Cable De-Embedding

TECHNICAL BRIEF

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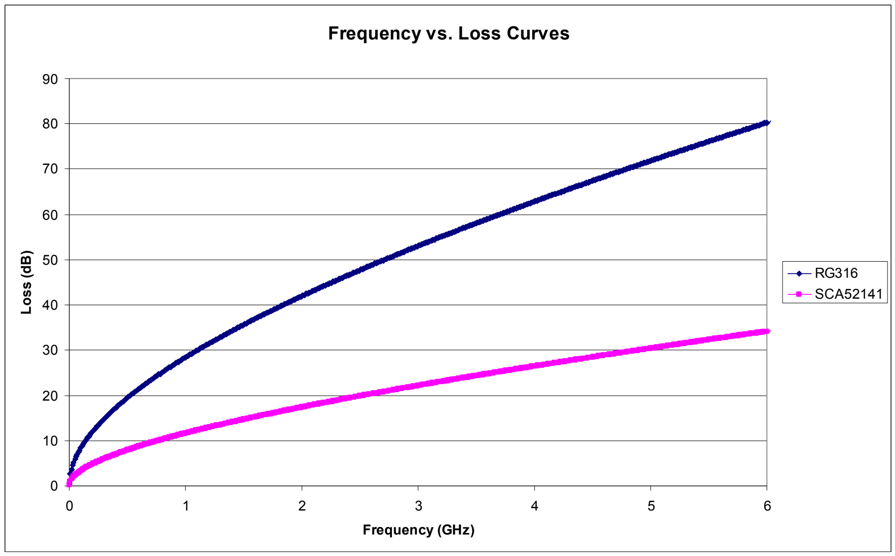
Summary

Cable De-Embedding is a standard feature on all LeCroy SDA 7 Zi Series Oscilloscopes. This feature enables the user to remove the effects of a cable from their measurements. Two typical measurements that are effected are amplitude and rise time. In this technical brief, you will see how two cables with very different loss curves can be de-embedded such that they measure very similar results.



The curves for these two cables are shown below in Figure 1. By looking at Figure 1, you can see that these two cables have very different responses up to 6GHz. These cables were both described by their manufacturer using the formula $A1 * \sqrt{Freq} + A2 * Freq$. The SCA52141 cable's constants were: A1 = 10.008, A2 = 1.601. The RG316 cable's constants were: A1 = 25.393, A2 = 3.017. These constants were verified by measuring the S21 response of the cables using a Vector Network Analyzer and comparing the calculated curves. Both of these cables are 36 inches, and have a propagation velocity of 69.5% as specified by the manufacturer. The cable description can be entered using A1 and A2 as we did because that information was provided, or the cable description can be entered based on S21 result from a network analyzer as a table of [attenuation at 100ft] at [frequency]. Once the table is entered, the scope will derive A1 and A2 from the table and display their values. The Cable setup can be saved for later reuse.

The source that was used for this application was a PCI Express 2.0 Compliant Video Card operating in 2.5GT/s mode and a PCI-SIG Compliance Base Board.

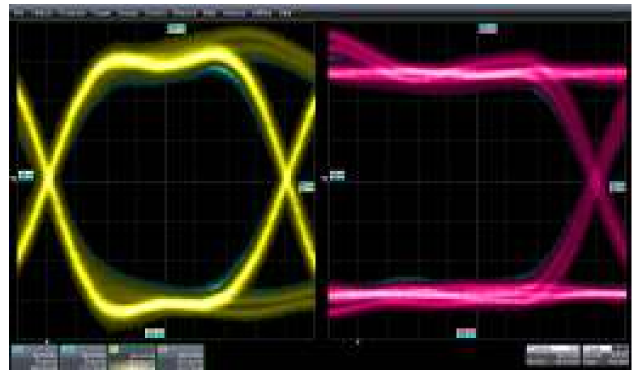
In the first screen image on the right, you can see the eye diagrams before and after the SCA52141 cable was de-embedded.

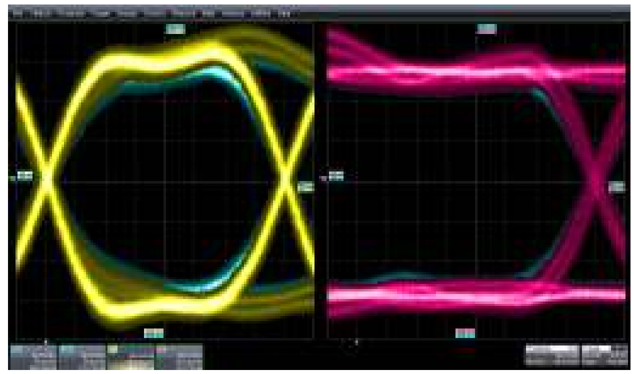
The second screen image shows the eye diagrams before and after the RG316 cable was de-embedded. You can notice that since the RG316 cable was more lossy than the SCA52141 cable, there is greater change in the eye diagram for it.

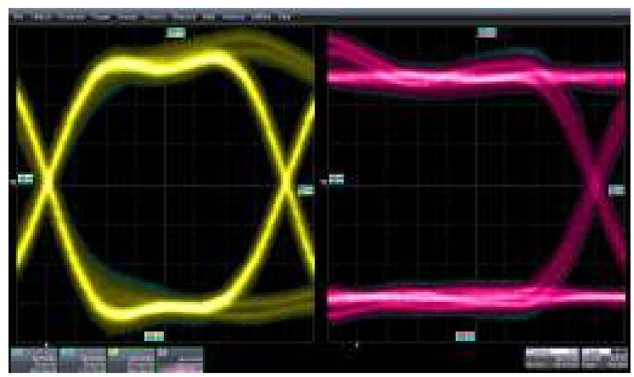
The last screen image shows eye diagrams taken with both cables after they were de-embedding from the measurement.   Notice that there is very little difference between these two eyes.

The table at the bottom of the page tabulates amplitude rise time and rise2080 measures before and after cable de-embedding was applied.

These results show how different cables can dramatically effect your measurements. However, de-embedding the cables, even if the cables behave very differently from each other, will increase the correlation between your measurements.







Cable	Amplitude	Rise time	Rise2080
SCA52141 Before De-Embedding	336.5	144.32	97.03
RG316 Before De-Embedding	323.53	150.75	100.6
SCA52141 After De-Embedding	350.23	137.93	93.88
RG316 After De-Embedding	353.69	137.81	93.65