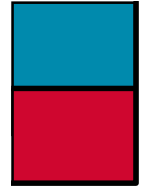




# Power over the MDI using the two Signal Pairs

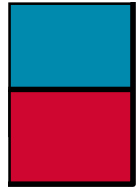
**Karl Nakamura**  
**karln@cisco.com**

**Roger Karam**  
**rkaram@cisco.com**

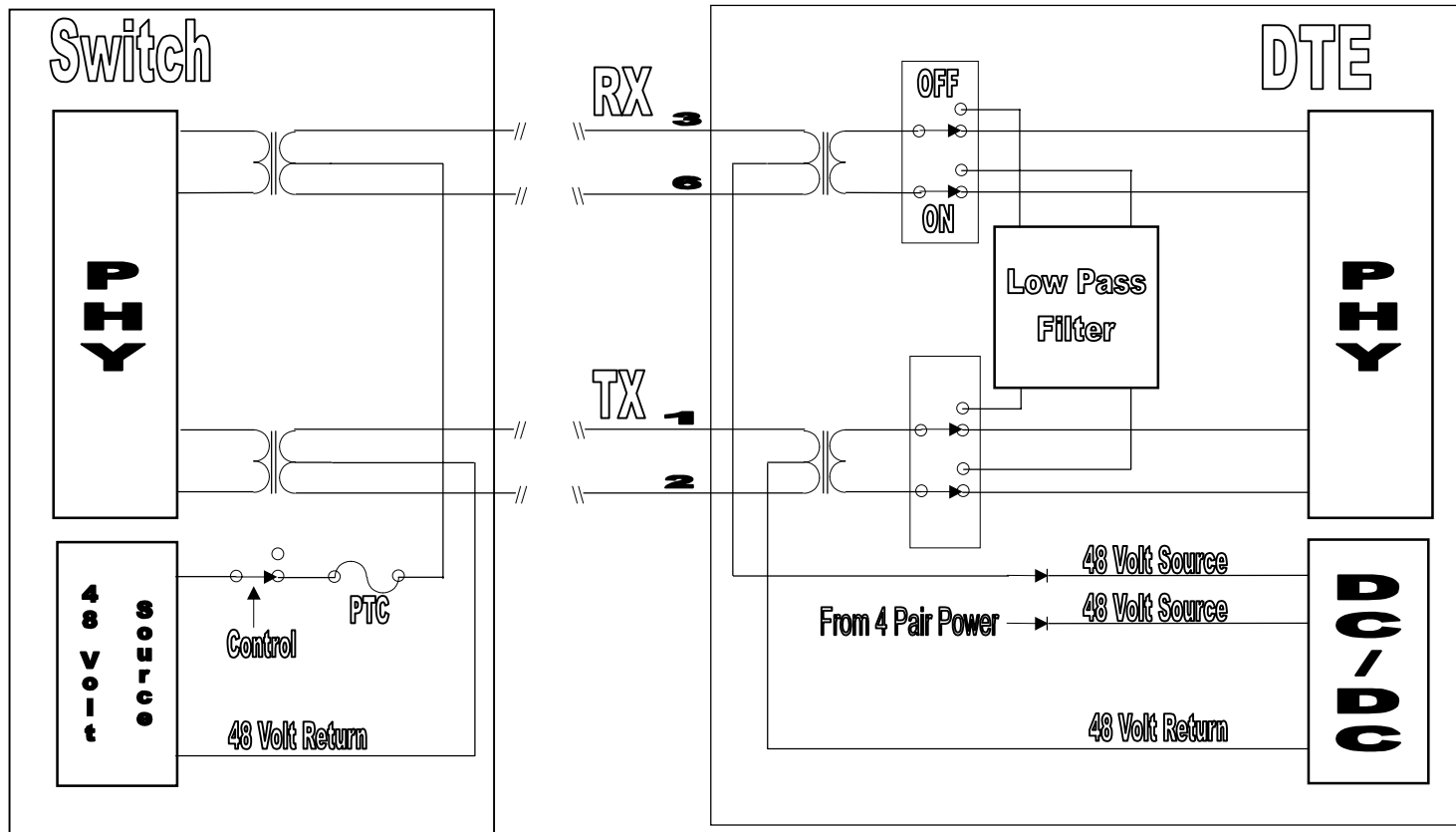


# 2 Signal Pair Operation

- **Overview**
- **Phone Discovery**
- **Power Delivery**
- **Signal Quality Impact**



# 2 Signal Pair Overview



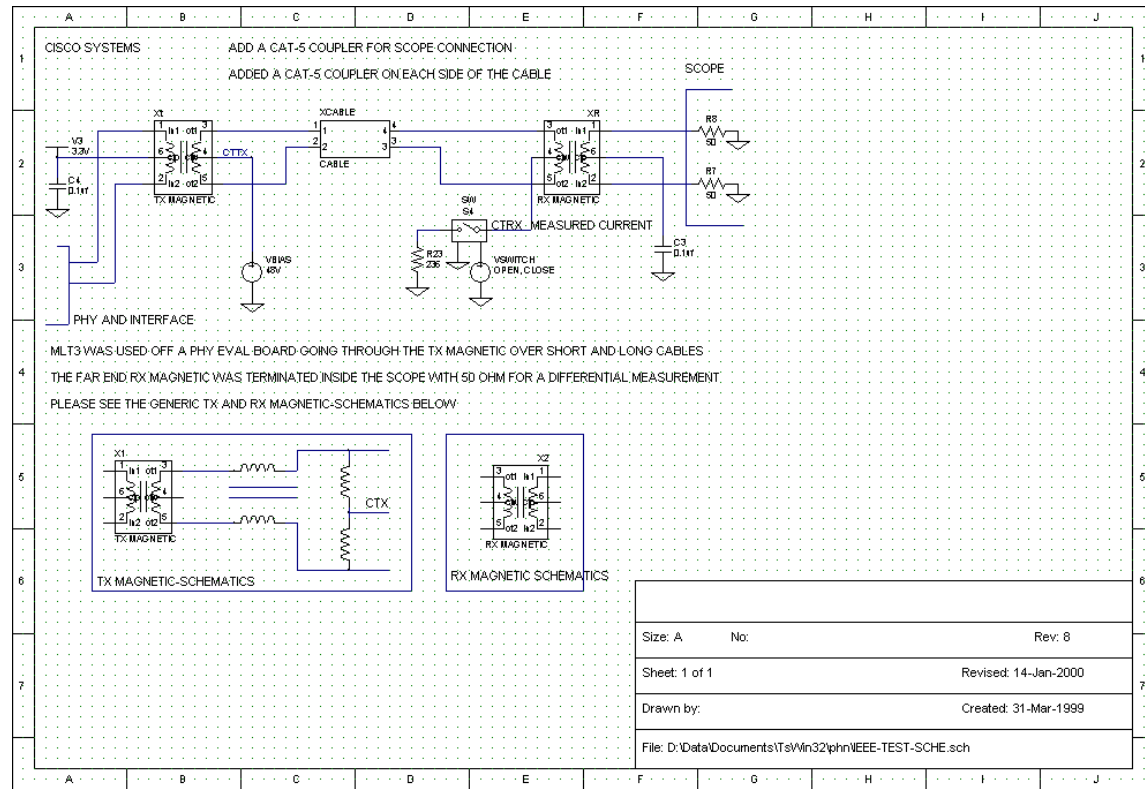


# Phone Discovery

- **Using Discovery Tone in Loopback without power (see “DTE Power via MDI” by Vafa Rakshani and Kevin Brown of Broadcom on 11/8/99, 3/8/00)**
- **Each Port on Switch Individually Controlled**
- **Power from Switch up to 8-10 Watts @ 48V (see “LAN Magnetics operating under DC Bias Conditions” by Henry Heinrichs of Pulse Engineering on 11/8/99)**



# Signal Quality Measurements



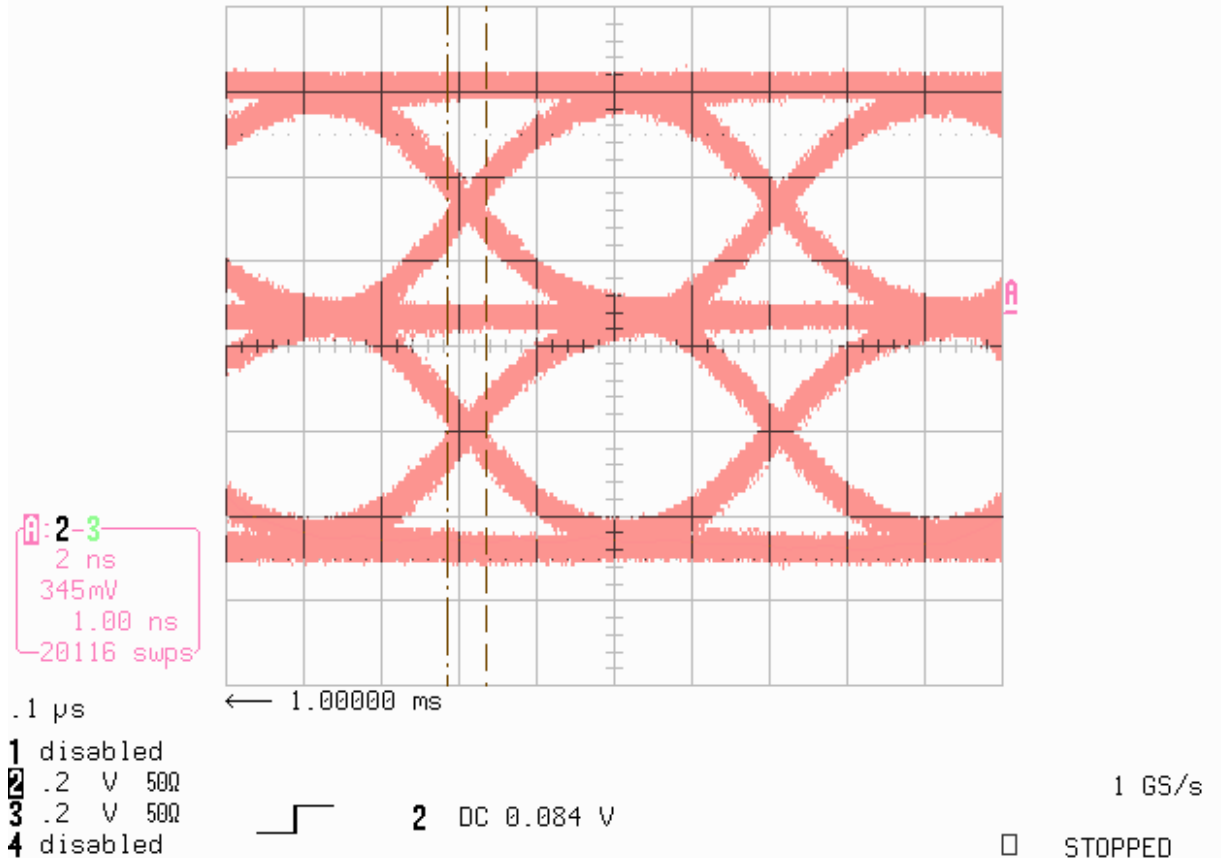




# Signal Quality Measurements

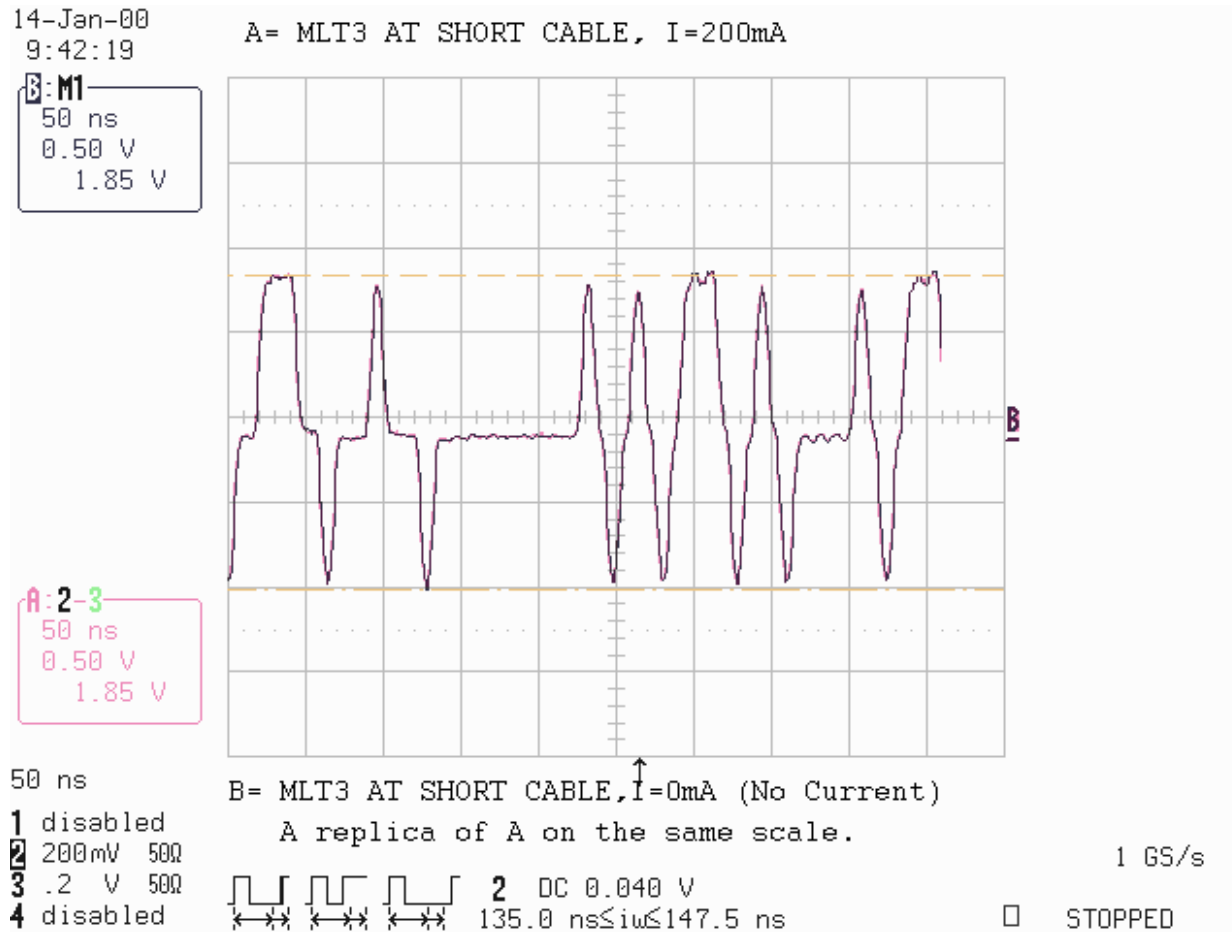
14-Jan-00  
9:46:41

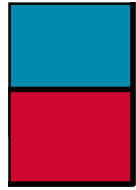
A= TX EYE, SHORT CABLE, I=0mA





# Signal Quality Measurements



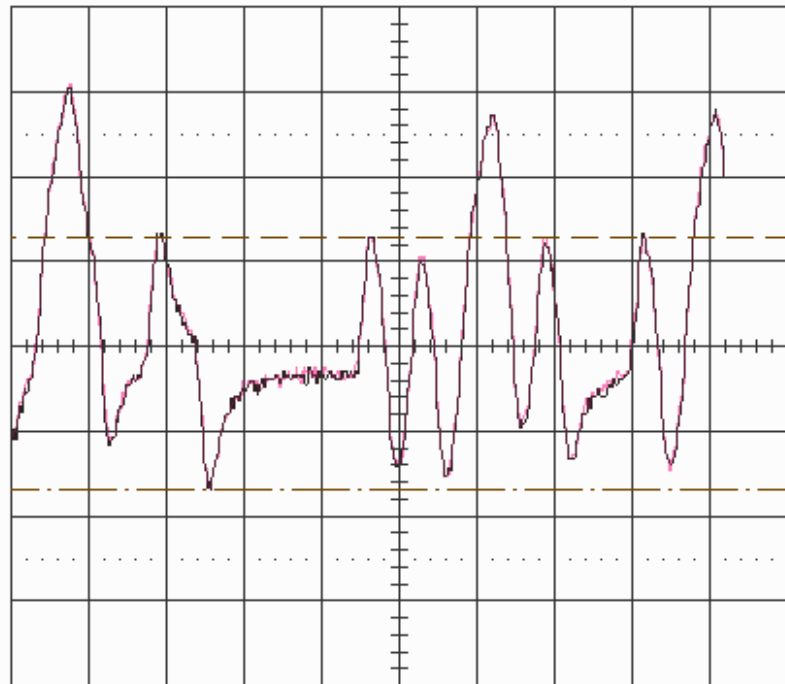


# Signal Quality Measurements

14-Jan-00  
10:00:14

A= MLT3 AT 120M CAT-5, I=200mA

M2  
50 ns  
154mV  
456mV

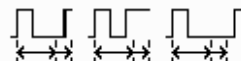


A: 2-3  
50 ns  
154mV  
456mV

50 ns

B= MLT3 AT 120M CAT-5, I=0mA

- 1 disabled
- 2 200mV 50Ω
- 3 .2 V 50Ω
- 4 disabled



2 DC 0.040 V  
135.0 ns ≤  $t_{iw}$  ≤ 147.5 ns

1 GS/s

STOPPED



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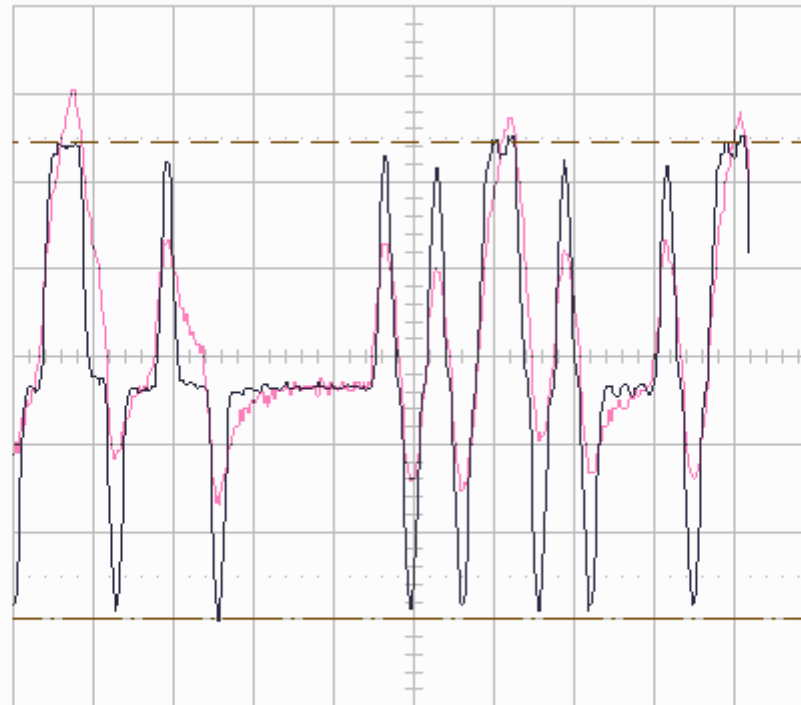
# Signal Quality Measurements

14-Jan-00  
9:57:29

SHORT AND LONG CABLE WAVEFORMS- REFERENCE

**B: M1**  
50 ns  
340mV  
1.844 V

**A: 2-3**  
50 ns  
154mV  
835mV



50 ns

1 disabled  
2 200mV 500  
3 .2 V 500  
4 disabled

LONG CABLE = 120M OF CAT- 5, ALONG WITH 3 CAT-5 COUPLERS.  
WAVEFORM A= LONG CABLE, WAVEFORM B= SHORT CABLE



2 DC 0.040 V  
135.0 ns ≤ iw ≤ 147.5 ns

1 GS/s

STOPPED

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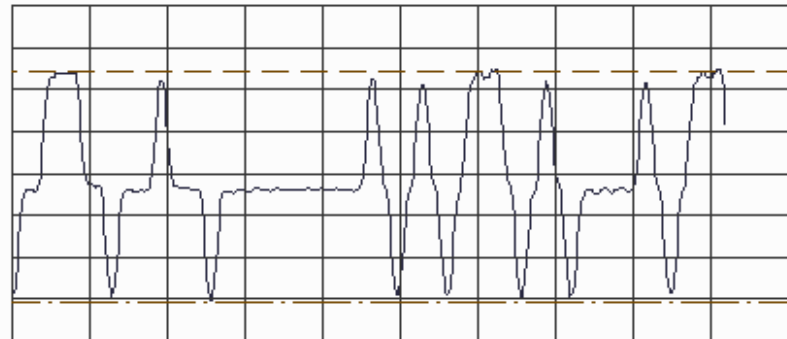


# Signal Quality Measurements

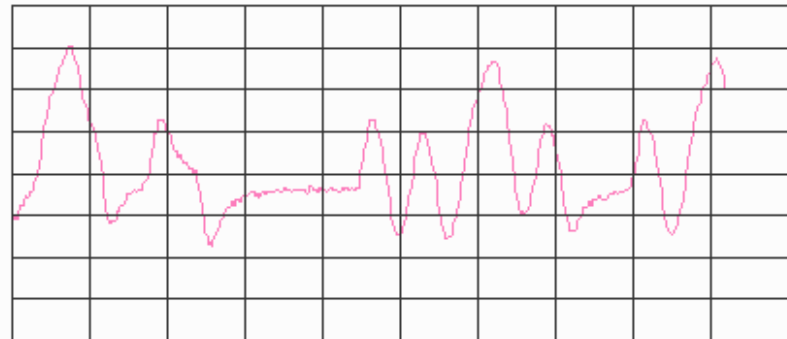
14-Jan-00  
9:58:10

SHORT- LONG CABLE SIGNALS FOR REFERENCE

**B: M1**  
50 ns  
340mV  
1.86 V



**A: 2-3**  
50 ns  
154mV  
843mV



50 ns

- 1 disabled
- 2 200mV 50Ω
- 3 .2 V 50Ω
- 4 disabled



2 DC 0.040 V  
135.0 ns ≤ iu ≤ 147.5 ns

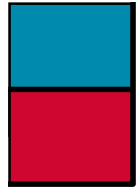
1 GS/s

STOPPED

SCO SYSTEMS



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# Detection Pulses

15-May-00  
16:53:53

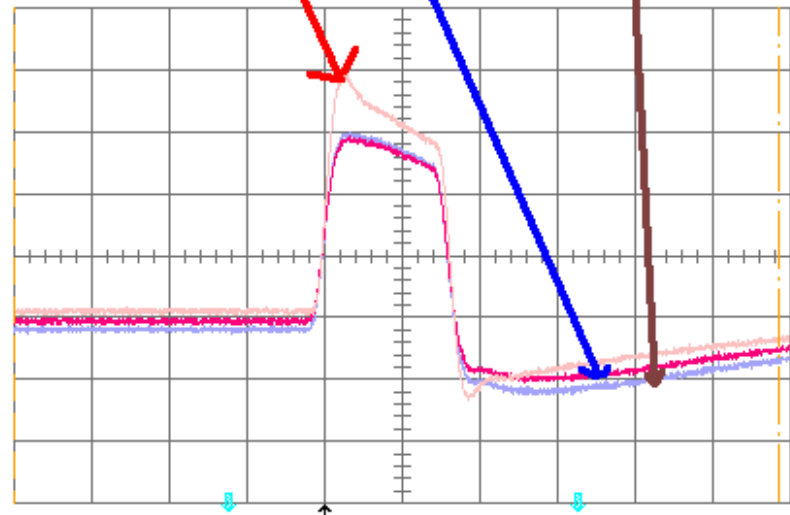
C: 2-3  
.5  $\mu$ s  
300mV

A: M1  
.5  $\mu$ s  
300mV

B: M1  
.5  $\mu$ s  
280mV

1  
.5  $\mu$ s  
1.00 V

### Detection Pulses, 0m, 120m Cat-5, 300FT Cat-3



	28 sweeps:	average	low	high	sigma
ampl(C)		1.172 V	1.156	1.391	0.043
width(C)		762.29 ns	759.37	764.23	0.97
Freq(C)		---	---	---	---

.5  $\mu$ s

1	.5	V	AC	$\times$
2	.2	V	50 $\Omega$	
3	.2	V	50 $\Omega$	
4	.1	V	DC	$\times$

Top pulse=0m, bottom two are round-trip via 120m of Cat-5 and 300Ft of Cat-3 cables via relays +mag



2 DC 0.172 V

2 GS/s

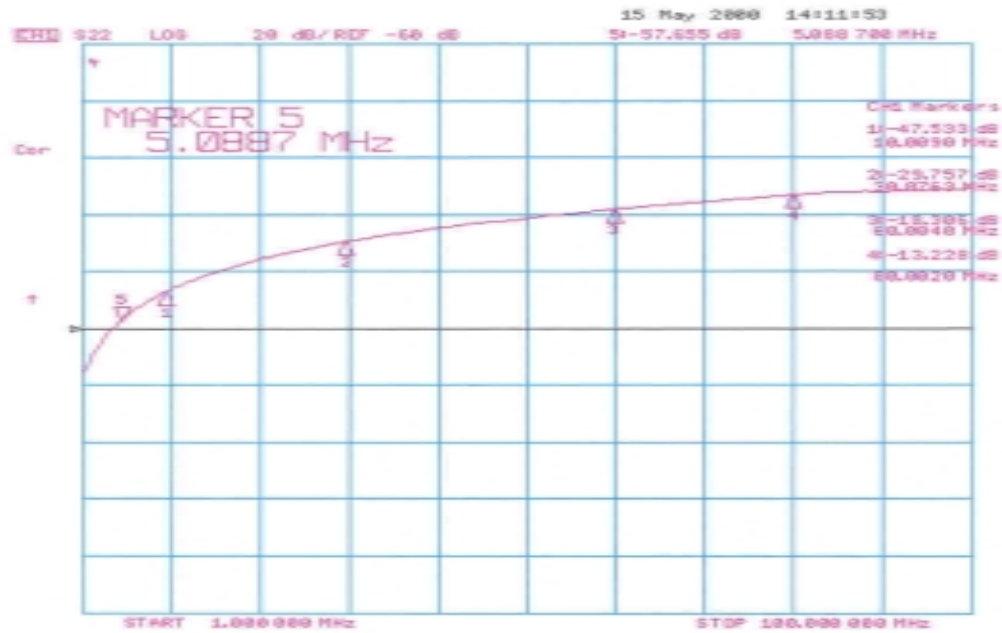
AUTO

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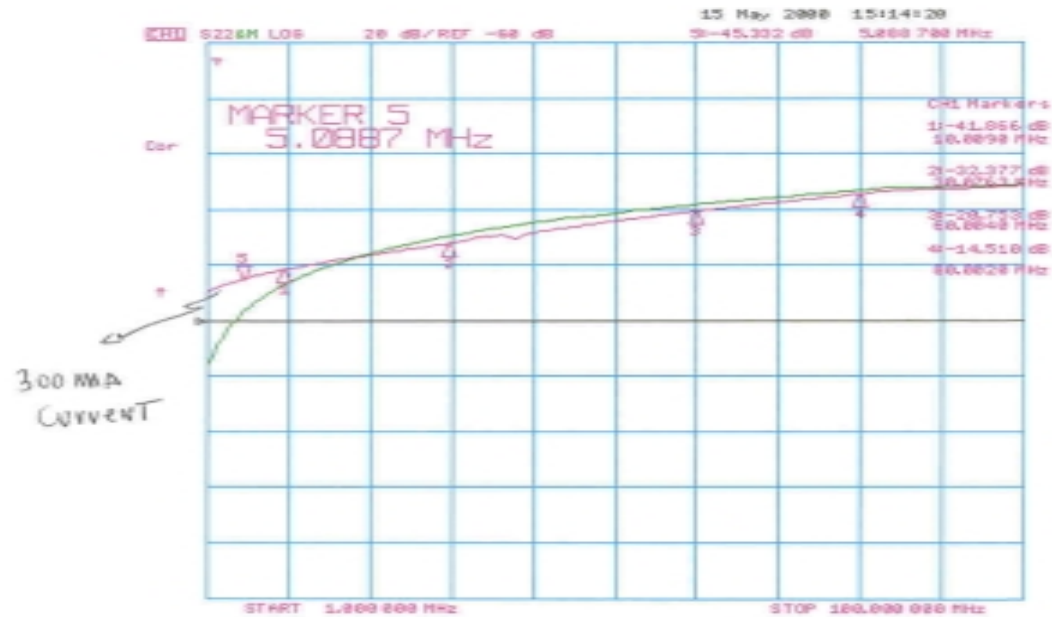
# Return Loss (No Current)



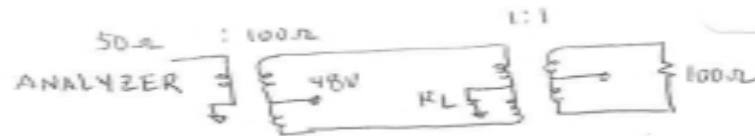
\* R LOSS / NO CURRENT



# Return Loss(With Current)

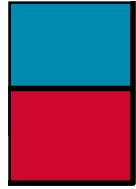


\* Return loss with 300mA/ 300 MA



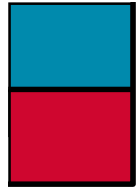
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# Advantages of 2 Signal Pair Powering From the Switch

- **Preserve 2-pairs legacy wiring**
- **No Patch Panel Work for New Line Cards**
- **Does not lock us in mid-span powering for ever**
- **No Patch Panel Work for Gigabit Ports**
- **No additional Rack Space Required**
- **Few Components needed on the Switch/DTE**
- **Isolated side of the Magnetics Features:**
  - 2000V Isolation and ESD Protection
  - Differential Signaling
  - Meets IEEE 802.3 SPECIFICATIONS
- **EMI Tested and Verified to meet FCC Class B limits at the DTE and the Switch**



# Integration Path for the Future

