Inexpensive 50Ω Feed Through Terminations

Chris Grossman

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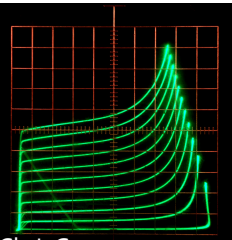
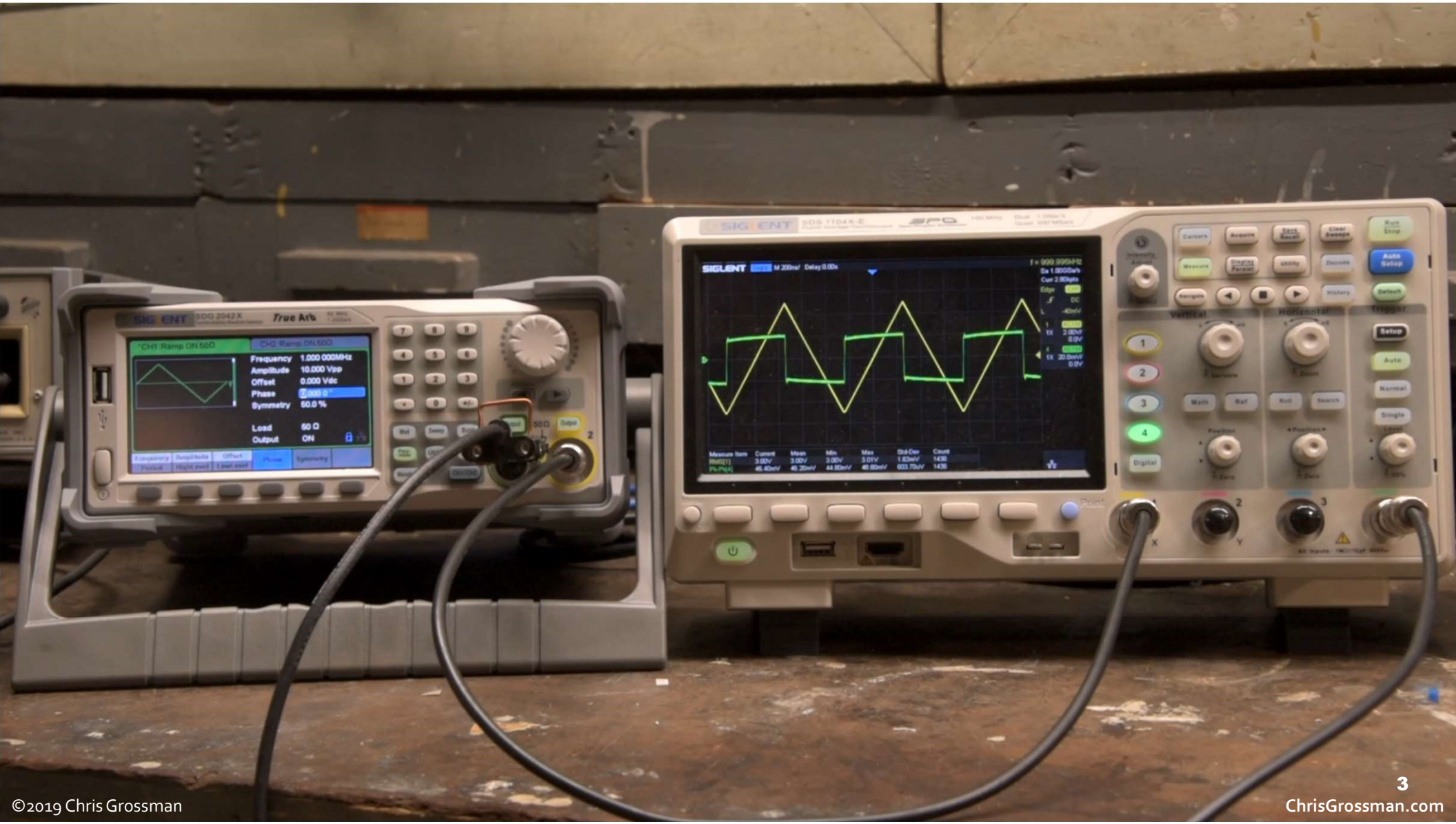
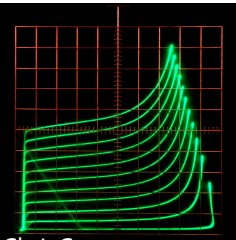
Why use a 50Ω feed through termination?



- A feed through termination is used to change the high input impedance of instrument or DUT to 50Ω to match the impedance of coaxial cable and/or 50Ω signal source
  - Oscilloscope inputs
  - Meter inputs
  - Amplifier inputs since many signal source outputs are designed to run into a 50Ω load
- When the cable is long compared to the signal wavelength
  - To avoid standing waves that vary the signal magnitude vs. frequency
- They are especially needed when signals have a fast rise time and are likely to reflect
  - If the source is good 50Ω (back terminated) it will dampen the reflections from the poorly terminated end of the cable
    - This is why you can often get away without using one
  - Worst case is when neither end of the coax is properly terminated in 50Ω



Fast (3ns) rise-time waveform with & without a 50Ω feed-through termination on the oscilloscope



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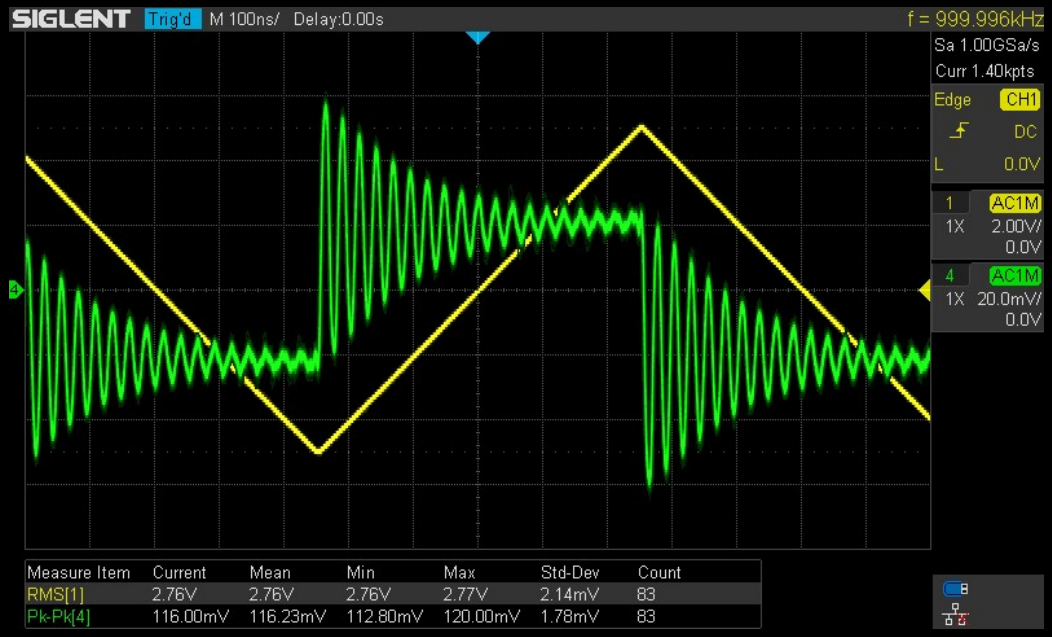
no termination

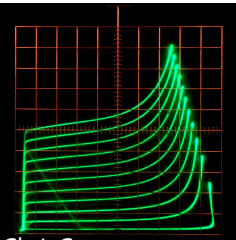


Measure Item	Current	Mean	Min	Max	Std-Dev	Count
RMS[1]	2.76V	2.76V	2.76V	2.77V	2.14mV	83
Pk-Pk[4]	116.00mV	116.23mV	112.80mV	120.00mV	1.78mV	83

50Ω termination

Measure Item	Current	Mean	Min	Max	Std-Dev	Count
RMS[1]	2.76V	2.76V	2.76V	2.77V	1.68mV	27
Pk-Pk[4]	45.60mV	46.37mV	44.80mV	48.00mV	799.45uV	27

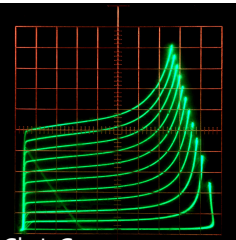
50Ω feed through termination cost



- I've been looking for some reasonably priced feed-through terminations for my home lab
- New terminations from domestic sources are priced from $45 to $200 each
- Used name-brand terminations on eBay are typically priced at $25+
  - A Tektronix 5W one I recently bought has "new old stock" arrived with burnt connections and had loose pieces rattling inside
- I'm not interested in plastic Chinese ones with BS specifications

- Recently some Chinese "Copper Adapter" 2 for $10 models appeared on Amazon Prime
  - I ordered some since I could easily get a refund if they were crap
  - They are not quite as advertised, but are still excellent for the money

2 for $10 50Ω feed-through terminations



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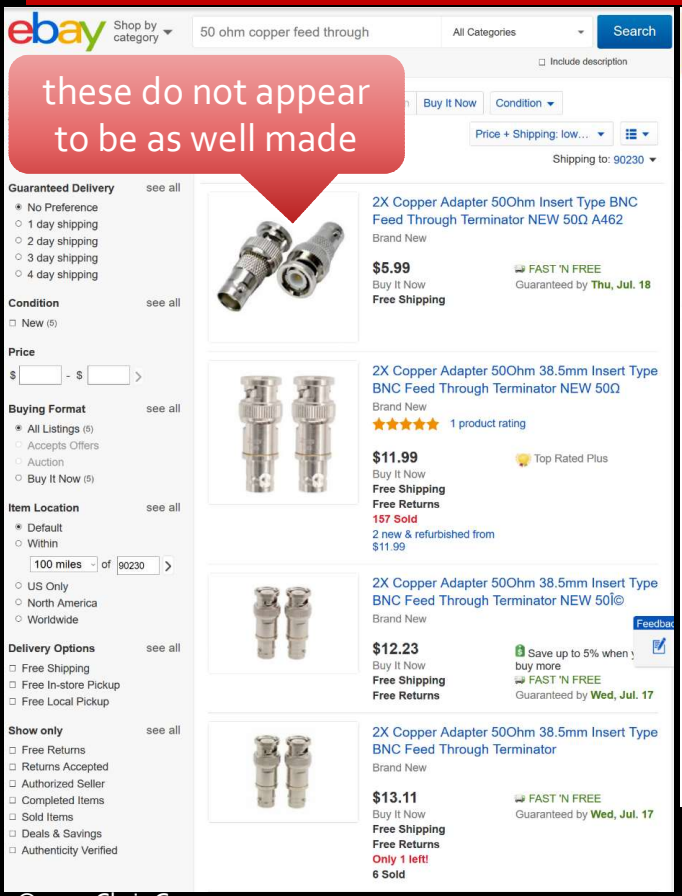
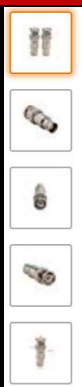
these do not appear to be as well made





Roll over image to zoom in

2X Copper Adapter 50Ohm 38.5mm Insert Type BNC Feed Through Terminator

by MOTOKU

3 customer reviews

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Prime member exclusive! Get an $80 gift card instantly: Pay $0.00 upon approval for the Amazon Prime Rewards Visa Card. No annual fee.

- 1. Please allow 1-3mm error due to manual measurement.Pls make sure you do not mind before you bid.
- 2. The color may have different as the difference display,pls understand.
- Electroplating bright all copper BNC male and femalehead. Internal 50Ω matched impedance.
- Link Mode: Insert Type; Material: Copper
- Impedance:50 ohm; Length: 38.5mm; Width: 15mm

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FREE delivery: **Tomorrow**
Order within 8 hrs 29 mins. Details

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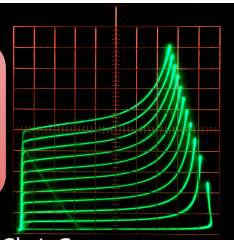
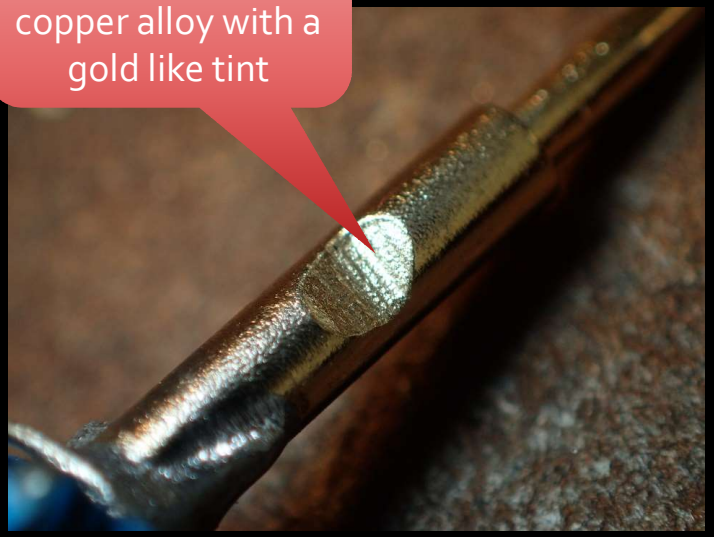
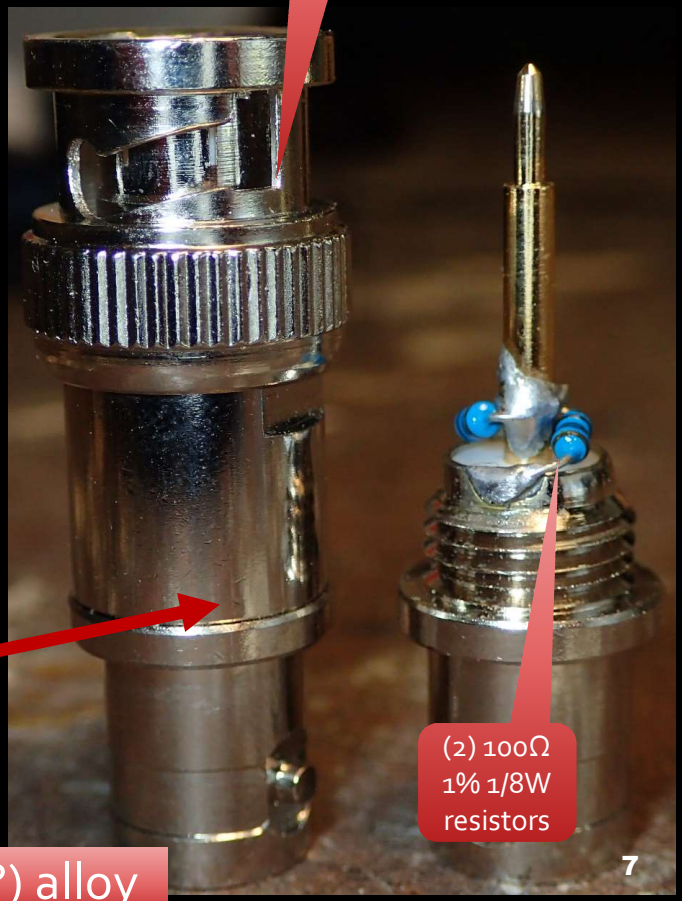
“Copper” 50Ω ¼W feed through termination



rotating portion is magnetic

center conductor appears to be a copper alloy with a gold like tint

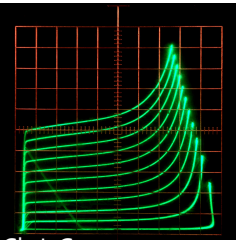




(2) 100Ω 1% 1/8W resistors

The body is a non-magnetic silver colored (Nickel?) alloy

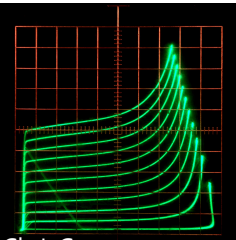
feed-through attenuators used for this video

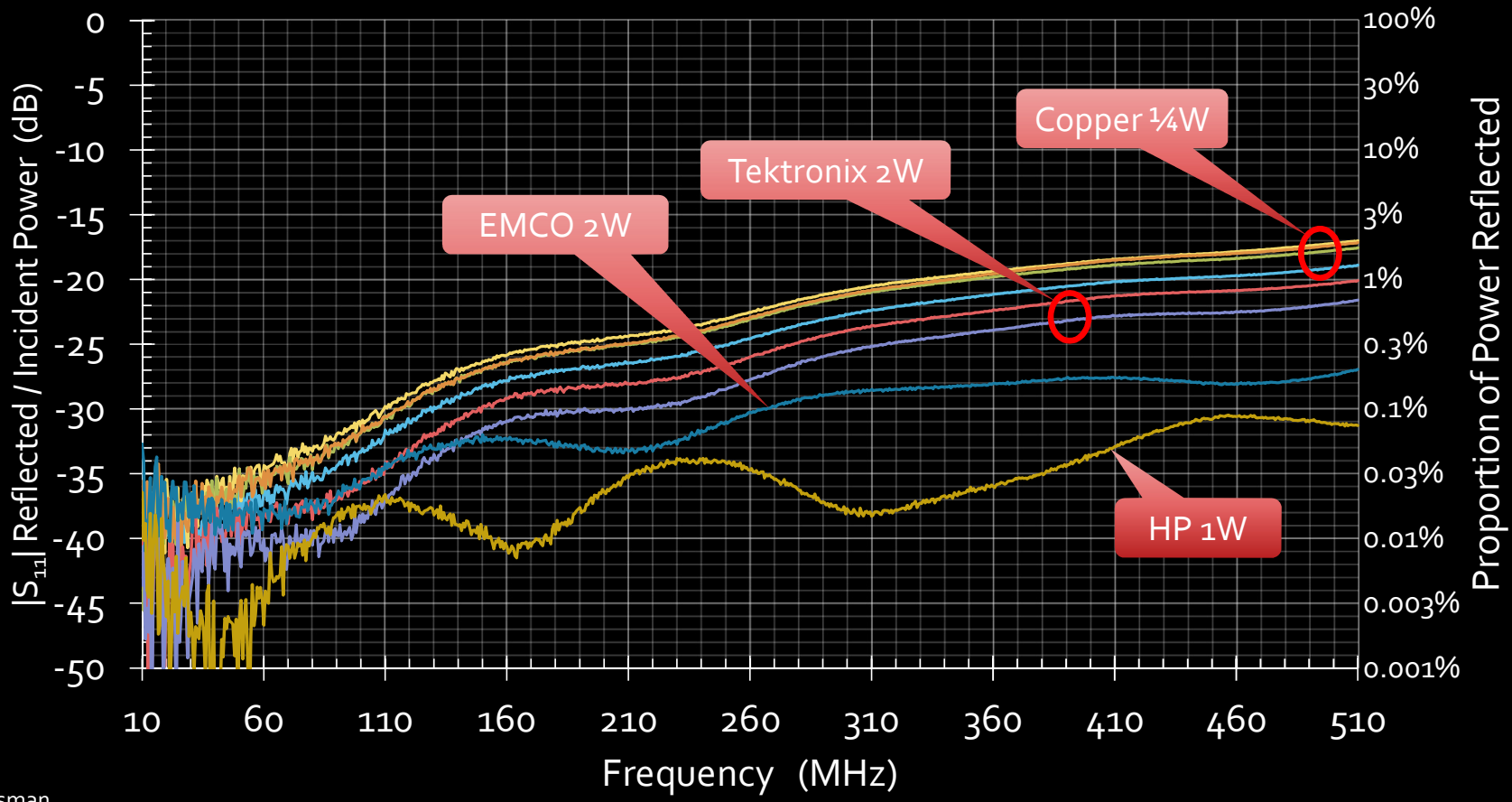


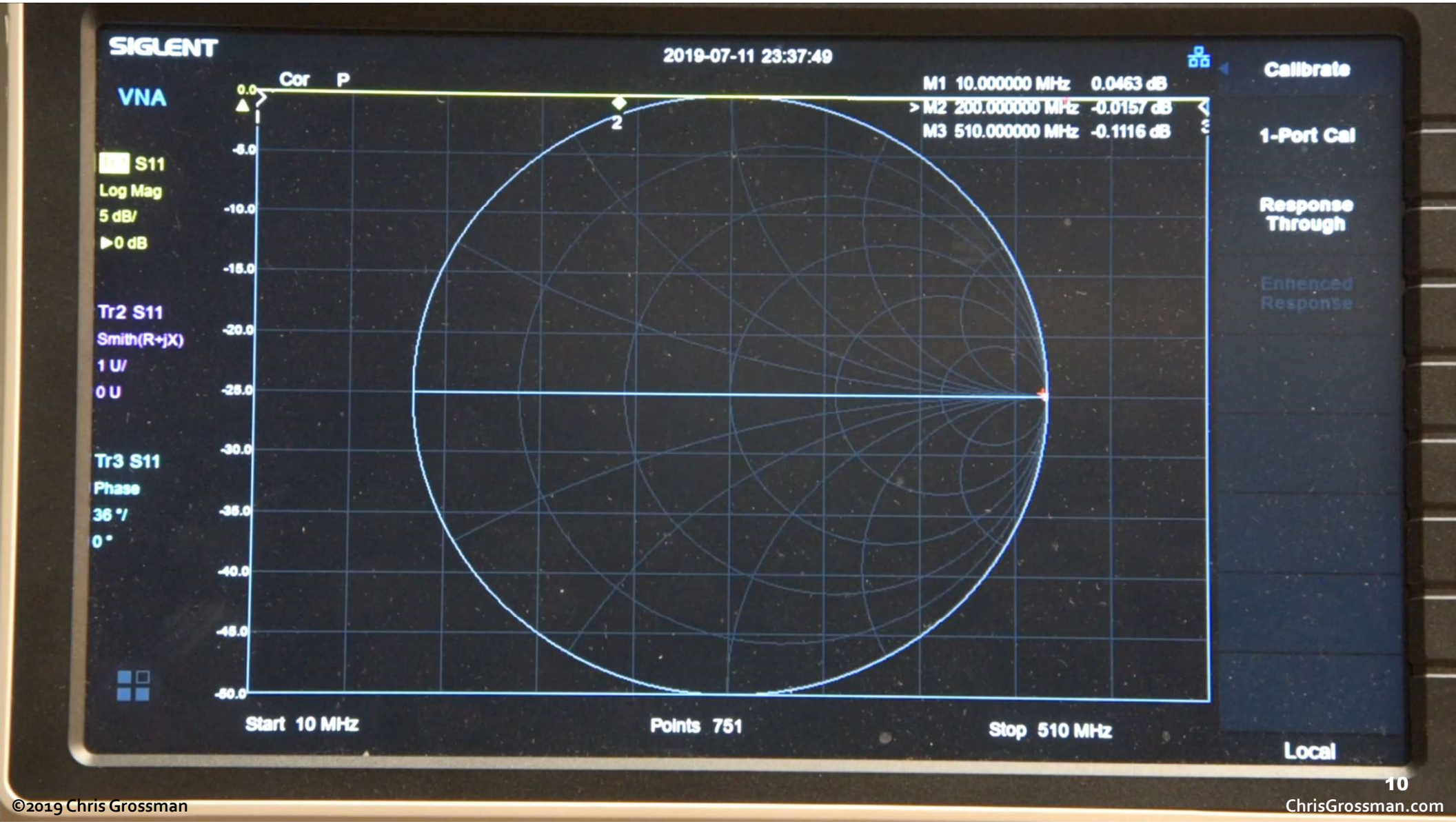
#	type	Power	R (Ω) 100 KHz	% error
1	Copper	¼ W	49.70	-0.6%
2	Copper	¼ W	49.86	-0.3%
3	Copper	¼ W	49.81	-0.4%
4	Copper	¼ W	49.73	-0.5%
5	Tektronix	2 W	50.70	1.4%
6	Tektronix	2 W	50.73	1.5%
7	EMCO	2 W	49.25	-1.5%
8	HP	1 W	49.93	-0.1%

measurements made with a DER EE DE-5000 LCR meter

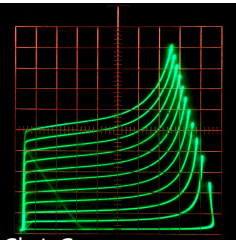
Feed through terminations at the end of a 50Ω cable & not connected to the oscilloscope







All 50Ω feed-though terminations connected to a Siglent SDS1104X-E input



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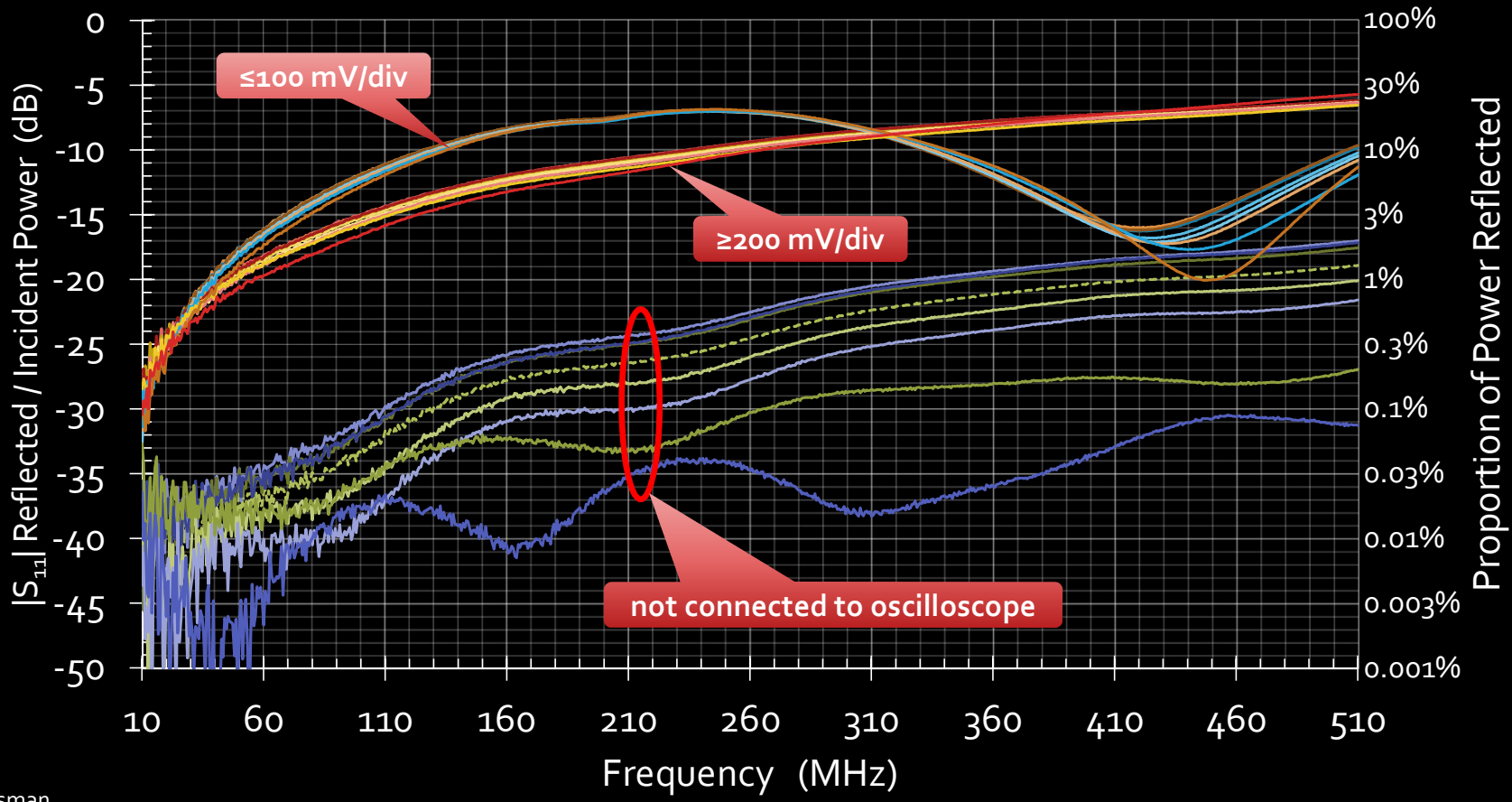

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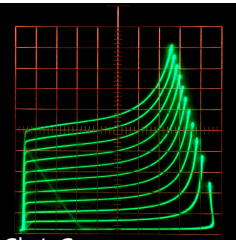
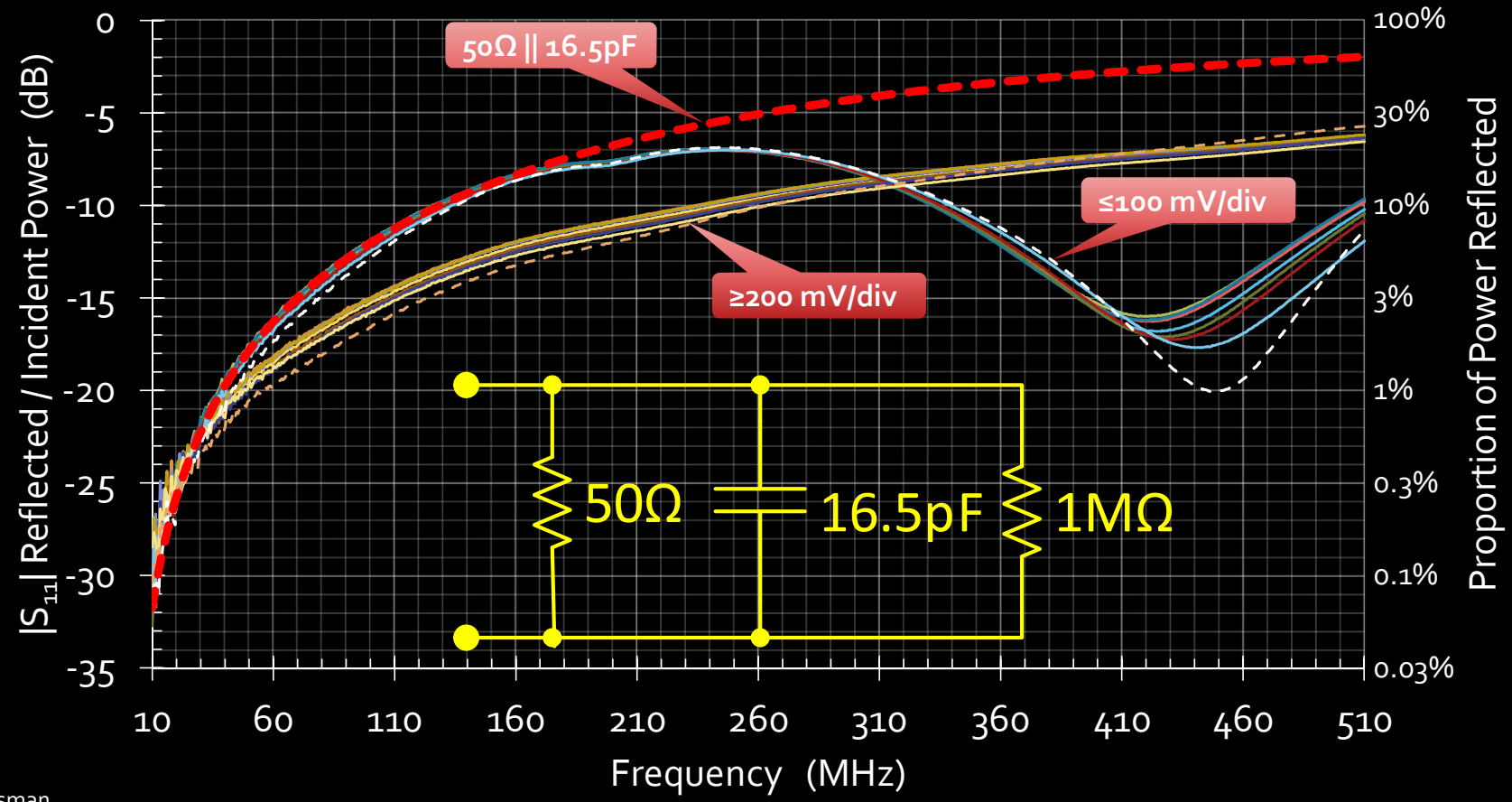
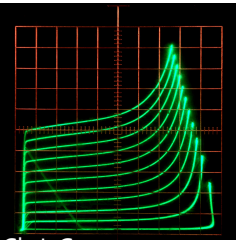


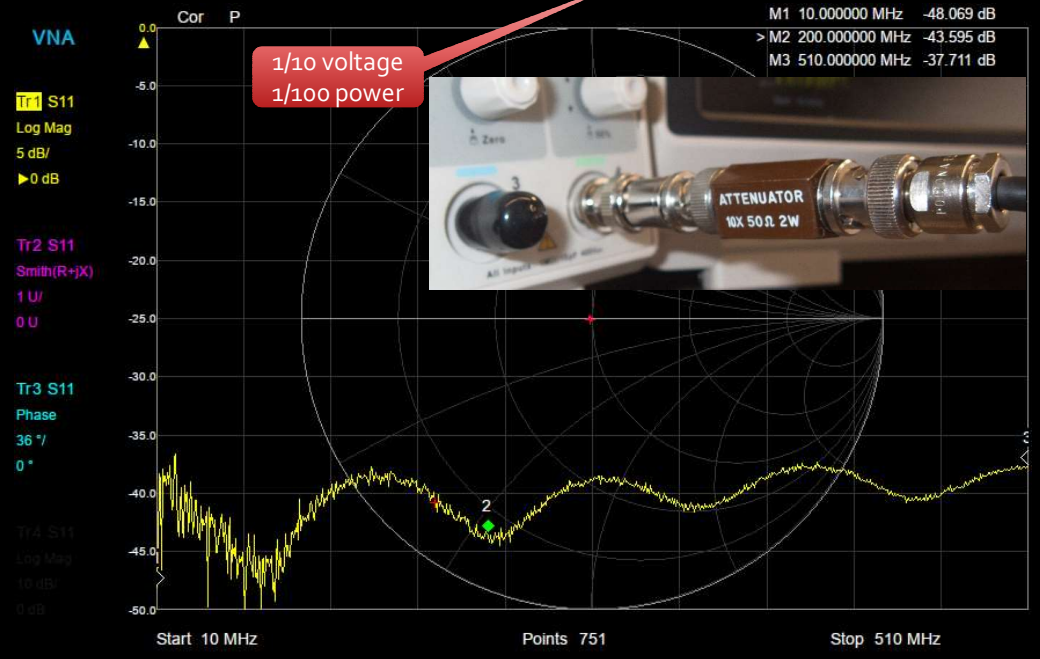


Improve your scope's input match with the use of an attenuator and a feed-through terminator



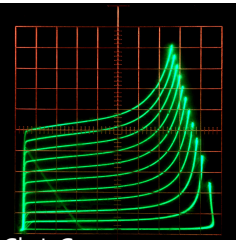
50Ω feed-through termination only

50Ω termination & 20dB attenuator



Use of an inline attenuator yields a better match but with a loss of signal magnitude

Improve your o-scope's input match with the use of an attenuator and a feed-through terminator



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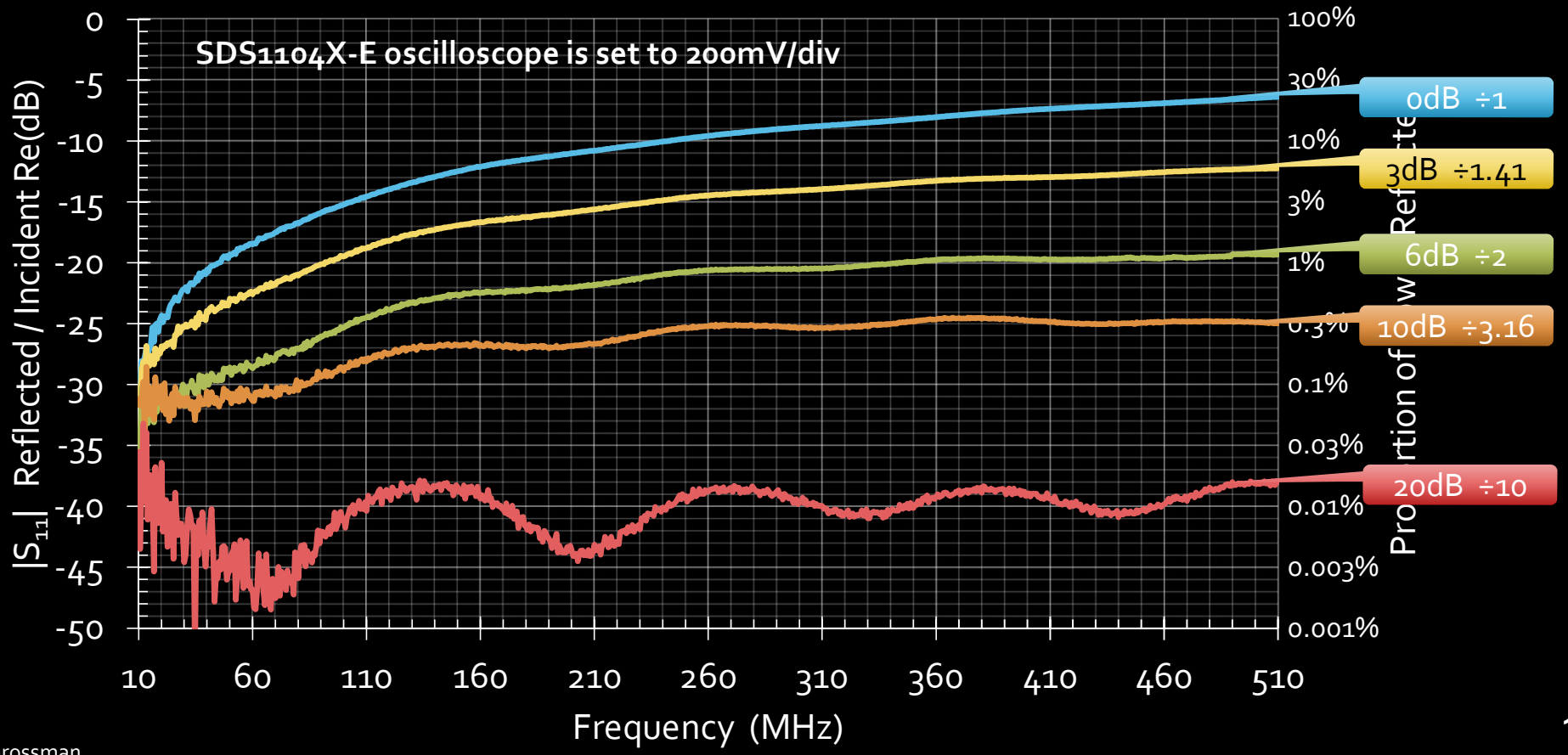
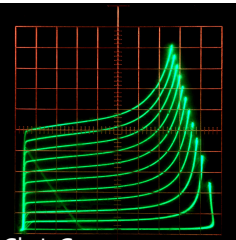
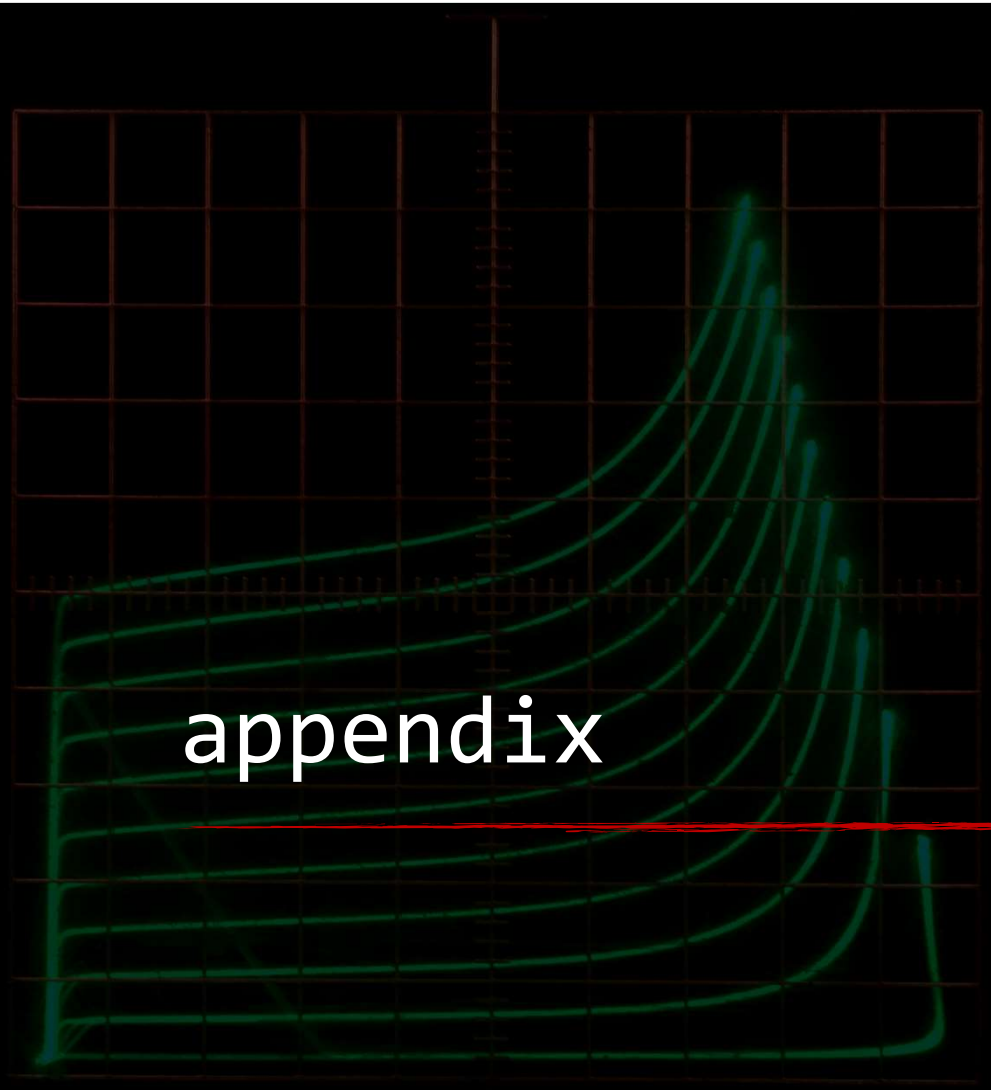


Conclusion

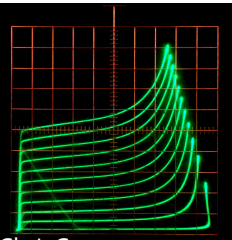


- All of the tested feed through terminations yield an equivalent ($|S_{11}|$) match when connected to a high impedance oscilloscope input
- The main consideration on which one to use is power handling capability
- The low-cost Chinese "copper" feed through terminations work great if you can live with the ¼W power capability
  - ¼W = 24 dBm = 3.5 V_{RMS}
- You can improve the input match to your oscilloscope (or almost any load) with the use of a fixed inline attenuator



appendix

“Copper” 50Ω feed-though termination connected to a Siglent SDS1104X-E input



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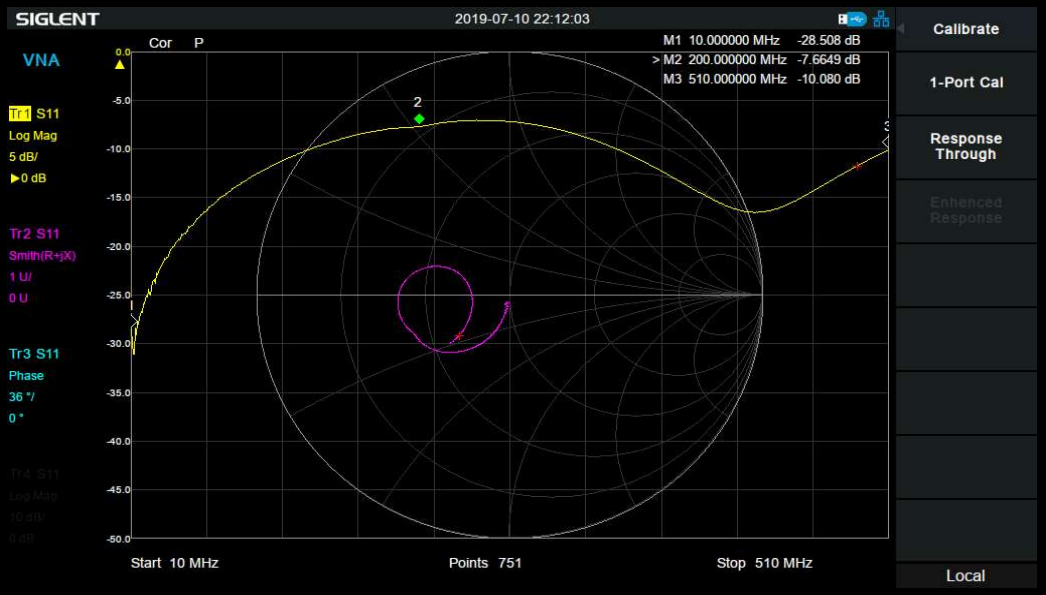
range ≤ 100 mV/div



range ≥ 200 mV/div