Clarifications of PCS 80B/81B Control Block for 1000BASE-T1

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Outline

- PCS Encoder baseline passed in March 2014 Meeting
  - PCS 80/81 encoding
  - Control block with Control code and Pointer
- Additional proposal
  - Specify the table of control codes and pointer
  - Clarifications of the GMII and PCS 80/81 Encoder mapping

TX GMII and PCS 80/81 Encoder mapping

- Mapping to Table 35-1 Permissible encodings of TXD<7:0>, TX_EN, and TX_ER

Table 35-1				**1000BASE-T1**
TX_EN	TX_ER	TXD<7:0>	Description	**Control Code <0:2>**
0	0	00~FF	Normal inter-frame	010
0	1	1	Assert LPI	101
0	1	0F	Carrier Extend	???
0	1	1F	Carrier Extend Error	???
0	1	Else	Reserved	???
1	0	00~FF	Normal data transmission	n/a
1	1	00~FF	Transmit Error Propagation	001

- According to the 4.1.2.1.1 and 4.2.3.4 in 802.3, the MAC layer does not perform either carrier extension or frame bursting in full duplex mode. Since 1000Base-T1 only supports full duplex mode, we do not expect the “Carrier Extend” and “Carrier Extend Error” from MAC through GMII.
- What Control codes should they be, in case they happened?
- The “Reserved” transaction was treated as IFG in 1000Base-T.

10G Control Codes

- In 10G, it clearly specifies what to do if the unspecified control code values appeared.
  - In 55.3.2.2.6, it mentioned "The control characters and their mappings to 10GBASE-T control codes and XGMII control codes are specified in Table 55–1. All XGMII and 10GBASE-T control code values that do not appear in the table shall not be transmitted and shall be treated as an error if received."

Table 55–1—Control codes

Control character	Notation	XGMII control codes	10GBASE-T control codes	10GBASE-T O code	8B/10B code[a]
idle	/I/	0x07	0x00		K28.0 or K28.3 or K28.5 without D20.5[b]
LPI	/LI/	0x06	0x06		K28.0 or K28.3 or K28.5 with D20.5[b]
start	/S/	0xFB	Encoded by block type field		K27.7
terminate	/T/	0xFD	Encoded by block type field		K29.7
error	/E/	0xFE	0x1E		K30.7
Sequence ordered_set	/Q/	0x9C	Encoded by block type field plus O code	0x0	K28.4
reserved0	/R/[c]	0x1C	0x2D		K28.0
reserved1		0x3C	0x33		K28.1
reserved2	/A/	0x7C	0x4B		K28.3
reserved3	/K/	0xBC	0x55		K28.5
reserved4		0xDC	0x66		K28.6
reserved5		0xF7	0x78		K23.7
Signal ordered_set[d]	/Fsig/	0x5C	Encoded by block type field plus O code	0xF	K28.2

Proposal for Control Block Clarification

- Specify the Table of Control Codes and Pointer
- Clarifications of the GMII and PCS 80/81 Encoder mapping

Table of Control Codes

- The control characters and their mappings to 1000BASE-T1 control codes are further clarified in the table of control codes, as shown below. All 1000BASE-T1 control code values that do not appear in the table shall not be transmitted and shall be treated as an error if received.
- The Table of Control Codes

New added		**Based on Lo_3bp_02_0314.pdf**		
Control Character	Notation	**1000BASE-T1 Control Code <0:2>**	GMII Transmit	GMII Receive
idle	/I/	010	Normal inter-frame	Normal inter-frame
LPI	/LI/	101	Assert LPI	Assert LPI
error	/E/	001	Transmit error propagation	Data reception error

Pointer in Control Block

- The Pointer<0:4> in Control block are clarified in the table below. All 1000BASE-T1 pointer values in the control block that do not appear in the table shall not be transmitted and shall be treated as an error if received
- The Table of valid pointer<0:4> in Control block

Pointer <0:3> in Control block	Pointer<4> in Control block
0000	0~1
1000	0~1
0100	0~1
1100	0~1
0010	0~1
1010	0~1
0110	0~1
1110	0~1
0001	0~1
1001	0~1

TX GMII and PCS 80/81 Encoder mapping

- The “Carrier Extend” and “Carrier Extend Error”, and “Reserved” transactions, if any occurred, are assigned to the Control Code<0:2> of “010”, “Normal inter-frame”, in the PCS 80B/81B Encoder.
- Mapping to Table 35-1 Permissible encodings of TXD<7:0>, TX_EN, and TX_ER

Table 35-1				1000BASE-T1
TX_EN	TX_ER	TXD<7:0>	Description	**Control Code <0:2>**
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0	1	1	Assert LPI	101
0	1	0F	Carrier Extend	010
0	1	1F	Carrier Extend Error	010
0	1	Else	Reserved	010
1	0	00~FF	Normal data transmission	n/a
1	1	00~FF	Transmit Error Propagation	001

RX GMII and PCS 80/81 Encoder mapping

- Neither “Carrier Extend” nor “Carrier Extend Error” transaction should occur in GMII Receive
- Mapping to Table 35-2 Permissible encodings of RXD<7:0>, RX_DV, and RX_ER

Table 35-2				1000BASE-T1
RX_DV	RX_ER	RXD<7:0>	Description	**Control Code <0:2>**
0	0	00~FF	Normal inter-frame	010
0	1	0	Normal inter-frame	n/a
0	1	1	Assert LPI	101
0	1	0E	False Carrier indication(*)	n/a
0	1	0F	Carrier Extend	n/a
0	1	1F	Carrier Extend Error	n/a
0	1	Else	Reserved	n/a
1	0	00~FF	Normal data reception	n/a
1	1	00~FF	Data reception error(*)	001

- (*) conditions for these are TBD.