1.0 Preamble

One of the motivations of following the IEEE802.3 Ethernet standard was to leverage the GMII and XGMII physical layer devices (PHY) that are in the market currently for 1000Base-X and 10Gbase-<various> (fiber optical). The 1 Gb/s PHY device provides line synchronization, frame delimiter indications, i.e. Start_of_Packet (SOP) and End_of_Packet (EOP), and idle state indications by encoding / decoding these states into 8B/10B control characters and defined Control order sets. It also provides 8B/10B coding error indications. The 10 Gb/s PHY device provides line synchronization, frame delimiter indications, i.e., Start_of_Packet (SOP) and End_of_Packet (EOP), and idle state indications by encoding / decoding these states into 64B/66B control characters and defined Control order sets. It also provides 64B/66B coding error indications via out of band signals.

The 1000Base-T Ethernet protocol is a copper base solution requires another method in order to determine synchronization, framer delimiter and idle state since this protocol needs to be compatible with 10/100 Mb/s Base-T solutions. In order to provide these functions it is required that the MAC layer sub-layer needs to prepend the following information to the data packet:

- **Preamble (PRE)** - 7 bytes. The PRE is an alternating pattern of ones and zeros that tells receiving stations that a frame is coming, and that provides a means to synchronize the frame-reception portions of receiving physical layers with the incoming bit stream.
- **Start-of-frame delimiter (SFD)** - 1 byte. The SOF is an alternating pattern of ones and zeros, ending with two consecutive 1-bits indicating that the next bit is the left-most bit in the left-most byte of the destination address.

The Preamble is used by the 10/100/1000Base-T in a shared media configuration in order to allow the Receiver PHY to acquire pre-clock synchronization, i.e. to have clock / data synchronization before SFD, for the packet being received. In the 1000Base-X application the Preamble is not required for Clock synchronization since there is constant activity on the line with either 8B/10B control or data characters. The 8B/10B encoding guarantees transition densities to assure clock synchronization is maintained.

On the Transmit direction the standard 1000Base-X PHY does not try to interpret the actual byte values within the PRE but after the GMII TX_EN is asserted, the first byte of the PRE is replaced by the SOP delimiter (Sct. 36.2.4.13 of IEEE 802.3). The remainder of the PRE plus SFD along with the packet data after clock / data synchronization transmitted without modification. Upon detection of the SOP at the receive end the PRE byte replaces the SOP control character before sending the packet to the GMII RXD<7:0>. The MAC only uses the SFD to determine the Start-of-Packet and ignores any PRE. Therefore the 1000Base-X MAC can operate with 0 bytes of PRE in the event no PRE was provided to the MAC (Sct. 35.2.3.2.2 of IEEE 802.3).

Since RPR PacketPHY is not compatible with IEEE802.3 10/100/1000Base-T, 1000Base-X, or 10GBase-<various> at the MAC layer there is not a requirement for the PRE length as defined in the IEEE802.3 specification to be 7 bytes in which the IEEE802.17 Annex B.2.1 lists erroneously as a requirement. Without generating a single PRE byte it is still compatible with the 1 Gb/s and 10 Gb/s fiber PHYs as it uses the same coding for line synchronization, frame delimiters, and idle state.

2.0 Interpacket Gap (IPG)

The IEEE802.3 Interpacket Gap requirement provides the ability for other stations on the same shared media network to have equal access to a share shared media 10/100/1000 Base-T Ethernet network and is part of the CSMA/CD protocol. When either a packet has been completely transmitted from a source station or it has detected the network is in used, it waits the minimum IPG before attempting to transmit another packet.

The insertion of the IPG is a MAC layer function and is not associated with the PHY functionality except when it is a 10/100/1000Base-T PHY as it provides collision detection indication and carrier sense which are not used (Sct. B.2.1.3 of IEEE802.17).

Since PacketPHY is not a copper PHY and/or a shared media base solution, which would use the CSMA/CD protocol, the requirement for IPG is not required. This is erroneously listed in the IEEE802.17 Annex B.2 and B.3 as a PHY requirement.

3.0   Summary

These physical layer requirements should not have been included for the RPR PacketPHY as these are specific IEEE802.3 MAC layer functions and therefore is not required as stated. By erroneously including these requirements it would reduce the bandwidth efficiency of the PacketPHY. This is due to the requirement that all packets which include fairness and control frames would need to add the additional bytes required for Preamble (7 bytes) and also be required to wait the IPG period of 96 nsec for 1G PacketPHY (12 bytes) between packet transmissions irregardless of the type of packet.

Based on this it is recommend that these two requirements be restated as follows:
- PRE length is required to be 1 byte minimum and the value is per the IEEE802.3-2002
- IPG be listed as an exception to the IEEE802.3-2002

These two PacketPHY requirements as currently stated compromises the bandwidth efficiency of PacketPHY while the change to PRE and the removal of IPG requirements does not compromise the use of standard IEEE802.3 GMII 1000Base-X PHYs or IEEE802.3 XGMII 10GBase-<various> PHYs.