SNR_{ISI}
(Clauses 136 and 137)

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Introduction

- 50GBASE CR and KR SNR_{ISI} limit appears to be not practical, both for test equipment and target designs
- Relates to comment 23

Test Equipment Measurement Results

Equipment	TXEQ preset	Vf	Pmax	pmax/ Vf	SNR$_{ISI}$ [dB]
802.3cd spec limit	Presets 1-3	0.34-0.6		CR: 0.49 KR: 0.75	CR: 36.8 KR: 43
Vendor A	1	0.591	0.578	0.976	38.82
Vendor A	2	0.301	0.437	1.453	39.01
Vendor A	3	0.303	0.442	1.459	38.87
Vendor A + 3dB PCB trace	1	0.6	0.507	0.845	35.09
Vendor A + 3dB PCB trace	2	0.273	0.374	1.37	36.49
Vendor A + 3dB PCB trace	3	0.2632	0.3549	1.028291	35.82
Vendor B	1	0.601	0.553	0.92	32.57

- SNR_ISI limit close to or above test equipment results
- Results after mated compliance boards will be worse than these

*Signal timing, linearity and output swing were optimized for the measurement

Simulation Results – COM Packages

Test Setup	TXEQ preset	Vf	Pmax	pmax/ Vf	sigma_e	SNR$_{ISI}$ [dB]
802.3cd spec limit	Presets 1-3	0.34-0.6		CR: 0.49 KR: 0.75		CR: 36.8 KR: 43
COM Test 1 Package	1	0.35	0.331	0.947	0.0022	50.78
COM Test 1 Package	2	0.176	0.248	1.413	0.002	50.4
COM Test 2 Package	1	0.35	0.302	0.862	0.002	39.83
COM Test 2 Package	2	0.176	0.226	1.287	0.0018	36.81

- SNR_ISI limit for KR is above long COM package results.
- Results after TF will be worse than these – fail KR limit also for the short package.
- Impairments of an actual measurement will make this worse.
- TX setup:
  - Vf (Preset1) = 0.35V
  - RJ = 200fs
  - RN = 1mV

Simulation Results –
COM Packages with KR Test Fixture

Test Setup	TXEQ preset	Vf	Pmax	pmax/ Vf	sigma_e	SNR_{ISI} [dB]
802.3cd spec limit	Presets 1-3	0.34-0.6		CR: 0.49 KR: 0.75		CR: 36.8 KR: 43
COM Test 1 Package + Test Fixture	1	0.348	0.274	0.789	0.002	30.2
COM Test 1 Package + Test Fixture	2	0.183	0.212	1.157	0.0017	29.4
COM Test 2 Package + Test Fixture	1	0.348	0.256	0.736	0.0017	31.8
COM Test 2 Package + Test Fixture	2	0.183	0.192	1.048	0.0016	31.13

- SNR_ISI limit for KR is above all simulated results.
- Does not include impairments of an actual measurement, which will make this worse.
- TX setup:
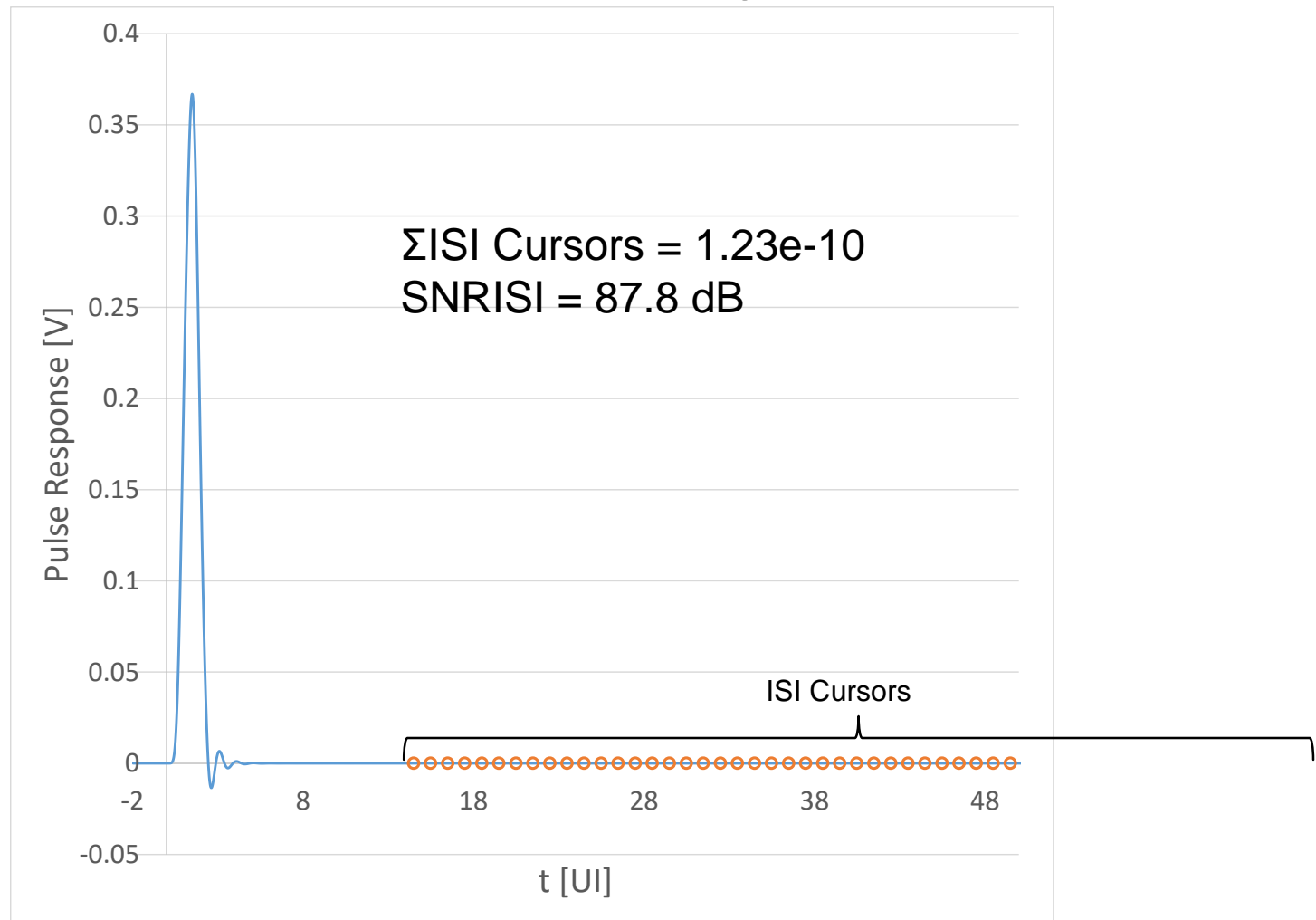 - Vf (Preset1) = 0.35V
  - RJ = 200fs
  - RN = 1mV

SNDR, SNRISI and SNRTX
(Clauses 136 and 137)

Simulation Results –
COM Packages with Mated Pair

Test Setup	TXEQ preset	Vf	Pmax	pmax/ Vf	sigma_e	SNR$_{ISI}$ [dB]
802.3cd spec limit	Presets 1-3	0.34-0.6		CR: 0.49 KR: 0.75		CR: 36.8 KR: 43
COM Test 1 Package + Mated Pair	1	0.346	0.241	0.696	0.0025	28.29
COM Test 1 Package + Mated Pair	2	0.174	0.179	1.032	0.0022	28.5
COM Test 2 Package + Mated Pair	1	0.345	0.219	0.633	0.0023	26.99
COM Test 2 Package + Mated Pair	2	0.172	0.162	0.942	0.002	27.32

- SNR_ISI limit for CR is above all simulated results.
- Does not include impairments of an actual measurement, which will make this worse.
- TX setup:
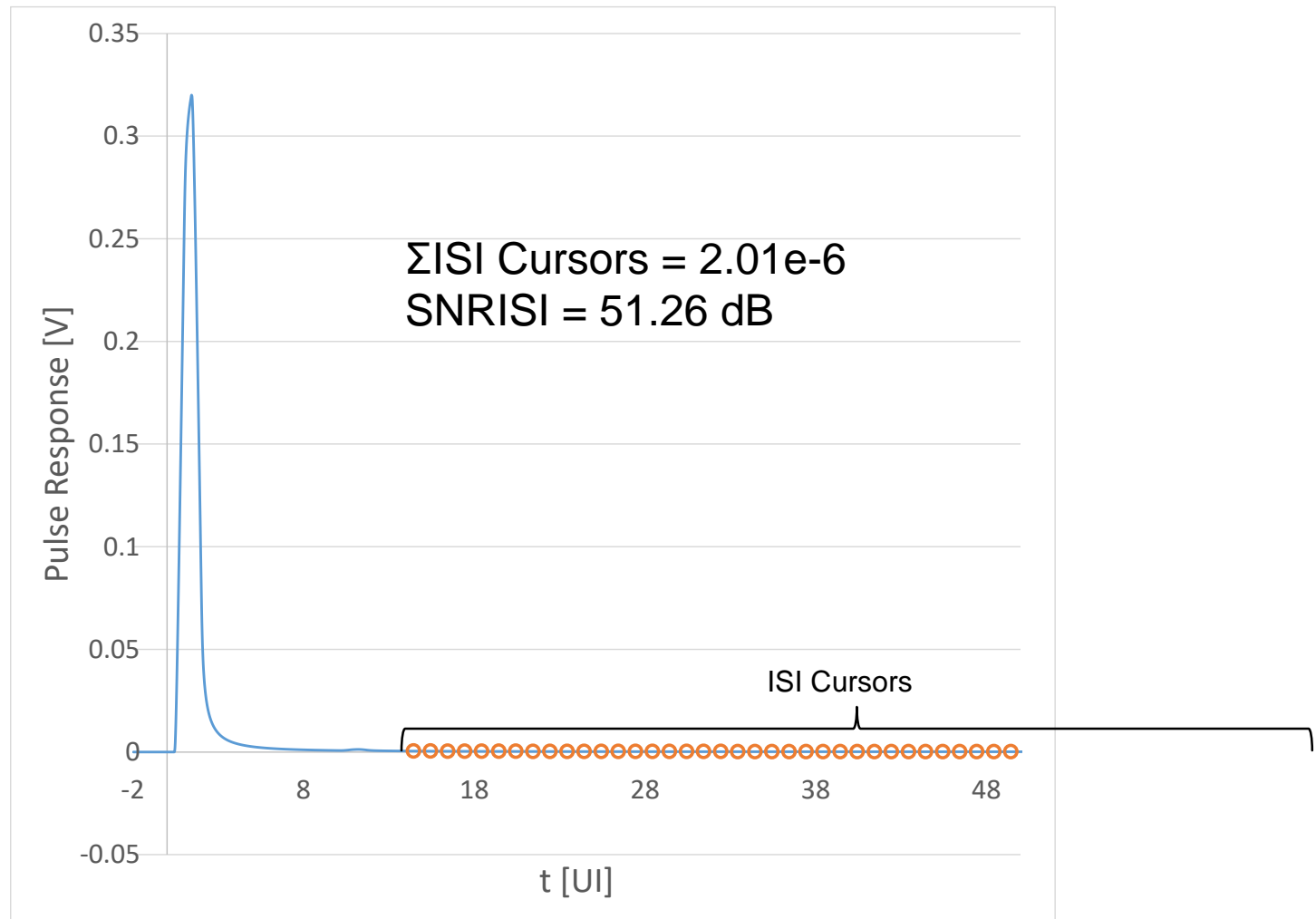   - Vf (Preset1) = 0.35V
    - RJ = 200fs
    - RN = 1mV

SNRISI (Clauses 136 and 137)

Looking Into SNR$_{ISI}$ Degradation

Driver Only (no package)

ΣISI Cursors = 1.23e-10
SNRISI = 87.8 dB

ISI Cursors

Pulse Response [V]

t [UI]

Looking Into SNR$_{ISI}$ Degradation
30mm Package, Cp=Cd=**0**F

ΣISI Cursors = 2.01e-6
SNRISI = 51.26 dB

ISI Cursors

Pulse Response [V]

0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05

-2   8   18   28   38   48

t [UI]

Looking Into SNR$_{ISI}$ Degradation

30mm Package, Cp = 1.8e-4 nF, Cd = 1.1e-4 nF

ΣISI Cursors = 2.28e-6
SNRISI = 51.03 dB

Reflections from Cd and Cp

ISI Cursors

Pulse Response [V]

t [UI]
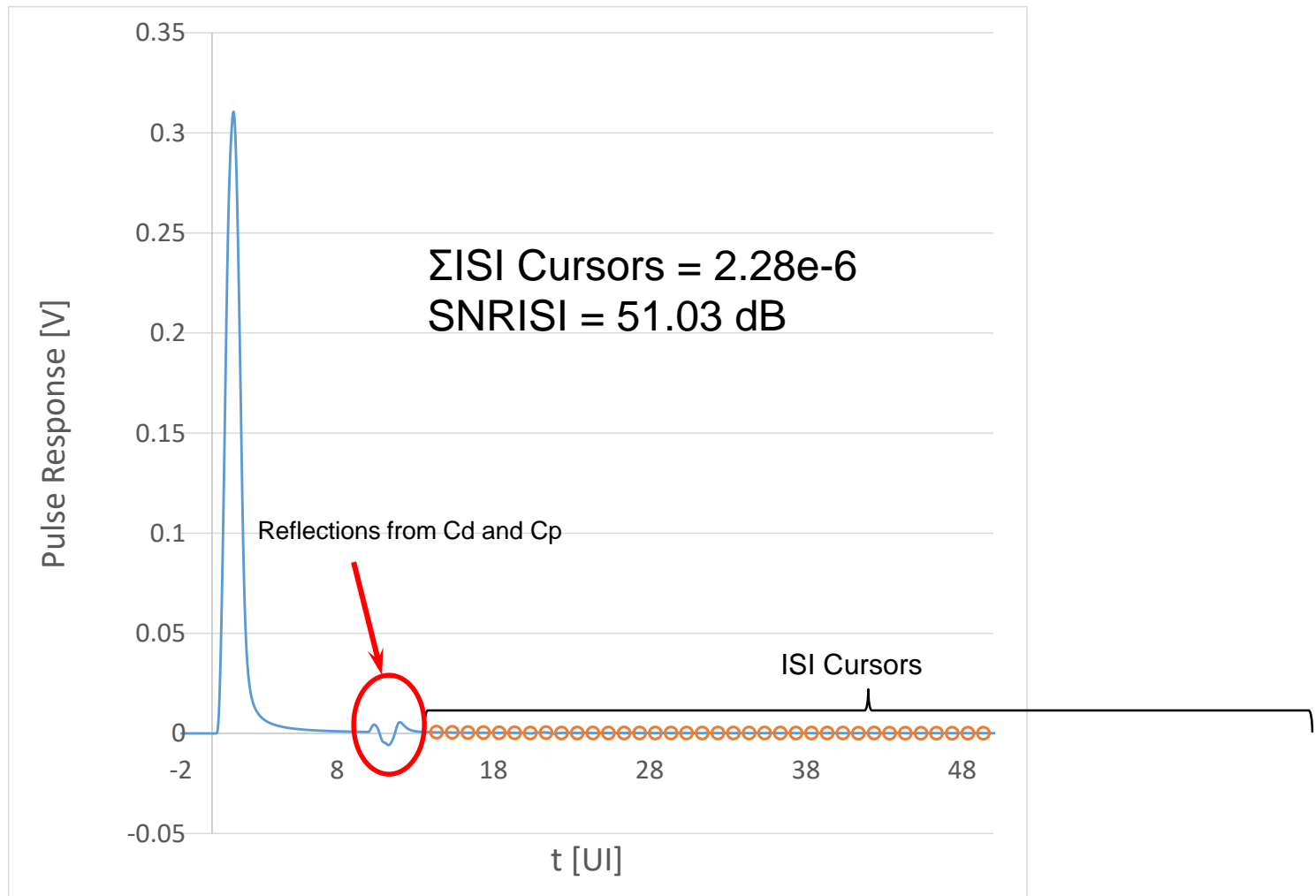
Looking Into SNR$_{ISI}$ Degradation

40mm Package, Cp = 1.8e-4 nF, Cd = 1.1e-4 nF

ΣISI Cursors = 1.34e-5
SNRISI = 36.41 dB

Longer measurement setup
(TF or MP) will include these
and other reflections,
degrading SNR$_{ISI}$

Reflections from Cd and Cp

ISI Cursors

Pulse Response [V]

t [UI]

Looking Into SNR$_{ISI}$ Degradation

30mm Package, Cp = 1.8e-4 nF, Cd = 1.1e-4 nF + KR TF

ΣISI Cursors = 0.0124
SNRISI = 31.8 dB

Reflections from Cd and Cp

ISI Cursors

Pulse Response [V]

t [UI]
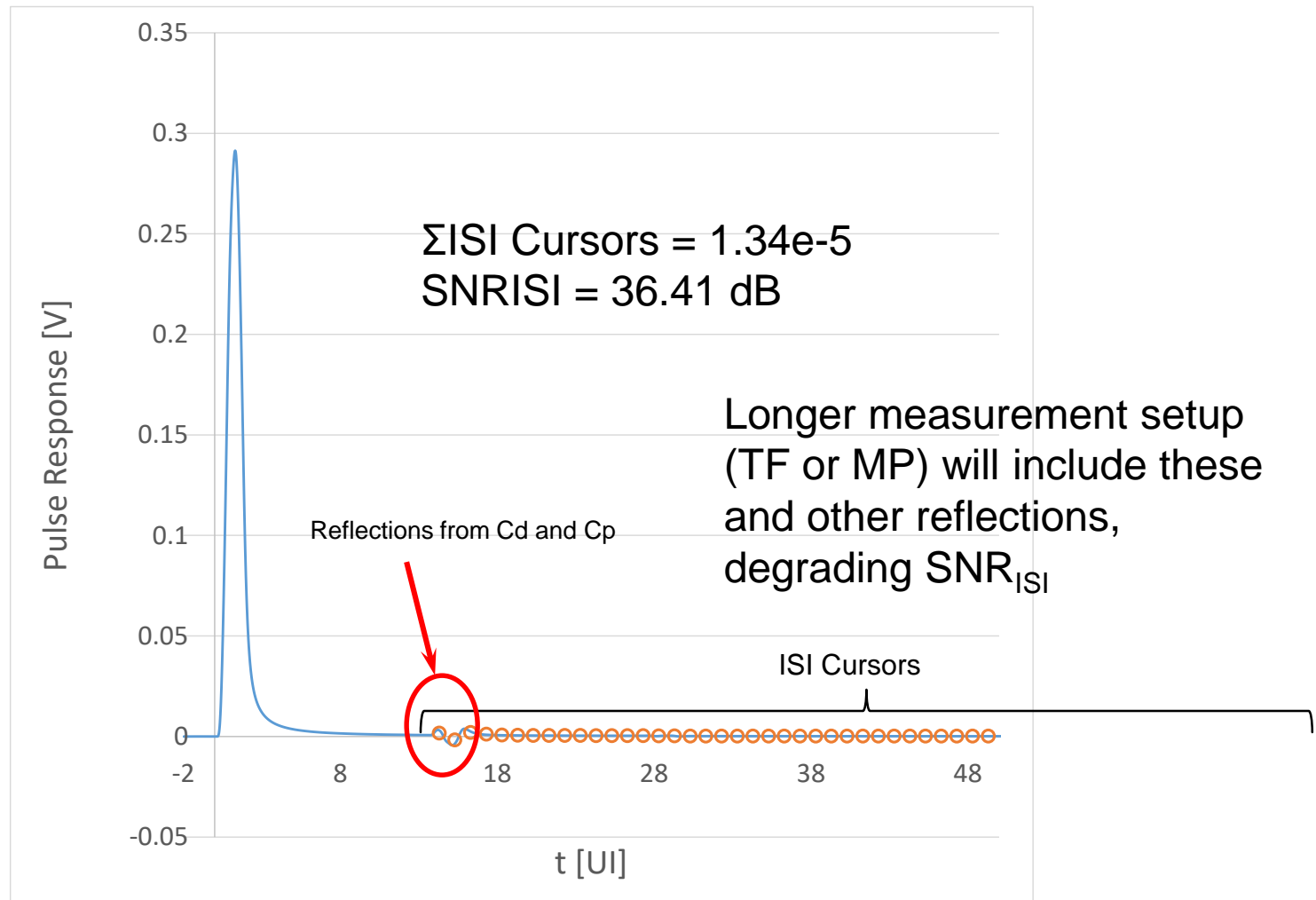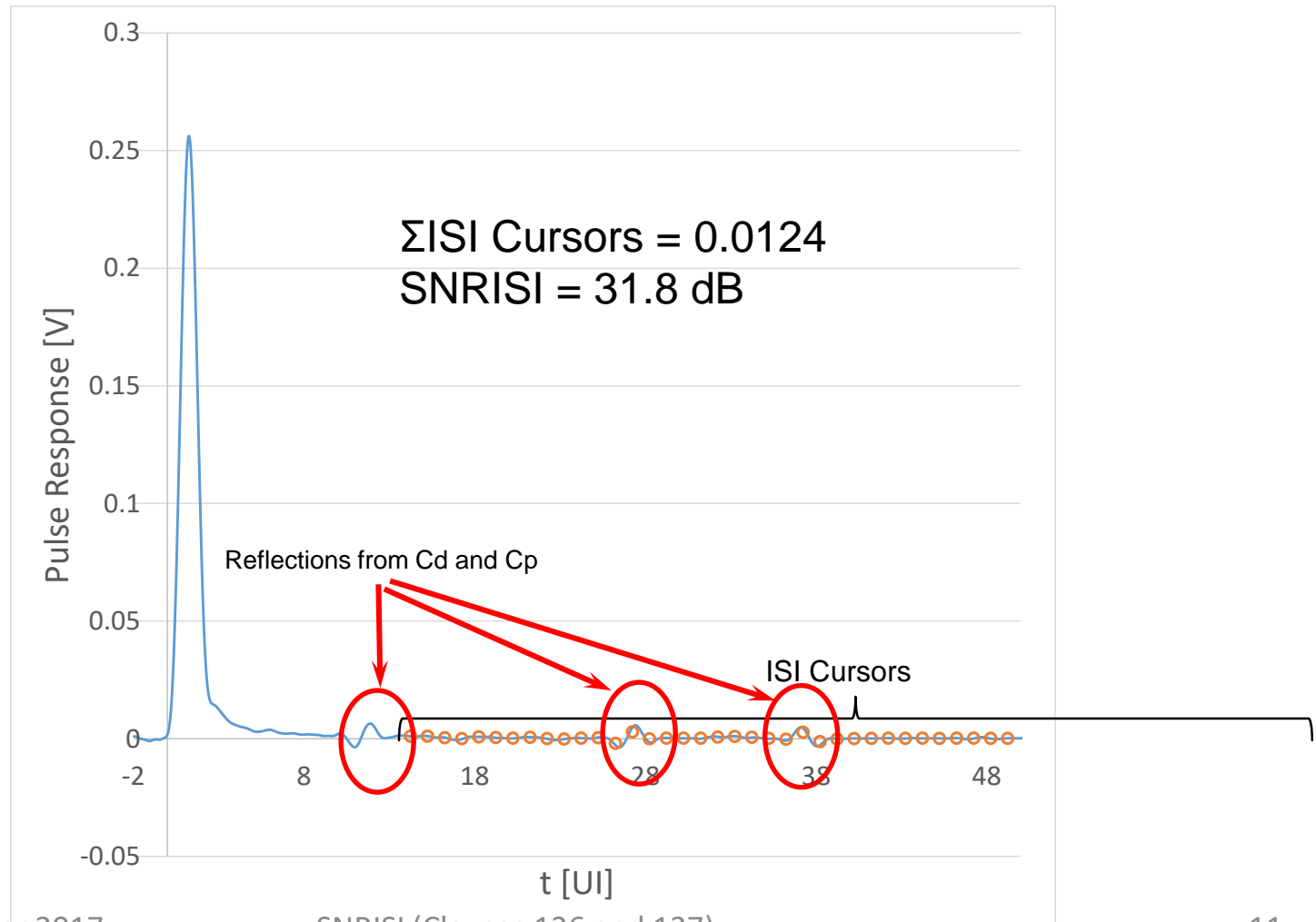
Conclusions

- 50GBASE CR and KR SNR_{ISI} limit appears to be not practical, both for test equipment and target designs – unpractical to meet with reasonable test setup.

- Target SNR_{ISI} values have to be revised, taking into account actual test setups.