Completing the draft & analysis of comments on D1.1

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Introduction

- Draft 1.1 has been generated and is available online. For questions:
  - Jose Tellado for PCS and PMA sections
  - Sandeep Gupta for the PMA Electrical
  - Eric Lynskey for the Management Interface
  - Chris DiMinico for the Link Segment
  - Terry Cobb for the MDI and environmental specification
- The draft has been updated from D1.0 and D1.1 should be consistent with all the key decisions that were been taken by the Task Force
  - One comment (#26) resolution was incorrectly incorporated
    - “Change "characteristic" to "nominal"”
  - We have ~200 TBDs in Draft 1.1
  - We have ~140 comments – some details are on the next slide

Comments

Name	E	T	TR
Brad Booth	45	13	8
Brett McClellan	1	23	
Pat Thaler		5	8
Bijit Haldar	5	5	1
Jose Tellado		3	3
Katsutoshi Seki			5
Scott Powell		3	
Gottfried Ungerboeck		3	
Joseph Babanezhad		2	
Sailesh Rao			1
Chris Pagnanelli, Raju Hormis, Takeshi Nagahori		1 each	

- Numbers are approximate
- ~30 are TR, ~60 are T, ~50 are E

T/TR comment breakdown by clauses

Clause	T & TR comments
28	19
55.1	6
55.2	1
55.3	27
55.4	7
55.5	4
55.7	5
55.8	2

- 28 is auto-negotiation
- 55.1 is the introduction
- 55.2 is the service primitives & interfaces
- 55.3 is the PCS section
- 55.4 is the PMA section
- 55.5 is the PMA electricals section
- 55.7 is the link specification
- 55.8 is the MDI specification
- Numbers are approximate

Major areas of focus for completion

- Full specification of the transmit frame
- Baseline specification for THP
- Power backoff
- Transmit PSD and/or associated pulse template
- Startup
- Auto-negotiation: Clause 28 comments

Transmit Frame

- Full specification of the transmit frame
  - Specific LDPC code & frame
  - Mapping of bits from XGMII to PAM symbols
  - Analysis of mean time between undetected error events
  - Previous decisions: PAM12; 800MHz; 64/65B based framing, 1-4 LDPC code words per 10GBASE-T PCS frame
- Proposals for transmit frame (check presentations for details)
  - PAM16 proposal with (2048,1649) LDPC code from Sailesh Rao
    - Significant differences from previous PAM8 (2048,1723) proposal
  - Double Square Constellation based proposal with (2048,1723) LDPC code from Powell/Shen/Ungerboeck
    - Significant improvement claimed on previously claimed performance results on (2048,1723) LDPC code
  - PAM12 framing proposal with (1024,833) LDPC code from McClellan/Dabiri
    - Replaces most frame synch bits in prior proposal with additional CRC bits to address mean time between undetected error events
- All present analysis of mean time between undetected error events

Transmit Frame Proposals

- As per editor's interpretation of authors' claims; this is not an endorsement of claims
  - Check original presentations which are on the .an website
- Life of universe:
  - 13.7 Billion years from a cosmological model based on Hubble's constant & density of matter and dark energy
  - 8-11 +-4 Billion years based on radioactive decay of certain elements
  - 12 +-3 Billion years based on age of the oldest white dwarfs

	Constel lation	Should task force consider proposal that ignore PAM12 decision as per slide 31 of: http://www.ieee802.org/3/an/public/sep04/agenda_1_0904.pdf	LDPC code/SNR margin	Impulse noise immunity	Mean time between undetected error events	Latency
Sailesh Rao	PAM16	Impulse noise performance of PAM12 & MTBUEE	~0.5dB worse than PAM12	Ranked 1 by SR	>914 Billion years	Equal to reference
Scott Powell, BZ Shen, Gottfried Ungerboeck	Double Square	Error propagation in binary to ternary mapping required by PAM12 & 0.8dB better SNR performance	~0.8dB better than PAM12	Ranked 3 by SR	>140,000 years	2x on LDPC
McClellan, Dabiri	PAM12	Compliant	reference	Ranked 2 by SR	>17 Billion years	reference

Tomlinson Harashima Precoding

- At the Ottawa meeting, the task force decided on:
  - "Small number of selectable precoders specified by rational transfer functions"
  - We currently have proposals for:
    - 4 IIR THP models from Powell/Shen/Ungerboeck & Golden
      - 2 Pole 3 zero IIR
    - 16 TAP FIR THP recommendation from Vareljian
    - 4 FIR THP results from Golden
  - Decision options:
    - Pick specific set of N (4) IIRs
    - Pick specific set of N (4 or ?) 16 (32?)-TAP FIR coefficients
    - Decide that the transmitter must implement either of:
      - 4 IIRs or N 16/32-TAP FIR coefficients
  - Selection of TX PSD specification may help in consistency of simulation results

Power backoff

- Two proposals for power backoff:
  - 5dBm, -1dBm, -7dBm, -13dBm from Powell/Shen/Ungerboeck
  - 5dBm, 2.5dBm, 0dBm, -2.5dBm, -5dBm from Golden/Tellado
  - Optimization for either:
    - 100m, 85m, 65m, 35m, 0m or
    - 100m, 75m, 50m, 25m, 0m
- Can we get a consensus proposal?
- Can we tie each power backoff level uniquely to a specific THP coefficient set?

Transmitter Power Spectral Density

- ~~Three~~ Two PSD proposals:
  - Powell/Shen/Ungerboeck (as tx filter)
  - Takatori/Vareljian
  - Pagnanelli → merged (as psd)

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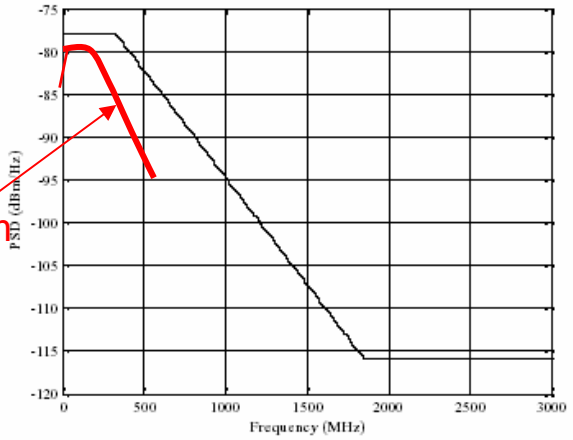
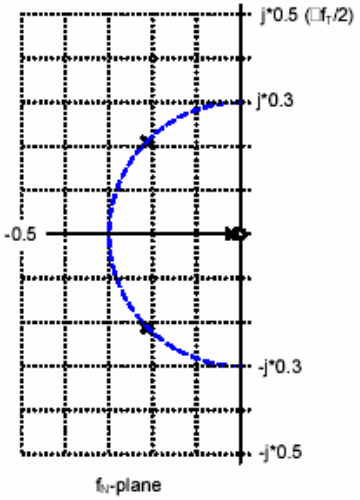
Transmit PSD Mask Definition



Gottfried's plot on the same scale

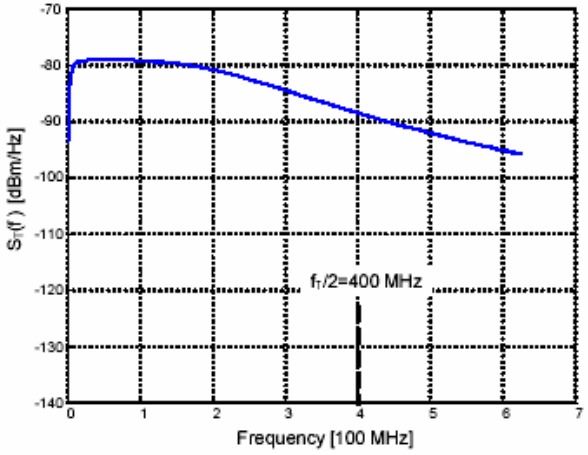
$$Mask(f_{MHz}) = \begin{cases} -78\ dBm/Hz, & 1 \le f \le 330 \\ -78 - \left(\frac{f-330}{40}\right) dBm/Hz, & 330 < f \le 1850 \\ -116\ dBm/Hz, & 1850 < f \le 3000 \end{cases}$$

Modulation rate f_T = 800 Mbaud, P_T = 5 dBm, TF = 2nd-order Butterworth filter with spectral null at dc ("BWF2dcn")



Zeroes in f_N-plane:
b1= 0.00000+j 0.00000

Poles in f_N-plane:
a1=-0.00500+j*0.00000
a2=-0.21213+j*0.21213
a3=-0.21213-j*0.21213



Achievable SNR vs. cable length does not critically depend on exact shape of $S_T(f)$

- Comment submitted to eliminate time domain pulse templates
  - PSD is claimed to be adequate

Startup

- Two proposals
  - Seki + supporters from: http://www.ieee802.org/3/an/public/nov04/seki_1_1104.pdf
    - Derivative of 1000BASE-T
    - Detailed state diagrams provided
  - Powell/Shen/Ungerboeck from: http://www.ieee802.org/3/an/public/nov04/ungerboeck_1_1104.pdf
    - No detailed state diagrams yet
  - Two options:
    - Have each developed further & then choose one?
    - Combine them, resolve conflicting ideas, then develop further?
- PMA training
  - Seki scrambler of 32 bits, length 2^32 (~ 4E9)
  - Ungerboeck: Repeating pattern 16K (~2^14)
  - **Decision point: repeating pattern or not?**
- THP and Power Backoff settings
  - Seki: Selected during autonegotiation but not specified in detail
  - Ungerboeck: Selected during start-up? Slide 24
- Polarity, Pair swap, Pair Skew
  - Seki details distinct functions to detect
  - Ungerboeck has not specified them yet
- PMA training control
  - Seki: 1 bit to indicate remote PMA ok.
  - Ungerboeck: New 48 bit InfoField indicating SNR, THP, power backoff etc.

Auto-Negotiation

- Main technical issues
  - Clause 45 MDIO needs to be added and registers need to be created, mapping between Clause 22 and 45
  - How to handle 16-bit message codes when using extended next pages
  - Does startup proposal break any of the Clause 28 timers
- Lots of editorial clean-up
  - Template changes, PICS renumbering, change bars

Other items

- Loop timing – Optional or required?
- Cable diagnostics – Does anyone want to put items together for this?
- Link specification
  - Class E augmentation – What is status of the work item proposal in ISO?
  - Brad suggests restructuring 55.7 because there are multiple link segments
  - Chris's comment:

    The editorial strategy was to follow Clause 40. 802.3an does follow Clause 40. 802.3an has only one link segment specified.
    55.7.2 is titled link transmission parameters (read 10GBASE-T link transmission parameters).
    A link segment "is" the worse case channel requiring a "shall" and associated PICS. There is only ONE "link segment" specification and that is based on "Class E". Class F complies with the "Class E" link segment specification with the addition of the 55.7 PSANEXT requirement for a Class F channel (required to meet our objective of specifying 100m over Class F).
    By specifying two link segments we infer Class E OR Class F specifications. Designing to Class F may not meet Class E therefore compatibility is not assured.
    When referring to media types the AND's are placed in the appropriate places i.e., when addressing the link transmission requirements; Class E and Class F. The OR's are enduser options i.e., Class E or Class F.