



On EEE and Auto-negotiation for ISAAC

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12/11/2023

Two potential objectives for ISAAC

- “Support optional energy-efficient ethernet optimized for automotive applications”
- “Support optional auto-negotiation”

https://www.ieee802.org/3/ISAAC/public/1123/Objectives_ISAAC_01a_100423.pdf

On EEE objective

- Energy-Efficient Ethernet (EEE) is optional part of ethernet standard for various speeds
 - To reduce the power consumption when there is no data to transmit
 - Note : The average data rate is lower than nominal link rate
- When can EEE be beneficial?
 - On and off data traffic
- Extra cost of EEE
 - Design & testing: higher relative cost, and longer time to market
 - Ongoing Interoperability, temperature ramp issues

EEE in higher rate direction

- Camera data flow is on and off
 - There is a vertical blanking period between frames where camera is not transmitting
- Camera rate can be lower than link rate
 - Examples: a 1G camera to 2.5G PHY, 5+G camera to 10G PHY
- Camera side (transmitter)
 - Power saving is minimal
- Switch/aggregator side (receiver)
 - PHY power can be reduced

EEE in the lower rate direction

- There is an opportunity to use EEE
 - Camera control signal is on and off
 - In most cases, the data rate is lower than 100Mbps especially after initialization phase
- The absolute power saving of EEE is low
 - The power consumption will be low for this direction
 - Timing recovery requirement limits the power saving benefit further

EEE trade off for ISAAC PHYs

Power saving	Transmitter (Camera side)	Receiver (Switch side)
Higher rate direction	Minimal	Possible
Lower rate direction	Limited	Limited

- Extra cost of EEE
 - Design & testing: higher relative cost, and longer time to market
 - Ongoing Interoperability, temperature ramp issues

On auto-negotiation

- Auto-negotiation enables PHYs in both sides of the link, determine the mode and speed of the link
- It is a very useful feature in dynamic and open systems
 - Mismatch prevention, maximize the rate of the link
- Auto-negotiation increases time to link, and overall cost of the PHY
- Automobile system is “closed”
 - Many existing automobile ethernet PHYs do not support it
- However, ISAAC PHY may be used in open systems
 - In this case, an optional auto-negotiation can be beneficial



Thank You