COM and Tx specifications

In support of comment 98

Charles Moore, Avago Technologies

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Suporters and contributors:

Liav Ben Artsi	Marvell
Ali Ghiasi	Broadcom
Adam Gallegos	Avago Technologies
Rich Mellitz	Intel
Regee Pataja	Avago Technologies
Adee Ran	Intel

When my comment 91 to D2.0 was accepted I was asked to to analysis to justify the specific changes I had made to make the NEXT crosstalk channel be faster than the victim channel.

My first approach was to see if I could get any guidance from the minimum rise time spec. I did simulations to see what rise time did for various channels of general interest. Starting with a 1ps rise time input to some sub-minimal channels:

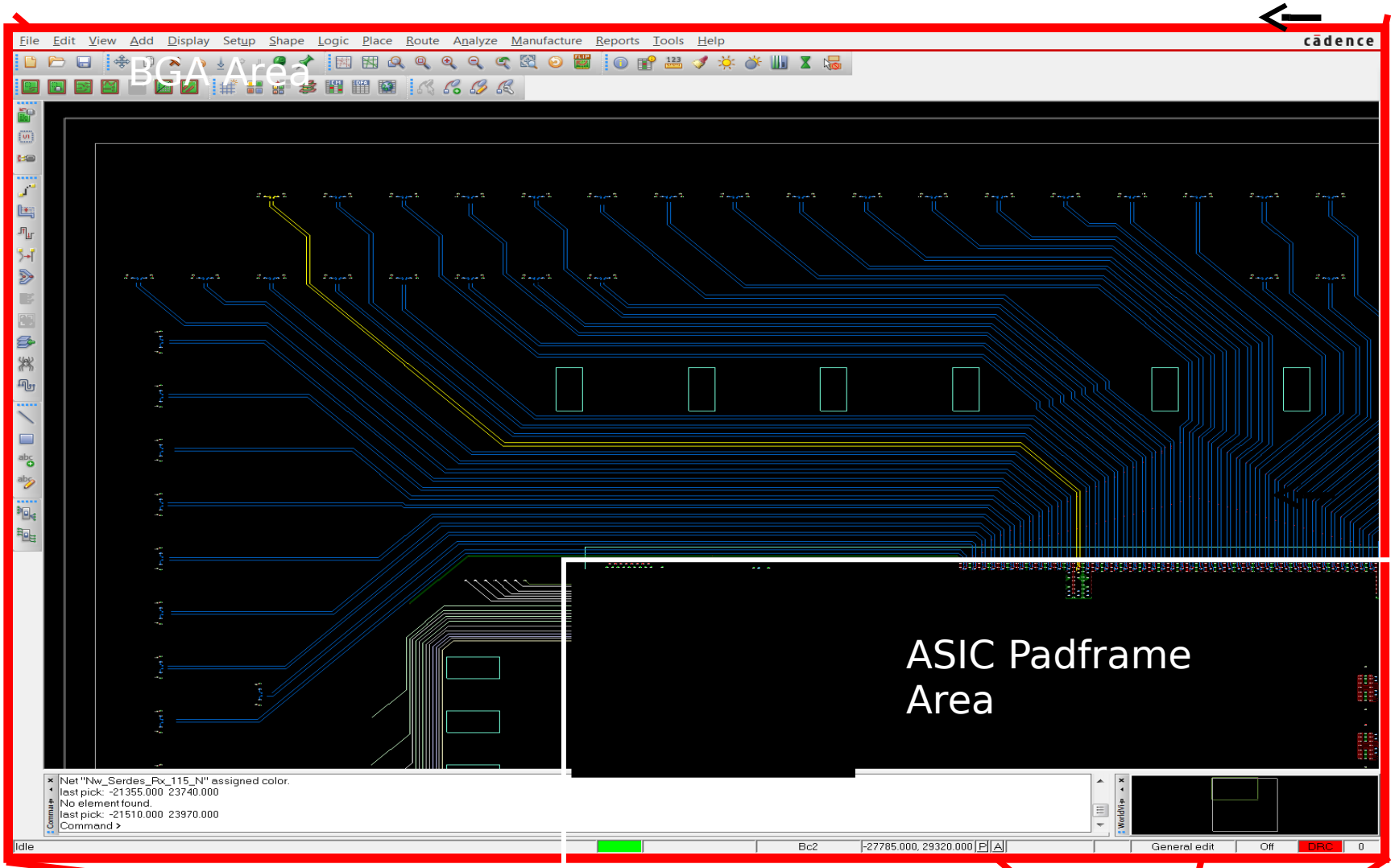
Device C	Package length	Board C	Fixture loss	filter	Rise time
0	0	0	1.2dB	33GHz 4 pole Bessel	10.2ps
0	12mm	0	1.2dB	33GHz 4 pole Bessel	18.4ps

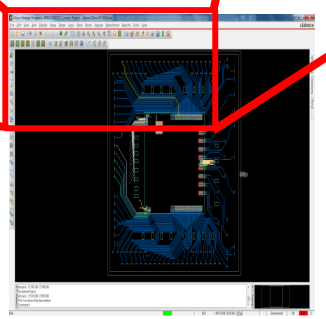
So with a minimum test fixture and the standard measurement filter and no package, the rise time already exceeded the specified minimum rise time for Clause 92 and 93 and when I added a 12 mm package trace, but no capacitance, the rise time exceeded the minimum for Clause 94. So the minimum rise time specs did me no good.

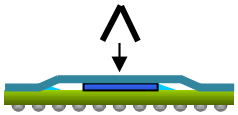
Since they can never be violated the specs do not seem to do anyone any good so I suggest that we eliminate: Clause 92.8.3.5, Clause 93.8.1.5, and Clause 94.3.12.5.

Next I went to our package designers and asked what a reasonable range of package trace lengths would be. They said 8mm to 35mm and showed me the next 2 slides

Route Example of High Speed SerDes

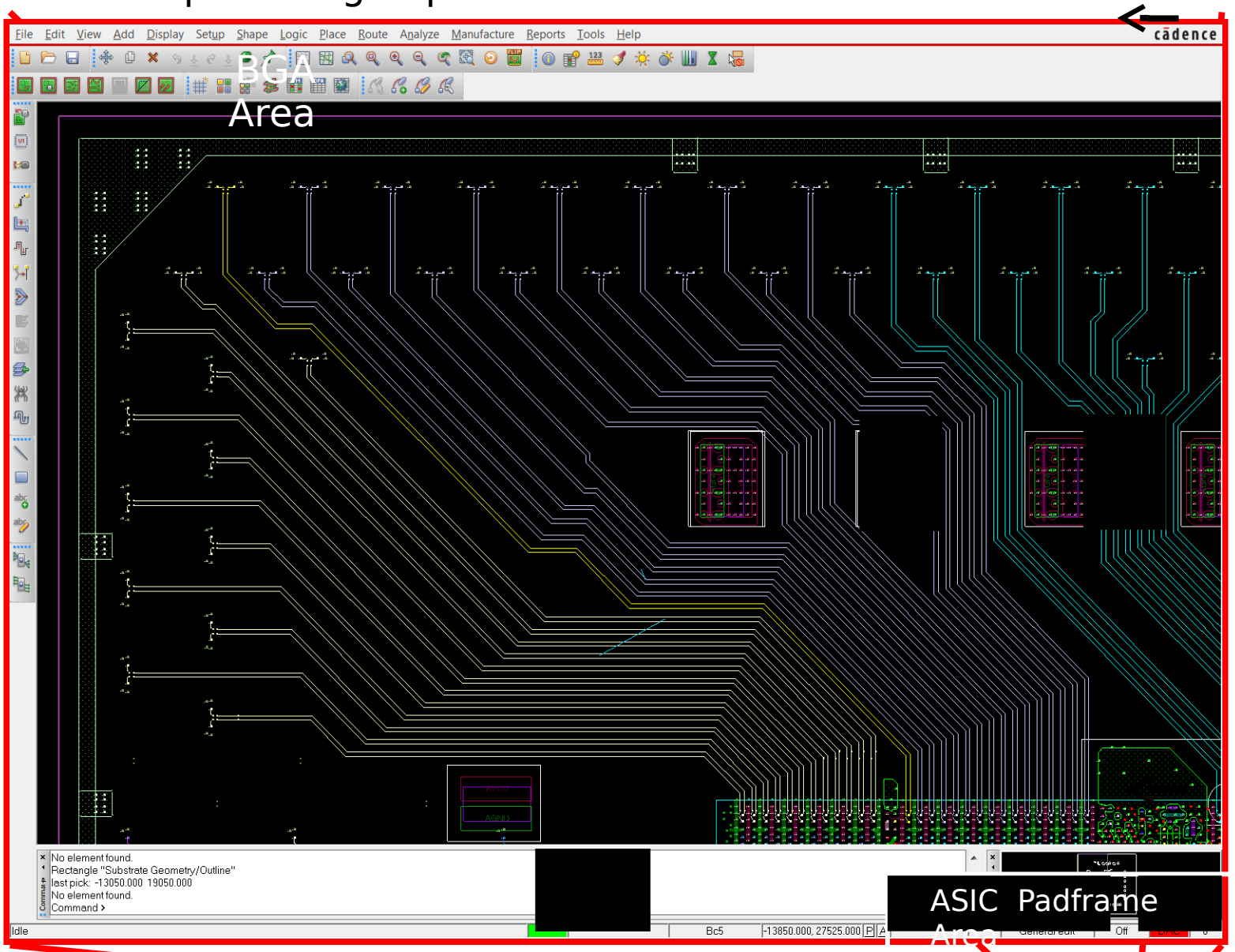






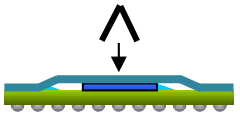
Die Size: ~24x24
Pkg Size: 57.5 x 57.5
Route Length: ~34mm

Route Example of High Speed SerDes



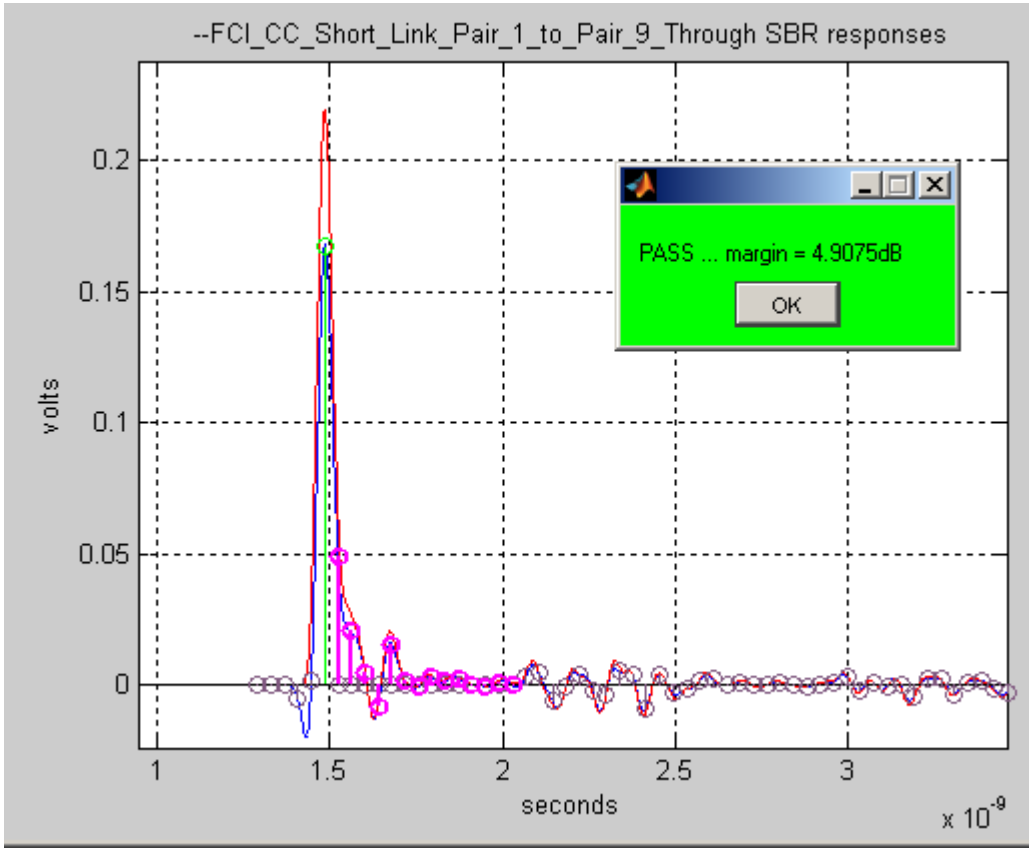
Substrate Edge

Die Edge

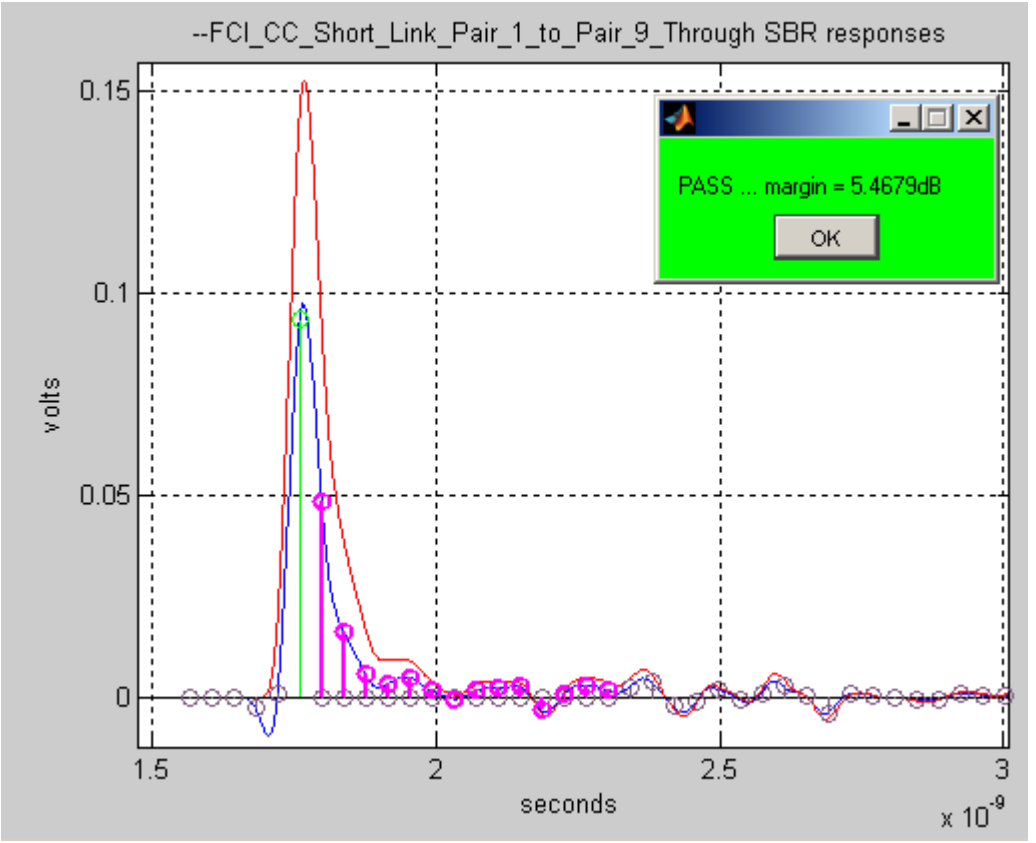


Die Size: ~24x24
Pkg Size: 55 x 55
Route Length: ~26mm

The question arises: how much channel reach does adding a longer package cost us. The answer is not simple. Liav Ben-Artsi points out that the longer package will produce a better return loss reducing some ISI while attenuating crosstalk and channel ISI as much as the signal. This can result in some channels actually working better with the longer package trace while other will work worse.



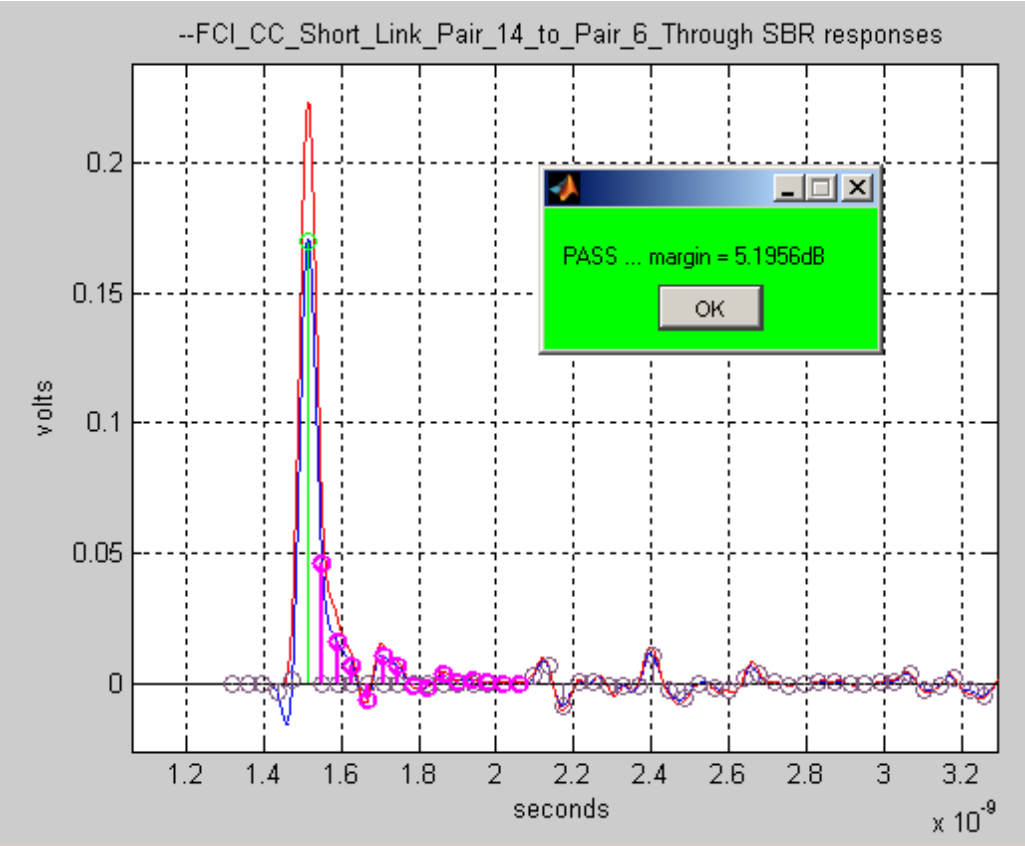
With 12mm package



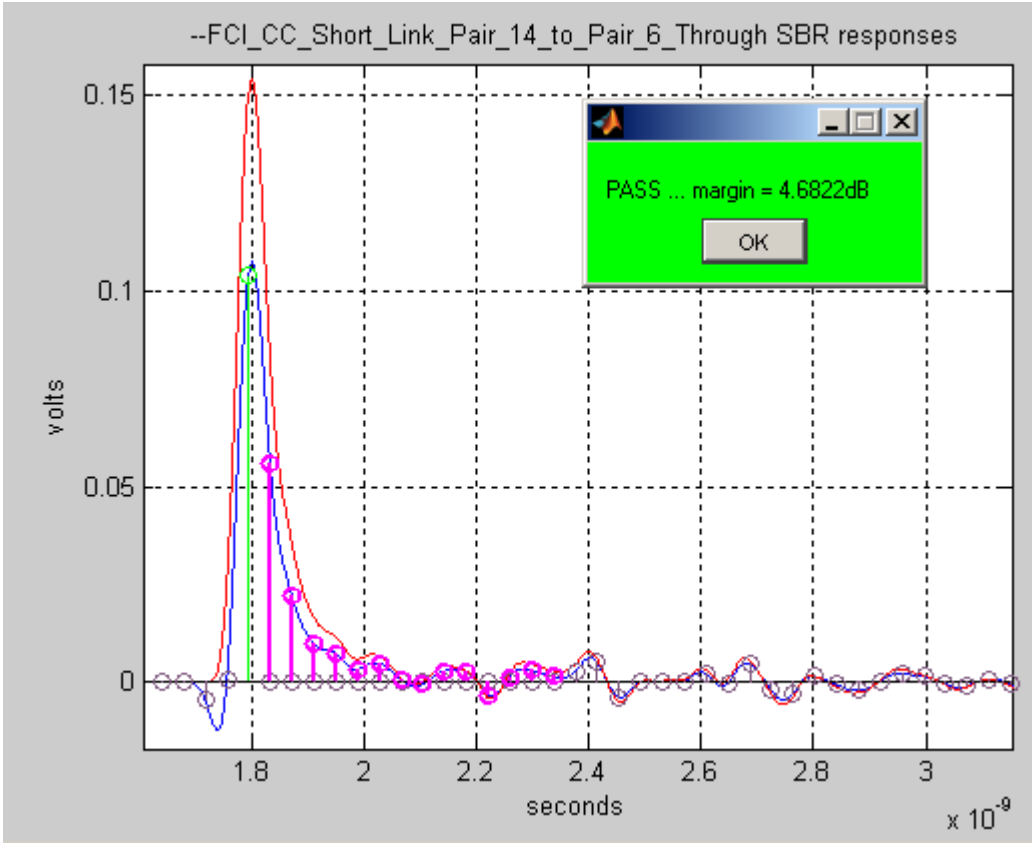
With 35mm package

Loss of peak amplitude is compensated by lower ISI noise

The previous slide showed a case where the longer package helped here is does not.



With 12mm package

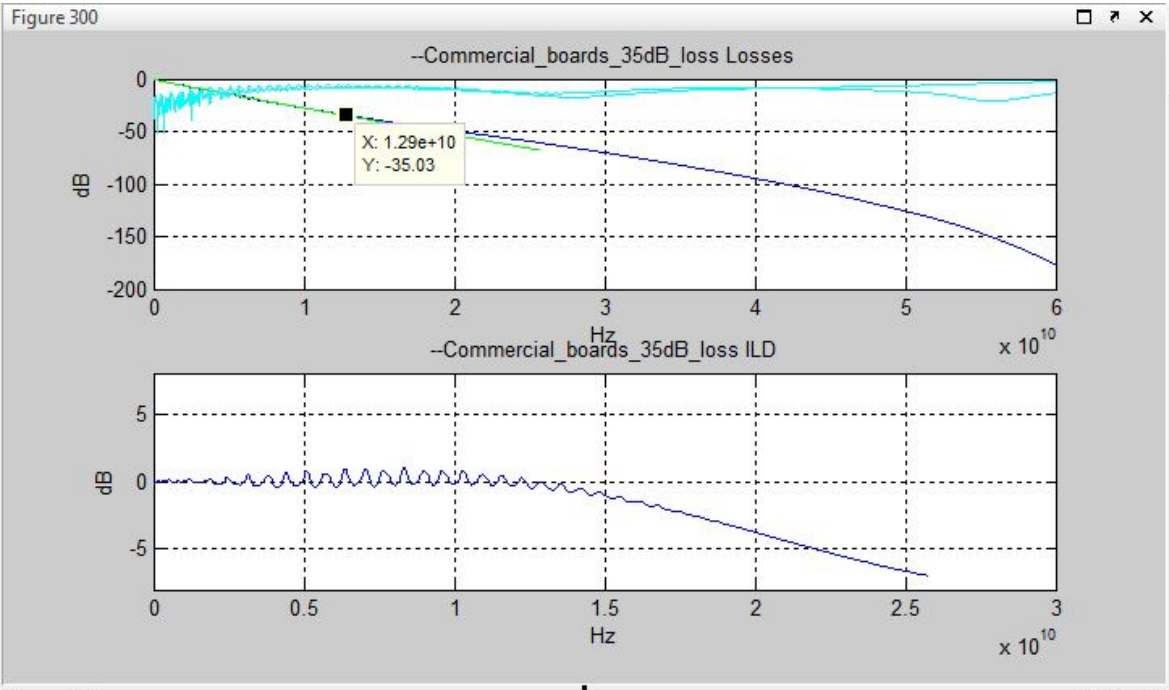


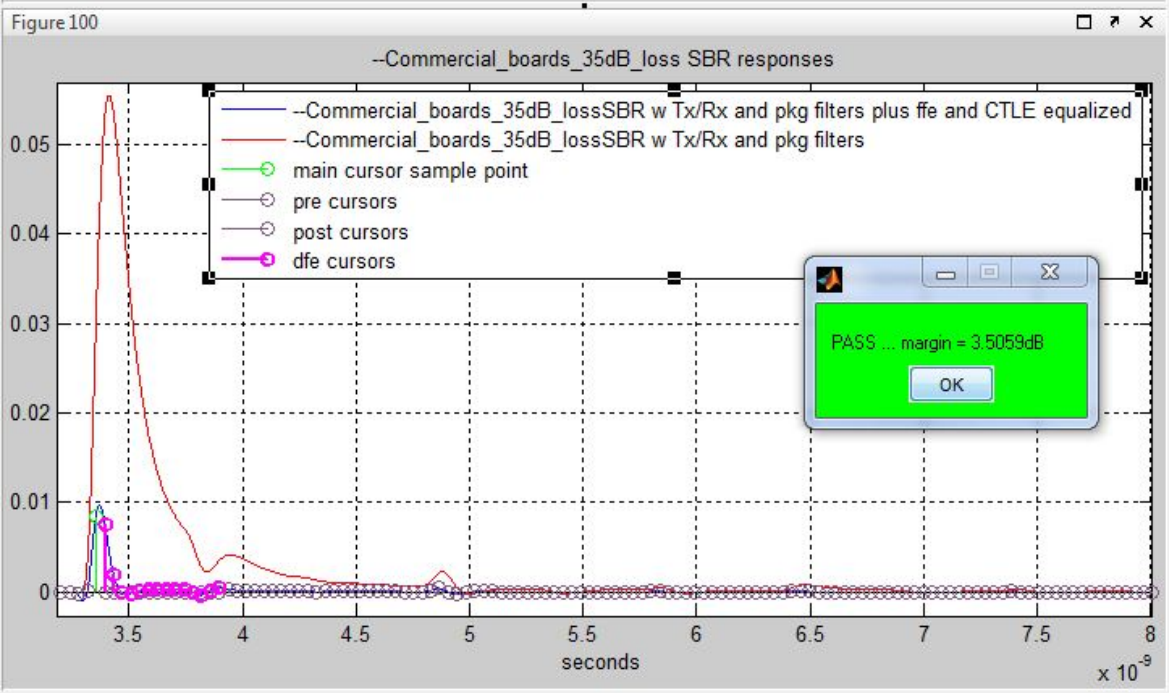
With 35mm package

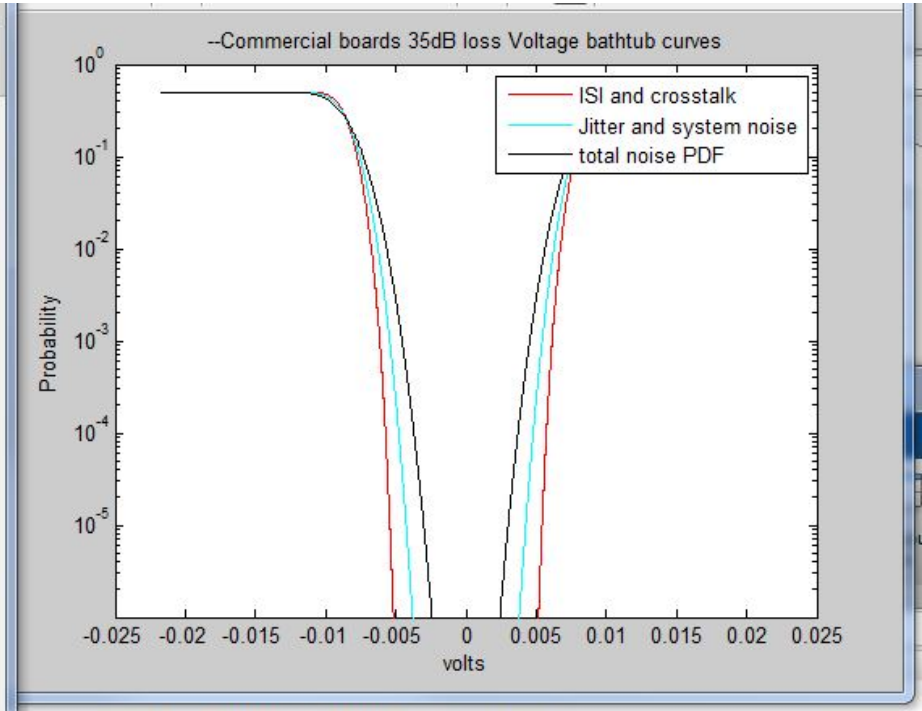
Loss of peak amplitude is not sufficiently compensated by lower ISI noise

But the final question is: will we be able to open a 35dB channel as our objectives require?

Rich Mellitz has provided the following channel model as one which has 35dB attenuation and usable COM with 35mm package models.








```
 channel_operating_margin_dB: 3.5059
        peak_interference_mV: 5.6700
peak_channel_interference_mV: 3.1500
                peak_ISI_mV: 3.1500
  peak_MDXTK_interference_mV: 0
 peak_MDNEXT_interference_mV: 0
 peak_MDFEXT_interference_mV: 0
available_signal_after_eq_mV: 8.4894
           fit_loss_dB_at_Fnq: 35.0156
                IL_dB_at_Fnq: 35.0010
              baud_rate_GHz: 25.7813
                    ILD_RMS: 0.6002
          equivalent_ISI_ICN: 6.1270e-04
  ctle_zero_poles_acdcgaindB: [1.6190e+09 2.5781e+10 6.4453e+09]
                acdcgaindB: -12
                 txle_taps: [-0.1000 0.6200 -0.2800]
                  dfe_taps: [14x1 double]
             sci_noise_FD_RMS: 0.1622
max_peak_interference_at_BER: 0.0032
                         FOM: 15.6624
                   dfe4_rss: 0.1096
                 file_names: '--Commercial_boards_35dB_loss'
```

Given the above, I recommend that we perform 2 COM tests, a compliant channel shall pass both.

Test 1:

- Victim Tx package trace 35mm
- Victim Rx package trace 35mm
- NEXT Tx package trace 12mm

Test 2:

- Victim Tx package trace 12mm
- Victim Rx package trace 12mm
- NEXT Tx package trace 12mm

All device capacitors 250fF, all board capacitors 180fF

Changing the package model will decrease the peak pulse amplitude to Vf ratio in the transmitter. We will need to change the specs in Clause 92.8.3.7.1, Clause 93.8.1.6.1, and Clause 94.3.12.6.2. Here are values for Clause 92.8.3.7.1 test:

Device C	Package length	Board C	Host board	filter	Peak pulse /V_f
250 fF	12mm	180 fF	Quadra_8p25in_ Pair8_9_THRU.s4p	33GHz 4 pole Bessel	0.54
250 fF	35mm	180 fF	Quadra_8p25in_ Pair8_9_THRU.s4p	33GHz 4 pole Bessel	0.46

Recommend peak pulse/V_f be specified as 0.44

Here are values for Clause 93.8.1.6.1 test:

Device C	Package length	Board C	Fixture loss	filter	Peak pulse /V_f
250 fF	12mm	180 fF	1.2dB	33GHz 4 pole Bessel	0.83
250 fF	12mm	180 fF	1.6dB	33GHz 4 pole Bessel	0.81
250 fF	35mm	180 fF	1.2dB	33GHz 4 pole Bessel	0.70
250 fF	35mm	180 fF	1.6dB	33GHz 4 pole Bessel	0.69
250 fF	25mm	180 fF	1.6dB	33GHz 4 pole Bessel	0.79

Recommend peak pulse/V_f be specified as 0.68

Here are values for Clause 94.3.12.6.2 test:

Device C	Package length	Board C	Fixture loss	filter	Peak pulse /V_f
250 fF	12mm	180 fF	1.2dB	33GHz 4 pole Bessel	0.94
250 fF	12mm	180 fF	1.6dB	33GHz 4 pole Bessel	0.92
250 fF	35mm	180 fF	1.2dB	33GHz 4 pole Bessel	0.85
250 fF	35mm	180 fF	1.6dB	33GHz 4 pole Bessel	0.84
250 fF	25mm	180 fF	1.6dB	33GHz 4 pole Bessel	0.87

Recommend peak pulse/V_f be specified as 0.82