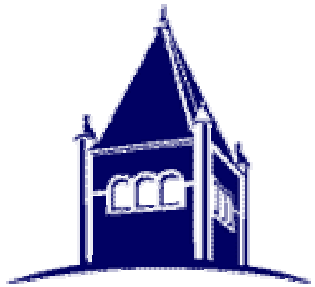


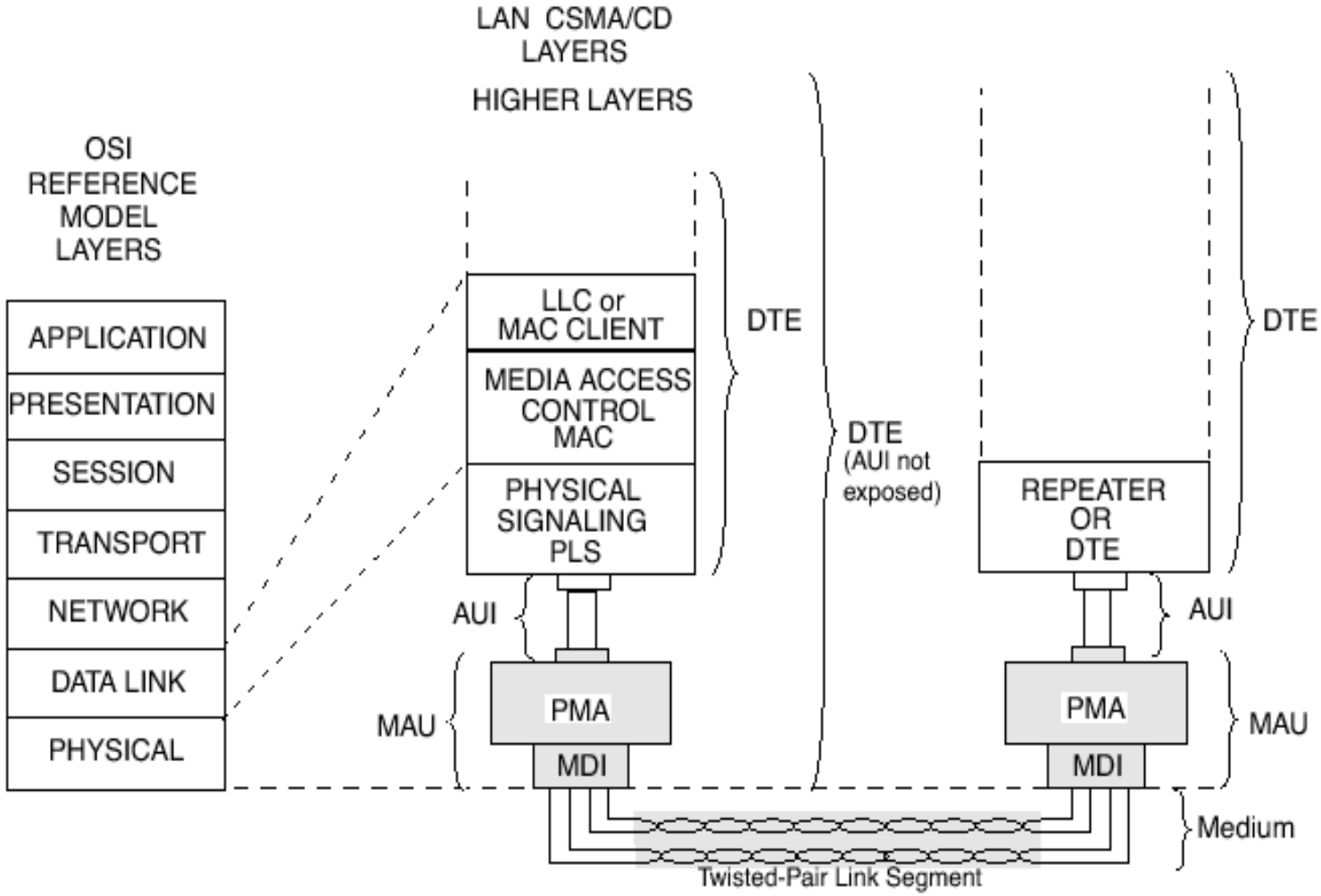
10Base-T

Medium Attachment Unit

Presentation Overview

- Location in the OSI Stack
- Interface with The Physical Signaling Sublayer (PLS)
- Interface with Physical Medium (Twisted Pair Link Segment)
- MAU Functionality

Location in the OSI stack



Interface with the PLS

- Provides 50m of cable separation between the DTE and the MAU. This is no longer implemented. You will not see 50m of cable hanging off 10Base-T devices.

The following messages can be sent by PLS sublayer entities in the DTE to PMA sublayer entities in the MAU:

Message	Meaning
output	Output information
output_idle	No data to be output
normal	Cease to isolate the MAU
(Optional)	
isolate	Isolate MAU
mau_request	Request that the MAU be made available

Description of Messages From PLS to MAU:

- Output message: PLS sends a output message to the PMA when it receives a bit (OUTPUT_UNIT) from the MAC.
- Output_idle message: PLS sends a Output_idle message to the PMA at all times when the MAC is not sending anything to it.
- Normal message: Is sent to the PMA after is receives the PLS start message from the Reset and Identity function.
- Isolate: A isolate message is sent to the PMA whenever the PLS receives SET_MONITOR_MODE from the management. The MAU responds by not allowing data to be impressed on the medium. This is used to ensure that the MAU will not interfere with the physical medium by affecting other transmissions from other stations.
- Mau_request: PLS senses this message if the PMA is sending the mau_not_available message and the MAC has sent the first bit of a new transmission. This is sent continuously until the MAC sends out the DATA_COMPLETE message.

Interface with the Physical Medium

- The interface with the physical medium is the MDI which is the RJ-45 connector.
- It is there to connect the MAU to the ethernet cable.

10 Base-T

- What is 10Base-T?

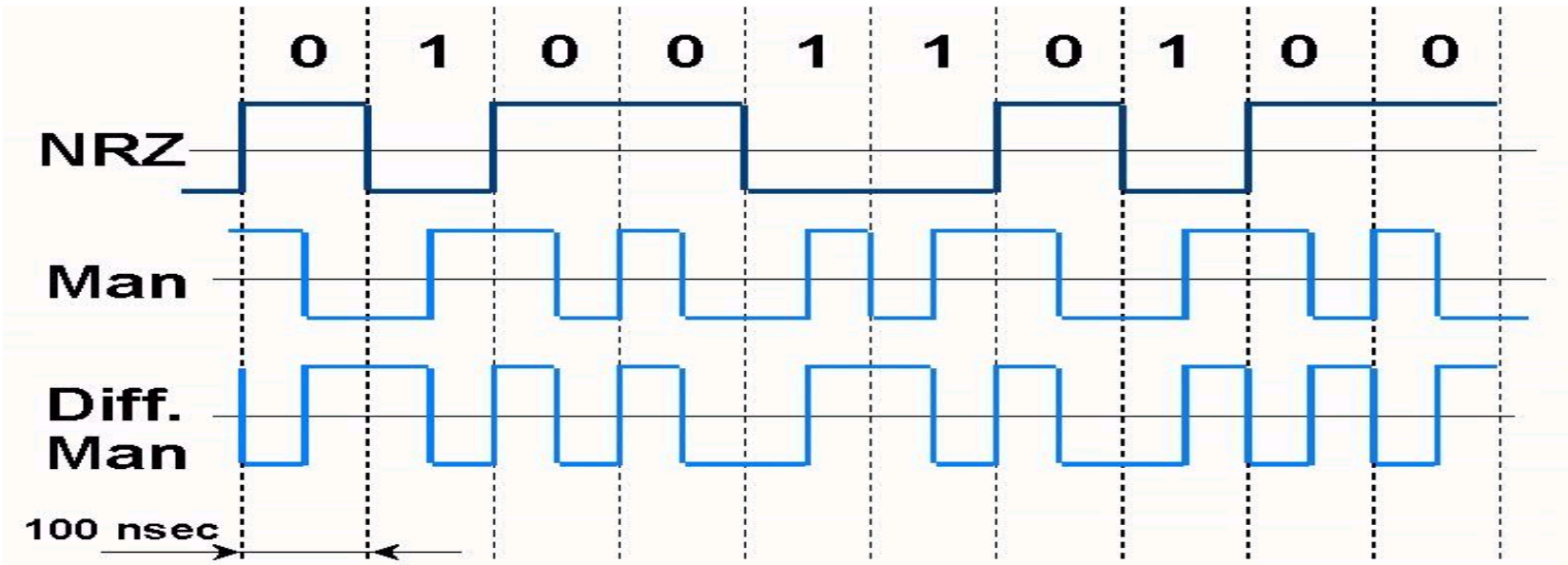
  10Base-T is twisted pair Ethernet, using star topology with a 100m diameter at a speed of 10Mbits/sec.

- What is the MAU?

  The MAU (Medium Attachment Unit) is the interface between the Physical medium and the AUI (Attachment Unit Interface). The MDI (Medium Dependant Interface) and PMA (Physical Medium Attachment) reside in the MAU. The MAU permits DTE(Data Termination Equipment) to confirm operation of the MAU and availability of the medium.

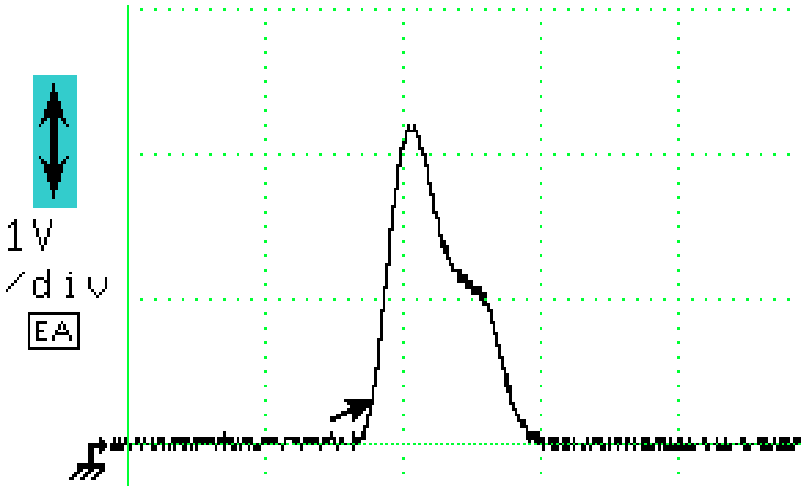
10Base-T

- The form of data encoding: 10Base-T uses Manchester encoding.
- About Manchester encoding:
  - Combines the Ethernet data with the clock signal.
  - The shape of Manchester encoding is a square wave with rounded edges.
  - While not transmitting → Zero volts on line.
  - Voltage High → Voltage Low = Logic 0
  - Voltage Low → Voltage High = Logic 1

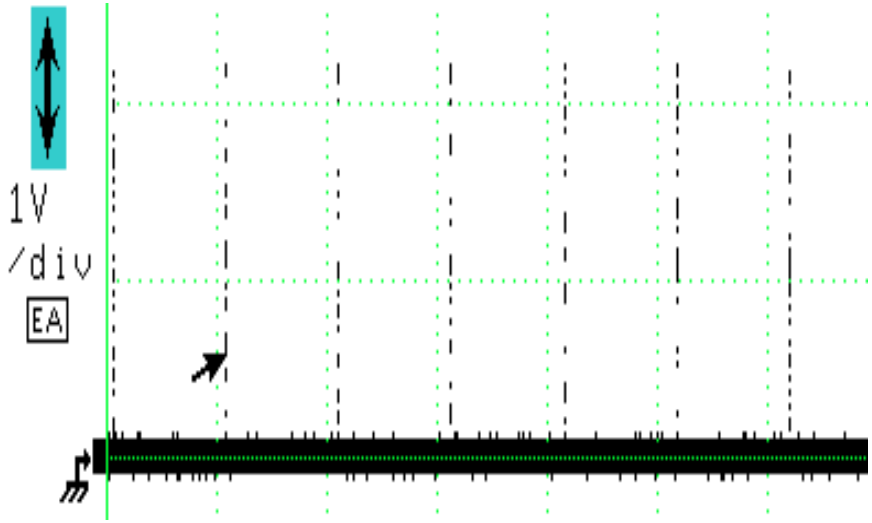


Idle

- Idle pattern of 10Base-T is a Link Test Pulse (LTP) sent every 16ms±8ms. In between LTPs there should be 0 Volts present on the line. LTPs are the same as a Normal Link Pulse (NLP).
- Idle is continuously sent unless the device is transmitting data.



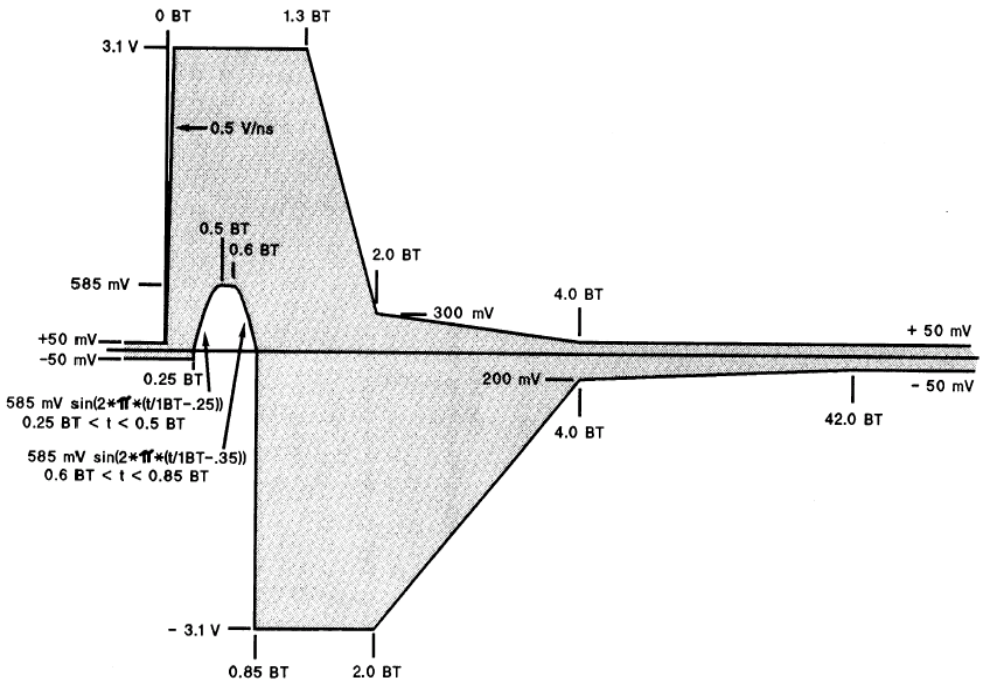
LTP zoomed in



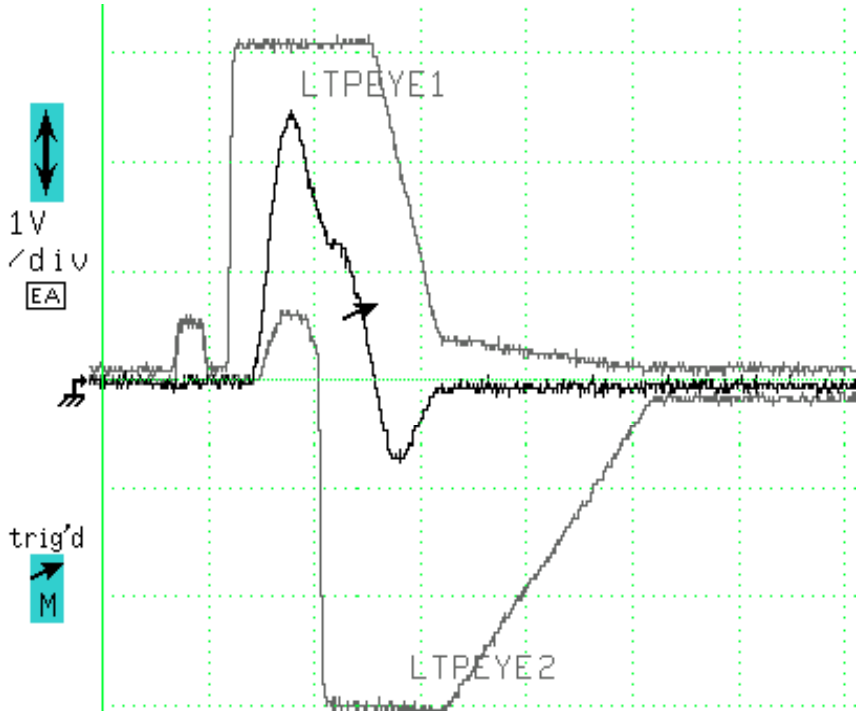
Several LTPs (line is idle)

Link Test Pulse

- A LTP should be bounded between ±3.1V with a width of no greater than 42 Bit Times (4200 ns).



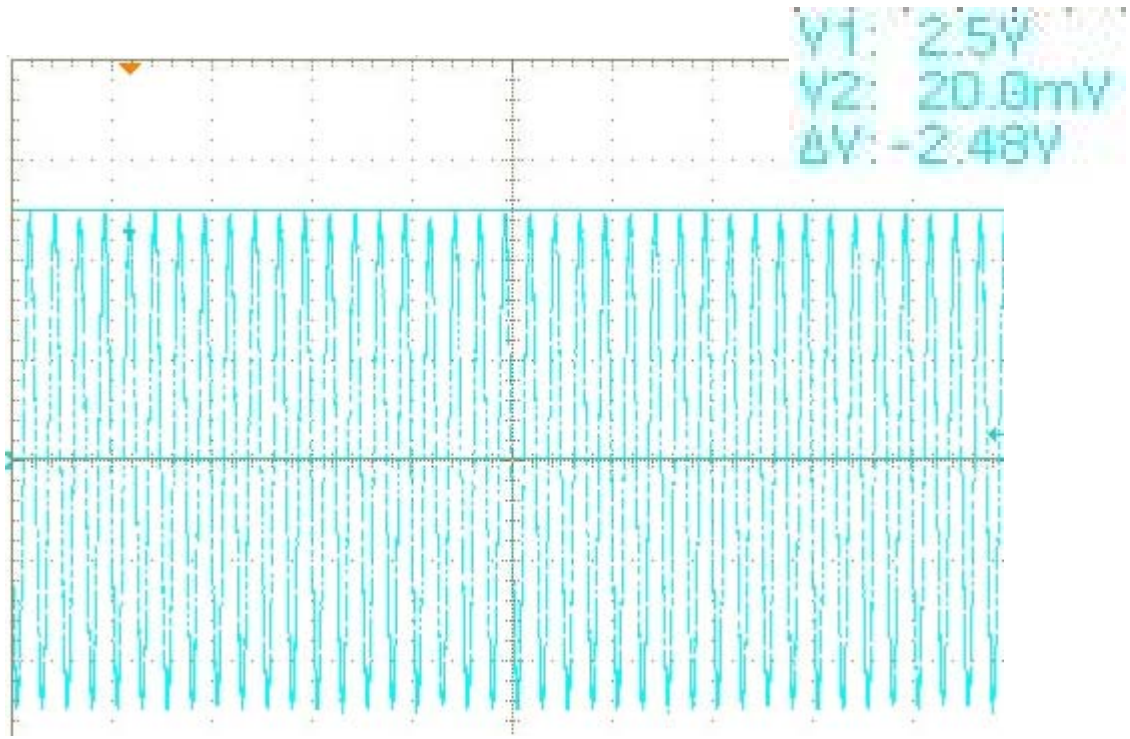
LTP Template



Example of LTP in the Template

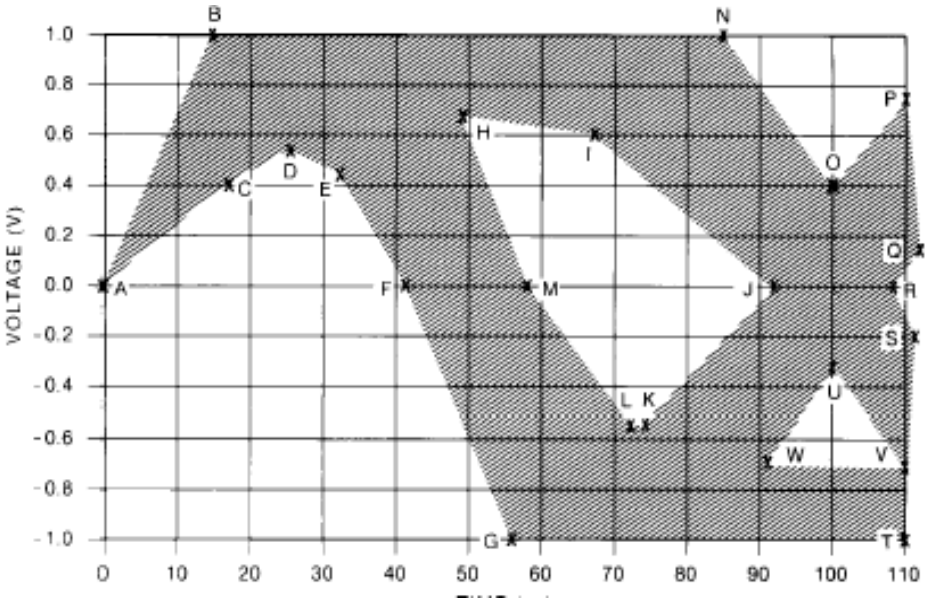
Waveform characteristics

- The peak differential Voltage a Device transmits shall be between 2.2V and 2.8V. This means the height of a frame should never be below –2.8 volts and above +2.8 volts or should never be below 2.2 volts and above –2.2 volts.

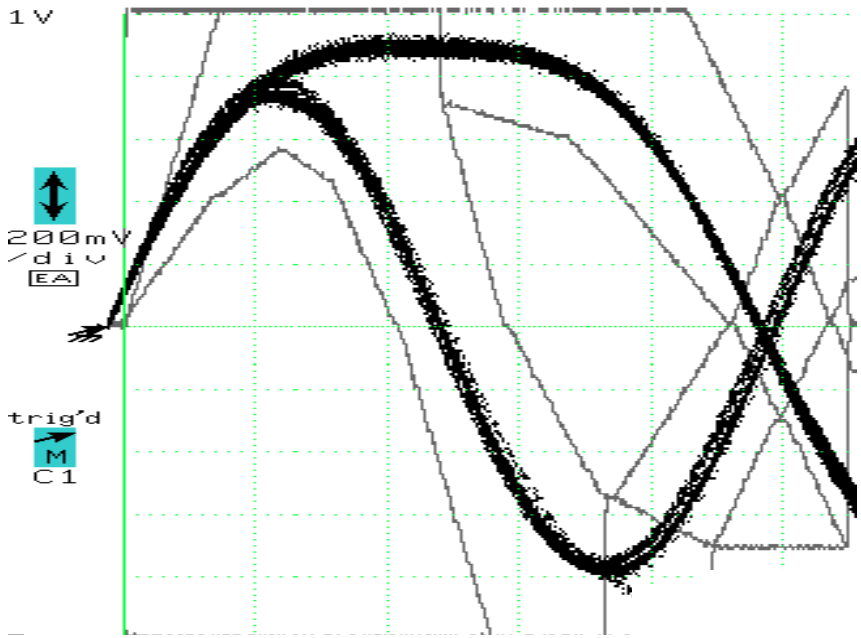


Waveform Characteristics Continued

- The output signal, when connected to the line model, should fall within the Template for all data sequences.



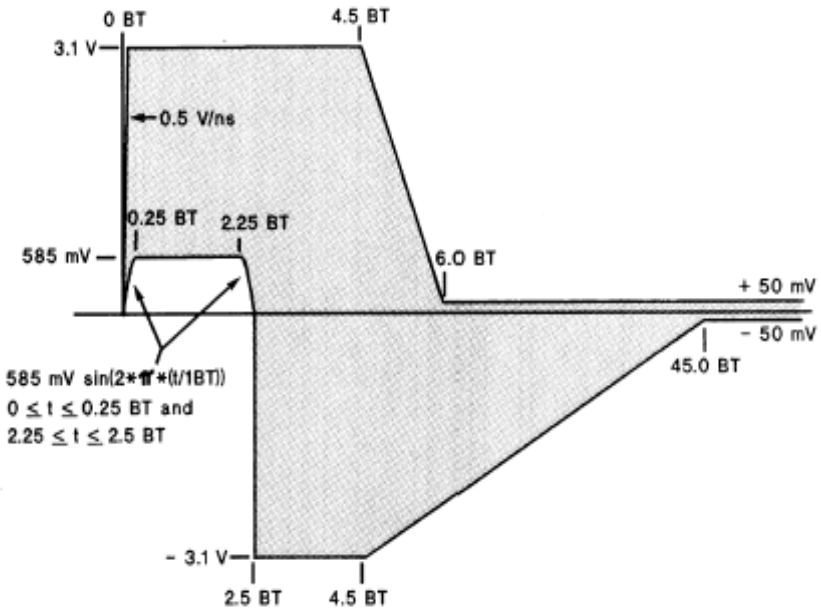
The Output waveform Template as seen in clause 14 of the 802.3 standard



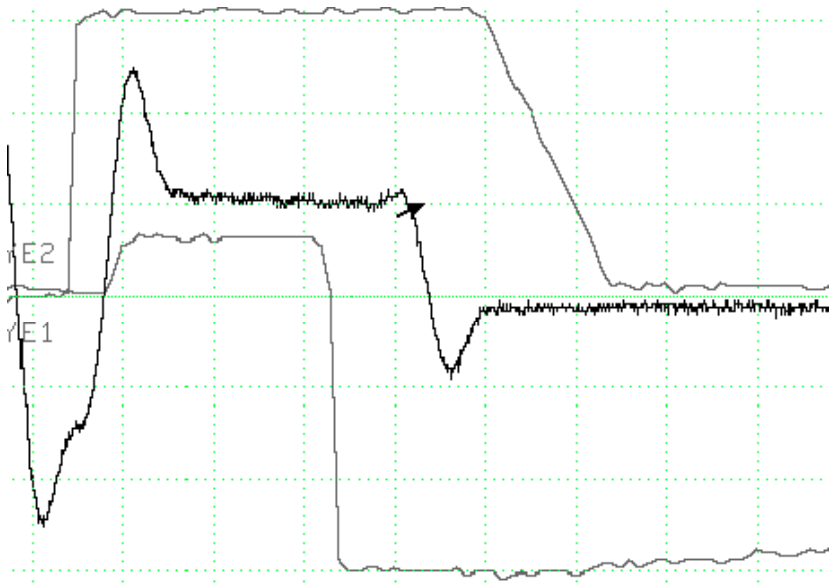
Capture from oscilloscope of the Ouput signal.

SOI Characteristics

- The Start of Idle (SOI or Start of TP_IDL) occurs at the end of a packet and shall always begin with a positive waveform.
- The SOI indicates when the end of a packet and the beginning of idle.
- The SOI shall fit with in the template below when connected to a load.



TP_IDL Template



TP_IDL with load in the template.

10Base-T

- What are the MAU functions?

In full duplex mode the MAU must provide the following functions:

- **Transmit, Receive, Loopback, Jabber, & Link Integrity Test**

In half duplex mode the MAU must provide all of the functions that full duplex mode does plus the following functions:

- **Collision Presence, SQE Test, Generation of the CSO signal on the CI circuit by jabber.**

Full Duplex Functions

- Transmit Function(fcn) ≡ Ability to transmit Manchester encoded data from the TO to TD circuit.
- Receive Fcn ≡ Ability to transmit Manchester encoded data from the RD to DI circuit.
- Jabber Fcn ≡ To prevent abnormally long reception of data on the DO circuit from indefinitely disrupting transmit on the network. While Jabber is enabled the transmit fcn and loopback fcn are disabled.
- Link Integrity ≡ Protects the Network from failures of the Simplex link attached to the RD circuit.
- Loopback ≡ Transfer data from the DO to DI circuit when the MAU is sending data on the TD circuit.

Half Duplex Functions

- Collision Presence ≡ Detects simultaneous occurance of data on the RD and DO circuits. Also, reports the event of a collision.

- Signal Quality Error (SQE) ≡ Signals to the DTE that the collision presence fcn is operational and can send a SQE message.

Receiver Characteristics

- Link_Loss_timer

  The amount of time in which it takes a device to lose link when it does not see activity. Quantum of time must be between 50-150ms.

- Acceptance Range of LTPs

  A device must accept and link off of LTPs spaced 16±8ms. A device should not link off of LTPs spaced < 8ms apart or >16ms apart.

- LTP Acceptance:

  Specified different heights and widths of LTPs which a device must accept and link off of.

- LC_max:

  Number of LTPs a Devices needs to obtain a link. Must be between 2 and10.

Jitter

- Jitter is the difference in time a event is supposed to occur to the time the event actually occurs. There are different types of jitter. There is random jitter and deterministic jitter.
- Random jitter ≡ It is modeled as white noise (infinite bandwidth). The offsets of the events are independent and can be characterized by the standard deviation from which the amplitudes are drawn.
- Deterministic jitter ≡ There are different kinds of deterministic jitter. By definition deterministic jitter can be approximately predicted and is a function of something else. There is intersymbol interference and Duty Cycle Distortion(DCD).

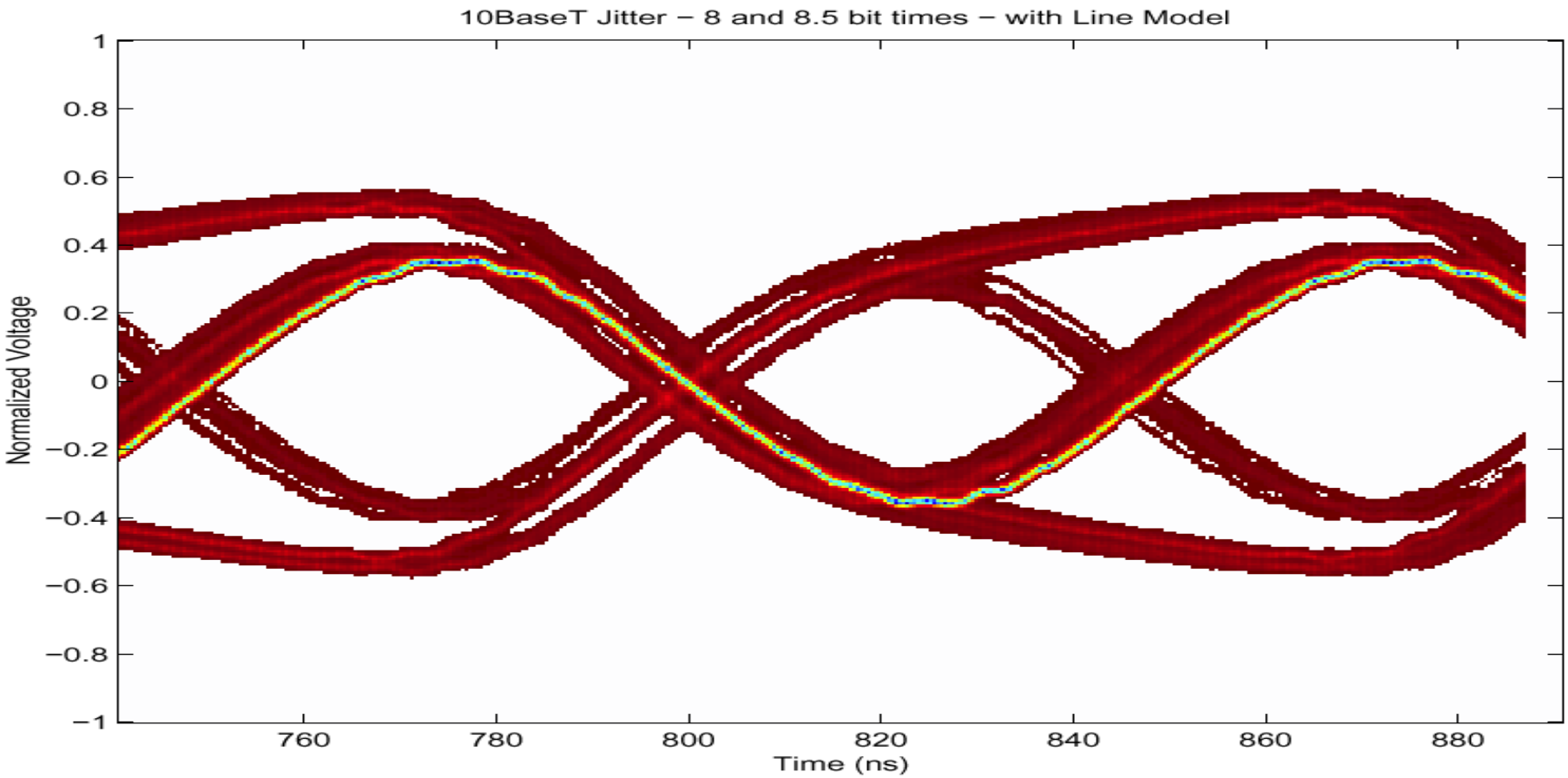
Jitter Continued

- Intersymbol Interference ≡ It is Data dependant. It is distortion that is a function of the pulses that precede and follow a specific pulse. The distortions are caused by bandwidth limitations.
- Duty Cycle Distortion ≡ It is the peak to peak deviation of the measured symbol interval from the expected value. DCD is a function of the deviation of the propagation of the signal rise and fall times.
- Total jitter ≡ It is the convolution of the deterministic jitter and the random jitter.

Jitter Continued

10Base-T Jitter Measurement:

- Jitter is measured at the 8 and 8.5 Bit times with and without the TPM present. With out the TPM a zero crossing should occur ±20ns at the 8 and 8.5 BT. With the TPM a zero crossing should occur ±11 ns at the 8 and 8.5 BT.



In Summary

- Type of encoding: Manchester
- Idle: LTPs every 16±8 ms. In between LTPs is 0 Volts.
- SOI(Start Of Idle): Always present at the end of a frame. Always a positive waveform.
- Amplitude: 2.2-2.8 Volts

References

- 802.3 IEEE Standard