

Negotiation Proposal for LPI EEE

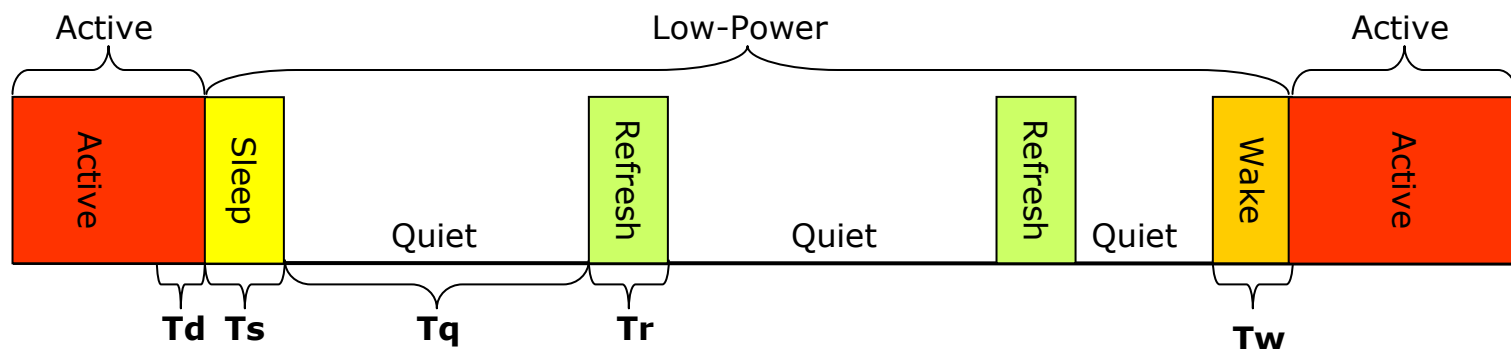
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Timing Parameters (from Hays_01_0308)

Term	Description
Decision Time (T_d)	Time used by higher-layer control policy to decide when to enter Low-Power state. Out of scope for 802.3az spec.
Sleep Time (T_s)	Duration PHY sends Sleep symbols before going Quiet.
Quiet Duration (T_q)	Duration PHY remains Quiet before it must wake for Refresh period.
Refresh Duration (T_r)	Duration PHY sends Refresh symbols for timing recovery and coefficient synchronization.
Wake Time (T_w)	Wait period where no data is transmitted to give the receiving system time to wake up.
Propagation Delay (T_p)	Transmission delay of the media from the MDI of the local device to the MDI of the link partner. Not shown in diagram.



Negotiation Proposal

- Negotiate EEE capability during Auto-Negotiation
- Specify T_s , T_q , and T_r as part of the standard
 - Unique values may be specified for each PHY type
 - Specification is preferred to simplify validation and interoperability testing
 - Assumes Task Force can select values to balance several considerations:
 - Efficient duty cycle for energy savings (favoring longer T_q and shorter T_r)
 - Robust PHY performance (favoring shorter T_q and longer T_r)
 - Loss of link detection (favoring shorter T_q)
- Negotiate T_w using MAC Control Frames (Clause 31 MCF)
 - $T_{w_{min}}$ and $T_{w_{max}}$ should be specified to provide boundary conditions
 - Negotiate T_w during normal operation prior to 1st entry into LP state
 - Longer Wake Time enables entry into deeper system power-saving states (See Hays_01_0108)
- T_d and T_p are N/A

EEE Auto-Neg Extension (1 of 2)

Use Message Next Page (Page 0) with reserved 0x10 message code for EEE Technology Next Page Message code (Annex 28C and Annex 73A).

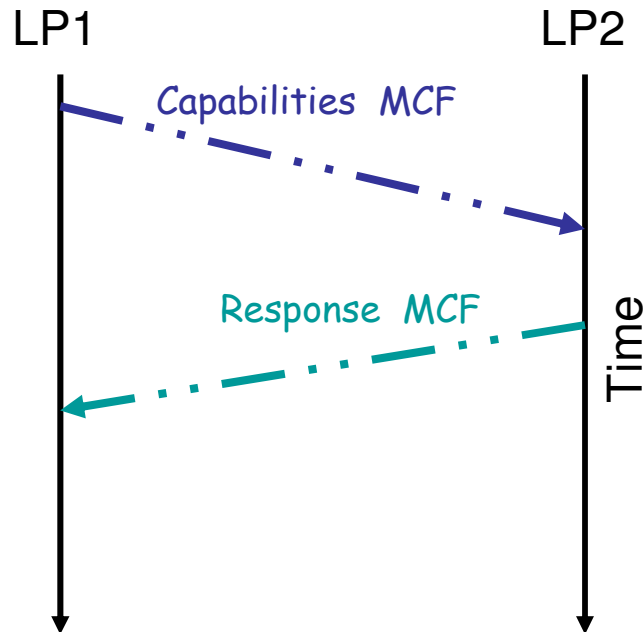
Message Count#	M 10	M 9	M 8	M 7	M 6	M 5	M 4	M 3	M 2	M 1	M 0	Message Code Description
10	0	0	0	0	0	0	0	1	1	0	0	EEE Technology Message Code. EEE capability unformatted next page to follow.
11 ...	0	0	0	0	0	0	0	1	1	0	1	Reserved for future Auto-Negotiation use

EEE Auto-Neg Extension (2 of 2)

Use Unformatted next page (Page 1) to define supported technologies.

Bit	Bit definition
U10:U7	Reserved transmit as 0
U6	10GBASE-KR (0 – EEE not supported 1 – EEE supported)
U5	10GBASE-KX4 (0 – EEE not supported 1 – EEE supported)
U4	1000BASE-KX (0 – EEE not supported 1 – EEE supported)
U3	10GBASE-T (0 – EEE not supported 1 – EEE supported)
U2	1000BASE-T (0 – EEE not supported 1 – EEE supported)
U1	100BASE-TX (0 – EEE not supported 1 – EEE supported)
U0	10BASE-T (0 – EEE not supported 1 – EEE supported)

Wake Time (T_w) Negotiation



Capabilities MCF - LP1 EEE system parameters (T_w)

Response MCF - LP2 EEE system parameters (T_w)

- $T_{w_{min}}$ to be specified as a function of PHY capabilities. All EEE-compliant systems should be required to support $T_{w_{min}}$.
- $T_{w_{max}}$ to be specified to bound design and test requirements. EEE-compliant systems may be allowed, but not required, to support T_w values up to $T_{w_{max}}$.
- T_w (actual wake time) negotiated to Lowest Common Denominator to ensure interoperability (e.g. end-to-end buffer support) and prioritize performance over energy savings
- Either Link Partner may send CMCF prior to 1st entry into Low-Power state
- Re-send CMCF if RMCF is not received after TBD time

EEE MAC Control Frame

Used for both Capabilities and Response MCF Frames.

6 OCTETS	<i>Destination Address</i>	
6 OCTETS	<i>Source Address</i>	
2 OCTETS	<i>88-08 (802.3_MAC_Control Type)</i>	
2 OCTETS	<i>EEE Wake (Opcode 00-07)</i>	
2 OCTETS	<i>Twake</i>	
2 OCTETS	<i>Ack</i>	<i>Reserved (transmitted as zeros)</i>
	<i>Padding + CRC</i>	

Parameter Semantics

Twake is a 2-octet, unsigned integer that defines Wake Time before move into Active state. The field is transmitted most-significant octet first, and least-significant octet second. The Twake parameter is measured in units equal to 512 bit times of the particular implementation. The range of allowable *Twake* values is TBD μ Sec.

Ack – Acknowledge

0 - EEE Capabilities MCF.

1 - EEE Response MCF.

Backup

MAC Control Frame Format (802.3 Clause 31)

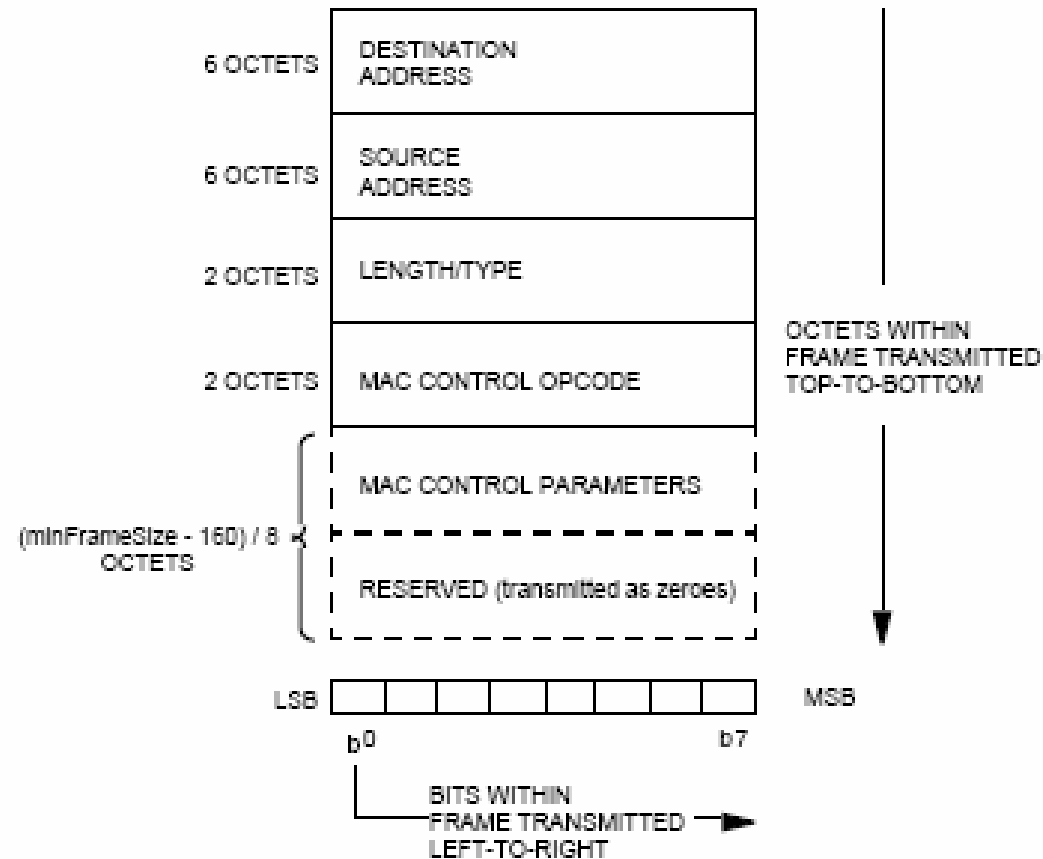


Figure 31-3—MAC Control frame format

MAC Control Opcode Assignments

Table 31A-1—MAC Control opcodes

Opcode (Hexadecimal)	MAC Control function	Specified in	Value/Comment	Timestamp ^a
00-00	Reserved			
00-01	PAUSE	Annex 31B	Requests that the recipient stop transmitting non-control frames for a period of time indicated by the parameters of this function.	No
00-02	GATE	Clause 64	Request that the recipient allow transmission of frames at a time, and for a period of time indicated by the parameters of this function.	Yes
00-03	REPORT	Clause 64	Notify the recipient of pending transmission requests as indicated by the parameters of this function.	Yes
00-04	REGISTER_REQ	Clause 64	Request that the station be recognized by the protocol as participating in a gated transmission procedure as indicated by the parameters of this function.	Yes
00-05	REGISTER	Clause 64	Notify the recipient that the station is recognized by the protocol as participating in a gated transmission procedure as indicated by the parameters of this function.	Yes
00-06	REGISTER_ACK	Clause 64	Notify the recipient that the station acknowledges participation in a gated transmission procedure.	Yes
00-07 through FF-FF	Reserved			

^aThe timestamp field is generated by MAC Control and is not exposed through the client interface.