

## IEEE 802.3af DTE Power via MDI

When PSE is periodically detecting.

Probing signal spectrum measurements and more.

Ad hoc A.I. 6.3

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- Acknowledgments to Shimon Cohen, PowerDsine



# Test objectives

- To determine the signal spectrum limitations for zero data errors at the following operating modes:
  - AC disconnect detection probing signal
  - Resistor Detection probing signal
- To confirm the calculated results as analyzed in A.I. 2.1.



# Background

- In some implementations AC disconnect signal required to be applied to the port most of the time
- Resistor Detection uses min 2 point measurements which is very low frequency ac signal constrained by other circuit parameters
- Resistor detection may run continuously generating up to 30Vpp low frequency signal across the the port
  - PSE is trying to detect other PSE/Non-compliant PD
- The target of the following work is to support the theoretical analysis conclusion that confirm that no data degradation is expected and we have huge margin.

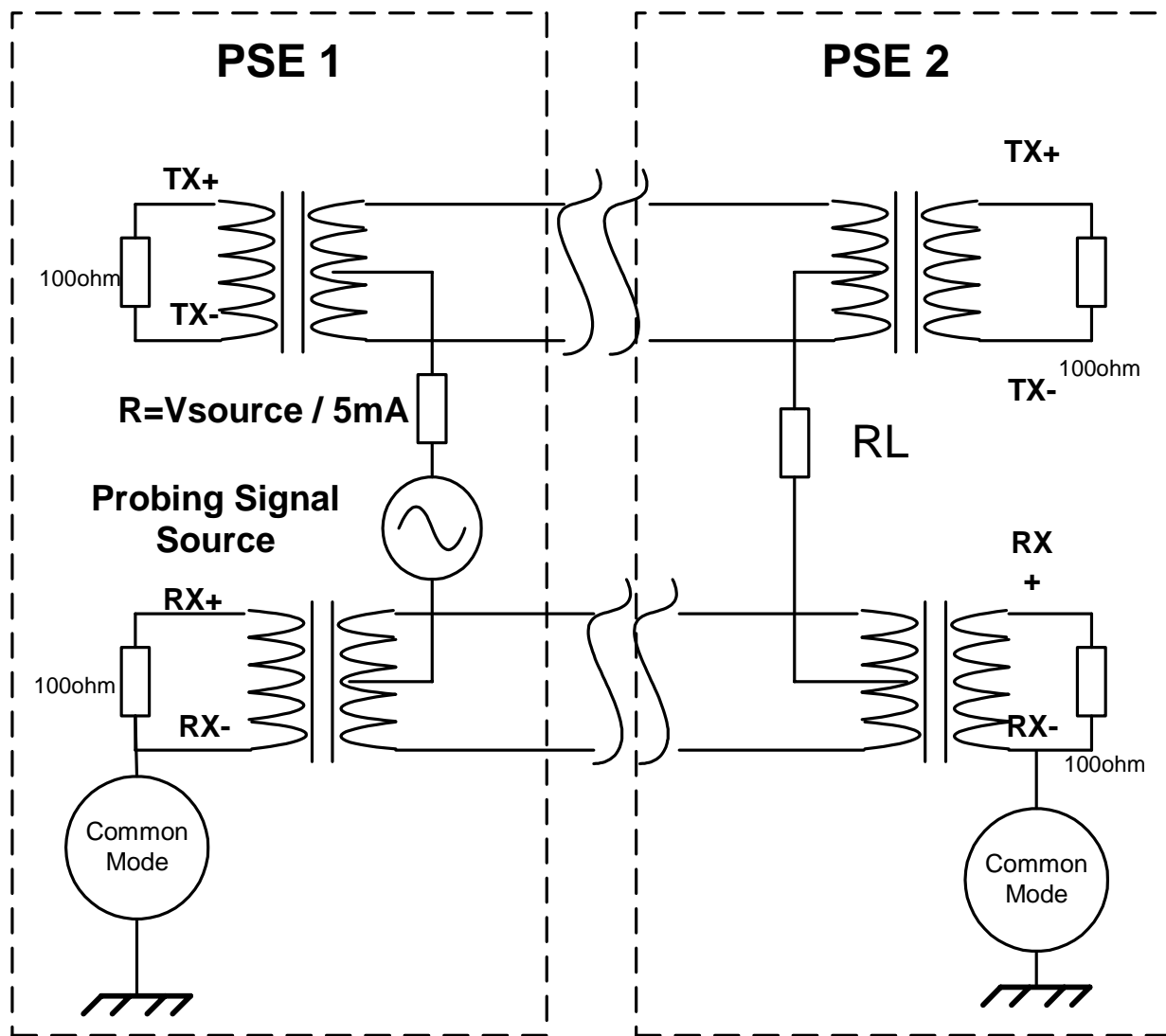


# Strategy for evaluating the spectrum limits

- Worst case signal amplitude : 30Vp during Resistor Detection
- Min Rise time / Fall time : Need to be confirmed
  - Currently specified 10us min.
- Max frequency : Not specified in IEEE802.3af
  - From EMI point of view → No issue (for the suggested spec at ad-hoc item 1.2)
    - Out of band of EMI standards
    - Close to zero noise, as demonstrated in March 2002
    - Required to be met by vendor.
    - Confirm again in this tests

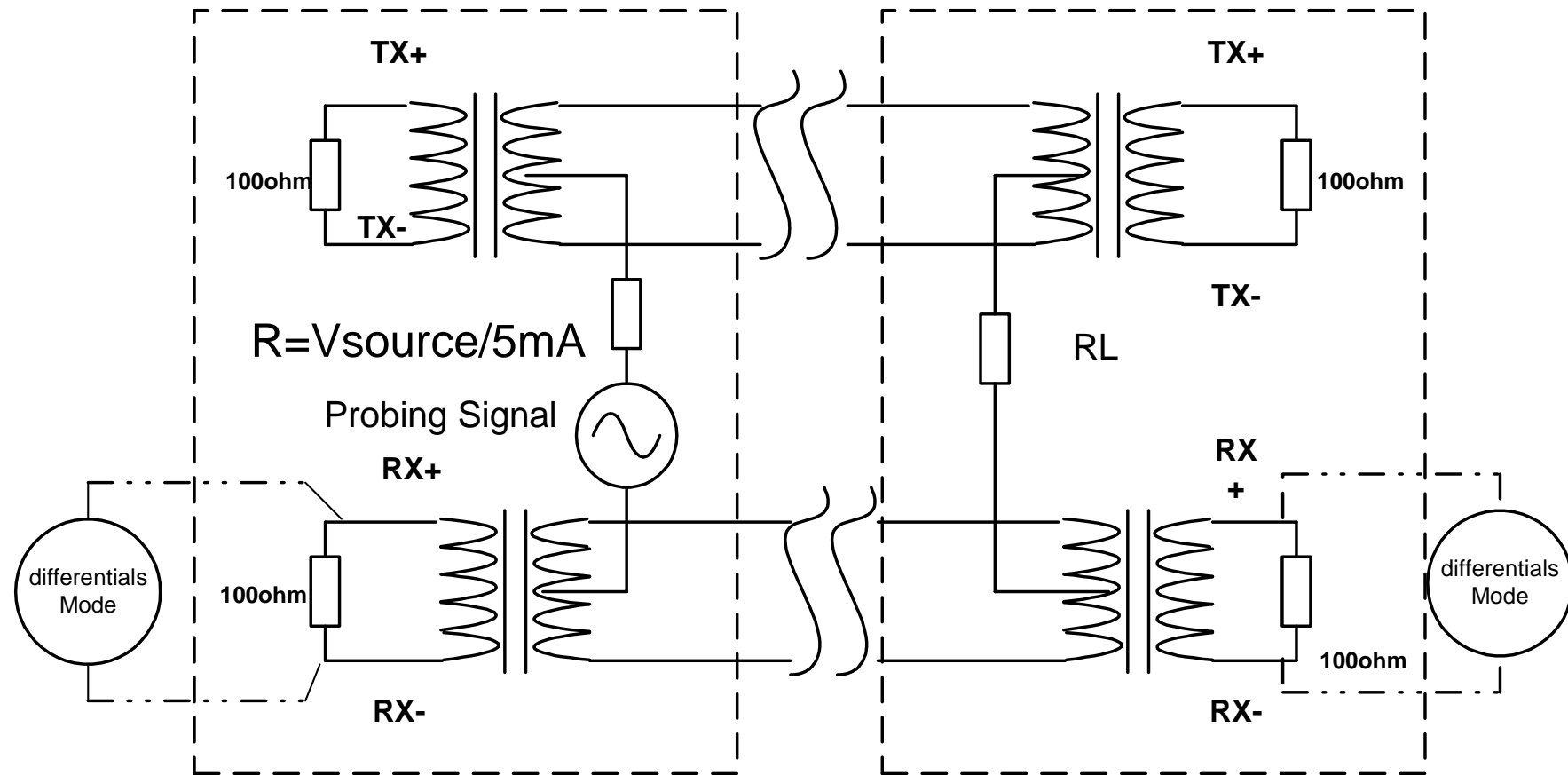


# Test setup-Common Mode noise measurements #1

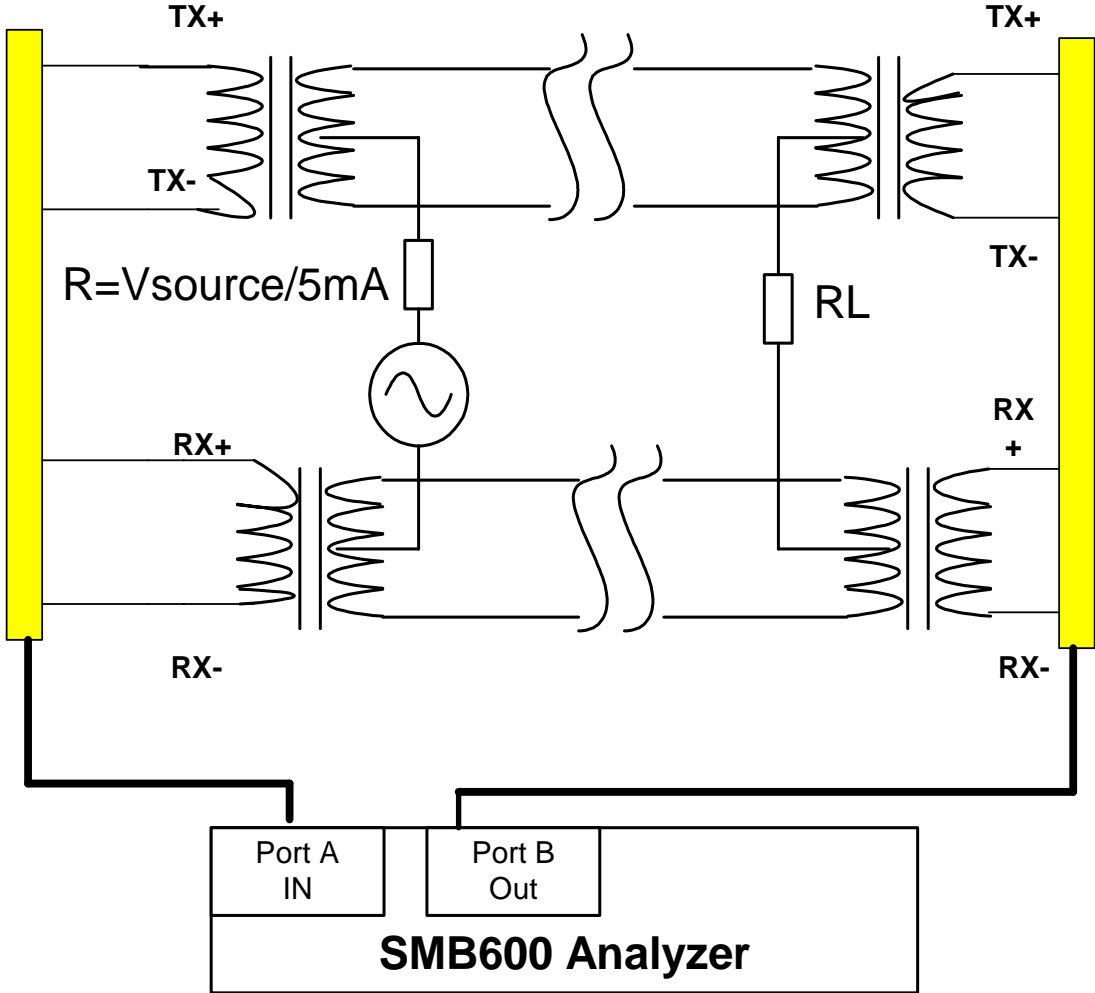


When PSE is periodically detecting-probing signal spectrum measurements and more. Yair Darshan, PowerDsine. May 2002

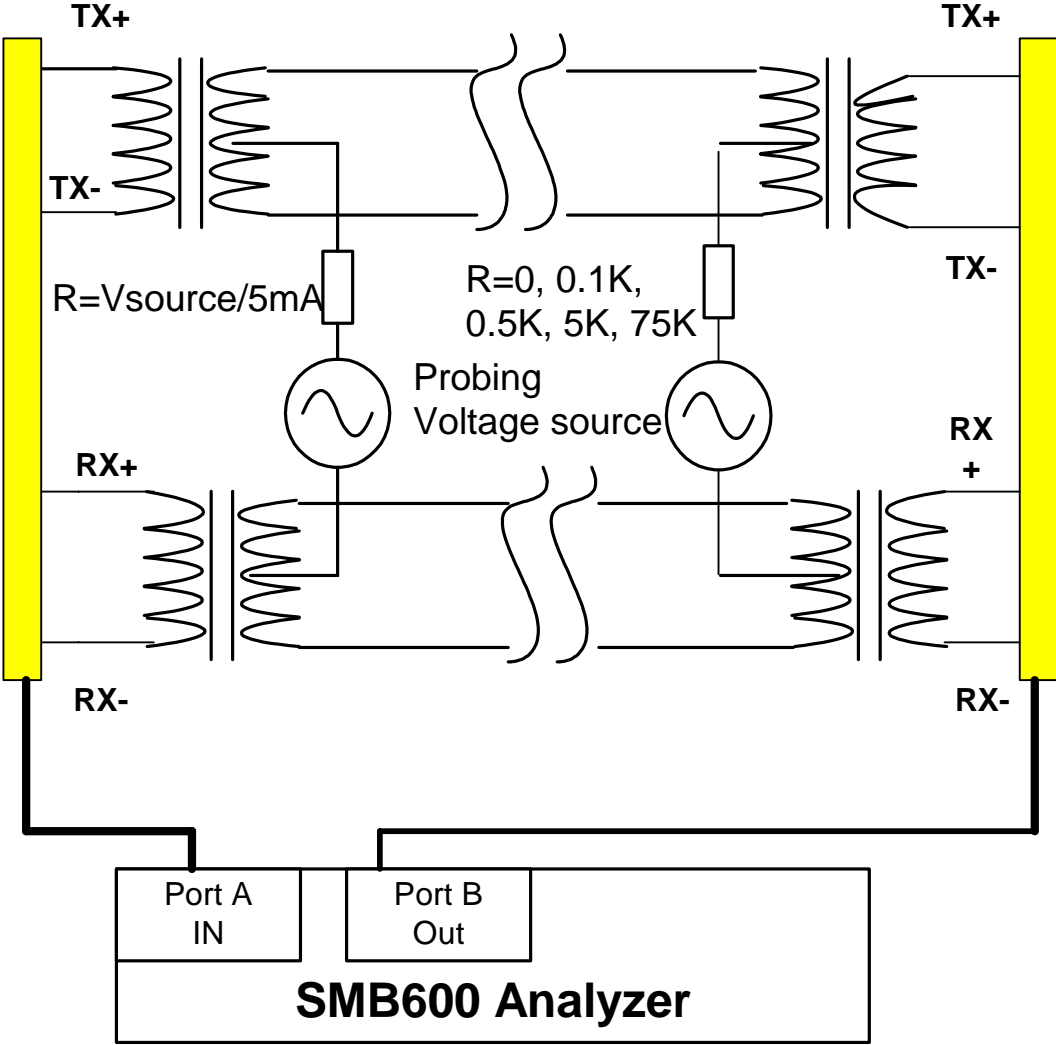
## Test setup-Differential Mode Measurements #2



# Test setup –Data Error Measurement # 3



# Test setup –Data Error Measurement # 4





## Test method

- Running Sine wave from 10Hz to 15MHz to evaluate the following worst case values:
- DM noise/ $V_{source}$  ratio
- CM noise/ $V_{source}$  ratio
- The  $V_{port}$  vs. Frequency envelope which above it, data errors  $>0$



# Data Error tests- test #1

- Cable length = 105meter
- Frequency range: 1MHz to 15MHz
- Amplitude=69Vpp , test setup limitation!

Results for 69Vp_p with 1MHz signal	Events		Rates	
	2-07 LN-3100 A	2-07 LN-3100 A	2-08 LN-3100 A	2-08 LN-3100 A
Tx Frames	339,796,590	148,810	339,796,566	148,810
Rx Frames	339,796,590	148,810	339,796,567	148,810
Rx Bytes	21,746,981,772	9,523,883	21,746,980,268	9,523,884
Collisions	0	0	0	0
CRC Errors	0	0	0	0
Alignment Errors	0	0	0	0
OverSize	0	0	0	0
Frag/UnderSize	0	0	0	0



## Tests # 2, 3, 4

- Same results as test # 1, no errors were observed for the following conditions:
  - 25Vp, 5MHz
  - 12Vp, 10MHz
  - 8Vp, 15MHz
- Voltage levels are limited by setup and not limited by data error.



# Conclusions

- Data integrity is kept, with large margin for the following conditions:
- 69Vpp/1MHz through 5K min
- Any practical cable length
- Loads from zero to 75K
- For dual voltage source or single voltage source ( setups 3 and 4)



# CM test results – 1m CAT5

<b>Test Results [mVpp]</b>				
	<b>CABLE=1M</b>			
	<b>Rs=5k</b>	<b>RL=500</b>	<b>RL=5K</b>	<b>RL=70K</b>
<b>Freq</b>	<b>Source Amplitude [Vpp]</b>	<b>Results</b>	<b>Results</b>	<b>Results</b>
100HZ	61	1	1	1
1KH	61	1	1	1
10K	60.4	1	3	3.5
100K	60.8	5	20	32
1M	57.2	33	48.5	50
2M	51.6	62.5	79.4	82.5
5M	27.6	30.5	30.5	30.5
8M	18	50	50	52
10M	15	48.1	48.1	48.1
13M	9.6	117	117	117
15M	9.6	98.4	98.4	98.4

1mV=Noise floor limitation



# CM test results – 120m CAT5

<b>Test Results [mVpp]</b>				
	<b>CABLE=120M</b>			
	<b>Rs=5k</b>	<b>RL=500</b>	<b>RL=5K</b>	<b>RL=70K</b>
<b>Freq</b>	<b>Source Amplitude [Vpp]</b>	<b>Results</b>	<b>Results</b>	<b>Results</b>
100HZ	60	1	1	1
1KH	60	1	1	1
10K	60	1	1	1
100K	60	1	1	1
1M	60	13.5	13.5	13.5
2M	55.2	26.5	26.5	26.5
5M	27.2	35	35	35
8M	18	44	44	44
10M	15	36.2	36.2	36.2
13M	9.2	39.4	39.4	39.4
15M	9.12	25.6	25.6	25.6

1mV=Noise floor limitation



# DM test results – 1m CAT5

<b>Test Results [mVpp]</b>				
	<b>CABLE=1M</b>			
	<b>Rs=5k</b>	<b>RL=500</b>	<b>RL=5K</b>	<b>RL=70K</b>
<b>Freq</b>	<b>Source Amplitude [Vpp]</b>	<b>Results</b>	<b>Results</b>	<b>Results</b>
100HZ	60	1	1	1
1KH	62.4	1	1	1
10K	64.4	1	2.5	3.5
100K	60.8	6	27	41.5
1M	60.8	45.6	65	65
2M	54.4	80.6	106	106
5M	28	33.8	33.8	33.8
8M	18.4	58.5	58.8	58.8
10M	15.2	43.8	43.8	43.8
13M	10.4	164	164	164
15M	10	152	152	152

1mV=Noise floor limitation



# DM test results – 120m CAT5

<b>Test Results [mVpp]</b>				
	<b>CABLE=120M</b>			
	<b>Rs=5k</b>	<b>RL=500</b>	<b>RL=5K</b>	<b>RL=70K</b>
<b>Freq</b>	<b>Source Amplitude [Vpp]</b>	<b>Results</b>	<b>Results</b>	<b>Results</b>
100HZ	60.8	1	1	1
1KH	60.8	1	1	1
10K	59.2	1	1	1
100K	60.8	3.5	3.5	3.5
1M	60.4	16.5	16.5	16.5
2M	50.4	25.5	25.5	25.5
5M	27.6	50	50	50
8M	18	60	60	60
10M	15	49.4	49.4	49.4
13M	9.4	53.7	53.7	53.7
15M	9.2	40.6	40.6	40.6

1mV=Noise floor limitation





# PHY noise requirements

- According to Fred Schindler data summarized from IEEE802.3  
The following Common Mode noise is permitted.

1) 10B-TX, 802.3, 14.3.1.3.5 Common-mode rejection, p276

The PHY must tolerate:

A common mode voltage of 25Vpp,  $\leq 500\text{KHz}$ , edge rates no slower than 4nS (20% to 80%).

This must not contribute more than 2.5nS edge jitter to the transmitted signal.

2) 100B-TX, ANSI X32.262-1995, 9.2.3 Common-mode rejection

The PHY must tolerate:

1Vpp sine wave, 0MHz to 125MHz.

There is another section that covers cross talk: 11.1.3

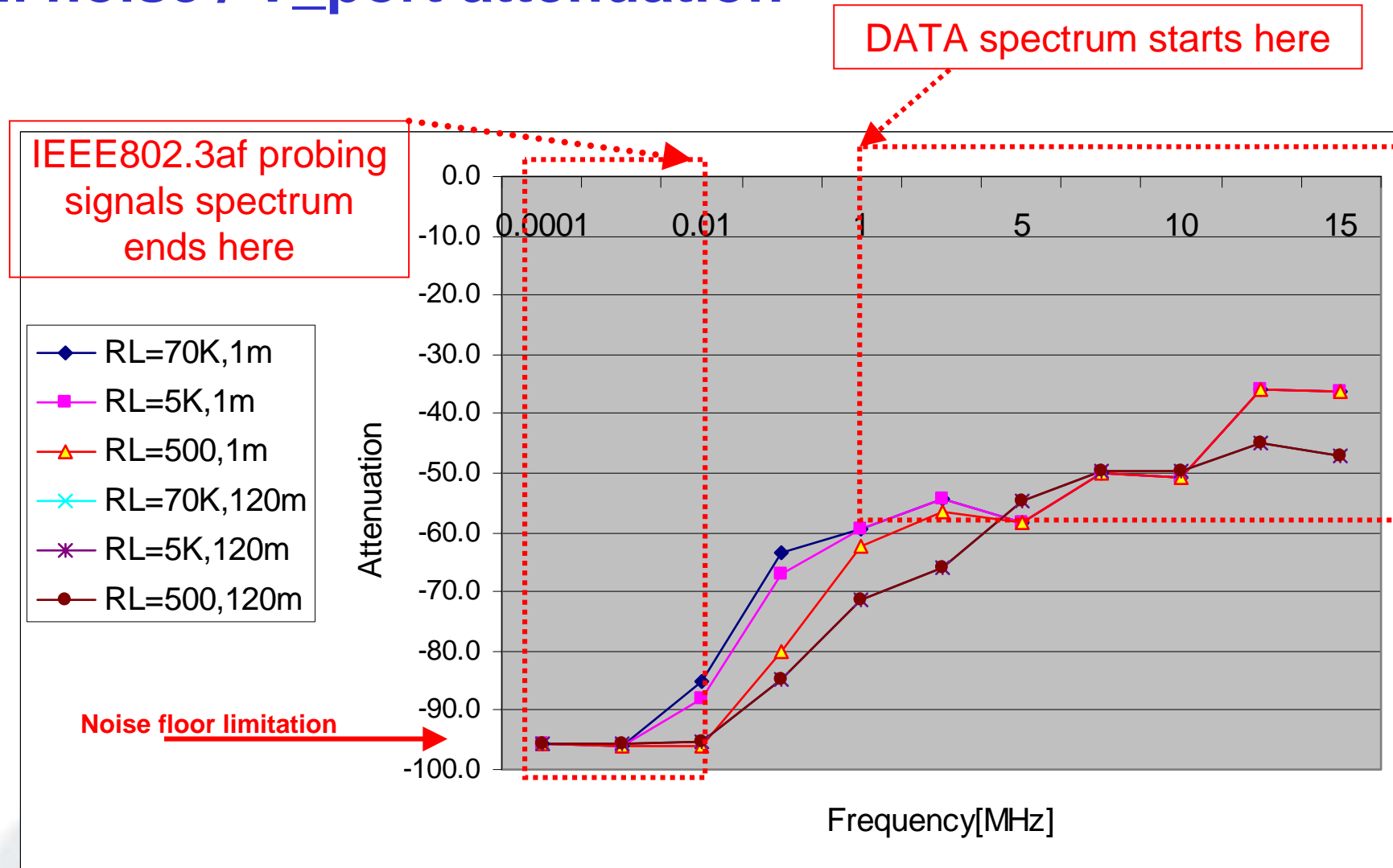
They are only concerned with cross talk above 1MHz.

3) 1000B-TX, 802.3ab, 40.6.1.3.3, Common-mode rejection

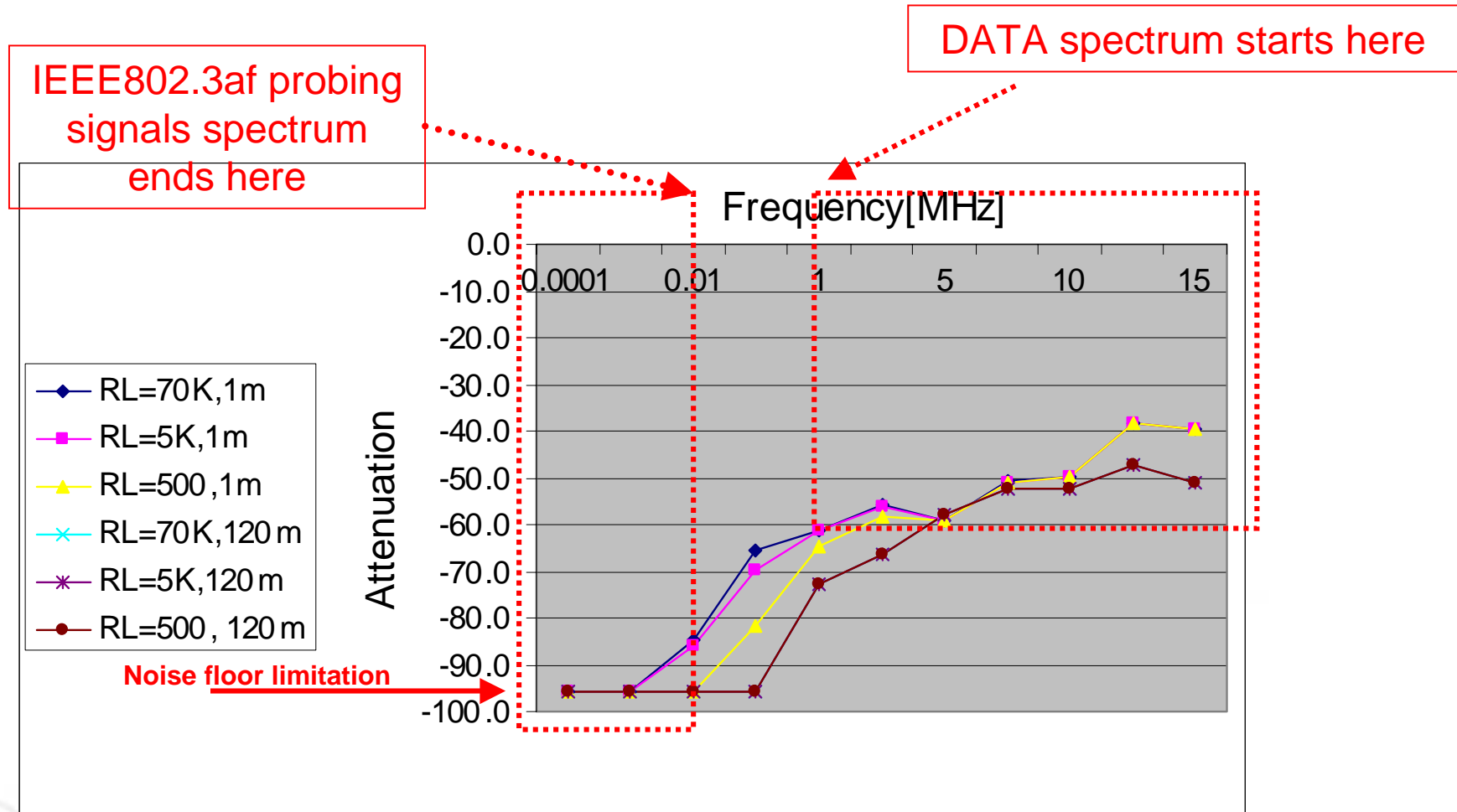
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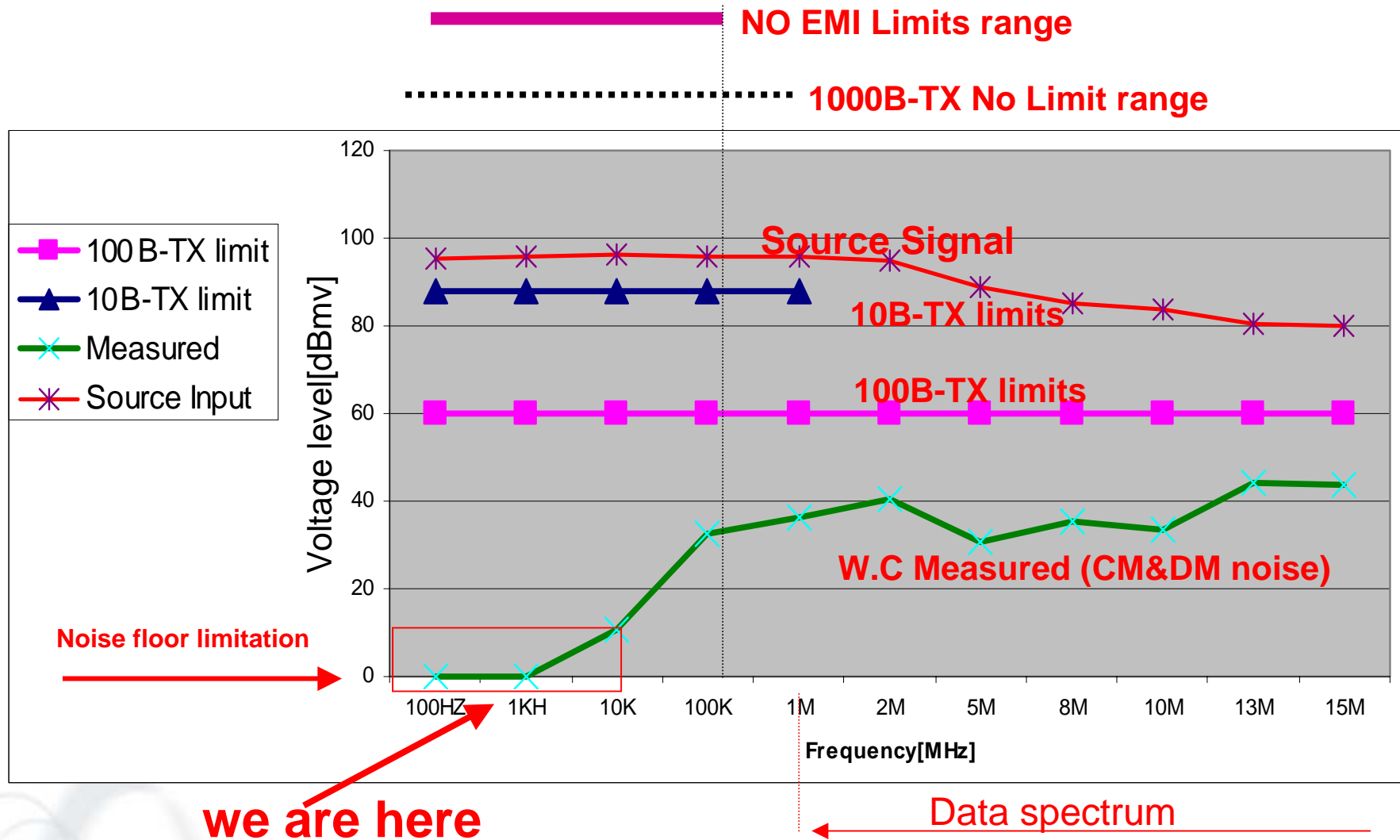
# DM noise / V\_port attenuation



# CM noise / V\_port attenuation



# Specifying IEEE802.3af probing signal spectrum for 60Vpp port signal



# Summary

- Suggested probing signal spectrum:
  - Amplitude: 30V max as defined by IEEE802.3af
  - Rise/Fall time: currently 10us specified, meets data error free requirements
    - Changing to  $dv/dt < 0.1V/us$  → No EMI
  - Frequency: up to 500Hz
- Periodically detecting (Signature or Disconnect) with the suggested probing signal spectrum is not generating data errors nor EMI.
- Suggested probing signal spectrum meets IEEE802.3 limits with huge margins

