IEEE 802.3ck
Input Referred Noise Consideration

John Calvin

Keysight Technologies

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Eta_0 is a differential noise term used to set the “Input Referred Noise floor”

- The Instrumentation version of this is it’s intrinsic differential noise floor. The need to raise the input referred noise floor to the “eta_0” level as a pre-requisite to performing VEC calculations, suggests the instruments noise floor is below that of eta_0 to begin with.

Vrms2Eta0.xlsx
18 KB

```
        H_ctf2=H_low2.*ctle_gain2;
    end

    %% Equation 93A-35 - independent of FFE setting %%
    sigma_N = sqrt(param.eta_0*sum( abs(H_sy(2:end) .* H_r(2:end) .* H_ctf(2:end) ).^2 .* diff(chdata(1).faxis)/1e9));
    sigma_N1= sigma_N;
    if OP.RX_CALIBRATION
        sigma_ne = get_sigma_noise( H_ctf2, param, chdata, sigma_bn); %% Equation 93A-48 %%
        sigma_NEXT=0;
    else
```

- The proposed level for eta_0 settled on our 03/25 meeting was 4.1e-8V^2/GHz which when integrated across 40GHz translates **<u>to 1.28mV</u>** RMS (differential) in terms of a minimum instrument noise floor V-RMS = sqrt(4.1e-8V^2/GHz * 40GHz)=1.28e-3V RMS

C2M VEC with Rx Noise: Yasuo Hidaka, Phil Sun: Credo

- http://www.ieee802.org/3/ck/public/adhoc/feb19_20/hidaka_3ck_adhoc_01_021920.pdf

Cl **120G** *SC* **120G.3.1** *P* **221** *L* **20** *#* 11

Hidaka, Yasuo Credo Semiconductor

Comment Type **TR** *Comment Status* **D** *VEC/EH/BMAX*

As we discussed in ad hoc in hidaka_3ck_adhoc_01_021920, I recommend max 9dB VEC at TP1a with Rx noise of eta_0 = 4.1E-8V^2/GHz.
In the same presentation, EH (min) and bmax(n) were also provided.

SuggestedRemedy

Change Table 120G-1 as follows:
Change the value of vertical eye closure (max) from TBD dB to 9 dB.
Change the value of eye height, differential (min) from 15 mV to 14mV.

Change Table 120G-9 as follows:
Change the value of eta_0 from TBD V^2/GHz to 4.1E-8V^2/GHz.
Change the value of b_max(1) from TBD to 0.5.
Change the value of b_max(2) from TBD to 0.15.
Change the value of b_max(3) from TBD to 0.1.
Change the value of b_max(4) from TBD to 0.05.

Alternatively, if a lower value of b_max(1) is preferred, the following is also OK.
Change Table 120G-1 as follows:
Change the value of vertical eye closure (max) from TBD dB to 9 dB.
Change the value of eye height, differential (min) from 15 mV to 13.5mV.

Change Table 120G-9 as follows:
Change the value of eta_0 from TBD V^2/GHz to 4.1E-8V^2/GHz.
Change the value of b_max(1) from TBD to 0.3.
Change the value of b_max(2) from TBD to 0.2.
Change the value of b_max(3) from TBD to 0.1.
Change the value of b_max(4) from TBD to 0.05.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

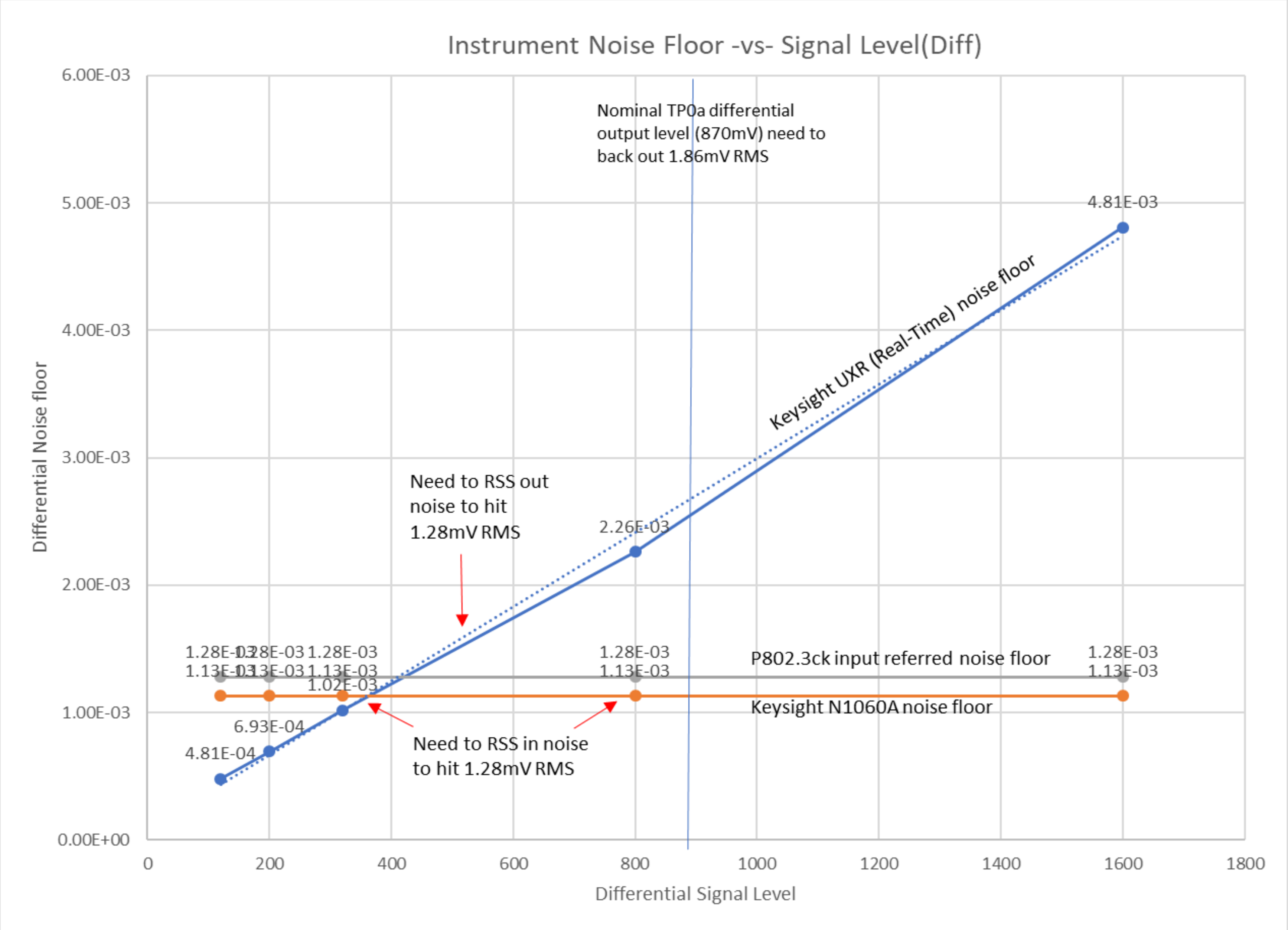
For task force discussion.

Simulation Conditions

- 405 test cases for each condition
  - 27 IEEE802.3ck C2M channels (same as base channel set in sun_3ck_01a_0120)
  - 15 cases of Tx PKG zp ([12:20 22:2:32] mm)
  - 1 case of Rx PKG zp (0mm for TP1a, 6mm for whole link)
- COM parameters (details in back up slides)
  - Same as sun_3ck_02_1119 (slides 19,20) except eta_0 and $b_{max}(1)$
  - COM 2.76

Type		TP1a			Whole Link		
Condition Label		TPx1	TPx5	TPx10	WLx1	WLx5	WLx10
eta_0 (V^2/GHz)		0.82E-8	4.1E-8	8.2E-8	0.82E-8	4.1E-8	8.2E-8
Result Label	VEC	VECx1	VECx5	VECx10			
	EH	EHx1	EHx5	EHx10			
	COM				COMx1	COMx5	COMx10
TX FIR		3 pre, 1 post optimized for each case			Coefficients fixed to the optimization result of TPxN for WLxN		
CTLE		2 zero, 3 poles optimized for each case			2 zero, 3 poles optimized for each case		
DFE		4 tap ($b_{max}(1)$=0.3 or 0.5, $b_{max}([2-4])$=0.2) optimized for each case			4 tap ($b_{max}(1)$=0.3 or 0.5, $b_{max}([2-4])$=0.2) optimized for each case		

Eta_0 noise term expressed as RMS noise voltage



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Backup Content

Input Referred Noise Floor Instrument Considerations

N1060A Module Specifications

N1060A General Specifications

Item	Option 050	Option 085
Bandwidth [a], 3 dB (user selectable)	50 GHz	50 GHz, 70 GHz, 85 GHz, and 95 GHz (characteristic)
Risetime (10% to 90%, calculated from TR = 0.35/BW)	7 ps (characteristic)	4 ps (characteristic)
RMS noise		
Characteristic	0.7 mV (50 GHz)	0.7 mV (50 GHz) 1.1 mV (75 GHz) 1.2 mV (85 GHz) 1.6 mV (95 GHz)
Maximum	1 mV (50 GHz)	1 mV (50 GHz) 1.3 mV (75 GHz) 1.6 mV (85 GHz) 2.0 mV (95 GHz)

- Sampling noise (with CDR) on equivalent time instrumentation is ~.8mV. Differentially this would be sqrt(2) * .8mV = 1.13mVrms
- +0.14mVrms margin
- Note this is at 50GHz not 40GHz

Input Referred Noise Floor Instrument Considerations

RMS Noise Floor – 1.85 mm (40 GHz to 70 GHz models)	UXR0404A / UXR0402A	UXR0504A / UXR0502A
Vertical setting, Full scale		
60 $mV_{full\ scale\ (fs)}$	340 µV (rms)	410 µV (rms)
100 $mV_{full\ scale\ (fs)}$	490 µV (rms)	560 µV (rms)
160 $mV_{full\ scale\ (fs)}$	720 µV (rms)	820 µV (rms)
400 $mV_{full\ scale\ (fs)}$	1.6 mV (rms)	1.8 mV (rms)
800 $mV_{full\ scale\ (fs)}$	3.4 mV (rms)	3.7 mV (rms)
1.6 $V_{full\ scale\ (fs)}$	6.7 mV (rms)	7.5 mV (rms)
4.0 $V_{full\ scale\ (fs)}$	16 mV (rms)	18 mV (rms)

- Real-time instrumentation at 40GHz and a 400mV single ended signal operates at aproximatly1.8mV rms. Differential at 800mV would have an intrinsic noise floor of sqrt(2) * 1.8mV = 2.5mV rms.