Open issues on the 1000m link specification

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- 802.3 cg long link as baseline is nearly completely specified.

- But there are still some open ties

Return loss

In the range of 10 MHz to 20 MHz IEEE 802.3 links and ISO cabling standards specify a slope for return loss.

At the moment only cg 1000 m channel specify a constant 19 dB.

To harmonize it is proposed to specify the same slope as all others between 10 and 20 MHz.

- $10 < f \leq 20$ MHz
- $Rl(f) = 24 - 5\log(f)$

Return loss of installed base cablings

As cables used nowadays in low bitrate industrial communications were usually designed with a resultant impedance much lower than the specification proposed now.

They will fail the return loss requirements.

Additionally due to higher insertion loss they will not meet the IL at 1000m length but some shorter length.

It was discussed with Steffen Graber that there could be a possibility to trade-off return loss for insertion loss.

Example: if link insertion loss is lower than 10 dB at 3,75 MHz return loss from 1 MHz to 4 MHz could go down to 12 dB.

This would help also if too many connectors are set at the beginning of a link.

If this Idea is accepted a curve should be developed.

Delay

- No value proposed in current baseline draft therefore if needed it would be proposed to use:

- at 3.75 MHz delay less than 5 500 ns

  This would correspond to a cable of 1000m with an NVP of 0.6. The 10 connectors do not need to be specified separately, because of the long link length.

Electromagnetic environment

At the moment the following table is specified (copied from 802.3bp) in current baseline draft:

•Adopt Table 97-15 electromagnetic classifications for 802.3cg baseline link segments

Table 97–15—Electromagnetic classifications Type B link segment

Electromagnetic	Minimum (dB)		
	E_1	E_2	E_3
Radiated RF – AM	3 V/m at (80 MHz to 1000 MHz) 3 V/m at (1400 MHz to 2000 MHz) 1 V/m at (2000 MHz to 2700 MHz)	3 V/m at (80 MHz to 1000 MHz) 3 V/m at (1400 MHz to 2000 MHz) 1 V/m at (2000 MHz to 2700 MHz)	10 V/m at (80 MHz to 1000 MHz) 3 V/m at (1400 MHz to 2000 MHz) 1 V/m at (2000 MHz to 2700 MHz)
Conducted RF	3 V at 150 kHz to 80 MHz	3 V at 150 kHz to 80 MHz	10 V at 150 kHz to 80 MHz

- What is the minimum dB entry for ?
- Why are other entries like surge and EFT missing?
- The table by itself makes little sense if there are no specifications referring to it, (like TCL…).

Electromagnetic environment II

- This Mice table is valid for the complete system
  - The cable is not disturbed by a 3 V/m field it just transforms it to reduce the effect on the receiver.
- The classification is already defined in cabling standards e.g. ISO/IEC 11801-1 and for the channel all specifications are set (differentiating shielded and unshielded channels) for E1 to E3:
  - **TCL**
  - **ELTCTL**
  - **Coupling attenuation**

Electromagnetic environment III example

TCL: E1 to E3 as an example from ISO/IEC 11801-1

E_A	$1 \le f \le 30$	$53 - 15 \times \lg f$, 40 max.	$63 - 15 \times \lg f$, 40 max.	$73 - 15 \times \lg f$, 40 max.
	$30 < f \le 500$ [b]	$60{,}3 - 20 \times \lg f$	$70{,}3 - 20 \times \lg f$, 40 max.	$80{,}3 - 20 \times \lg f$, 40 max.

The 40 dB max is just for measurements , for systems the equation applies.
Other classes show similar values

Electromagnetic environment IV

- Proposals:
- use a reference to ISO/IEC 11801-1 and delete the table. With that TCL, ELTCTL and coupling attenuation limits are specified.
- As the 1000m channel is still not named for values refer to Class Ea from 1 to 30 MHz.

Loop resistance

Loop resistance specification is not needed for Data Transmission but for remote powering.

To avoid overheating of the cables in short channels the key specification is Ohm /m for the cable in the channel.

In 11801 there is the freedom to create a channel with any cable as long as the channel values are met. The new specification Ohm/m reduces somehow the freedom but still does not specify the cable to be used. As the channels are max 100m this is not an issue.

The dilemma for the 1000m channel is that shorter channels will be the majority to be used and to meet the channel values thinner cables would be preferable.

Thicker cables are included.

Loop resistance

- Comparing the resistivity of cat 6a (~75mOhm/m) and the 22 mOhm/m of the Industrial cable all formulas for power feeding can be expanded from 100m to around 350m,
  - But only if the thick cable is used
  - The Phy does not need it

Loop Resistance

How to solve this? There are different possibilities:

1. Do not specify any value (ore TBD) and let the cabling group solve this inconsistency.
    1. It is also important to define how to mark the channels when installing.
2. Ask ISO/IEC to come up with new equations and limits.
    1. Bundled one pair channels will generate less heat than 4 pair channels
    2. But some cables will tolerate much higher currents
    3. To solve how to deal with short channels
3. Define for remote feeding sub channels like 100 to 1000m in 100m steps.

Step 1 and 2 prefered

Alien noise

PSAACR-F (which is always used to specify the li mit of PSAFEXT in all links) is length dependent. All Channels till now are 100 m long and therefore the limit is specified for this length. For cg 1000m would result in very high limits at short length, and as we are interested below 20 MHz the specification should **use 100m** too (like IL where the 1000m are specified by 10 times 100m).

Long runs 500 to 1000m in industry will be shielded and then there is also no issue about short disturbers if the cables are bundled.

ALIEN NOISE II

Proposal up to 20 MHz :

Keep from the baseline proposal :

PSANEXT =37,5-17log(f/20) equals 59-17log(f)

Could go up from 37 to 42

Add to baseline proposal:

PSAACR-F=38-20 log (f/20) equals 64-20log(f)

100m reference length

It assumes the industrial long runs are shielded (E3) to avoid short runs disturbing long runs.

Thank you