REQUIREMENTS UPDATE FOR IEEE802.3 RTPGE

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  - Requirement list update (includes by feedback from Japanese car industry players and differentiation on some features)
- Information covered in separate slide sets
  - Reach 15m/40m
  - PoE
  - Wake-up
  - 10 uA quiescent current
  - EMC

BER 10e-10

- The car industry has end-to-end requirements on application level
  - This effects start up times (see wake-up slides)
  - This effects quality requirements over the link
- The transmission technology is supposed to NOT impair the end-to-end performance

  ➔ BER 10e-10 after equalization and decoding

Reference Clock/Crystal Accuracy

- Crystal needs to operate in the automotive temperature range (-40℃ to 105℃/125℃)
- Reliability in this temperature range needs to be assured with automotive qualification. The less accurate the clock, the cheaper
- Today ±250ppm crystals are readily available for automotive
- At the same time: The more accurate the clock, the shorter the start-up time and a short start-up is essential
- ±100ppm is the typical value for data center applications and standard for 1000base-T

- The RTPGE standardization needs to take the trade off between costs and start-up time into account.

Automotive RTPGE Requirements

	Mandatory	Additional/optional
Physical Medium	Electrical wiring harness, UTP preferred	others are possible (STP and coax are options)
Max. link length	15 m for passenger vehicles	40 m for commercial vehicles
No. of in-between connectors	4	
Remaining Bit Error Rate	< $10e^{-10}$	
Electro-Magnetic Compatibility	Will be explained in detail by Stefan Buntz (Daimler)	See e.g. ISO11452-1,2,3,4, CISPR25, ISO7637-3, IEC6100-4-2, ISO10605
DC decoupling	Necessary (capacitive with common mode choke or transformer)	
Connectors	As compact as possible, own specification, first electrical parameters (impedance etc.), then mechanical, Multi-Pin connecter is preferred	
PoE	Yes, for wake up	For intelligent sensors
Data interface to Layer 2 (MAC)	Standard interfaces (low pin count), RGMII, SGMII	

*) Changes to slides shown in May interim are marked in blue

Automotive RTPGE Requirements

	Mandatory	Additional/optional
IEEE802.3az (EEE)	yes	Optional for Japanese industry players
PHY Latency TX MAC to TX MDI	Tbd (fundamental effect on the PHY)	
PHY Latency RX MDI to RX MAC	Tbd (fundamental effect on the PHY)	
PHY jitter	Tbd in IEEE802.3	
Crystal accuracy	Crystal must meet automotive temperature range as well as start-up requirements;	Depending on cost and added value +/- 50 ppm might be OK, +/- 100 ppm might be OK, or more

Additional Requirements

these requirements must be met to guaranty interoperability and common diagnosis concepts in automotive that are supported by higher layer standards (e.g. AUTOSAR, JASPAR)

	Mandatory	Additional (optional)
PHY-Wake-UP	Typical wake-up concepts in automotive must be considered. Typically wake-up through buslines and Microcontroller	
Link acquisition time (PHY to PHY link start up time)	< 100 ms	
Diagnosis for link up	Signal Quality Indicator	
Enhanced diagnosis	Cable and link break/ short circuit/ wrong voltage	
Control interface to Microcontroller	standard automotive µc interfaces (MDIO, SPI…)	
Safety Concept	HW pin (EN) with Glitch filter	

Some Typical Product Requirements

	Mandatory	Additional (optional)
Ambient Temperature	-40 … 125 °C	
Quiescent current while system is switched off	< 10 µA	
Power Consumption	As small as possible	E.g. < 300 mW per port for the available process node today, less in future
Configuration interface	Standard Interfaces for automotive Microcontroller (MDIO, SPI, …)	
Automotive Qualification	AEC Q-100	
I/O Voltage Level GP	3.3 V	Selectable if possible (EMC optimization)
Costs	competitive in respect to total cost of ownership (PHY, peripherals, connector, cables)	