Unconfirmed Minutes - Multiple MCS IEEE 802.3bn EPoC Ad Hoc – 022113

Attendance

Attendee	Present
Alan Brown – Aurora	x
Andrea Garavaglia – Qualcomm	
Avi Kliger – Broadcom	
Bill Keasler – Ikanos	x
Bill Powell – ALU	x
Charaf Hanna – ST Micro	
Christian Pietsch – Qualcomm	x
Curtis Knittle – CableLabs	x
Dave Barr – Entropic	
Dave Urban – Comcast	
David Law – HP	
Duane Remein – Huawei	x
Dylan Ko – Qualcomm	
Ed Boyd – Broadcom	x
Ed Mallette – Brighthouse	
Eugene Dai – Cox	
George Hart – Rogers	
Guansheng Lu – Huawei	
Hesham ElBakoury – Huawei	
Jim Farmer – Aurora	
Joe Solomon – Comcast	
John Dickinson – Brighthouse	
John Ulm – Motorola	
Jorge Salinger – Comcast	
Juergen Seidenberg – BK Tel	
Juan Montojo – Qualcomm	
Leo Montreuil – Broadcom	x
Liuming Lu – B-Star	
Lup Ng – Cortina	
Marc Werner - Qualcomm	
Marek Hajduczenia – ZTE	x
Mark Laubach – Broadcom	
Matt Schmitt – CableLabs	
Michael Peters – Sumitomo	x
Michel Allard – Cogeco	x
Mike Darling – Shaw	
Mike Emmendorfer – Arris	
Nicola Varanese – Qualcomm	x
Ony Anglade – Cox	

Patrick Stupar – Qualcomm	
Peter Wolff – Titan Photonics	
Raanan Ivry – Wide Pass	x
Ramdane Krikeb – Videotron	
Ron Wolfe – Aurora	
Saif Rahman – Comcast	
Sanjay Kasturia – Qualcomm	
Satish Mudugere – Intel	
Steve Shellhammer – Qualcomm	x
Thushara Hewavithana – Intel	
Tim Brophy – Cisco	
Tom Staniec – Cohere	
Tom Williams –Cablelabs	
Venkat Arunarthi – Cortina	
Victor Hou – Broadcom	x
Volker Leisse - CEL	
Yitshak Ohana - Broadcom	

Agenda

- Attendance

- Review IEEE Patent Policy

- Review past straw-poll

- New proposed straw-poll

- Finish presentation from Ed Boyd on US Bursting

Patents Policy

- Everyone familiar with the policy; no response to call for patents

Review Last Week's Straw Poll

MMP shall be used in bursting DS and US transmissions in the EPoC standard

YES: 20   NO: 1   Undecided: 10

New Straw Poll

The EPoC standard shall support multiple modulation profiles for the bursting DS and US PHY and a single modulation profile for the continuous DS PHY.

Answer	Total
Yes	
No	
Undecided	

Discussed whether this poll was really necessary this week, since it really is just a more specific wording of last week's straw poll.

Attendees stated that this poll wouldn't really change their decision; that those who were undecided would remain undecided until more technical presentations were made.

It was decided to postpone this poll until more technical presentations were made and the undecided could make up their minds.

US Bursting – Ed Boyd

Use the synch pattern to get the AGC and CDR

- The burst delimiter tells when data begins

Slide 6:

- Are the grey rows zeros in the bins?
    - Should be no data – they are guard bands
    - 0 amplitude; shouldn't be transmitting
    - Equivalent to laser on/off? Potentially. Also helps to deal with clocking issues
- Marker doesn't take the whole block of symbols; just in the block somewhere.
- CE: Means there are pilots/channel estimation (CE) in there
- Probably need 100 ns of protection in the guard bands; probably 1 carrier group
    - Depends on the modulation of the subcarriers?
        - In the 1D to 2D translation, assumes that the split is done based on capacity
        - Probably an open carrier group in between the groups (could be more if the OLT has nothing to transmit)
- In EPoC, would burst 3 be OFDMA, meaning that multiple CNUs are transmitting?
    - Yes. You can see burst 2 ending as burst 3 begins
    - A given block in this diagram is how many CNUs?
        - Going to be 2 or more CNUs
- We will need to make sure this synchs with the PHY design
- Size of the block corresponds to the block interleaver
- Do all bursts always have the same number of symbols?
    - Burst blocks are always the same length, because of the block interleaver in the US
        - 8 symbols, block interleaved. Could be a different number of symbols; could be configurable.

Slide 11: Upstream MMP

- Upstream bursts always have the potential for shortened bursts; MMP has no impact on this.
- Do different implementations handle the conversion from Byte to TQ differently?
    - CNU converts bytes to TQ and reports TQ; CLT grants TQ
    - MMP does not require a CNU to have multiple equations; but each CNU may use different equations
- All profiles need to have basically the frequency/capacity shape

- By interleaving the carriers, you can shuffle to remediate the differences
- Frequency interleaving does this shuffling
- Ed will add the frequency interleaving/shuffling into this presentation
- CLT PHY is more complex
  - Cost will be localized to the CLT; probably not an impact on the CNU (or the OLT MAC layer.
  - CLT PHY doesn't need to know what the next profile it will receive, because it gets the burst marker, right? Yes.

Slide 12: Detecting and Decoding MMP

- Lots of profiles or a limited set?
  - Think that a limited number makes sense. Have seen a proposal of 4, but it doesn't have to be that low.
  - The more there are, the more complex it becomes.
- Burst markers are 16QAM?
  - Assume they are a lower modulation order to be easily detected
  - Do you need to know when to expect the end marker?
    - Don't think so. Could have different pilots in the markers; that could signal the end of a burst.
    - Think that switching modulation profiles when a marker is received may be challenging.
    - If the end marker is also a lower modulation, that could signal the receiver to stay in the lower modulation, looking for the next burst marker and the profile to change to.
    - Proposals for the markers are being developed now.
  - What about multi-channel? Is that only down?
    - Multichannel is only for TDD?
    - Multichannel DS for FDD only, at this point.
    - No symmetric service for FDD
      - 192 MHz in the US is plenty for operators for a long time
- Markers are needed, regardless of MMP. The PHY needs to know when a burst starts and ends.
  - MMP means that a little more data needs to be carried in the marker to communicate profile
- Does the burst marker at the end of a interleaving block significant?
  - Used to signal shortened code word
  - How do you synchronize between CNUs?
    - The interleaver depth is fixed.
    - This is described in the last set of slides.

Slide13: Multiple LLIDs and EPoC Bursts

- Burst profiles are independent of LLID

- - - o Multiple LLIDs can use the same burst profile (single PHY)
- If the OLT schedules the LLIDs close enough, they could all be in the same burst
- The PHY in the CNU will group them together if they are close enough.
- LLID grants can be overlapped; they could be multiplexed – determined above the MAC layer
- Upstream MMP: assume a PHY per modulation profile?
  - o Wouldn't have more than one profile on a single CNU, so each CNU has a single PHY. The MP could change, but then it would have a different PHY (and wouldn't use its previous PHY)
- Possibility of using a different profile at different times, based on conditions?
  - o This wouldn't be the case. The best profile for the conditions experienced by the CNU would be used; this would be a profile for the worst conditions.

Slide 14: TDD MMP

- 2 profiles in the DS?
  - o CNU will need to be able to decode the robust, broadcast/multicast profile (LCD) and the preferred unicast profile
- CNU would need to decode fewer profiles than the CLT will use

Slide 15: TDD DS

- Transmit idles on the last profile used until you have to change?
  - o Yes, that probably makes sense
- How will broadcast messages be handled?
  - o They would be grouped in LLID to a logical PHY with the LCD profile that everyone listens to
  - o All CNUs listen to this profile and their unicast profile
- CNUs are searching for their start marker to listen to a message
  - o CNUs decode all start markers
  - o Start markers are low modulation, like pilots
  - o Could be decoding a profile that has frames that are not addressed to the CNU; will just drop frames that are not yours
- Could have a map in a fixed location, but not a lot more efficient
- Assuming that data symbols are spread across all available sub carriers?
  - o The data stretches across the block interleaving
  - o Assumes that the US and DS use same PHY and methodology. Looks like the US with not guard band
    - ▪ If there are disadvantages to this approach, we can change.
  - o If you don't need time interleaving, it would got through the number of symbols it needs until it is done. Could be less wide.
  - o Width is related to the interleaver; length is related to the amount of data that the scheduler let be transmitted on the profile.

Open to solving this problem without using the lower modulation burst marker?

- Open, but should be discussed with more of the PHY experts
- There is an advantage to doing it at a low QAM modulation, because you can be sure that everyone can decode and that errors are not due to being unable to decode a higher modulation marker

Also have to take care of false alarms if start markers are in the wrong place