Ensuring horizontal margin in Annex 120G

(comment #41)

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Problem statement

- Eye symmetry mask width (ESMW) and eye width are TBD

- Eye opening measurement method is missing important details for the calculation of ESMW and eye width

- The need for ESMW and eye width specifications has been questioned

- This presentation considers alternatives…

Alternative to eye symmetry mask width (ESMW)

- Draft 1.3 refers to 120E.4.2 for eye height measurement method

- 120E.4.2 states that the cumulative distribution function (CDF) of the signal voltage is constructed from samples "within 0.025 UI of time TCMID"

- Eye height (EH) and vertical eye closure (VEC) are derived from this signal voltage CDF
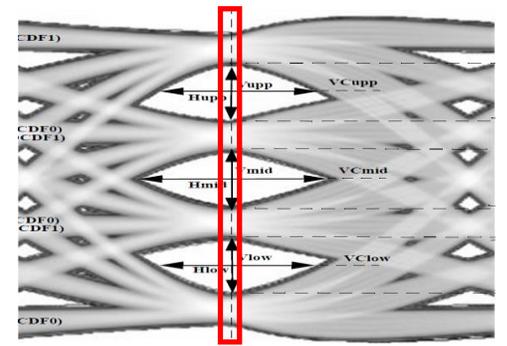
- Histogram window could be expanded

- Window width is effectively a uniform jitter distribution or "timing uncertainty" allowance for actual receivers

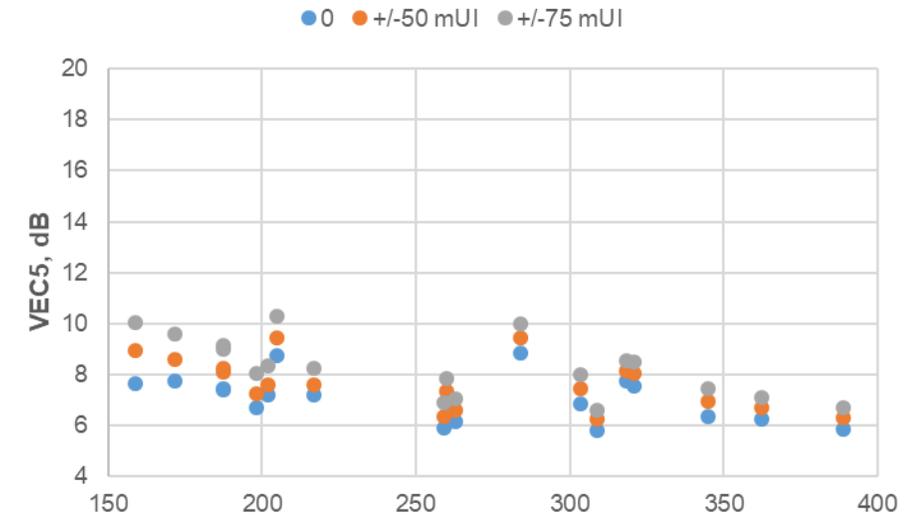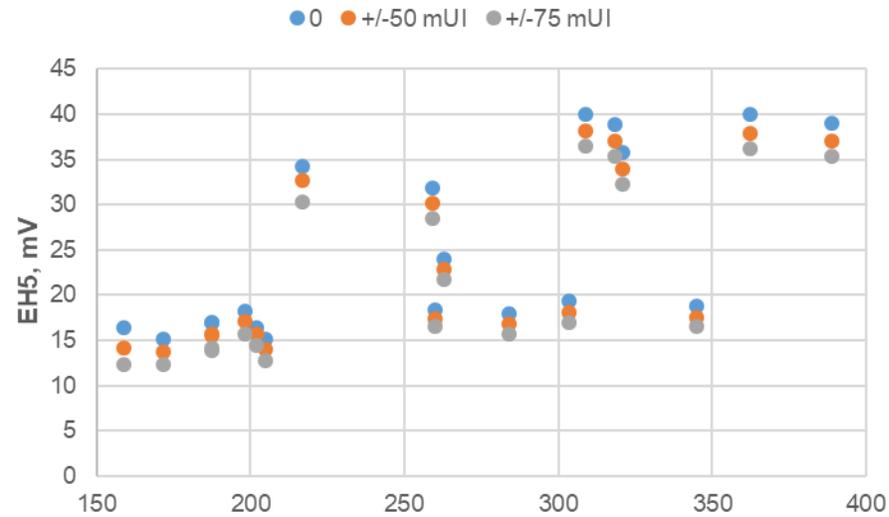- Reduced EH and VEC with higher jitter and eye asymmetry
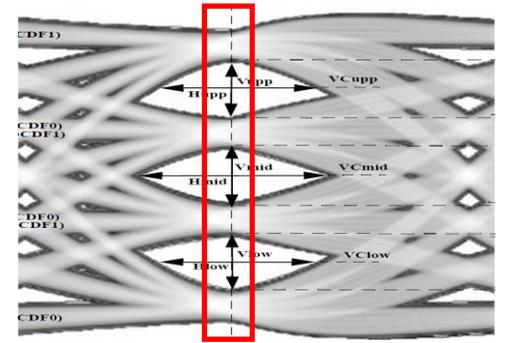
- Could also consider different allowances for static and random timing errors

- Note: Vertical metrics that consider timing uncertainty facilitate optimization of the transmitter equalizer and reference receiver
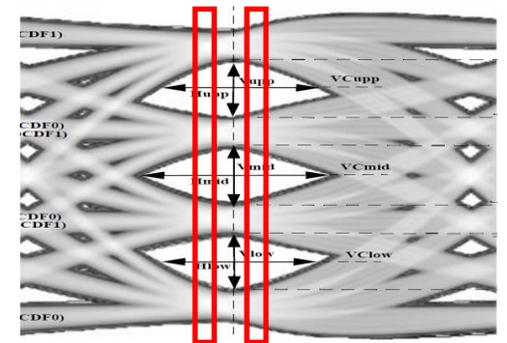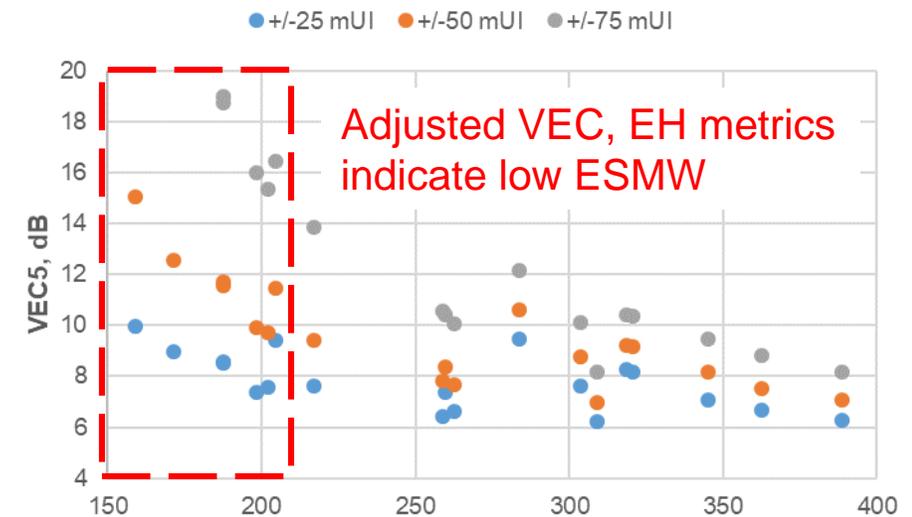
Metrics at TP1a plotted as a function of "estimated ESMW"

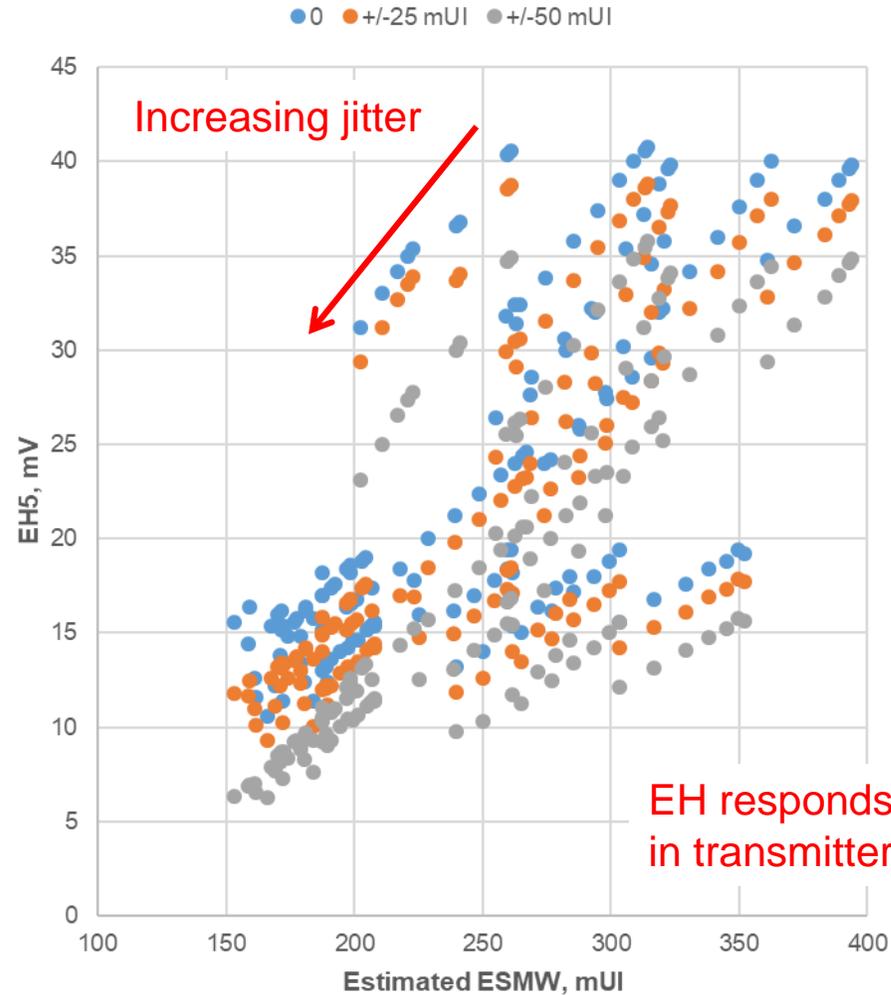|		
Expand histogram window (D1.3 comment #41)		
Measure at time offsets • 2 measurements centered at time offsets indicated in the legend • 40 mUI histogram window • Choose the worst result		Adjusted VEC, EH metrics indicate low ESMW
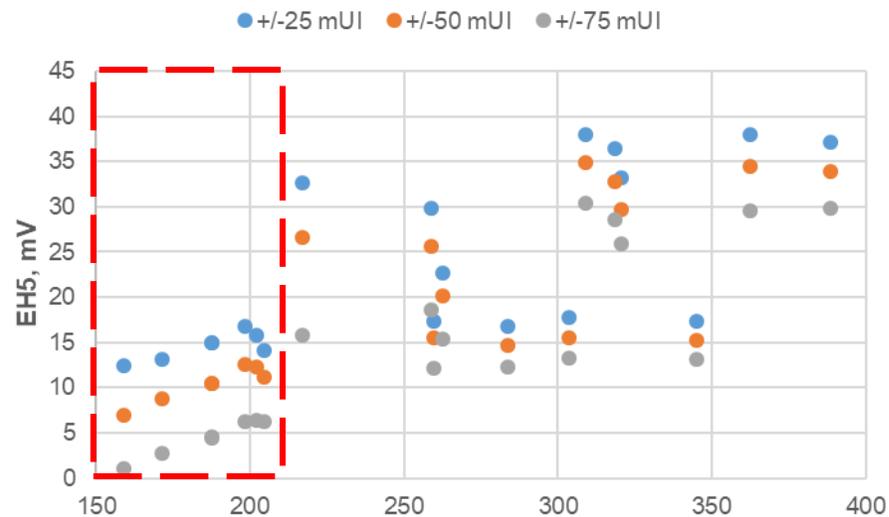
EH sensitivity to jitter

	Sweep σ_{RJ} from 0 to 35 mUI, A_{DD} = 20 mUI	Sweep A_{DD} from 10 to 45 mUI, σ_{RJ} = 10 mUI
Measure at time offsets • 2 measurements centered at time offsets indicated in the legend • 40 mUI histogram window except for offset 0 • Choose the worst result		

Increasing jitter

EH responds to increases in transmitter output jitter

VEC sensitivity to jitter

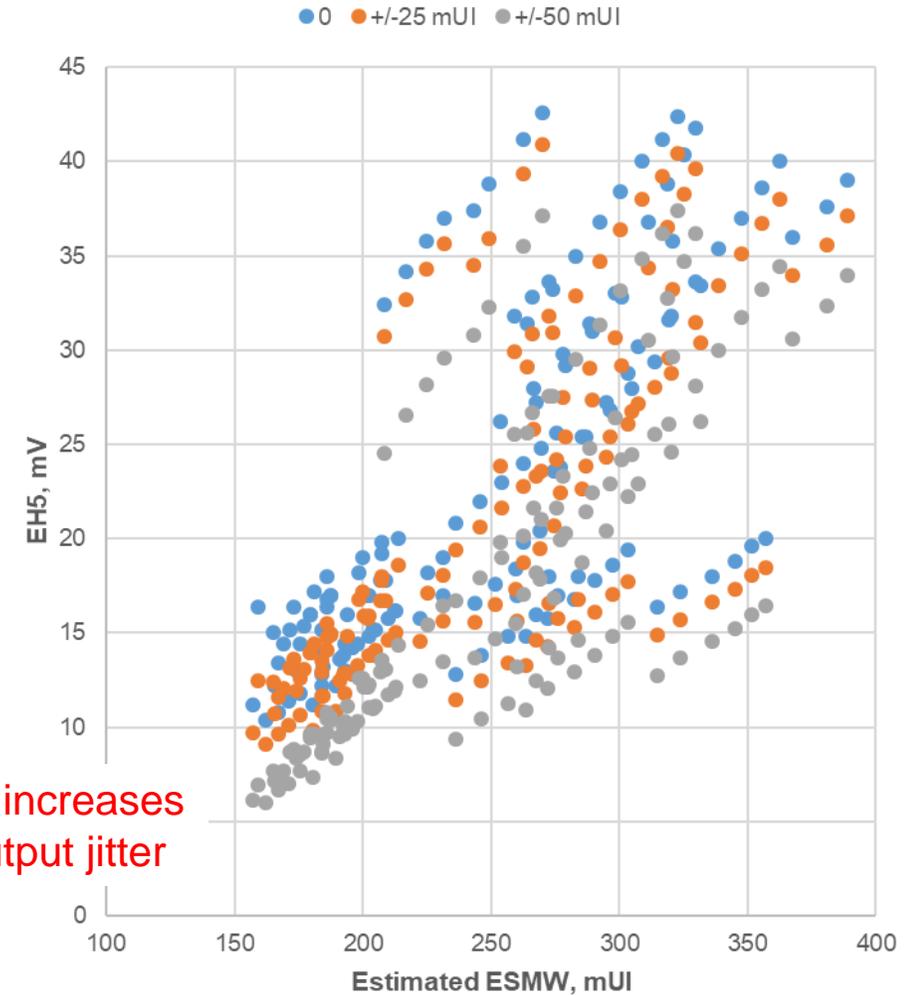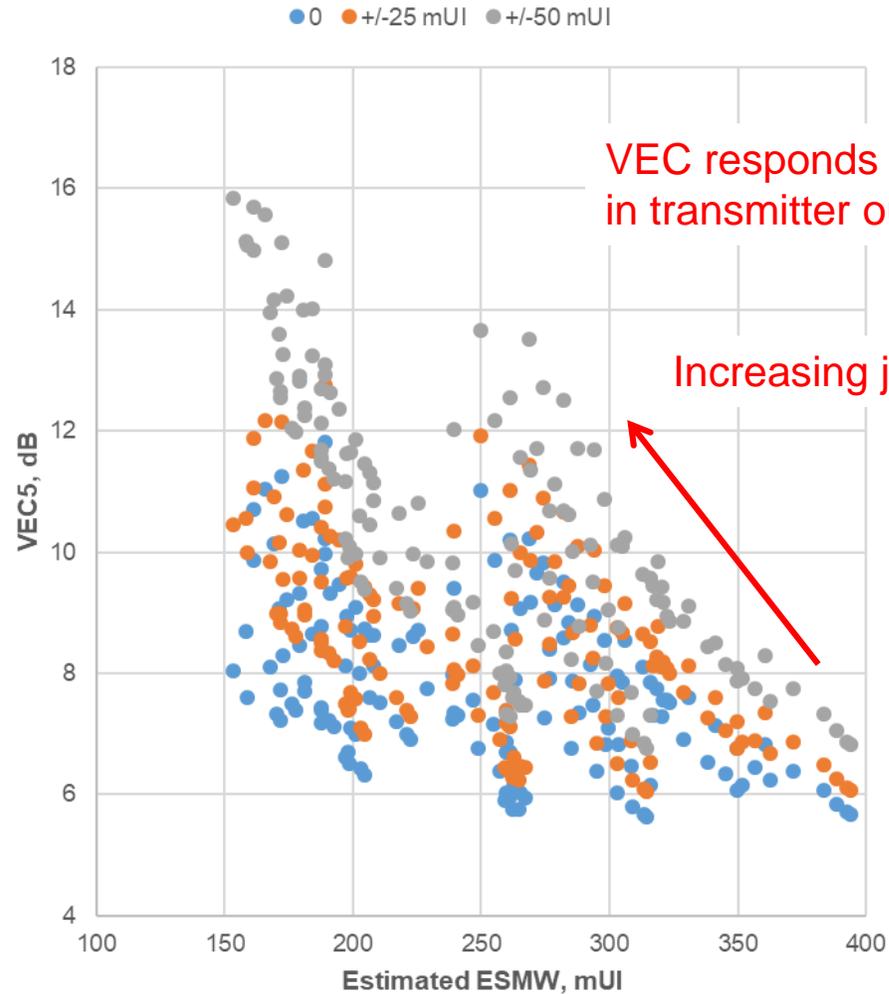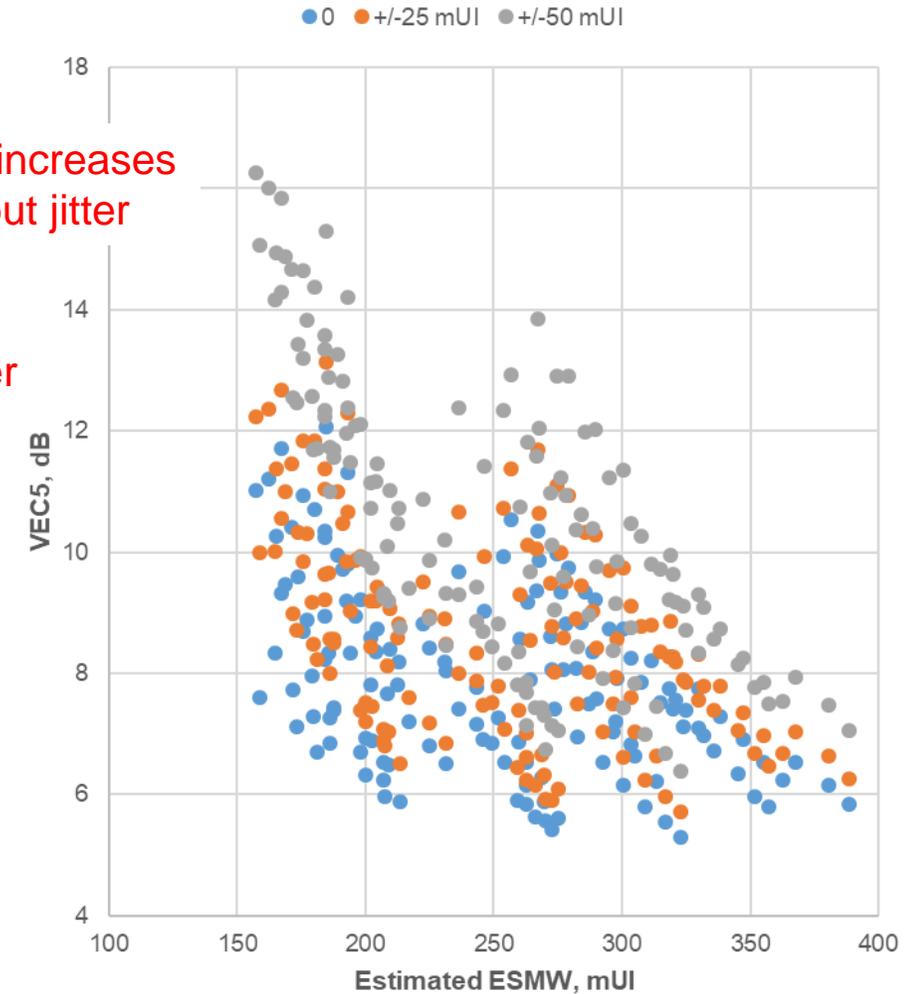|	Sweep σ_{RJ} from 0 to 35 mUI, A_{DD} = 20 mUI	Sweep A_{DD} from 10 to 45 mUI, σ_{RJ} = 10 mUI
Measure at time offsets • 2 measurements centered at time offsets indicated in the legend • 40 mUI histogram window except for offset 0 • Choose the worst result		

Comparison of the options

Desirable property	EH and VEC (in D1.3)	Separate jitter measurement	ESMW	This proposal (2 offsets)
Ensure margin for receiver timing uncertainty	Only considers nominal phase	Does not include DDJ		
Applicable to the reference receiver output		Must account for "effect of DFE"		
Applicable to the same transmitter and receiver setting used to compute EH and VEC		Must account for "effect of DFE"		
Discriminates against transmitters with high jitter	Some EH, VEC penalty			
Discriminates against horizontal asymmetry in the reference receiver output	No trend with ESMW			
Easily included in reference receiver optimization metric			Find setting that meets all criteria	Minimize VEC (and check EH)
Allows more flexible definition of the "effect of the DFE"		Need to consider transition regions	Need to consider transition regions	

Summary

- Horizontal margin is desired to accommodate timing uncertainty in actual receivers

- Such margin does not need to be enforced with ESMW or eye width

- Instead, EH and VEC can be measured at offsets relative to the nominal sampling time

- The worst-case measurement is taken as the EH (and VEC) result

- This is easy to document as a supplement or exception to the method in 120E.4.2

- This approach allows transmitter and receiver optimization to directly take horizontal margin into account

- EH and VEC limits may need to be adjusted to account for the impact of such a change