signal Quality Indicator (SQI) levels:
  - **DOWN:** BER is considered too high, therefore receiver status is NOT OK. No packets can be transmitted in both directions, since there is no Gigabit link. OAM is always available
  - **MARGINAL:** Quality of the link in terms of BER is good and MTBE long, however the system is operating almost in sensitivity point
  - **GOOD:** Quality in terms of BER and MTBE is good and there is margin to stay on this condition.

- Sensitivity, Link Margin, BER:
  - Link Margin (LM) is defined as the extra SNR available in receiver respect to sensitivity point (see clause 114.3.2.3)
  - The sensitivity point is considered as the minimum power received in TP3 such that a BER < 10^{-12} is provided by the link in both directions. LM = 0 dB at sensitivity point.
  - There is a SQI per direction, in the same way that there is a LM per direction.
  - Link status is UP when both directions provides a good receiver status (see 114.3.2.1.3).

Questions?