

# Interleaver Depth and Proposed Baseline for PHY Control function

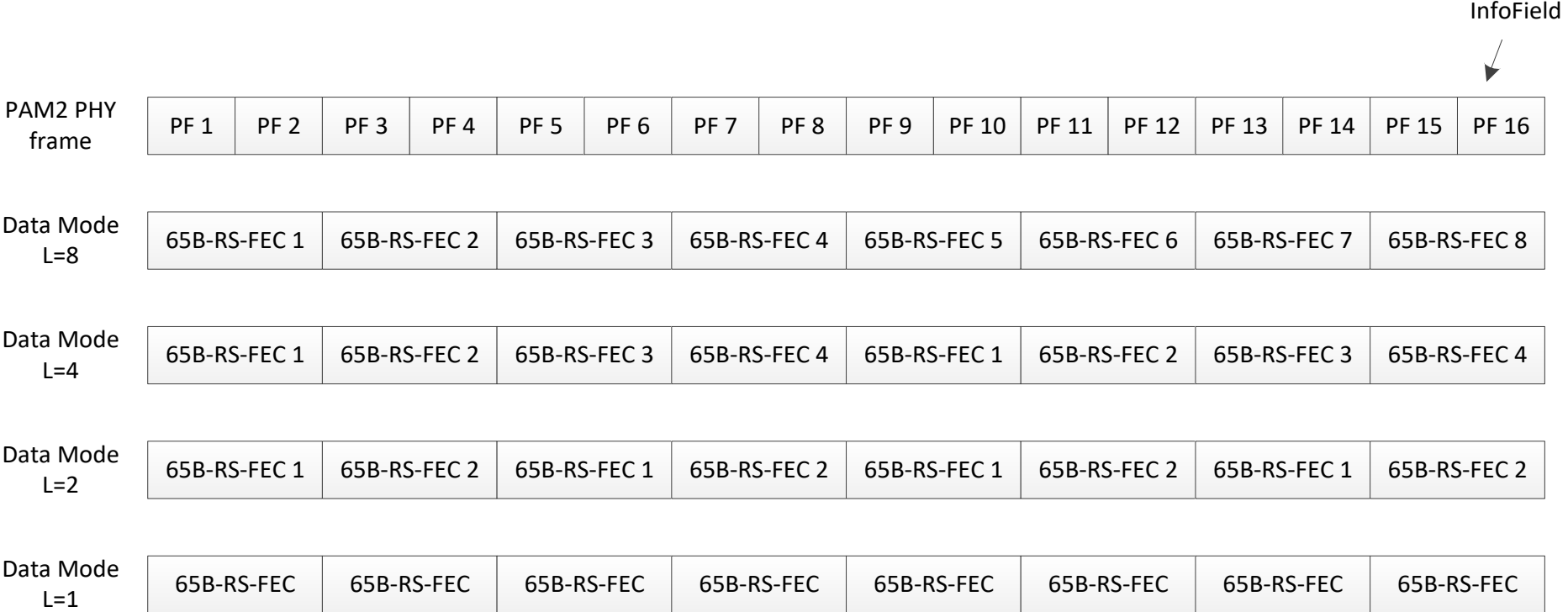
October 17, 2018

Mike Tu  
[tum@broadcom.com](mailto:tum@broadcom.com)

# Proposed Baseline

- InfoField Exchange
  - Interleaving depth = 1, 2, 4, or 8
    - Transmitter must support all four choices for all speeds
  - Precoder selection = bypass,  $1+D$ ,  $1-D$ ,  $1-D^2$ 
    - Transmitter must support all four selections
  - OAM and EEE enabled only if both sides support it
- PAM2 training PHY frame length = 8 x data mode RS-FEC frame length
  - Partitioned into 16 partial frames
  - Each side maintains a partial frame counter which is embeded in InfoField
  - Switch from PAM2 to PAM4, and enable precoder based announced partial frame counter values
- Data mode RS FEC interleaving boundaries aligned with PAM2 training PHY frame boundaries

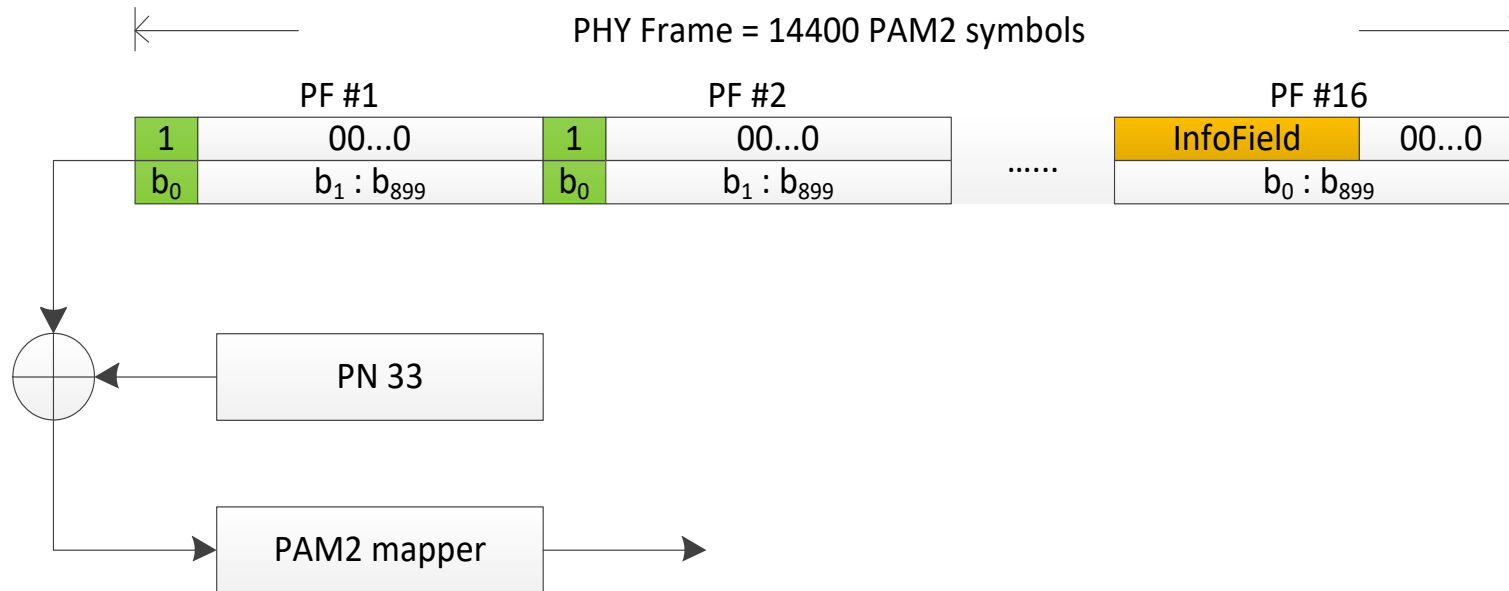
# Alignment of PAM2 and Data Mode Frames



- L=8: 1 superframe ⇔ 8 x 65B-RS-FEC frame
- L=4: 1 superframe ⇔ 4 x 65B-RS-FEC frame
- L=2: 1 superframe ⇔ 2 x 65B-RS-FEC frame
- L=1: 1 superframe ⇔ 1 x 65B-RS-FEC frame

# PAM2 Training PHY Frame Format

- Data mode RS FEC (N=360, K=326, m=10) → 1800 PAM4 symbols
- Training frame consists of 8x1800 = 14400 PAM2 symbols
  - 2.56usec for 10G, 5.12usec for 5G, and 10.24usec for 2.5G
- 16 partial PHY frames
  - Each partial frame = 900 PAM2 symbols
  - First bit of each partial PHY frame is inverted as alignment markers
  - InfoField XOR'ed at the start of the 16<sup>th</sup> partial frame



# InfoField

## 96-bit Infofield

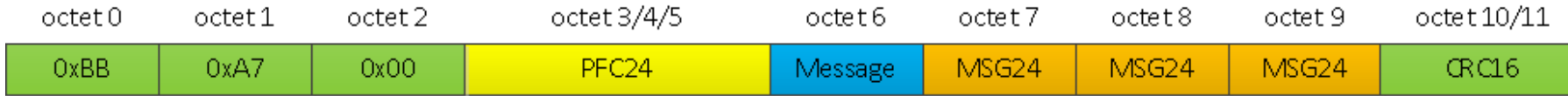


Table 149-tt1 – InfoField message field valid MASTER settings

PMA_state<7:6>	loc_rcvr_status	en_slave_tx	reserved	reserved	reserved	reserved
00	0	0	0	0	0	0
00	0	1	0	0	0	0
00	1	1	0	0	0	0
01	1	1	0	0	0	0

Table 149-tt2 – InfoField message field valid SLAVE settings

PMA_state<7:6>	loc_rcvr_status	timing_lock_OK	reserved	reserved	reserved	reserved
00	0	0	0	0	0	0
00	0	1	0	0	0	0
00	1	1	0	0	0	0
01	1	1	0	0	0	0

# InfoField Formats at Different States

octet 1	octet 2	octet 3	octet 4/5/6	octet 7	octet 8/9/10			octet 11/12
0xBB	0xA7	0x00	PFC24	Message	MSG24	MSG24	MSG24	CRC16

Figure 149-nn1 – InfoField format

octet 1	octet 2	octet 3	octet 4/5/6	octet 7	octet 8/9/10		octet 11/12
0xBB	0xA7	0x00	PFC24	Message	UsrCfgCap		CRC16

Figure 149-nn2 – InfoField TRAINING format

octet 1	octet 2	octet 3	octet 4/5/6	octet 7	octet 8/9/10		octet 11/12
0xBB	0xA7	0x00	PFC24	Message	DataSwPFC24		CRC16

Figure 149-nn3 – InfoField COUNTDOWN format

# Capability Bits

- EEE enabled only if both PHYs set EEEen = 1.
- OAM enabled only if both PHYs set OAMen = 1.
- InterleaveDepth
  - Oct10<2:1> = 00 ⇔ L=1
  - Oct10<2:1> = 01 ⇔ L=2
  - Oct10<2:1> = 10 ⇔ L=4
  - Oct10<2:1> = 11 ⇔ L=8
  - Tx must support the requested interleaving depth
- PrecodeSel
  - Oct10<4:3> = 00 ⇔ precoder bypass, or no precoder
  - Oct10<4:3> = 01 ⇔ 1-D
  - Oct10<4:3> = 10 ⇔ 1+D
  - Oct10<4:3> = 11 ⇔ 1-D<sup>2</sup>
  - Tx must support the selected precoder

octet 8								octet 9								octet 10							
0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Seed (or Reserved)																EEEen	OAMen	Interleaved epth	PrecodeSel	Reserved	Reserved	Reserved	

# PHY Control state diagram

- Start with MS PAM2 half duplex
- SL PAM2 starts after en\_slave\_tx=1
- MS and SL check for loc\_rcvr and rem\_rcvr status OK
- Exchange EEE, OAM capabilities, precoder selection, and interleaver depth
- Exchange exact time for each PHY to switch into PCS Test
- Local count down and enter TX SWITCH state
  - Precoder enabled, send PAM4
- Remote count down and switch to PCS Test
- 10G RS layer responsible for data flow control after link up

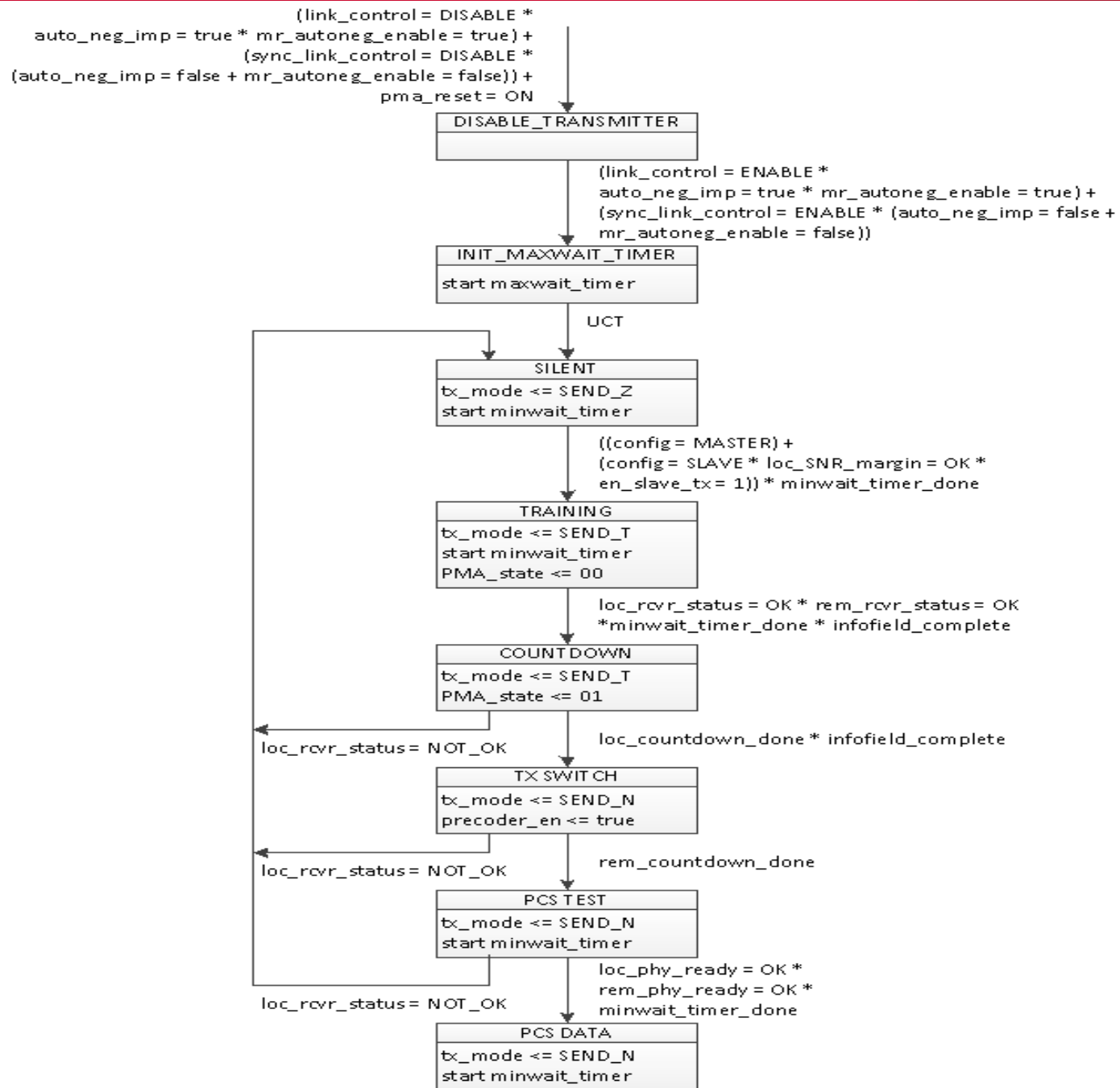


Figure 149-16 – PHY Control state diagram



# PHY Control state diagram (cont.)

- Need to redefine “rem\_countdown\_done” to be based on implicit counter values, instead of checking last InfoField.
- Need to define “PCS\_status” based on Clause 55.

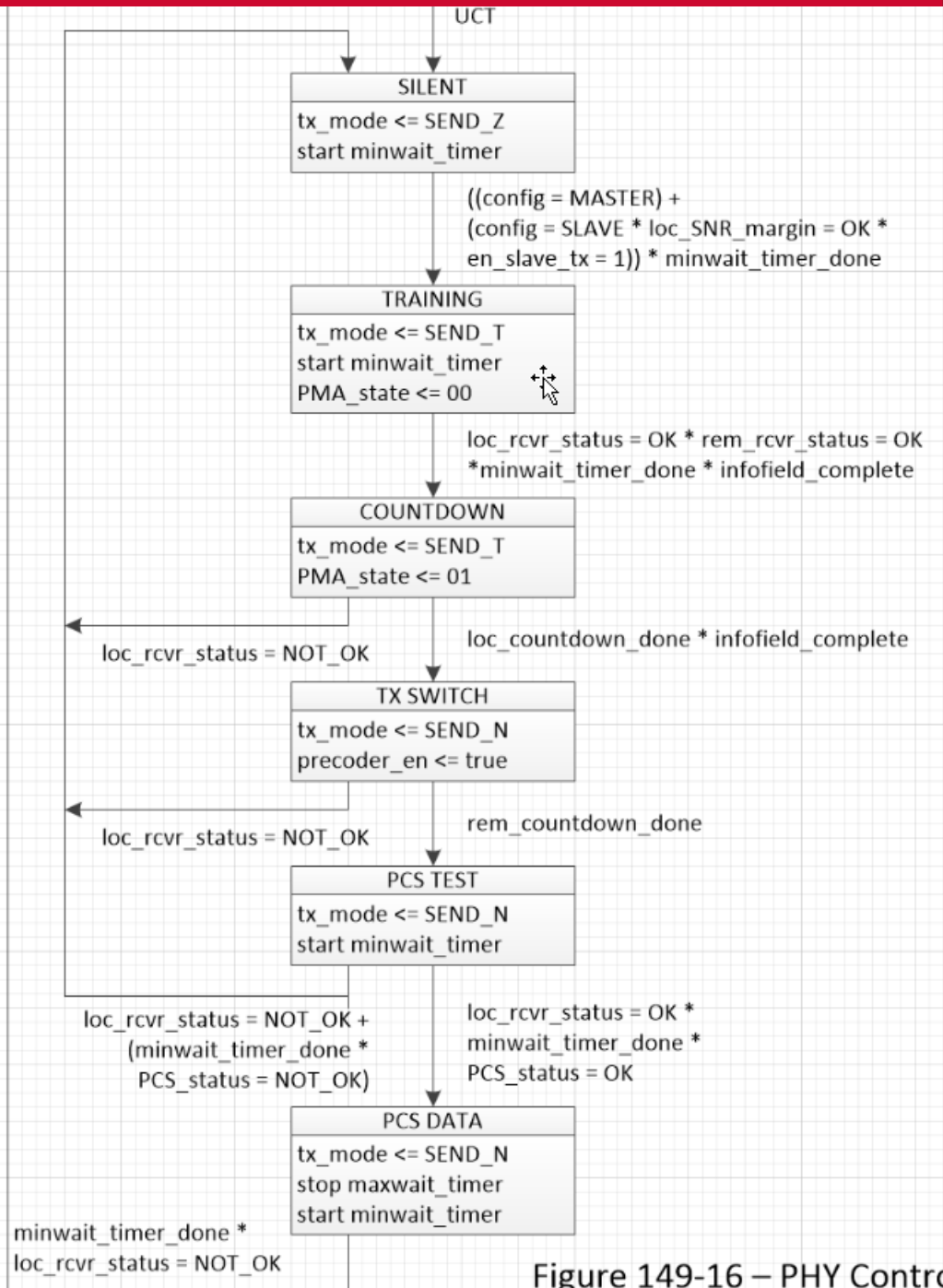
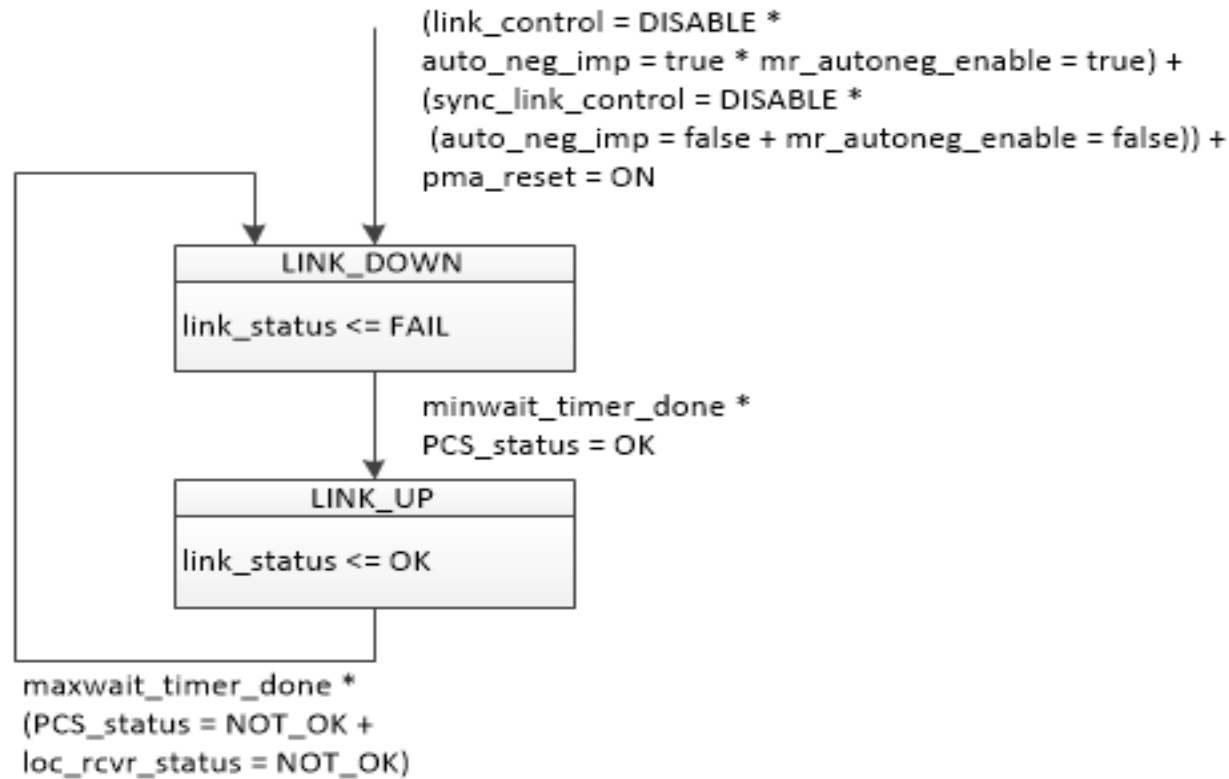


Figure 149-16 – PHY Control state diagram

# Link Monitor state diagram



NOTE 1 – maxwait\_timer is started in PHY Control state diagram (see Figure 149-16).

NOTE 2 – The variables link\_control and link\_status are designated as link\_control\_mGigT1 and link\_status\_mGigT1, respectively, by the Auto-Negotiation Arbitration state diagram (Figure 98-7) if the optional Auto-Negotiation function is implemented.

Figure 149-17 – Link Monitor state diagram