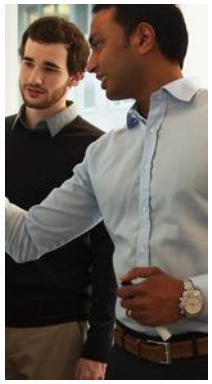


ERL Observations

IEEE 802.3cd, Rosemont IL, March 5/6, 2018

Nathan Tracy

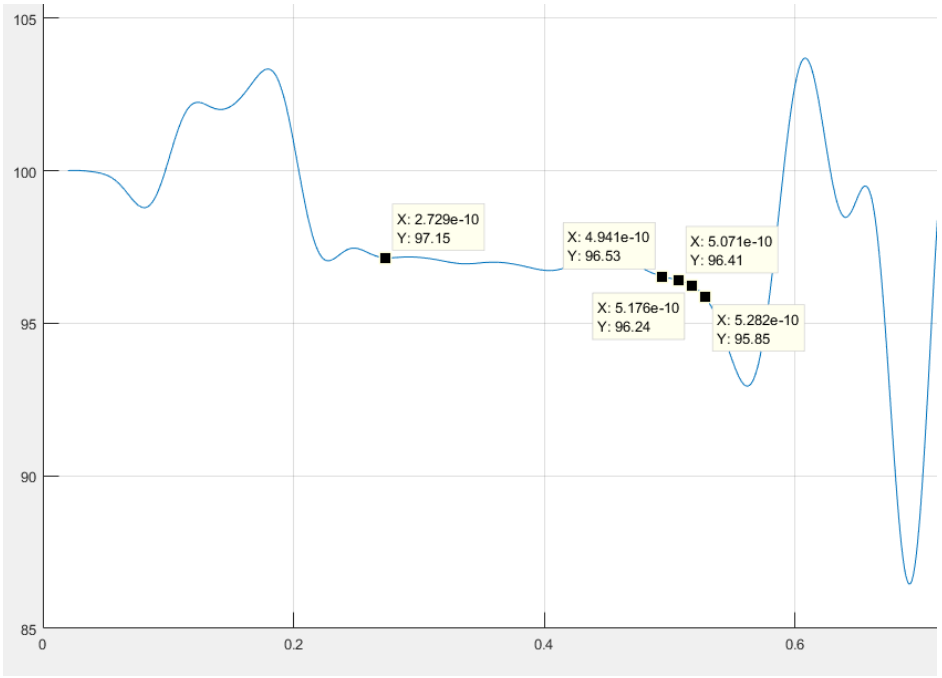
Frequency Start, Step, and Stop Requirements

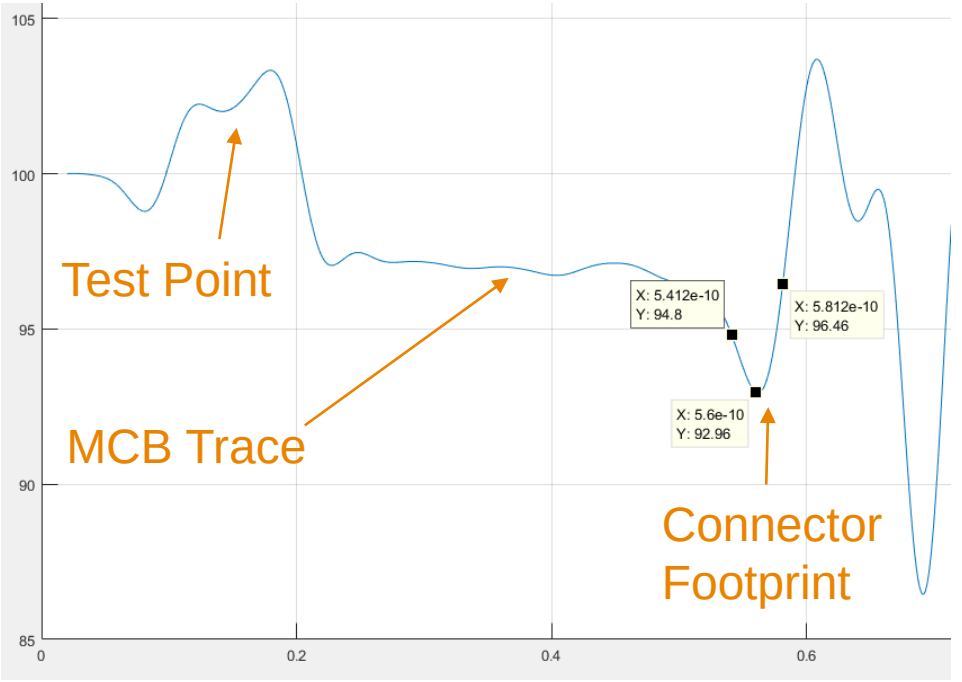
- Frequency start (maximum), stop (minimum), and step size (maximum) can greatly impact ERL, should be defined like COM in Annex 93A.1.1 or Table 136-16
- Data below shows the same channel run with 4 different stop frequencies

Freq. Start (GHz)	Freq. Stop (GHz)	Freq. Step (GHz)	ERL11 (dB)	ERL22 (dB)
0.01	19	0.01	11.79	18.65
0.01	20	0.01	14.00	18.23
0.01	25	0.01	18.88	18.63
0.01	26.5	0.01	18.88	18.58

Test Fixture Delay

- Test fixture delay can have a large impact on ERL depending on test fixture design and what delay value is used.
- Picking a delay value based on impedance profile is subjective.





Test Fixture Delay

Subjectively selecting fixture delay value from TDR profile allows for ERL values to vary

Fixture Delay (Secs.)	Freq. Start (GHz)	Freq. Stop (GHz)	Freq. Step (MHz)	ERL11 (dB)	ERL22 (dB)
2.279E-10	0.01	26.5	10	14.75	15.19
4.941E-10	0.01	26.5	10	18.42	18.18
5.071E-10	0.01	26.5	10	18.67	18.39
5.176E-10*	0.01	26.5	10	18.88	18.58
5.282E-10	0.01	26.5	10	19.09	18.77
5.412E-10	0.01	26.5	10	19.35	19.01
5.600E-10	0.01	26.5	10	19.71	19.36
5.812E-10	0.01	26.5	10	20.13	19.74

*** TE Interpreted Value**

Test Fixture Delay

- Current IEEE test fixture requirements allow for a large variation in test fixture delay, therefore an automated method to determine each individual fixture's delay is required for accuracy of ERL
- Channels with different connectors at each end require a different fixture delay value that can be used to calculate ERL at each end

IEEE Compliant MCB	Fixture Delay (picoseconds)
Fixture A	503.5
Fixture B	517.6
Fixture C	683.5
Fixture D	737.6
Fixture E (Coax)	1873.0

Summary

I believes ERL is a viable replacement for differential return loss

My TE coworkers and I will continue further validation of the tool on backplane and copper cable channels

I provide the following observations based on TE analysis as well as areas for further refinement:

- Test fixture delay, T_{fx}, achieves beneficial effect of removing test fixture trace from channel characterization but has a degree of subjectivity in choosing the fixture delay
- Variable fixture delay is necessary to accommodate different industry interfaces and compliance boards
- Current test fixture delay methodology needs to be enhanced with ability to input two different delays to accommodate channels with different compliance boards on each end, i.e. QSFP28 to SFP28 breakout cable
- Start frequency max, step size max, and stop frequency min can have impact on ERL if not properly defined, should incorporate same guidelines as used for COM (Annex 93A.1.1)