



Optimized Power Coupling Inductance

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Introduction

When we defined unit loads, one of the goals was to optimize power coupling inductance based on load current

A mixing segment has a power coupling inductance budget

Exceeding the minimum budget causes data droop

Power coupling inductors 'sum' in parallel

Data integrity calculations assumed an even distribution of inductance across the nodes:

17 nodes (1 MPSE, 16 MPDs), with 85uH power coupling inductance each

$85\mu\text{H} / 17 = 5\mu\text{H}$ minimum parallel inductance

This presentation discusses:

- 1) A more optimal way to distribute Power Coupling Inductance**
- 2) Required changes to the TCI return loss specifications to allow PCI optimization**

Power Coupling Inductance Budget

The mixing segment power coupling inductance budget is linked to each node's power budget

Fewer high unit load devices can coexist on a mixing segment

Therefore, higher unit load MPDs can absorb more of the power coupling inductor budget

Doing this allows high current device to use smaller power coupling inductance value

This optimizes cost and size

This was proposed in November 2023: [Paul_02_da_2023_11_13.pdf](#), slide 3

Power Coupling Inductance Optimization

Unit Load	Old Distribution (uH)	New Distribution (uH)
1U	80	160
2U	40	80
4U	20	40
8U	10	20
16U	5	10
MPSE	80	10

The new distribution distributes Amps per Henry evenly across the unit load types and the MPSE

The new distribution provides a drastic improvement on the MPSE economics and has little to no effect on the MPD economics

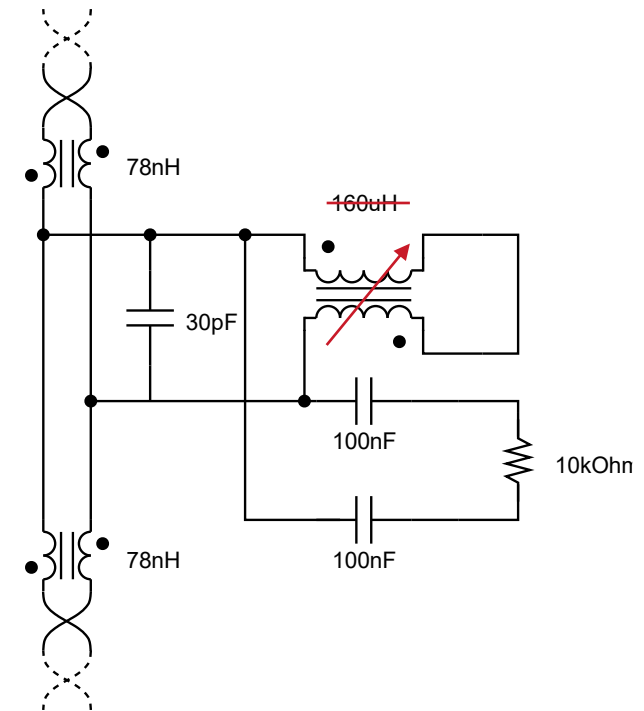
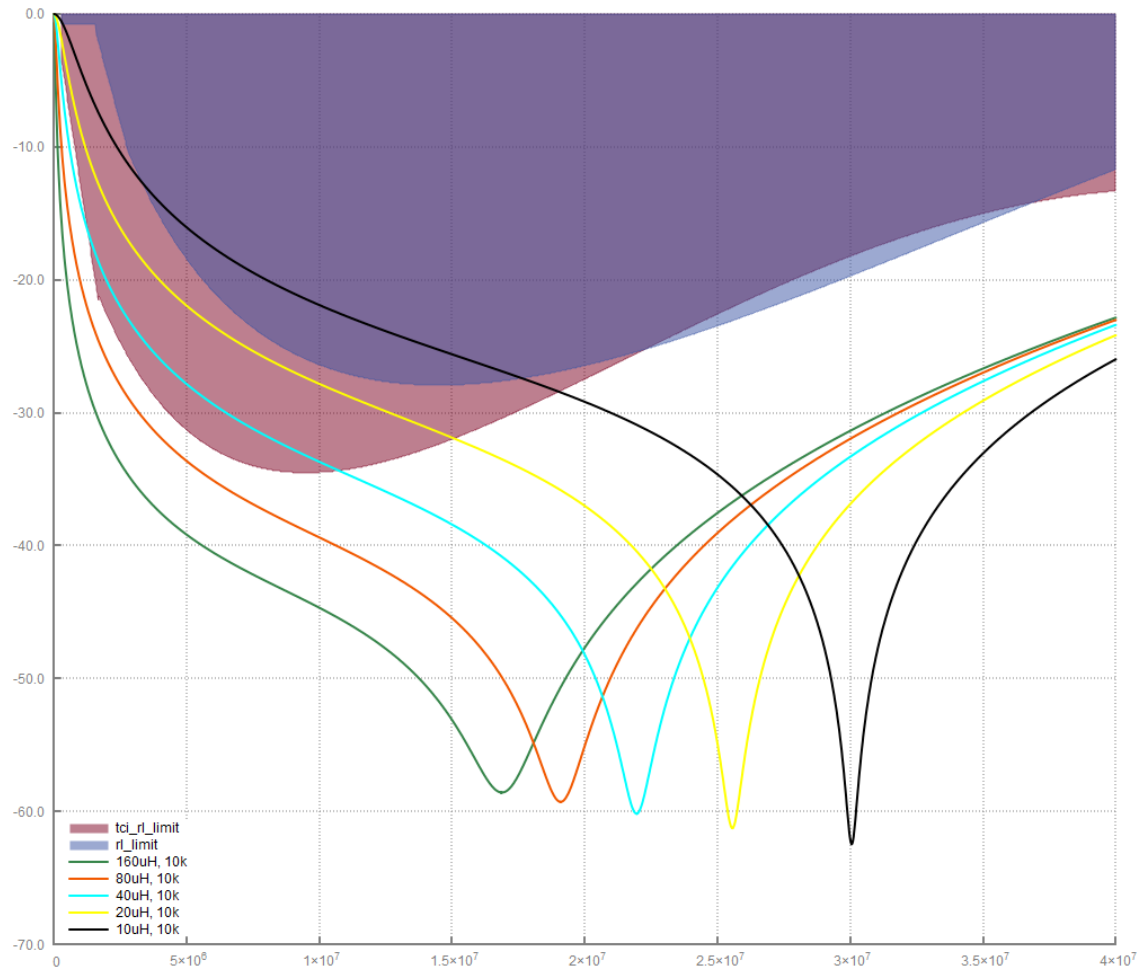
Power Coupling Inductance Compliance

In 802.3da Draft 2.0, the power coupling inductance is limited by the TCI Return Loss limit specified in clause 188

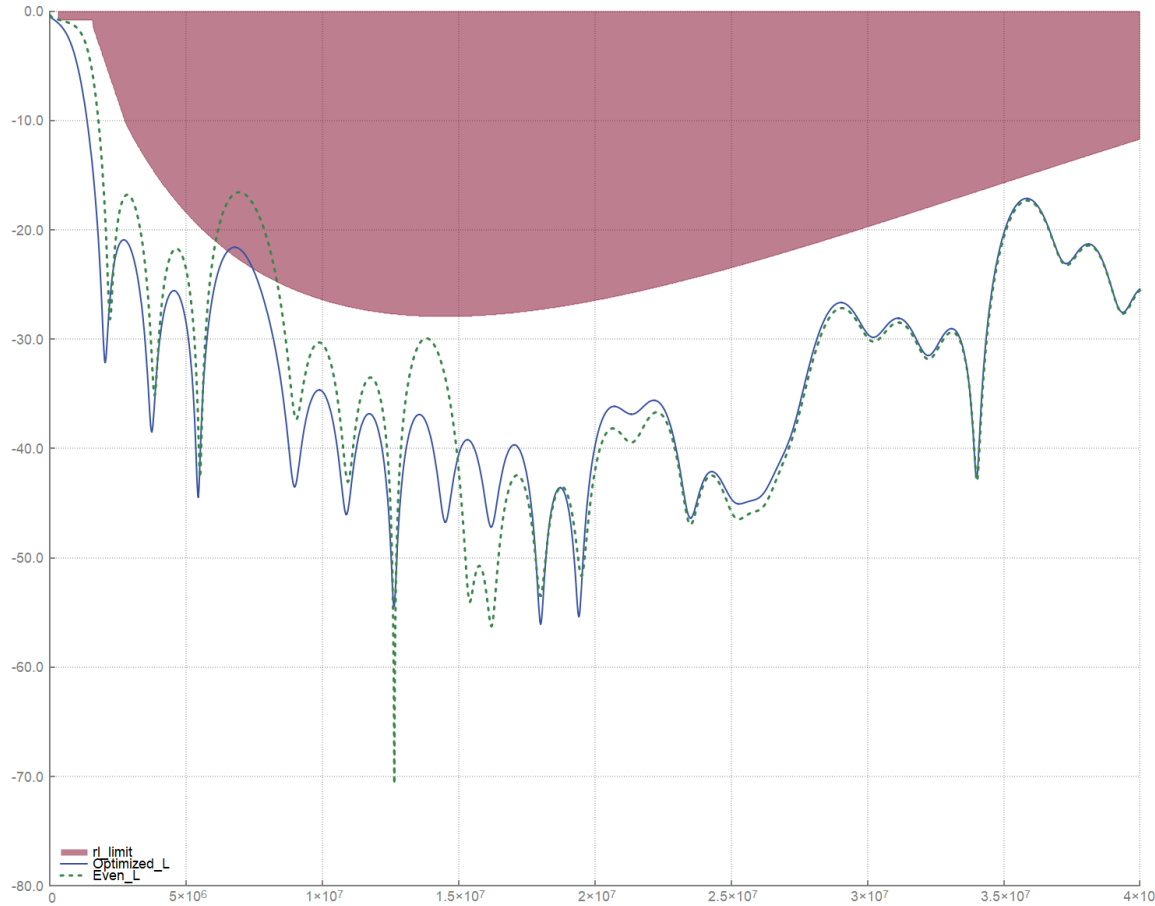
The TCI return loss limit is calculated for nodes with ~80uH power coupling inductance

We need it to accommodate ~10uH for 16U devices and 160U for 1U devices

Return Loss with Different Power Coupling Inductors



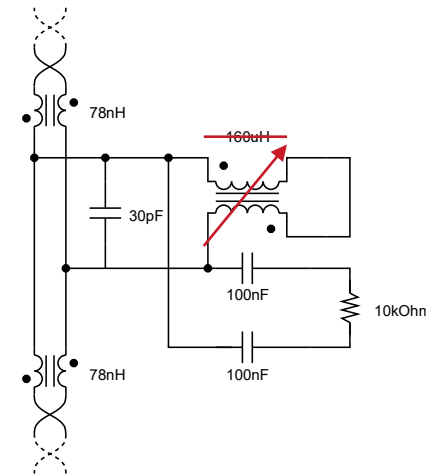
Mixing Segment RL – Looking at Mixing Segment from Transmitter



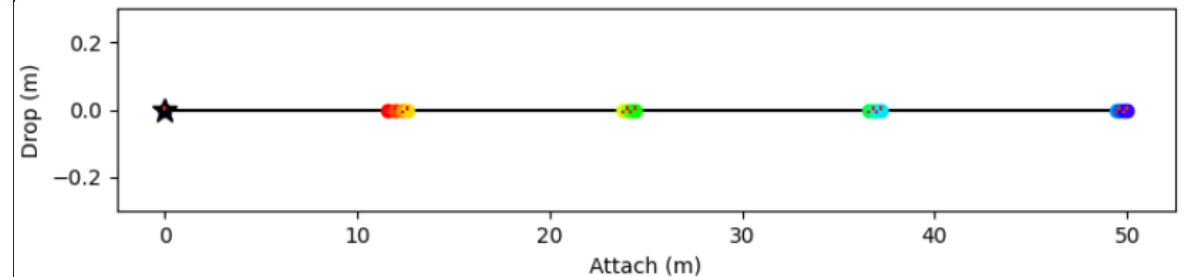
Even_L -> 85uH All 17 Nodes

Optimized_L -> 10uH Transmitter, 160u * 16 PDs

Node Configuration:



Network Configuration: 4 Clumps, 4 nodes per clump



Conclusion

I am requesting a 'Task Force To Do' on this topic

Is there consensus on the new power coupling inductance distribution?

I need help changing the Clause 188 return loss specifications to accommodate the power coupling inductance distribution