
SPE Multidrop Enhancements Mixing Segment Considerations Update

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Background

- IEEE P802.3da Task Force Work Items

<https://www.ieee802.org/3/da/workitems/index-word.html>

Mixing Segment	specifications (IL, RL, mode conversion, etc.), MDI specs (tighter than CG?)
MDI + stub	connection (inductance, capacitance, resistance)

- Follow-on July 2020 Single Pair Multidrop Considerations
 - https://www.ieee802.org/3/da/public/jul20/diminico_SPMD_01_0720.pdf
- Update to be first week in November 2020
 - Multidrop Model for SPMD Multidrop mixing segment characteristics with 18 AWG cable model

Contributors

- **Piergiorgio Beruto – Canovatech**
- **Steffen Graber – Pepperl+Fuchs**
- **Paul Wachtel, Bob Voss, Ron Nordin – Panduit**

SPMD Multidrop Topology

- Use validated 802.3cg Multidrop Model as basis for SPMD-E Multidrop mixing segment characteristics
 - 802.3cg Mixing segment
 - up to at least 8 nodes and 25 m in reach

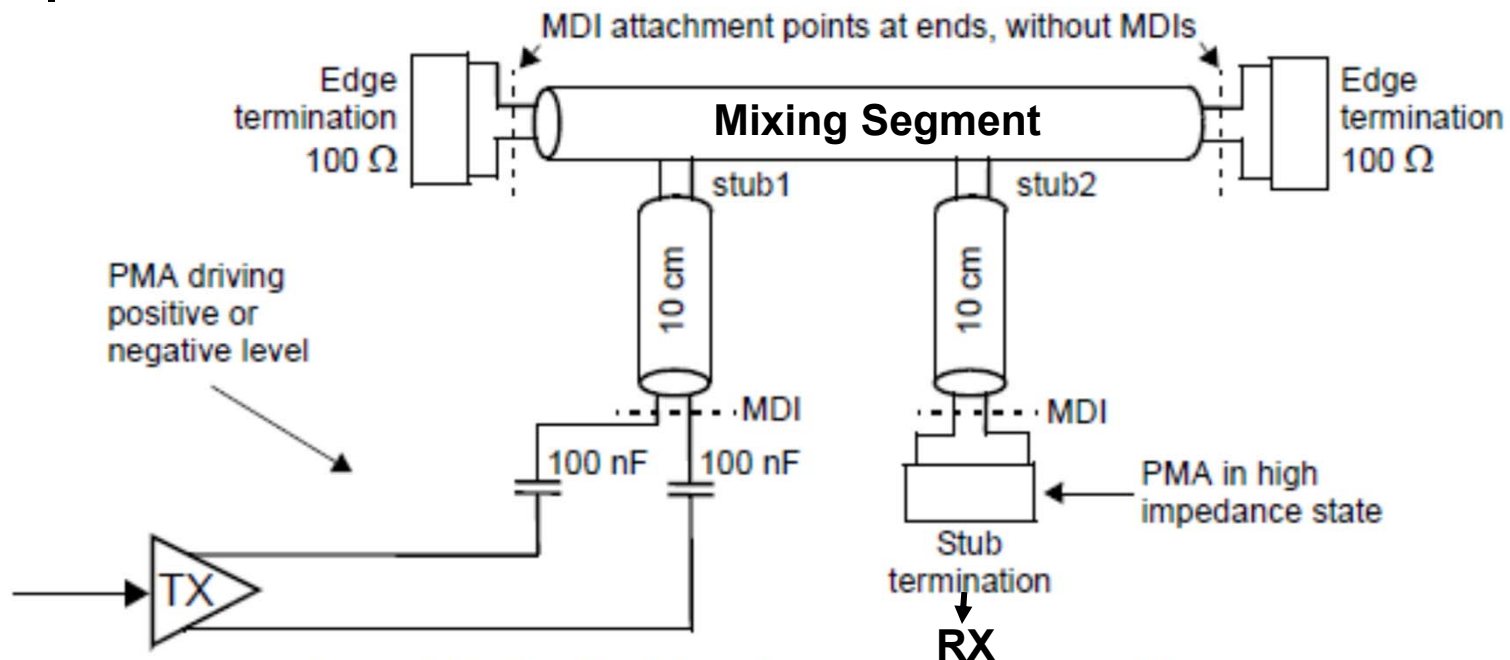


Figure 147-20—Multidrop line termination and PMA

147.9.2 MDI electrical specification – TX - PoDL

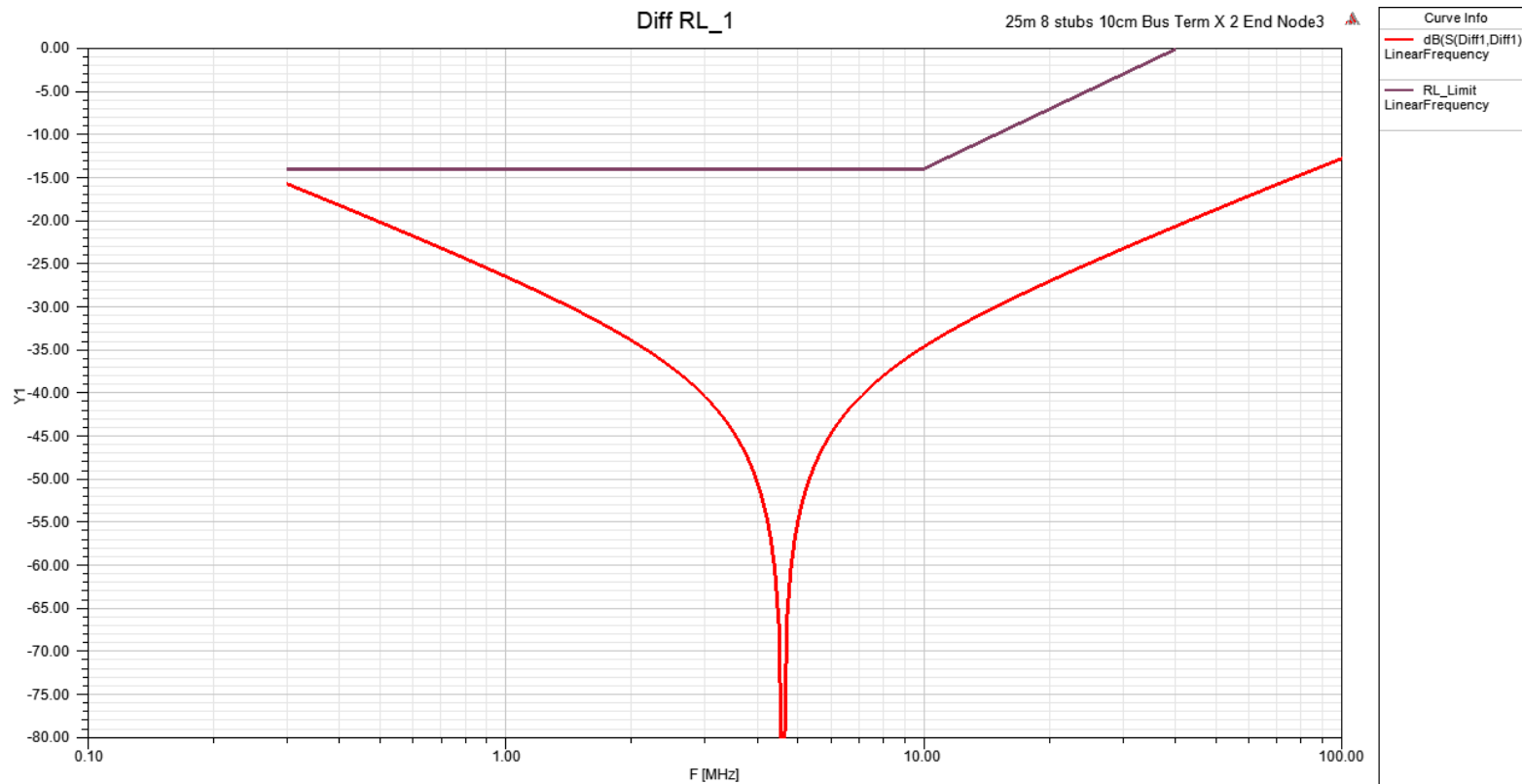
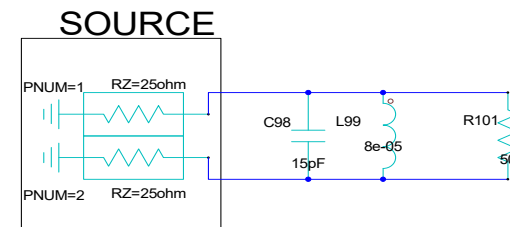


Table 147-4—MDI impedance limit parameters

Parameter name	Unit of measure	Minimum value	Maximum value
R	$k\Omega$	10	—
L	μH	80	—
C_{tot}	pF	—	180
C_{node}	pF	—	15



147.9.2 MDI electrical specification – RX - PoDL

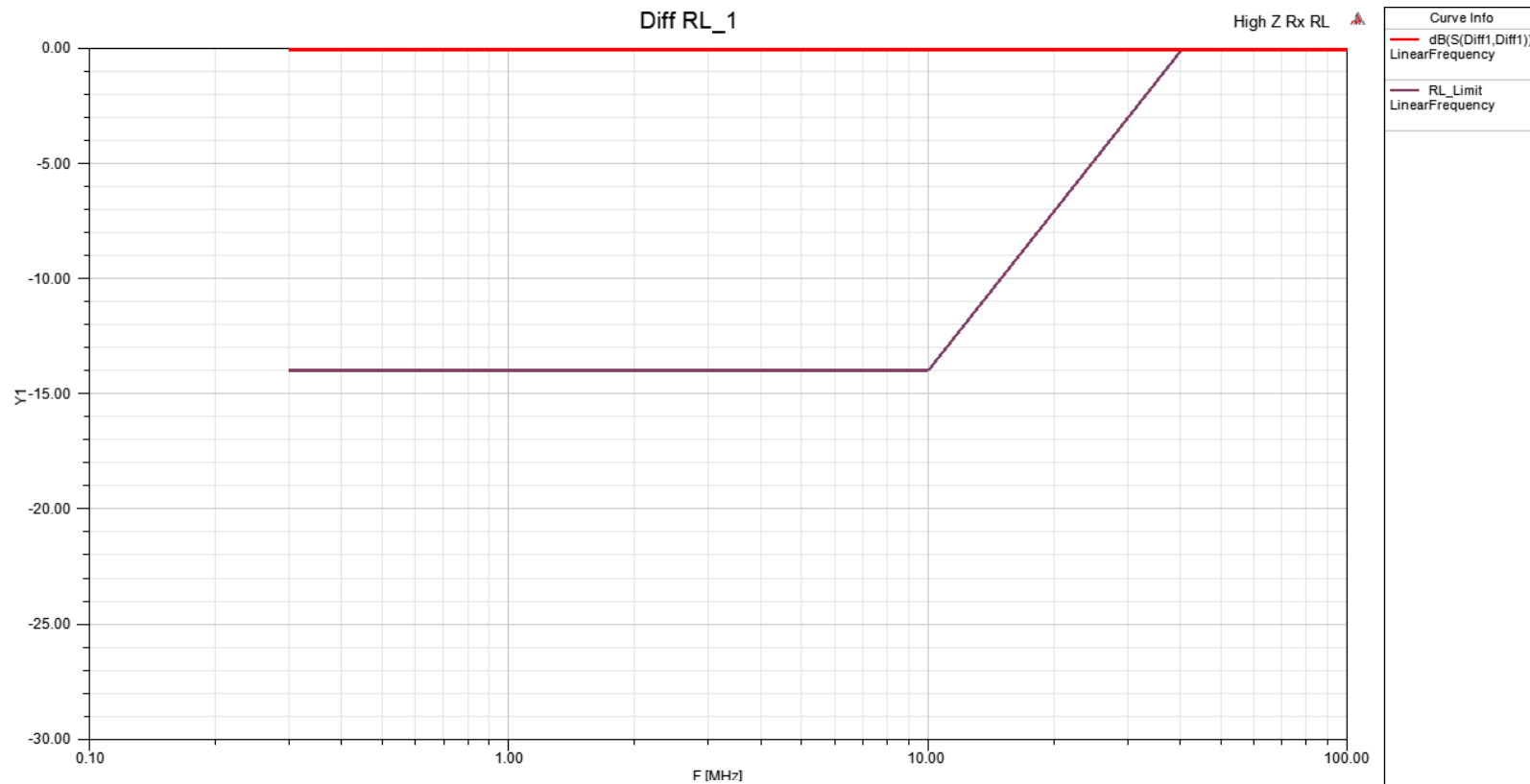


Table 147-4—MDI impedance limit parameters

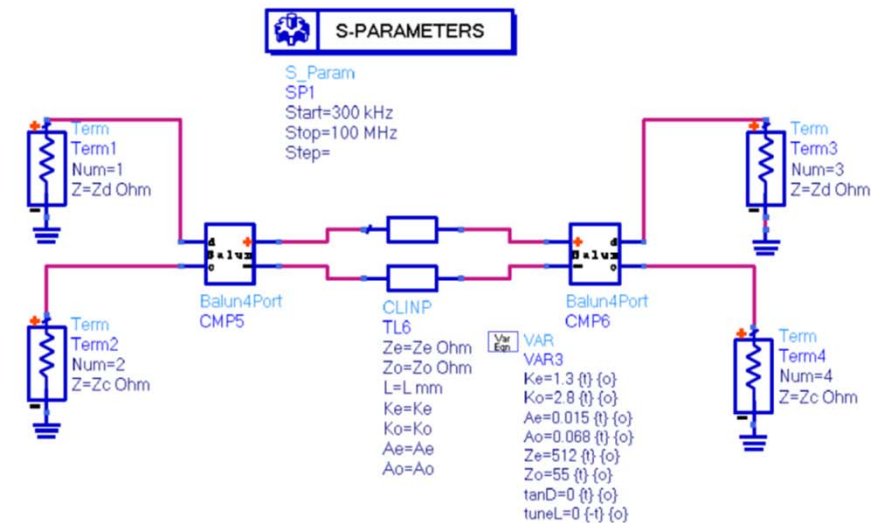
Parameter name	Unit of measure	Minimum value	Maximum value
R	$k\Omega$	10	—
L	μH	80	—
C_{tot}	pF	—	180
C_{node}	pF	—	15

10 SPE Cable Modeling Contribution

Cable modeling with ADS CLINP

- measurement of a „typical“ UTP cable (15m) at room temperature acc. to OPEN Alliance test specification (TC2)
- Fitting of CLINP parameters
 - $A_e = 0,015\text{dB/m@5MHz}$
 - $A_o = 0.068\text{dB/m@5MHz}$
 - $Z_e = 512\Omega$
 - $Z_o = 55\Omega$
 - $K_e = 1,3$
 - $K_o = 2,8$

($Z_d=100\Omega$, $Z_c=25\Omega$)



10SPE Study Group Automotive Channel for Multi-Drop Stefan Buntz, Daimler AG
http://www.ieee802.org/3/10SPE/public/adhoc/buntz_10SPE_03_1005.pdf

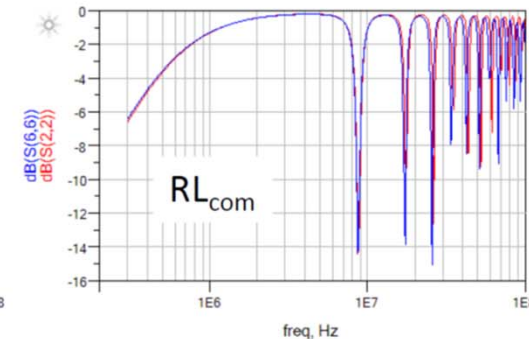
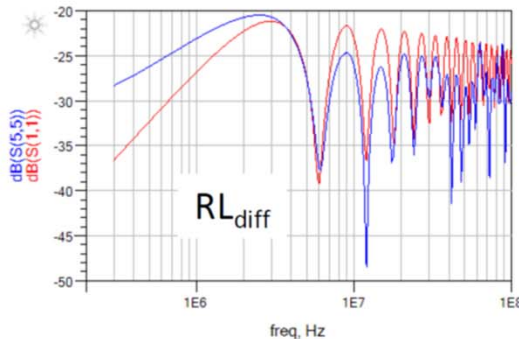
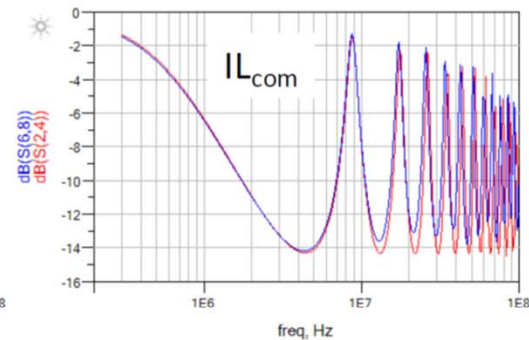
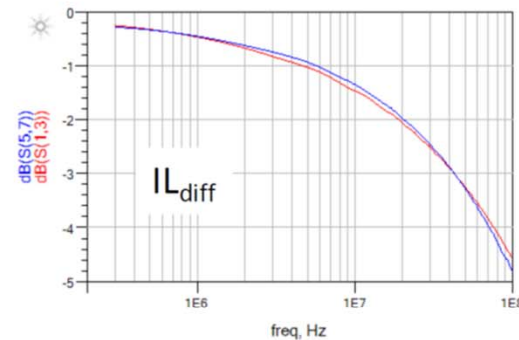
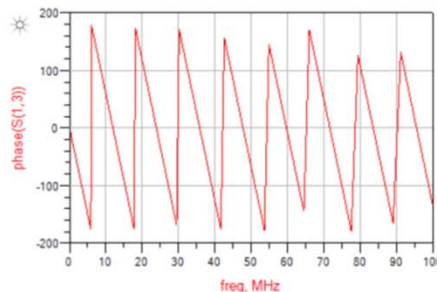
10 SPE Cable Modeling Contribution

fitting results (=15m point-to-point channel)

Measurement

Simulation CLINP

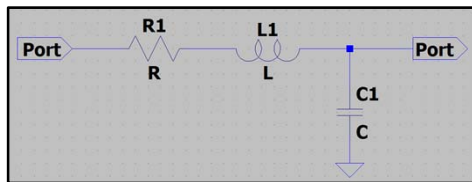
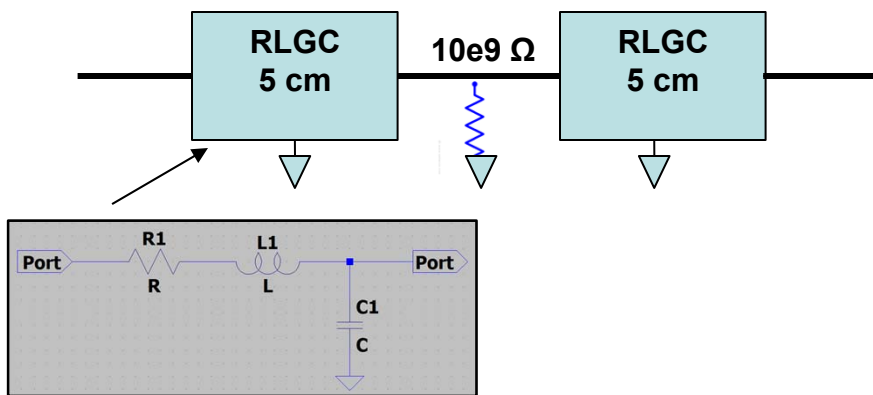
- ~5dB attenuation at 100MHz for differential signal
- <20dB Return Loss
- Phase is constant:



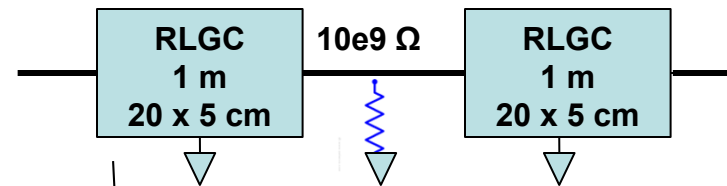
10SPE Study Group Automotive Channel for Multi-Drop Stefan Buntz, Daimler AG
http://www.ieee802.org/3/10SPE/public/adhoc/buntz_10SPE_03_1005.pdf

Analysis Cable Model

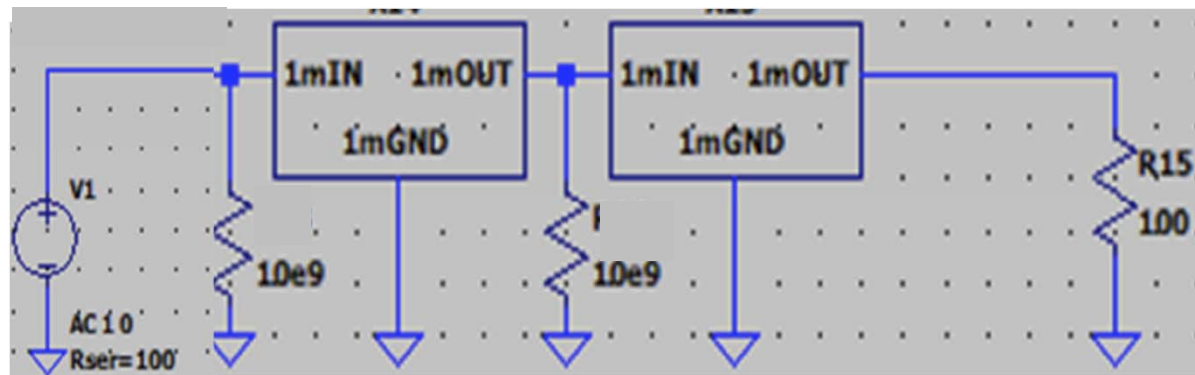
- 5 cm RLCG



- Concatenate 20*5 cm RLCG - 1 m

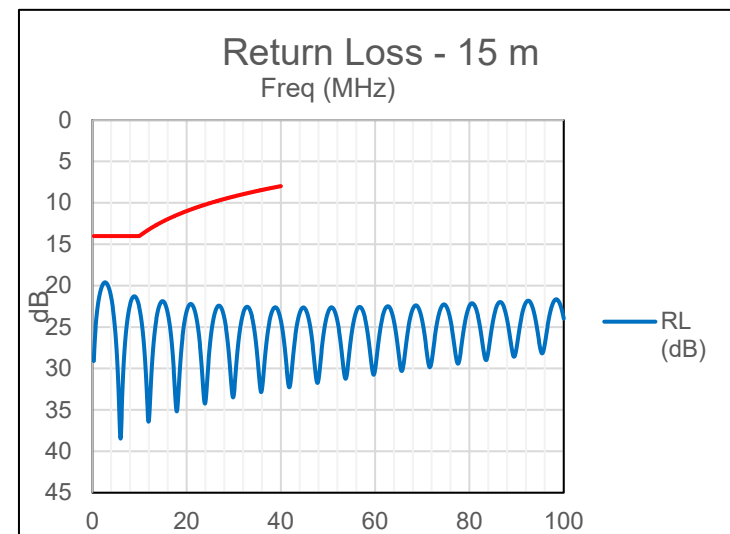
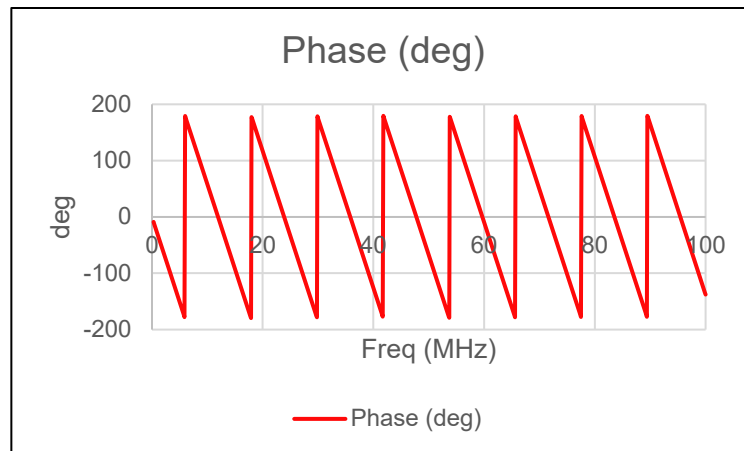
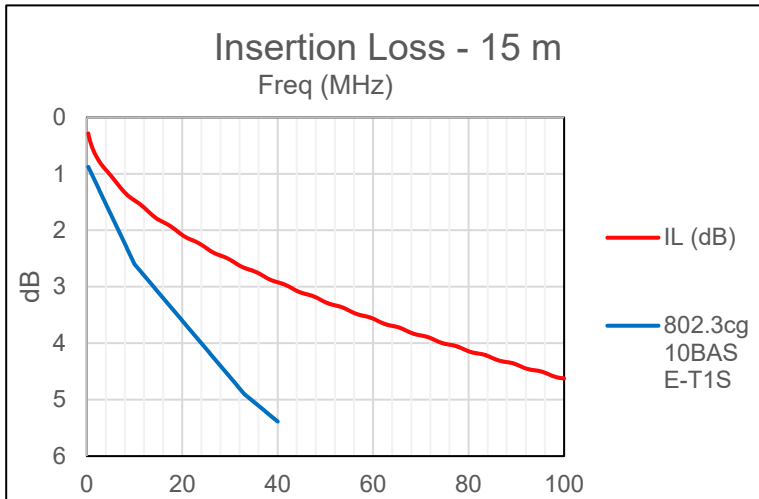
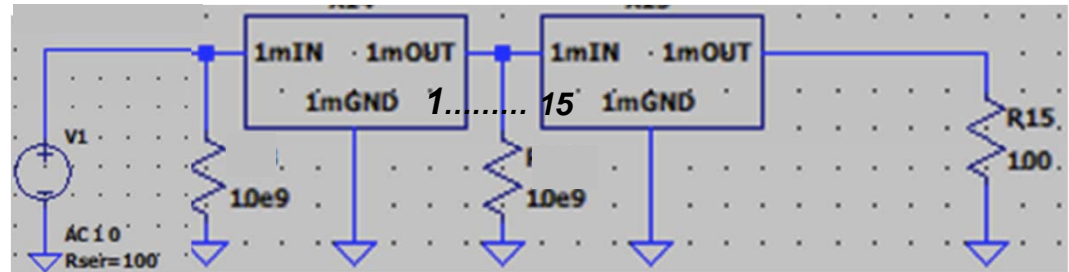


- Spice model 1 m cable sections



Analysis Cable model – 15 meters

- 1 m - 15 sections

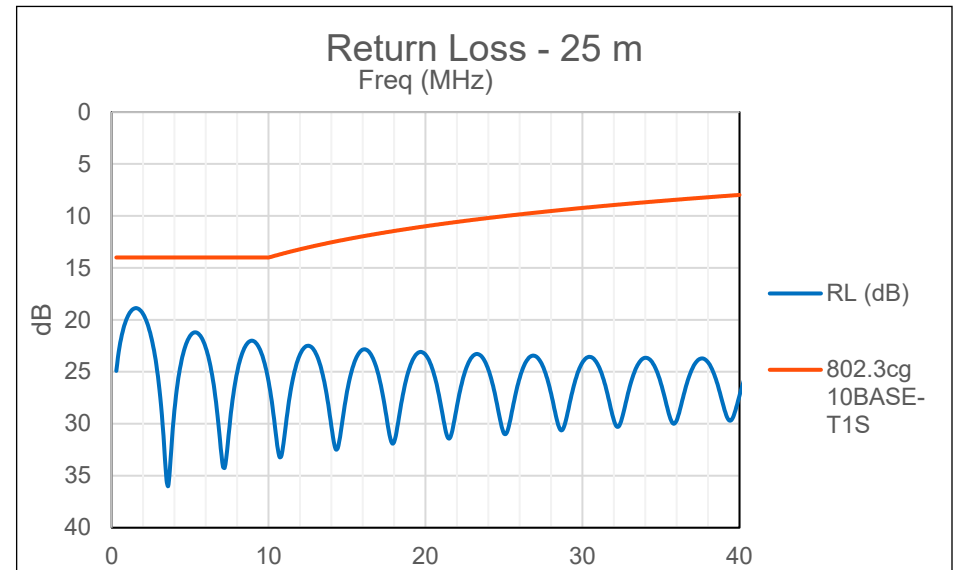
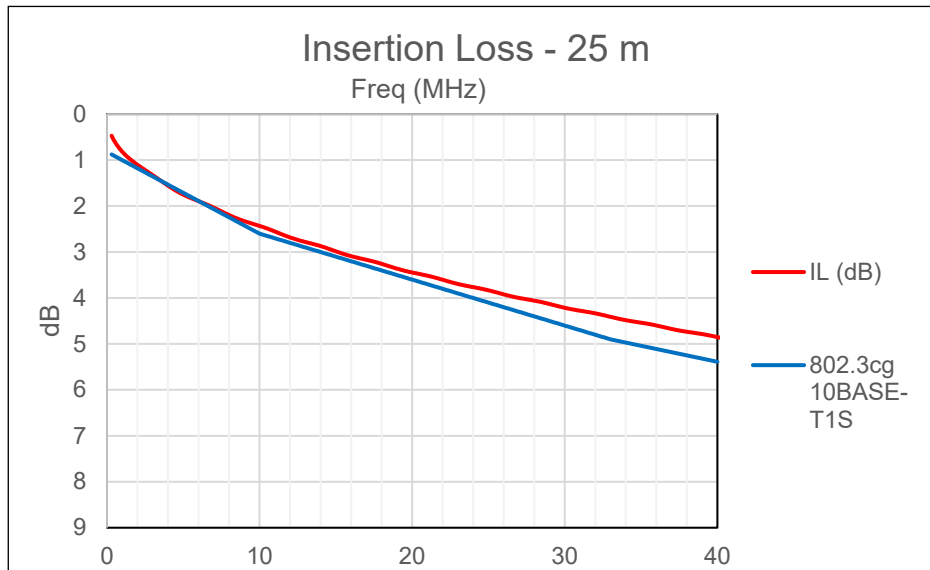
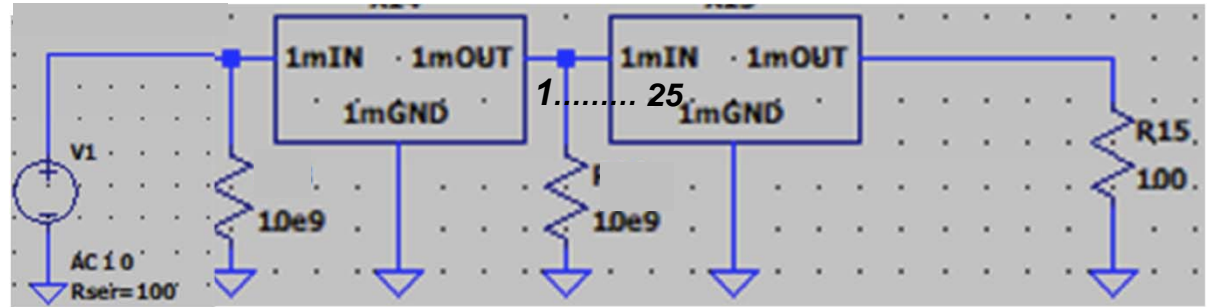


Consistent with >>10SPE Study Group Automotive Channel for Multi-Drop Stefan Buntz, Daimler AG

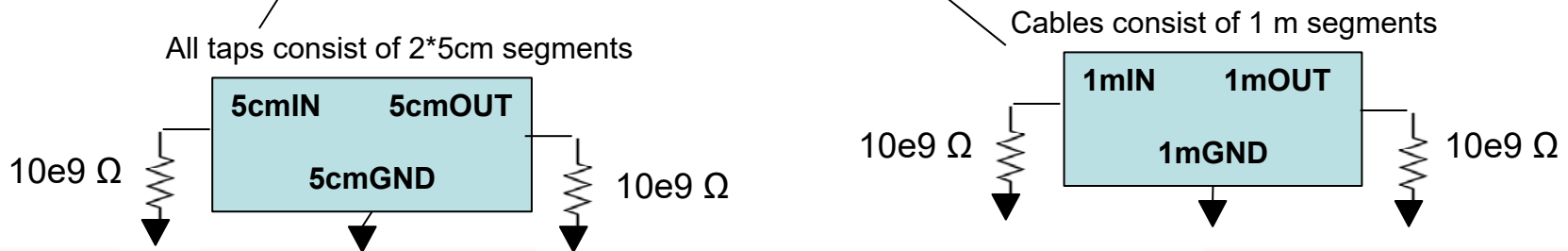
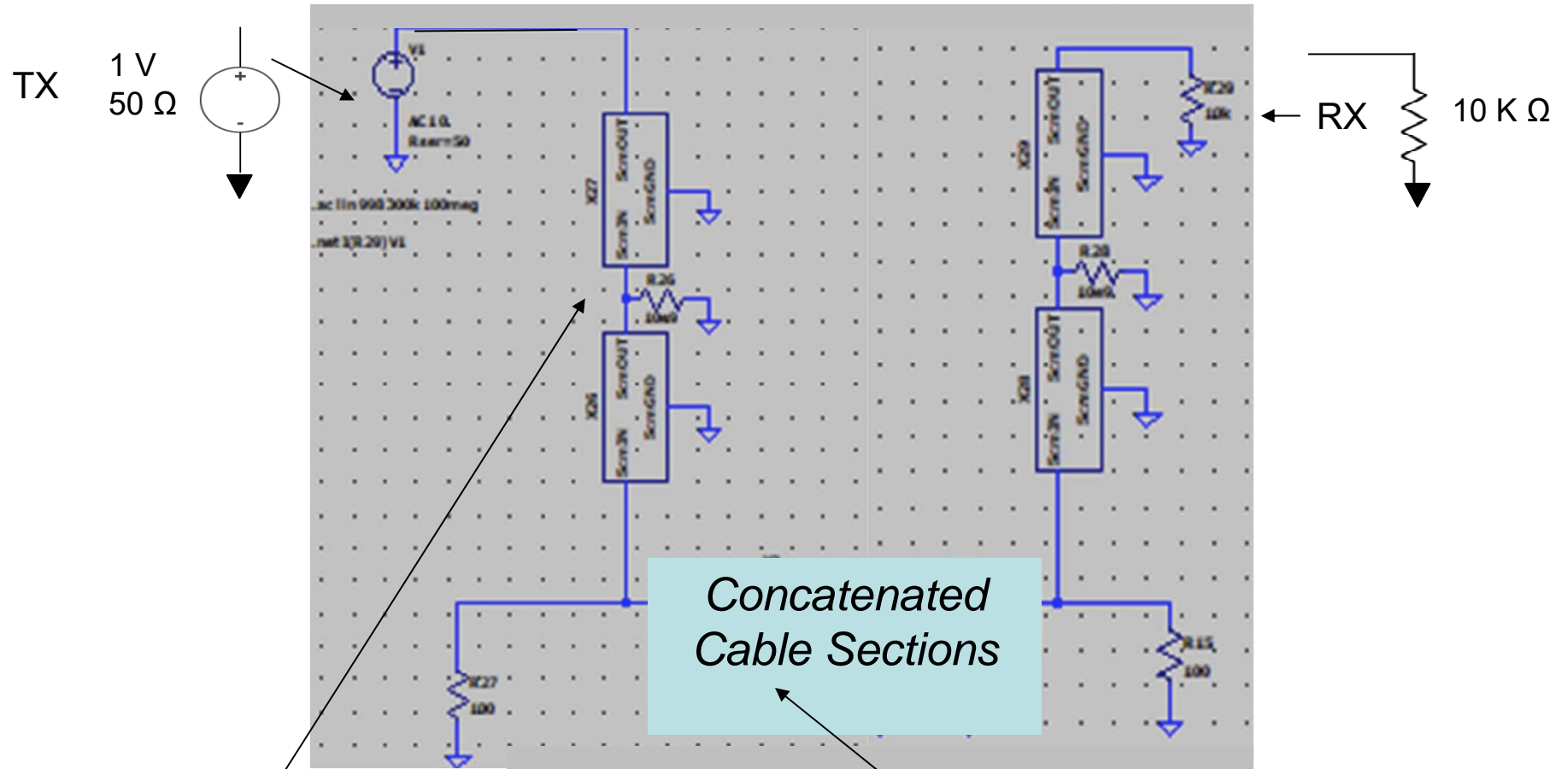
http://www.ieee802.org/3/10SPE/public/adhoc/buntz_10_SPE_03_1005.pdf

Analysis Cable model – 25 meters

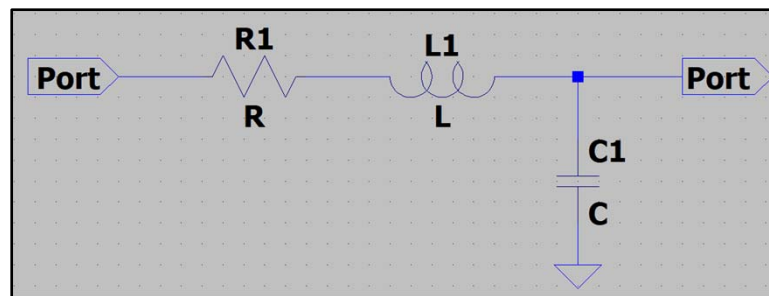
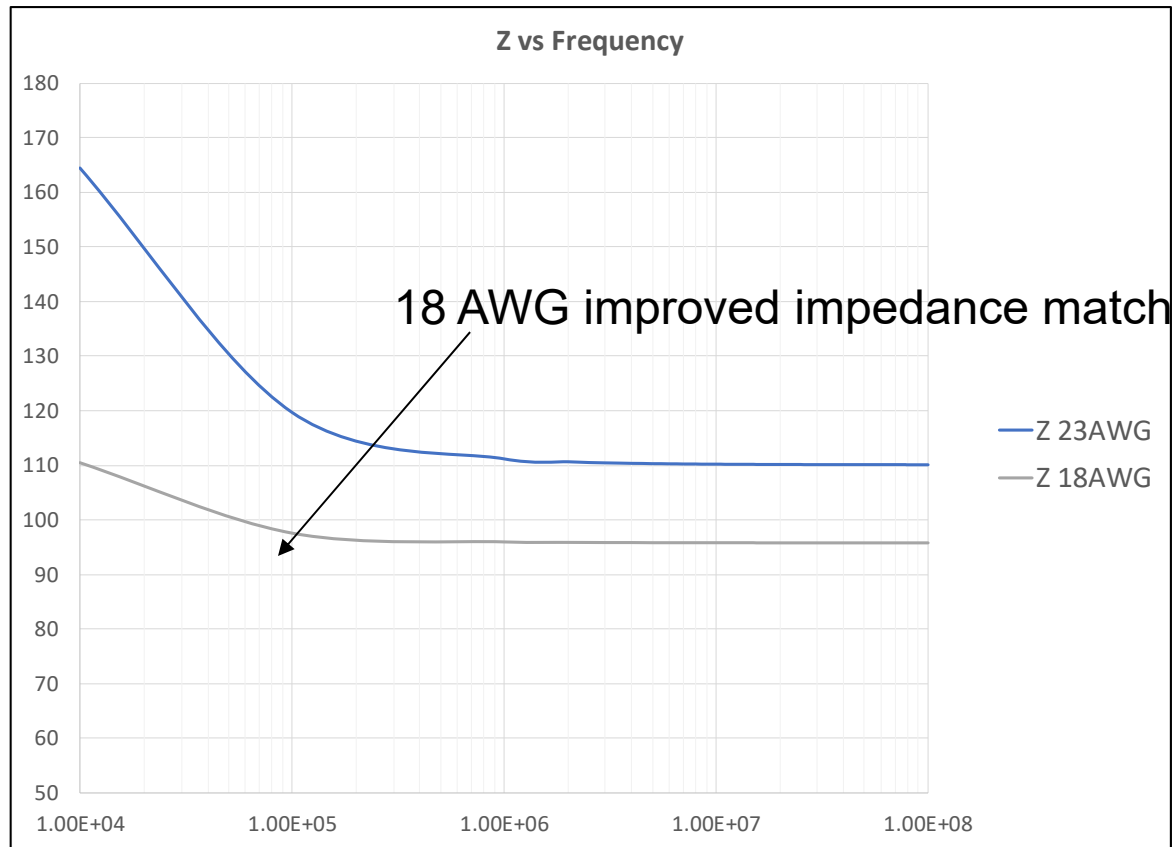
- 1 m – 25 sections



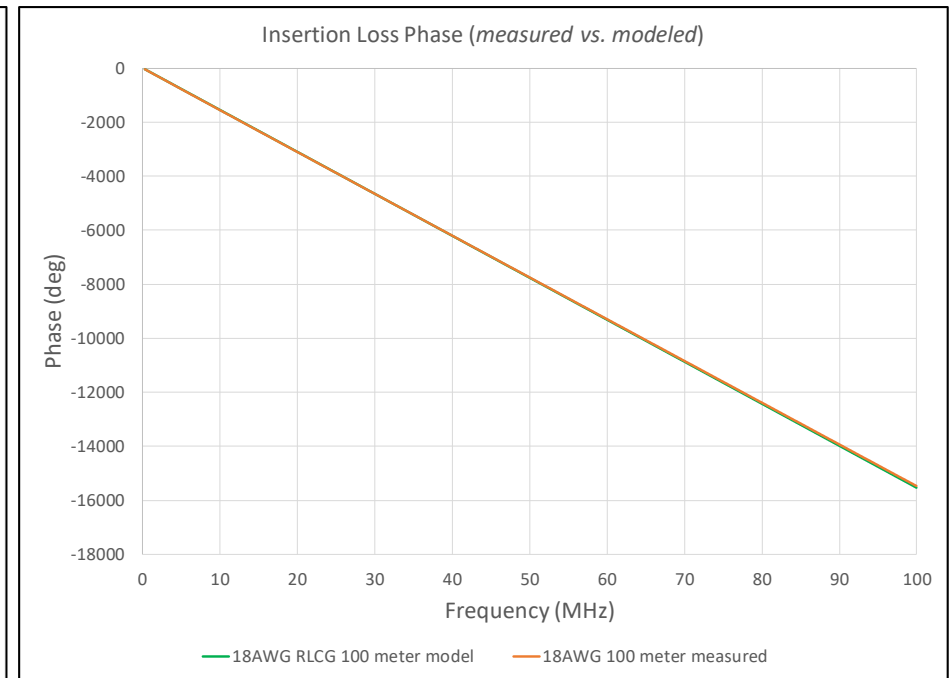
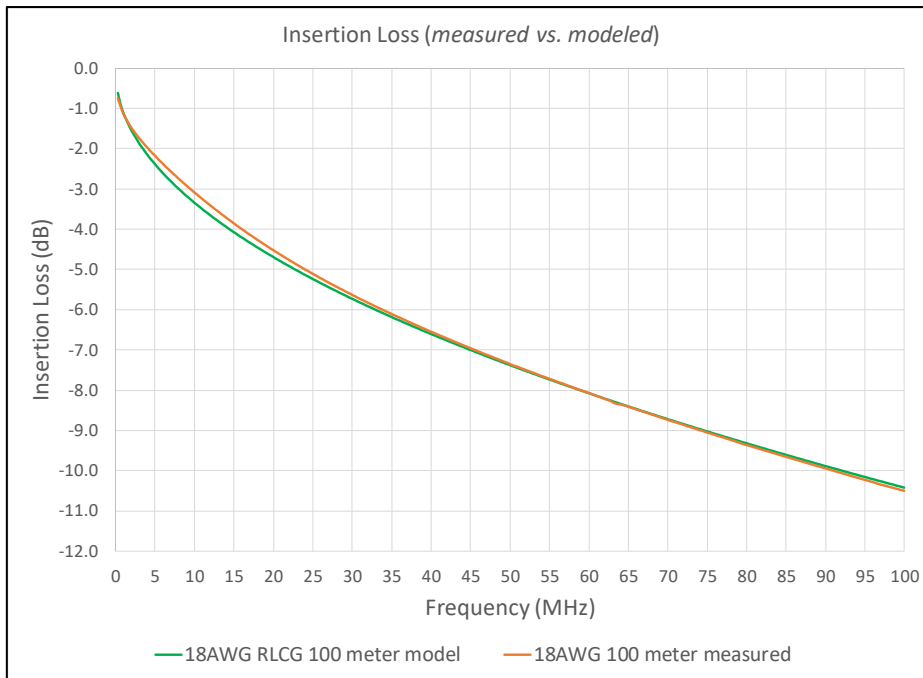
Source and Load without PoDL



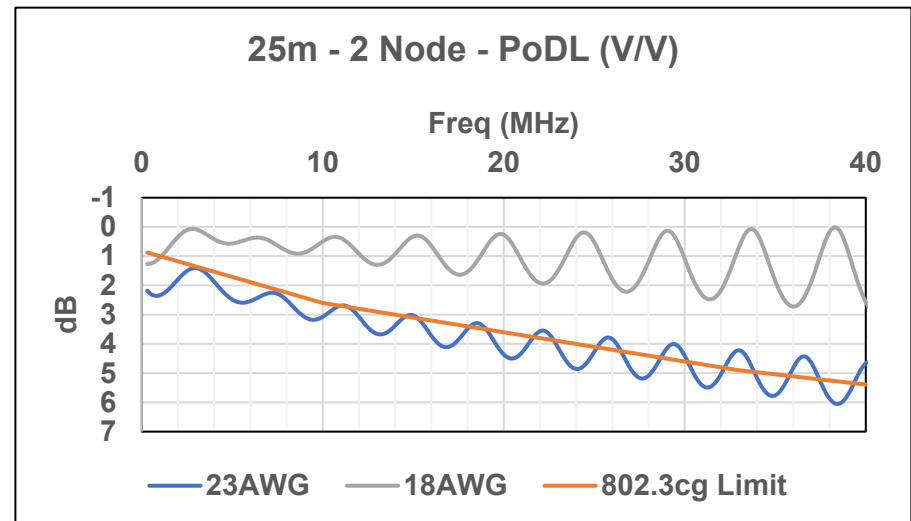
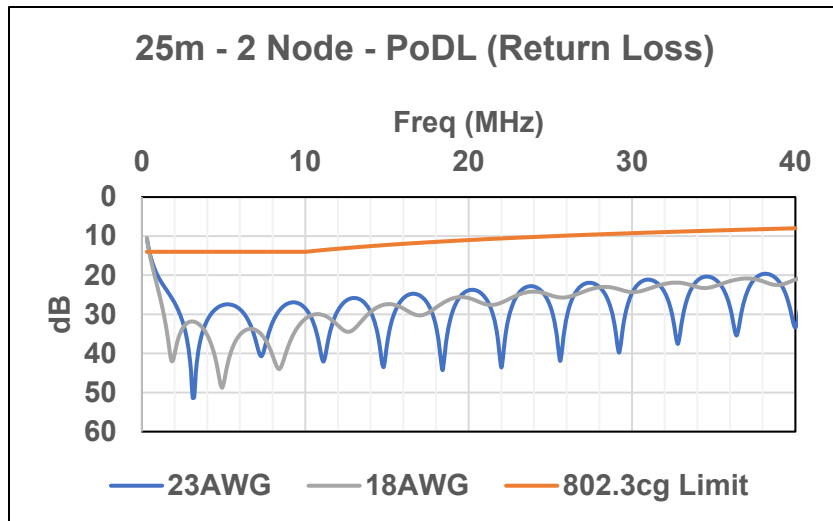
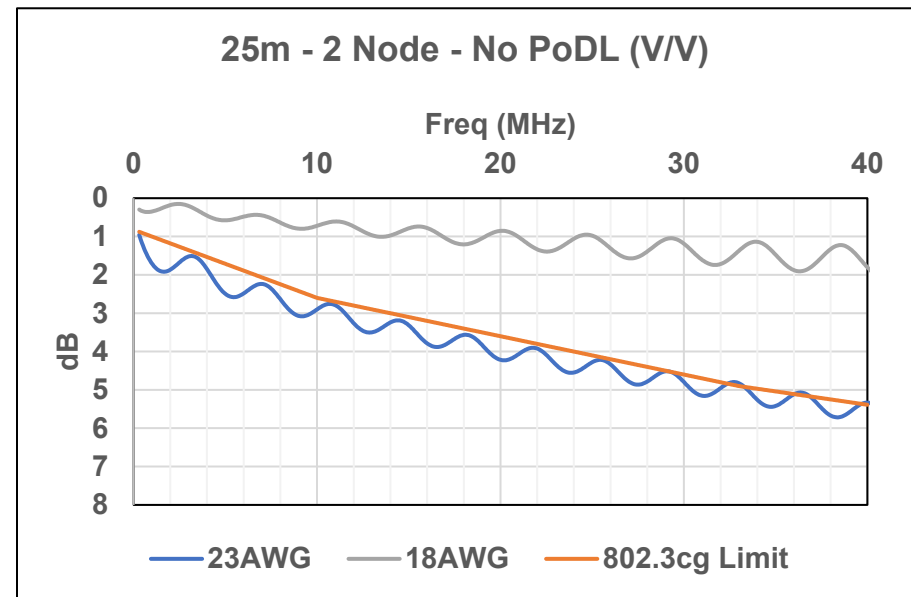
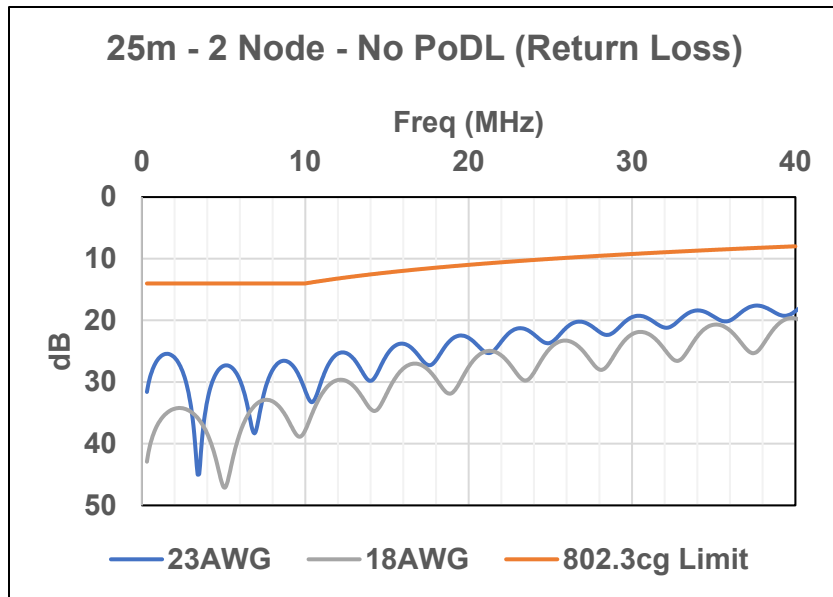
RLCG Model – 23 AWG, 18 AWG



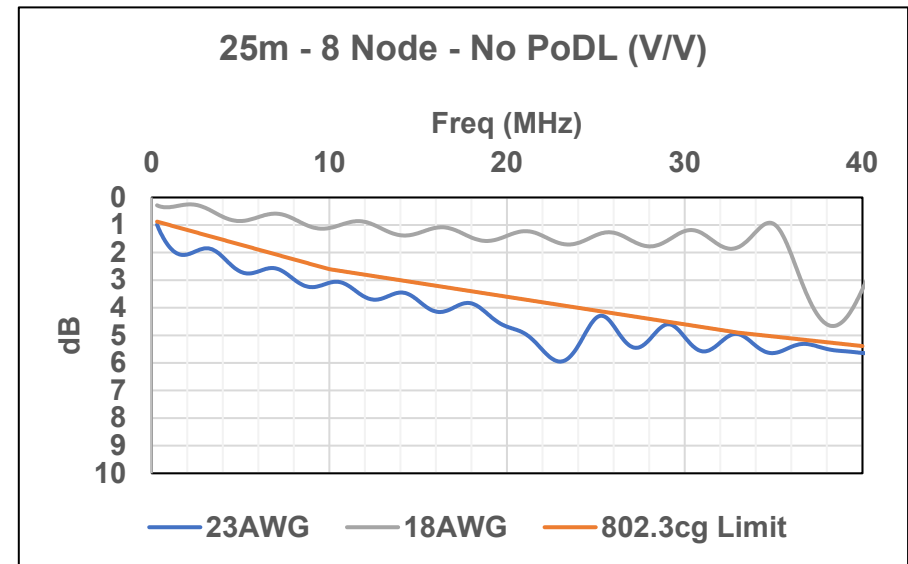
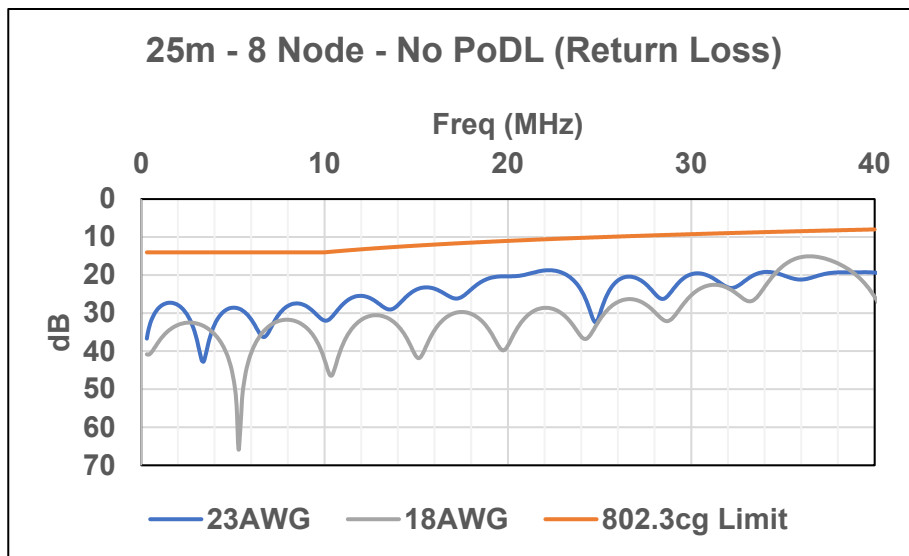
18 AWG RLCG Model vs. Measured



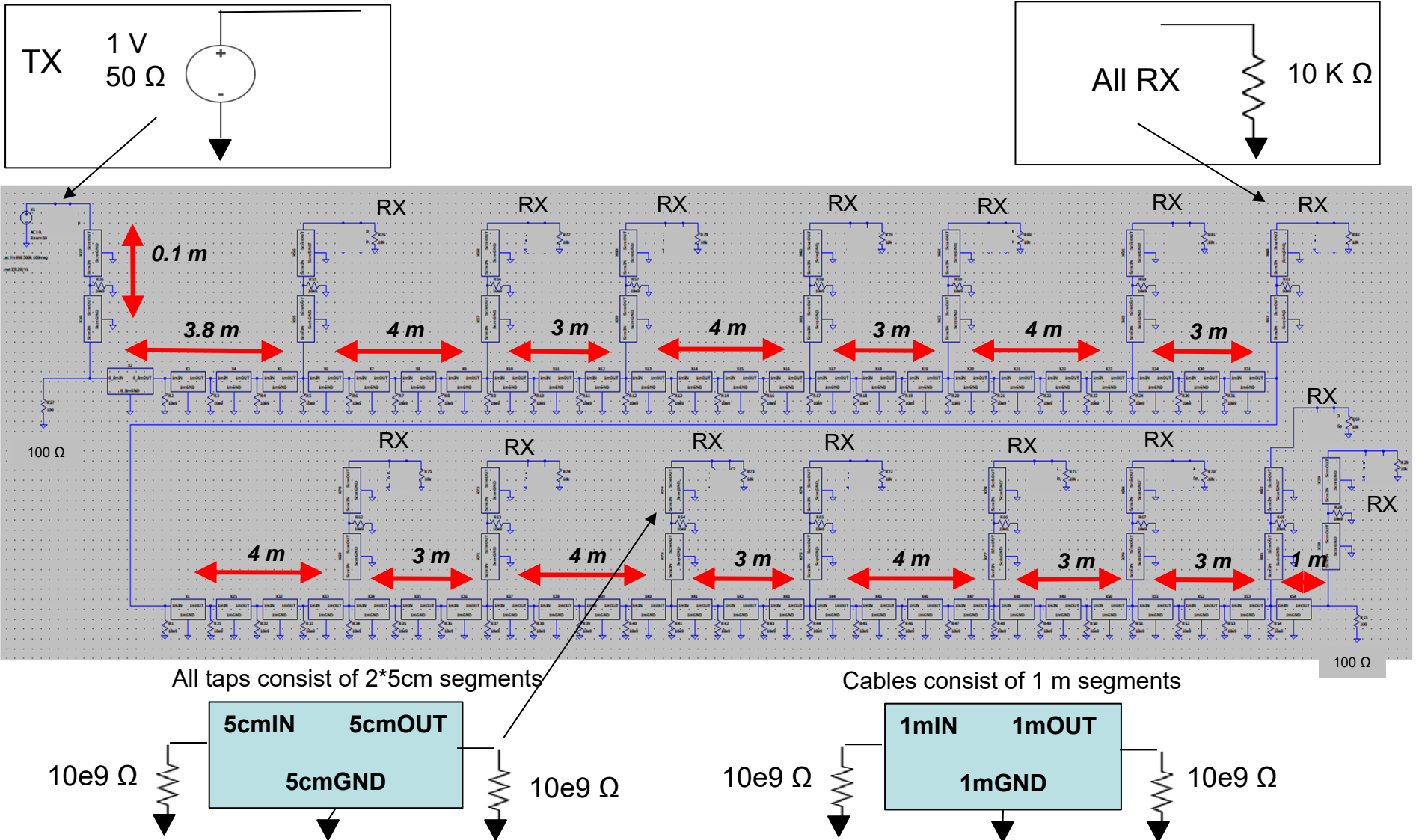
25 m 2 tap – Cable 23 AWG, 18 AWG



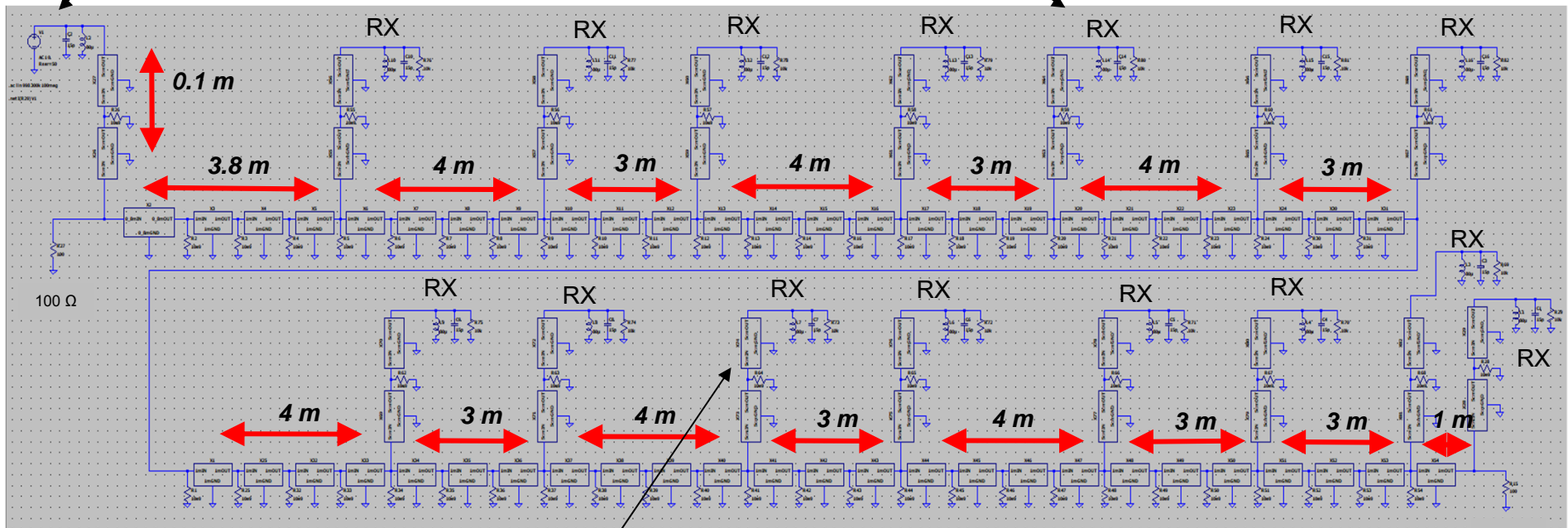
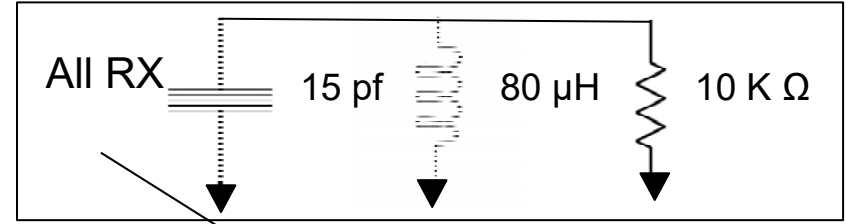
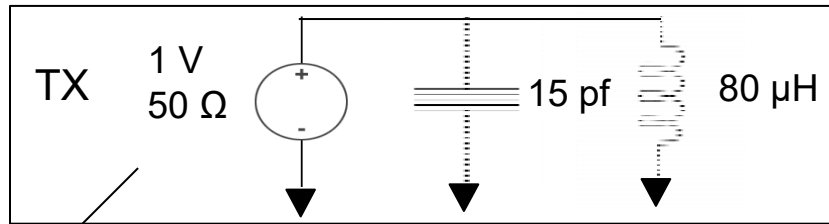
25 m 8 tap – Cable 23 AWG, 18 AWG



50 m –16 tap – no PoDL

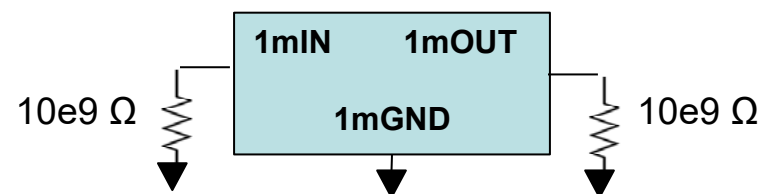
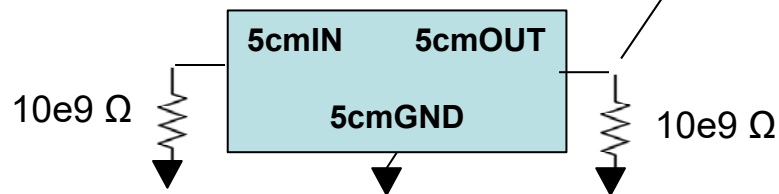


50 m –16 tap – PoDL



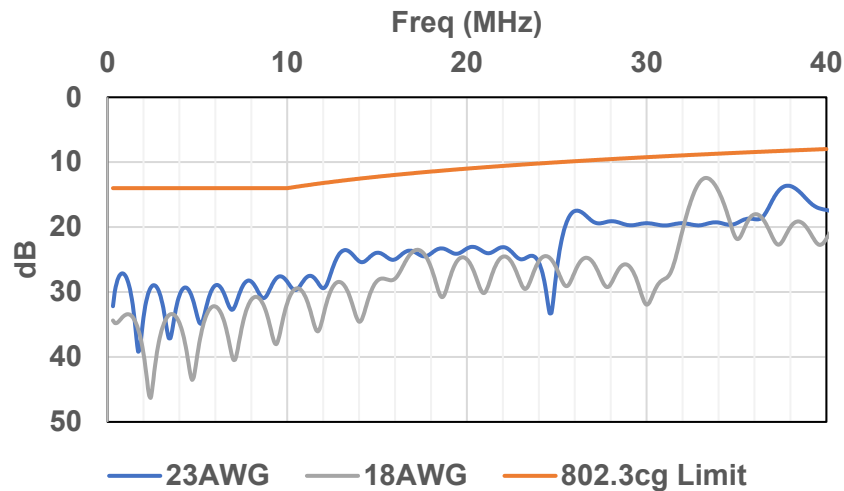
All taps consist of 2*5cm segments

Cables consist of 1 m segments

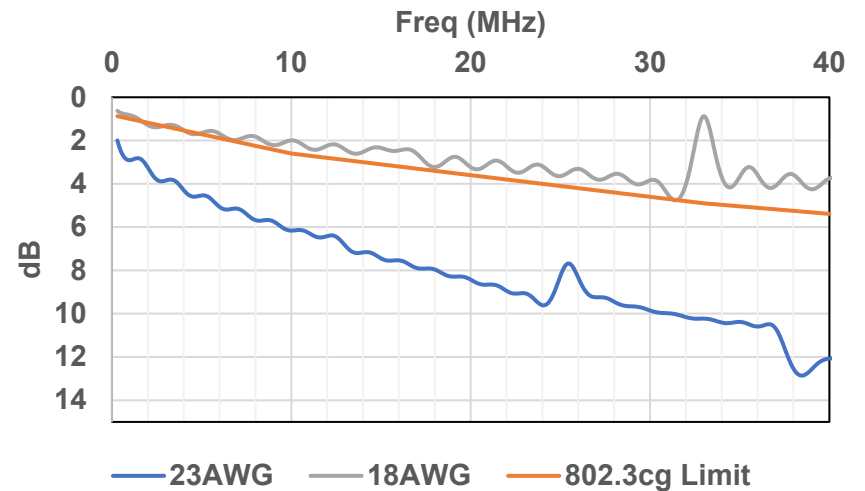


50 m 16 tap – Cable 23 AWG, 18 AWG

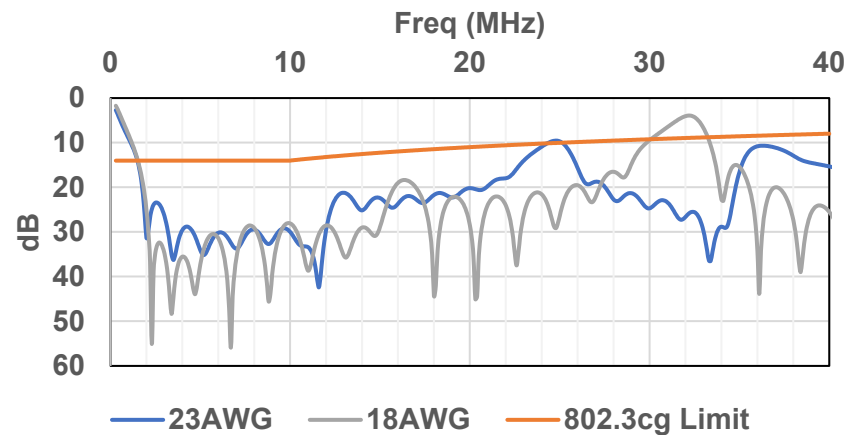
50m - 16 Node - No PoDL (Return Loss)



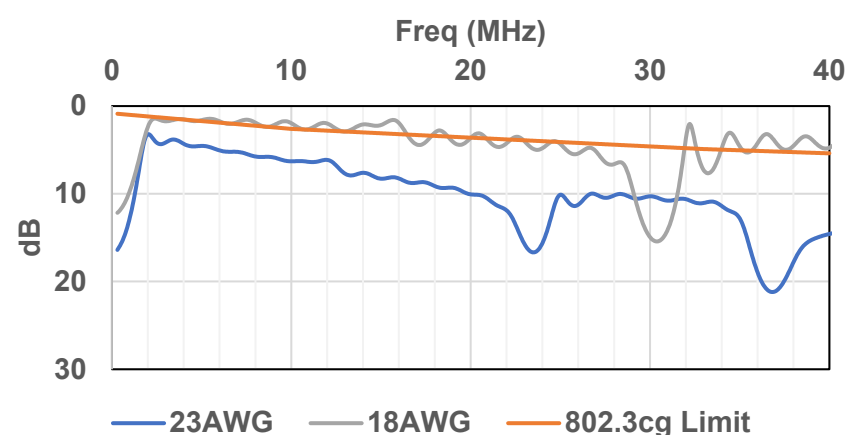
50m - 16 Node - No PoDL (V/V)



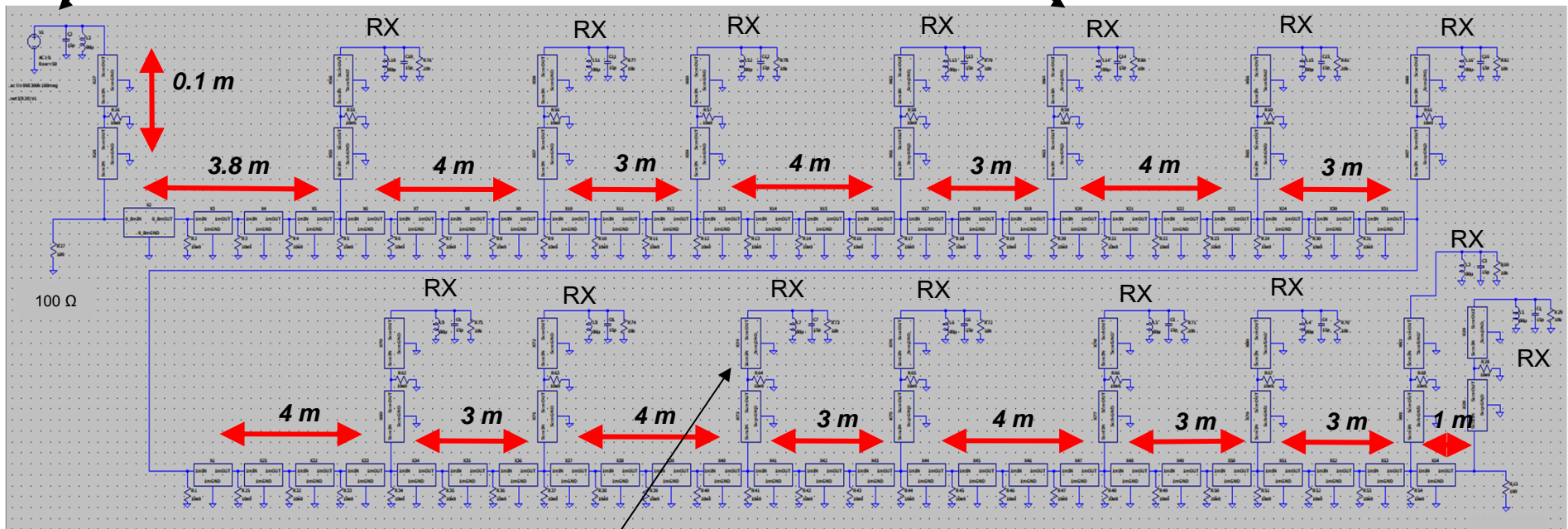
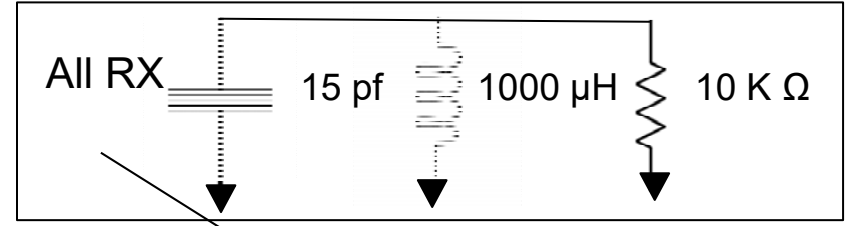
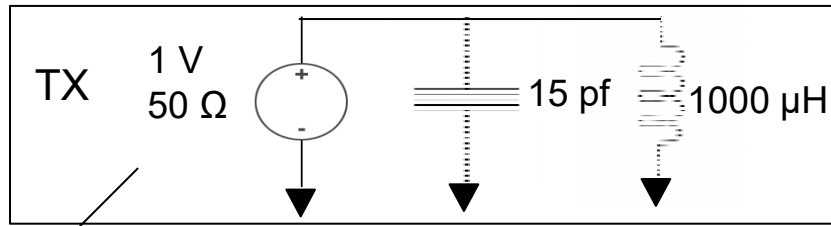
50m - 16 Node - PoDL (Return Loss)



50m - 16 Node - PoDL (V/V)

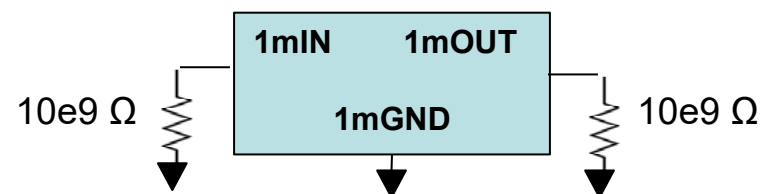
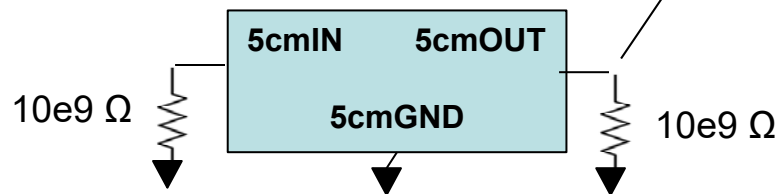


50 m –16 tap – 1000 μ H PoDL

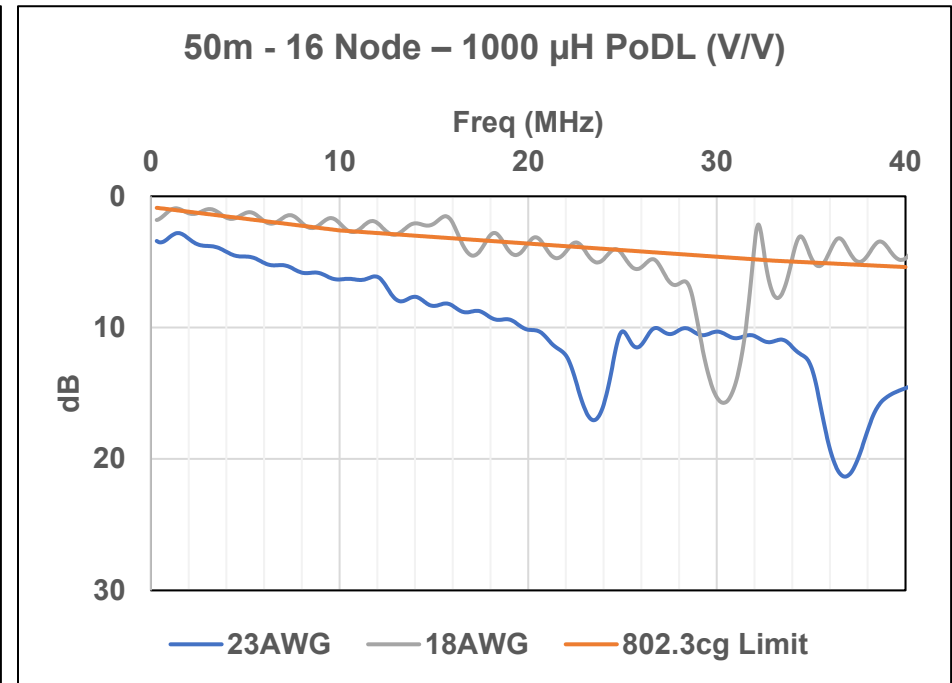
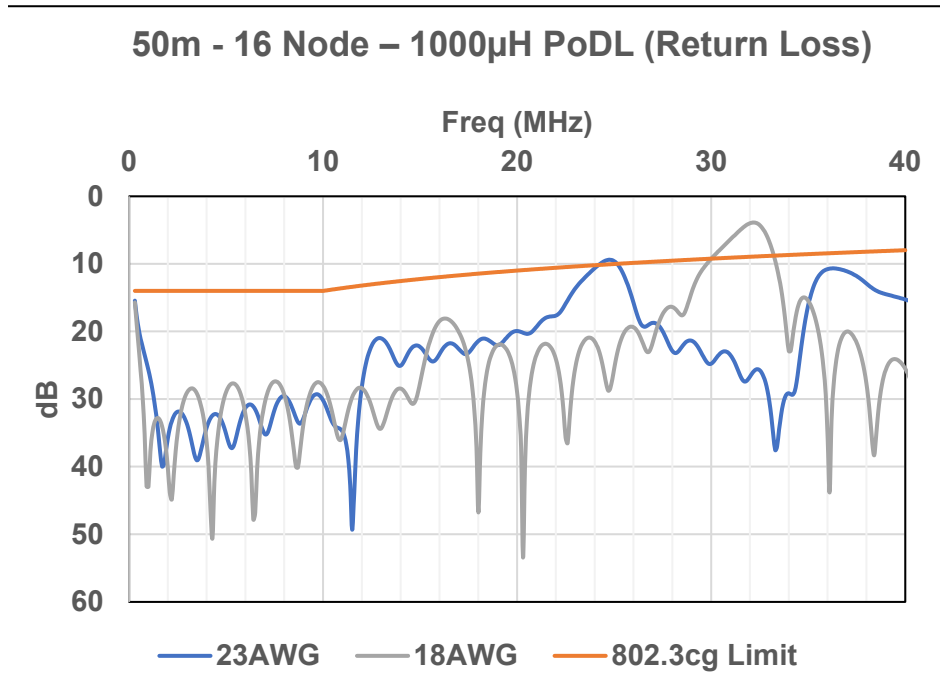


All taps consist of 2*5cm segments

Cables consist of 1 m segments



50 m 16 node – Cable 23 AWG, 18 AWG



MDI impedance limit parameters

Parameter name	Unit of measure	Minimum value	Maximum value
R	k Ω	10	—
L	μ H	1000 μH	—
C_{tot}	pF	—	180
C_{node}	pF	—	15

Summary recommendations

- IEEE P802.3da Task Force Work Items

<https://www.ieee802.org/3/da/workitems/index-word.html>

Mixing Segment	Specifications (IL, RL, mode conversion, etc.), MDI specs (tighter than CG?) –
Recommendation	- Consider 802.3cg link segment as baseline with adjusted IL/RL > 20 MHz (TBD).
Follow-on	- IL, RL- worse case tap spacing versus frequency
MDI + stub	Connection (inductance, capacitance, resistance) –
Recommendation	- Change MDI electrical minimum inductance for each MDI attachment point from 80 μ H to 1000 μ H (TBD).
Follow-on	- Further considerations inductance, capacitance, resistance