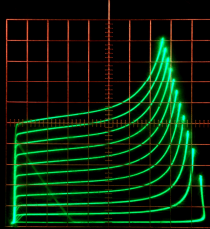


Inexpensive 50Ω Feed Through Terminations



Chris Grossman
July 14, 2019

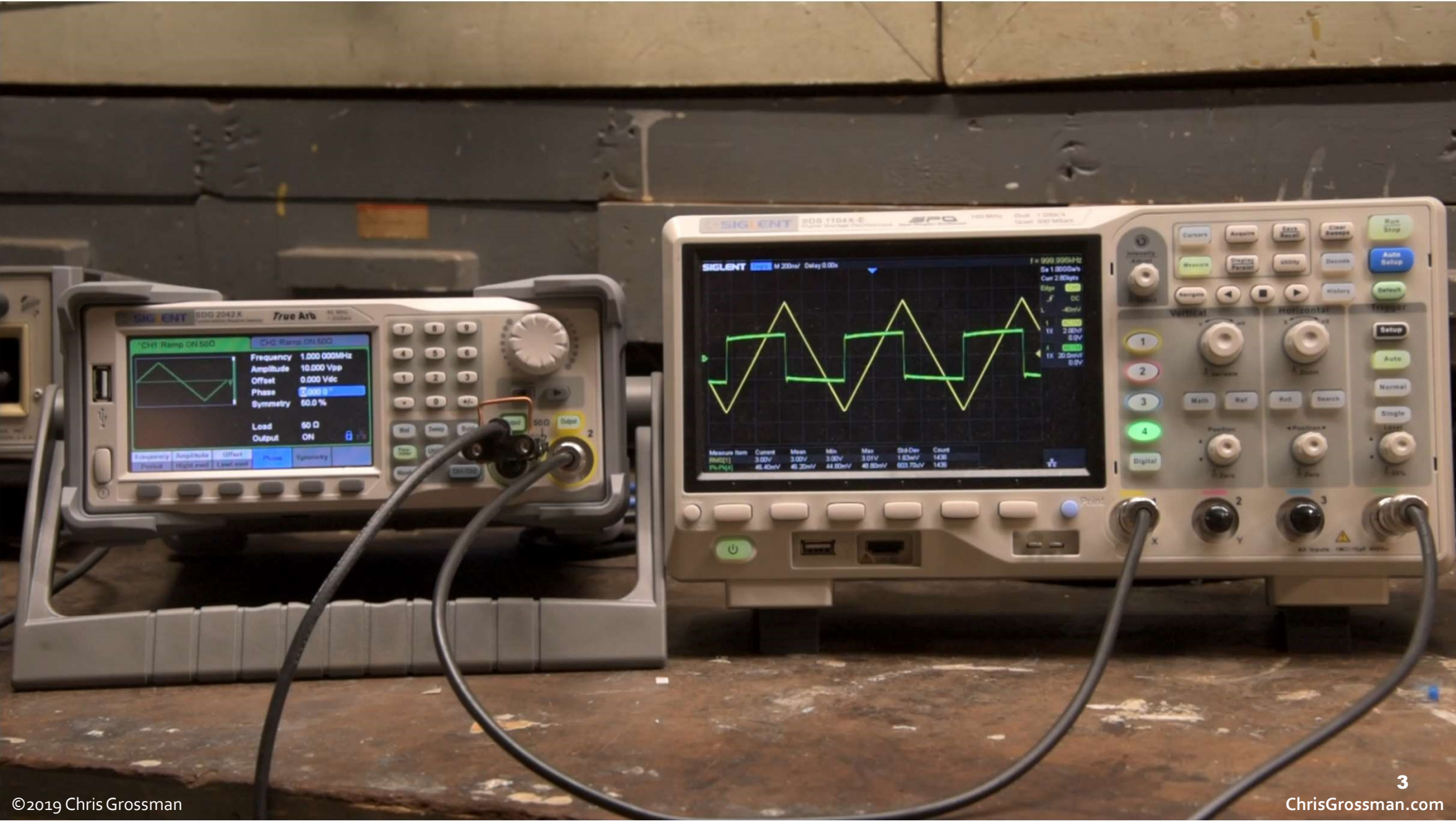
ChrisGrossman.com



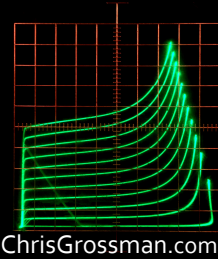
ChrisGrossman.com

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



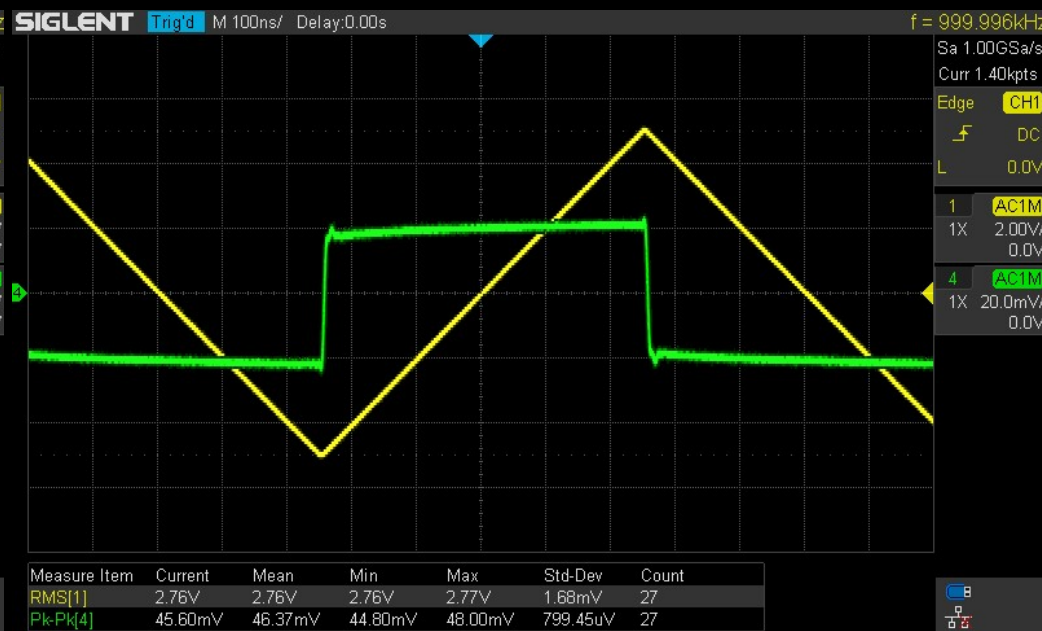
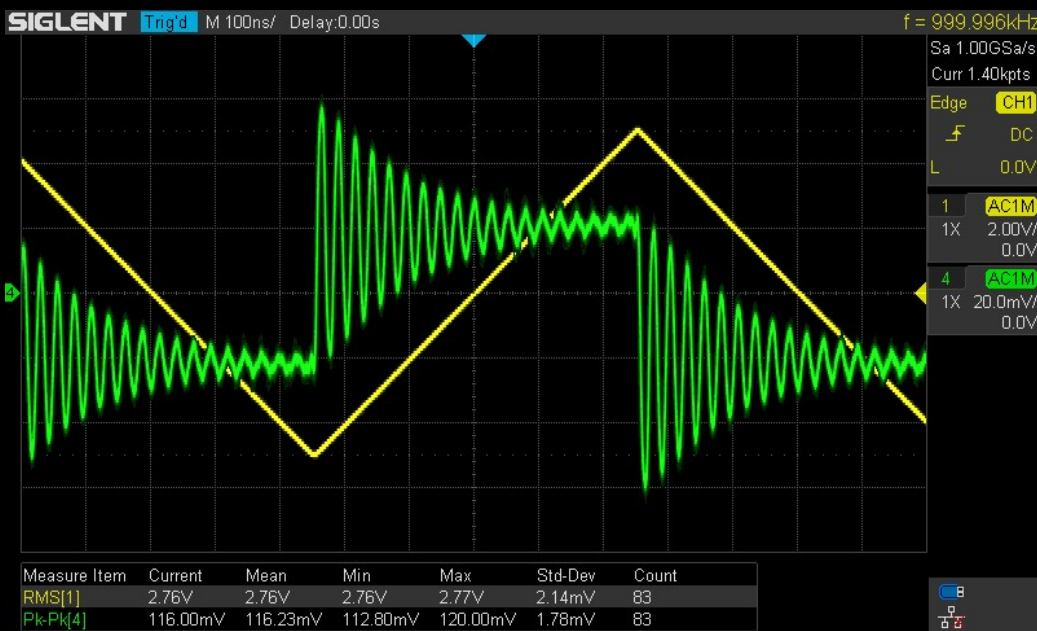
Fast (3ns) rise-time waveform with & without a 50Ω feed-through termination on the oscilloscope



ChrisGrossman.com

no termination

50Ω termination

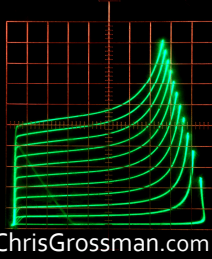


50Ω feed through termination cost

- 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



ChrisGrossman.com

Shop by category: 50 ohm copper feed through

these do not appear to be as well made

Buy It Now Condition Price + Shipping: low... Shipping to: 90230

Guaranteed Delivery

- No Preference
- 1 day shipping
- 2 day shipping
- 3 day shipping
- 4 day shipping

Condition

Price

Buying Format

- All Listings (6)
- Accepts Offers
- Auction
- Buy It Now (5)

Item Location

- Default
- Within 100 miles of 90230
- US Only
- North America
- Worldwide

Delivery Options

- Free Shipping
- Free In-store Pickup
- Free Local Pickup

Show only

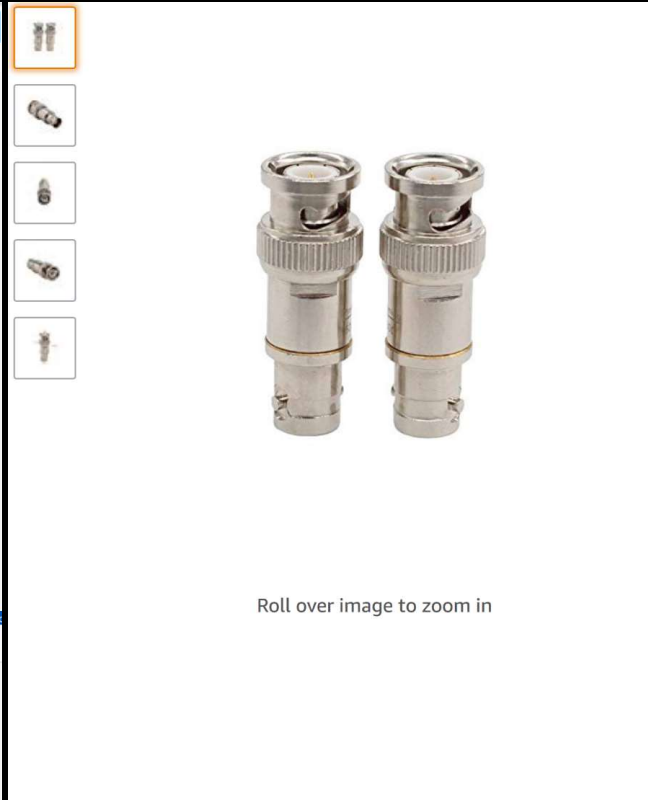
- Free Returns
- Returns Accepted
- Authorized Seller
- Completed Items
- Sold Items
- Deals & Savings
- Authenticity Verified

2X Copper Adapter 50Ohm Insert Type BNC Feed Through Terminator NEW 50Ω A462
Brand New
\$5.99 Buy It Now Free Shipping FAST 'N FREE Guaranteed by Thu, Jul. 18

2X Copper Adapter 50Ohm 38.5mm Insert Type BNC Feed Through Terminator NEW 50Ω
Brand New
\$11.99 Buy It Now Free Shipping Free Returns 157 Sold 2 new & refurbished from \$11.99 Top Rated Plus

2X Copper Adapter 50Ohm 38.5mm Insert Type BNC Feed Through Terminator NEW 50Ω
Brand New
\$12.23 Buy It Now Free Shipping Free Returns Save up to 5% when you buy more FAST 'N FREE Guaranteed by Wed, Jul. 17

2X Copper Adapter 50Ohm 38.5mm Insert Type BNC Feed Through Terminator
Brand New
\$13.11 Buy It Now Free Shipping Free Returns Only 1 left! 6 Sold FAST 'N FREE Guaranteed by Wed, Jul. 17



2X Copper Adapter 500hm 38.5mm Insert Type BNC Feed Through Terminator

by MOTOKU
★★★★☆ 3 customer reviews

Price: \$9.99 ✓prime FREE One-Day & FREE Returns

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

\$9.99
✓prime FREE One-Day & FREE Returns

FREE delivery: **Tomorrow**
Order within 8 hrs 29 mins. [Details](#)

In Stock.

Qty: 1

Add to Cart

Buy Now

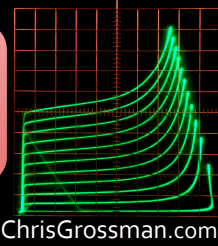
Sold by MOTOKU and Fulfilled by Amazon.

Gift-wrap available.

Add to List

Add to your Dash Buttons

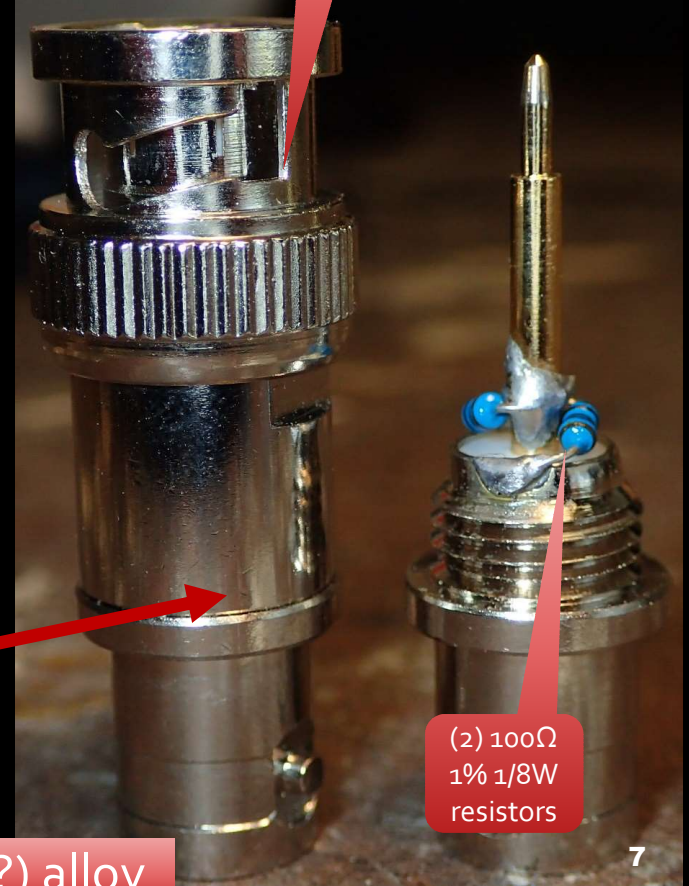
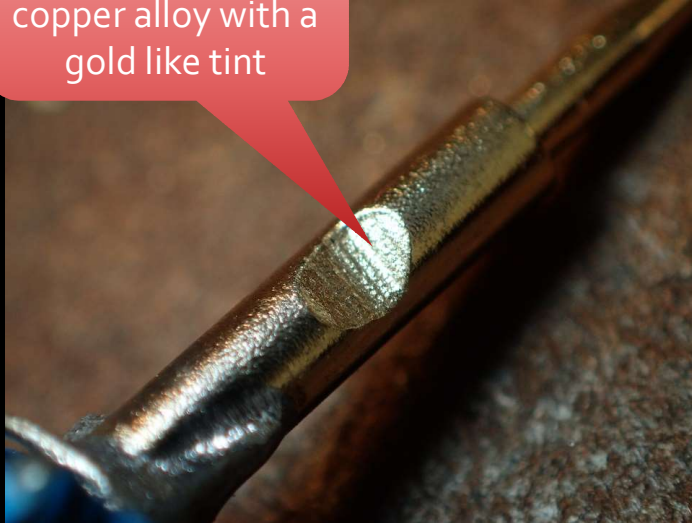
“Copper” 50Ω ¼W feed through termination



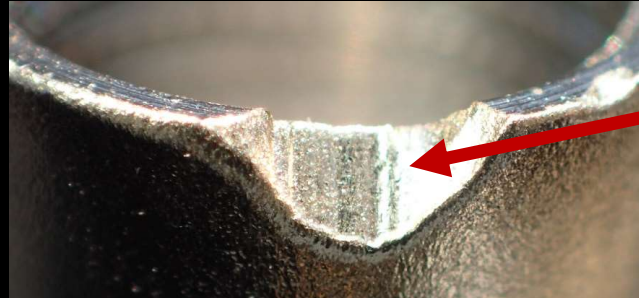
ChrisGrossman.com

rotating portion is magnetic

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

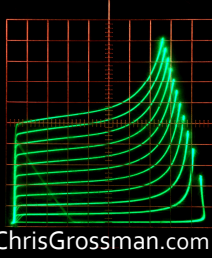


(2) 100Ω
1% 1/8W
resistors



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

feed-through attenuators used for this video



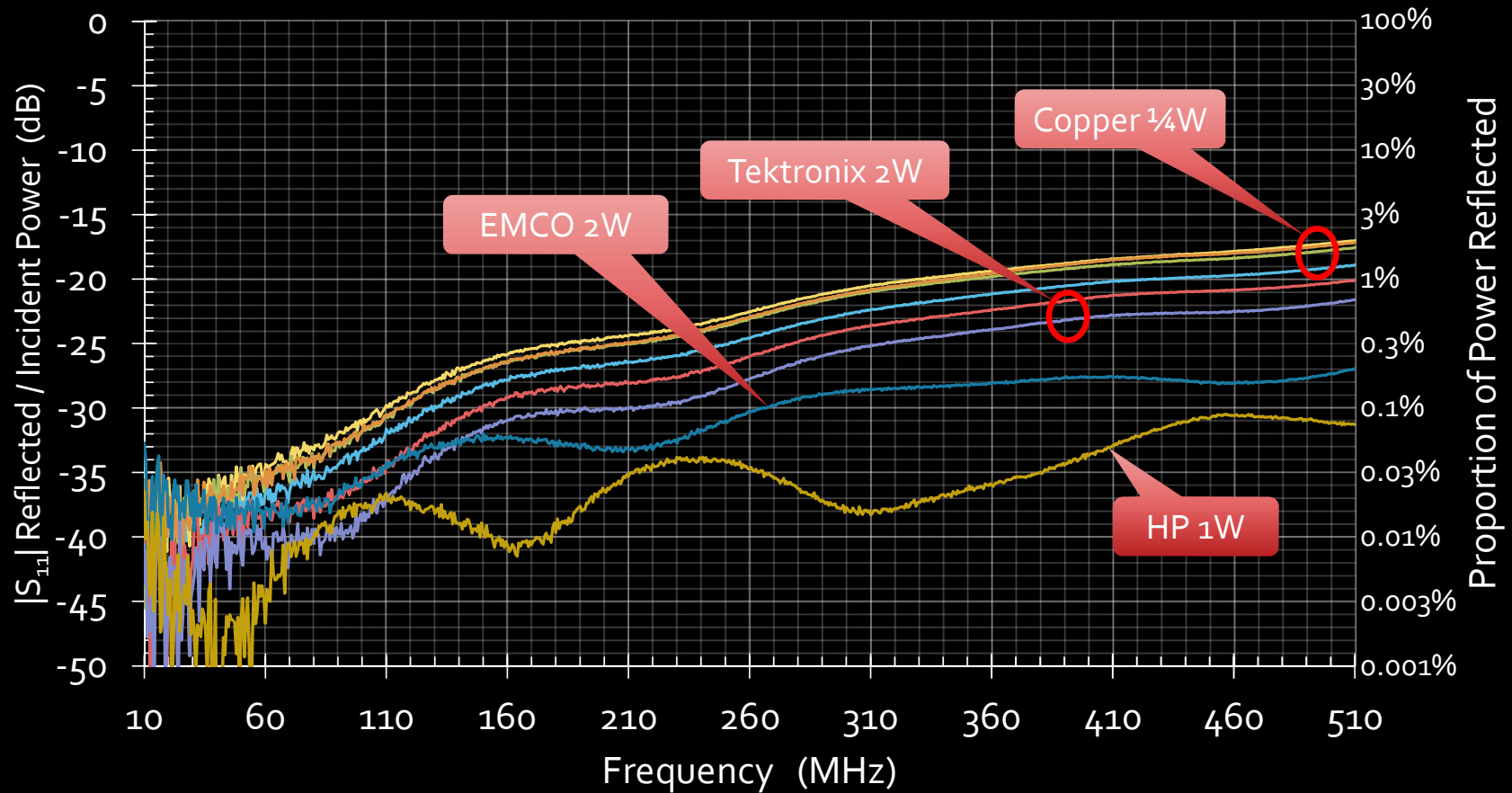
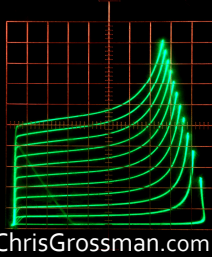
ChrisGrossman.com

#	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



SIGLENT

2019-07-11 23:37:49

dB

VNA

Cor P

M1 10.000000 MHz 0.0463 dB

> M2 200.000000 MHz -0.0157 dB

M3 510.000000 MHz -0.1116 dB

Calibrate

1-Port Cal

Response Through

Enhanced Response

S11

Log Mag

5 dB/

▷0 dB

Tr2 S11

Smith(R+X)

1 U/

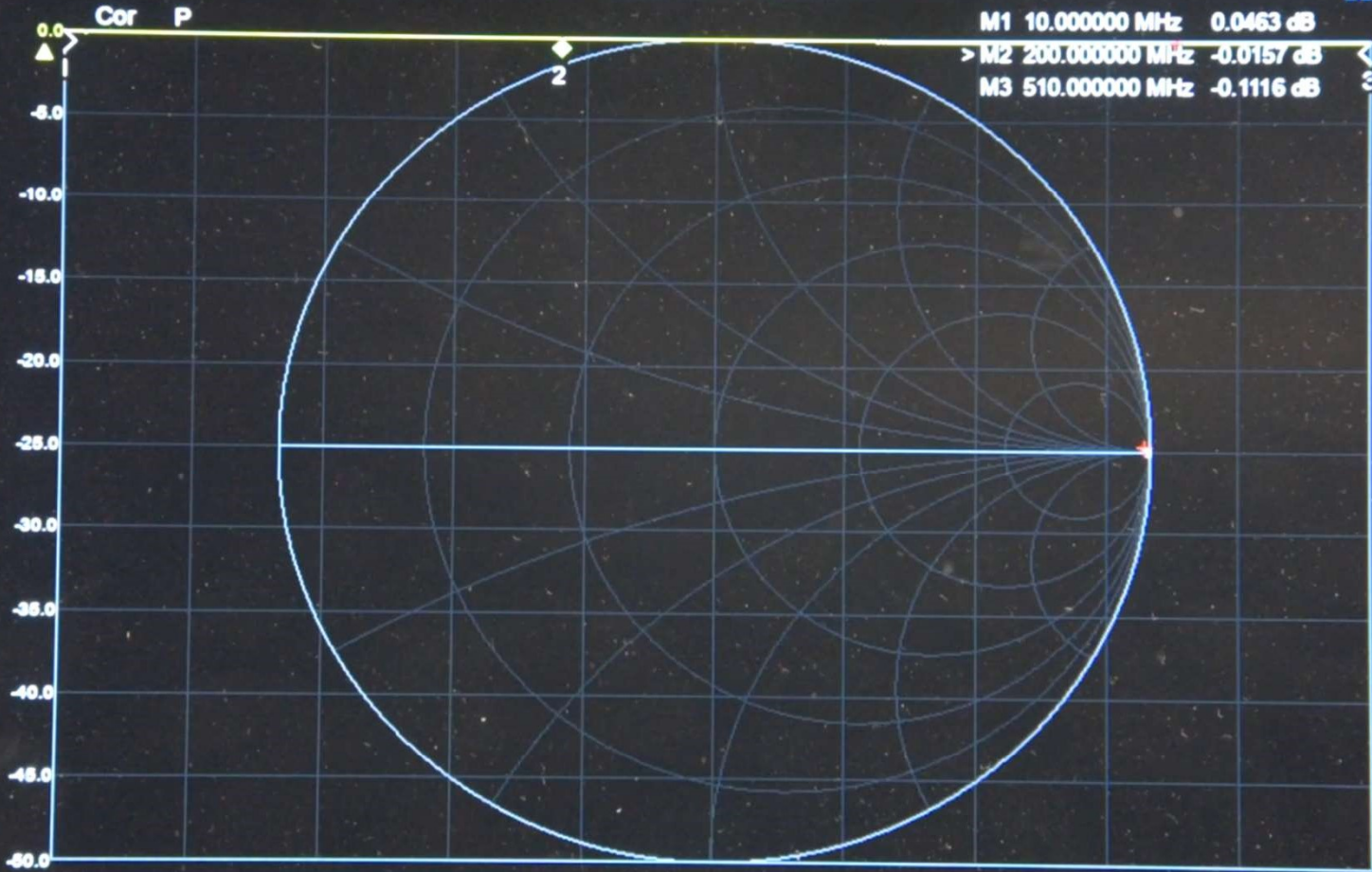
0 U

Tr3 S11

Phase

36 °/

0 °



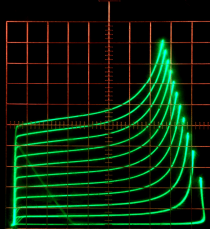
Start 10 MHz

Points 751

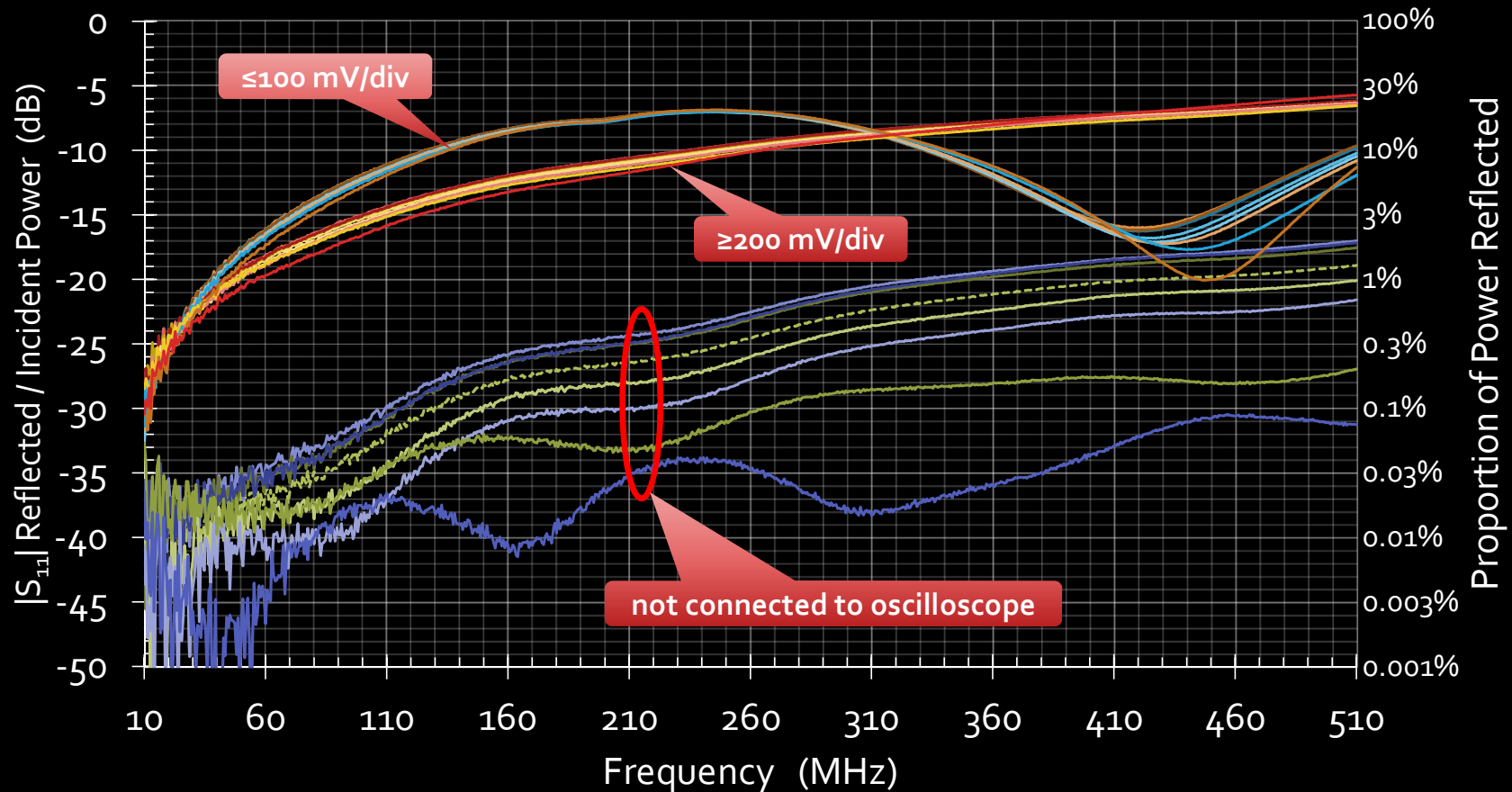
Stop 510 MHz

Local

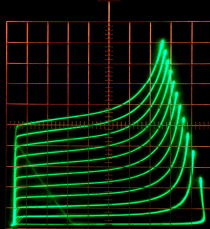
All 50Ω feed-through terminations connected to a Siglent SDS1104X-E input



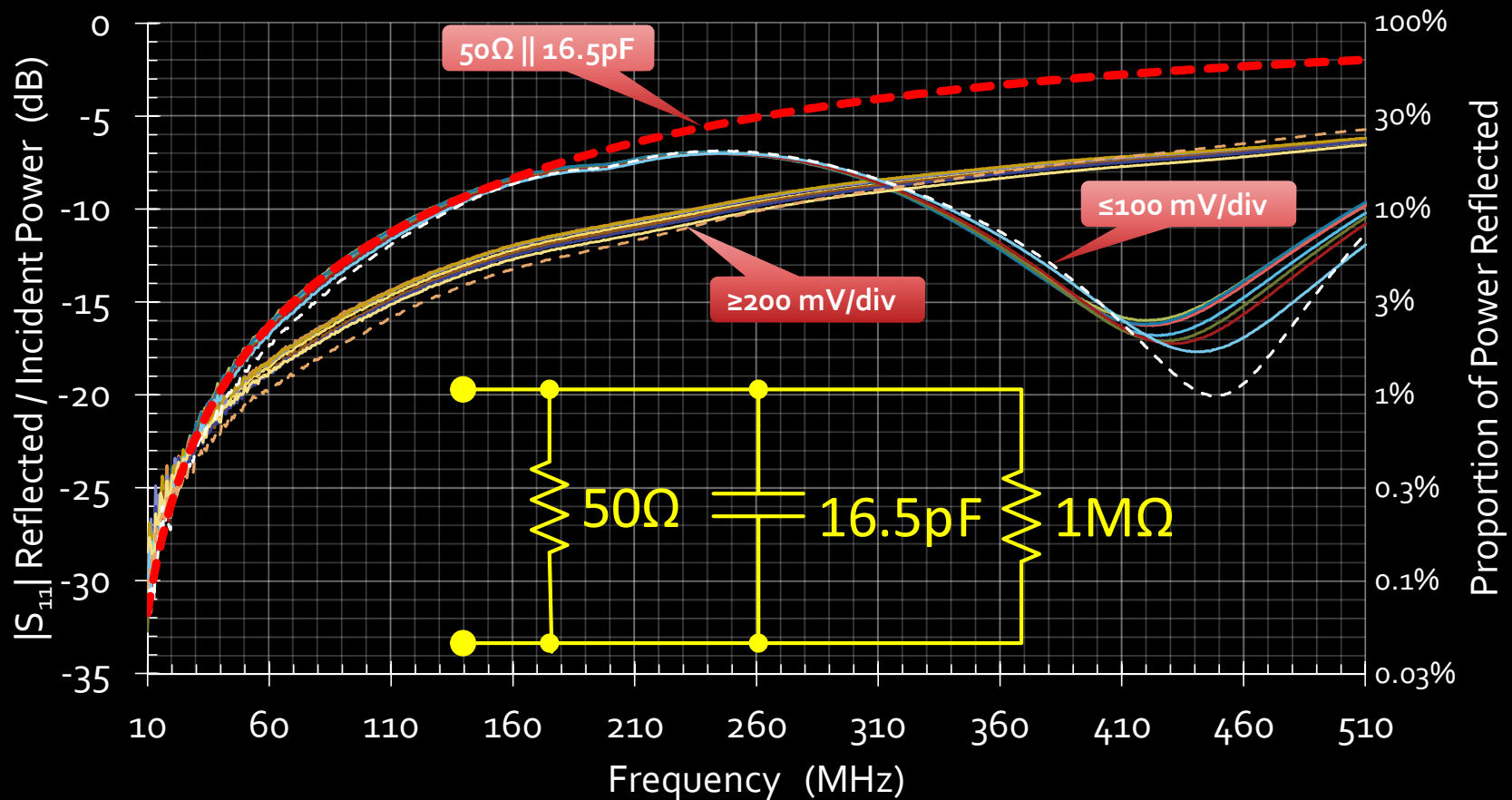
ChrisGrossman.com



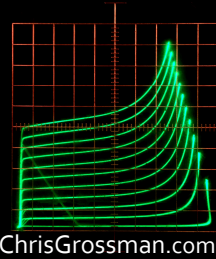
All 50Ω feed-through terminations connected to a Siglent SDS1104X-E input



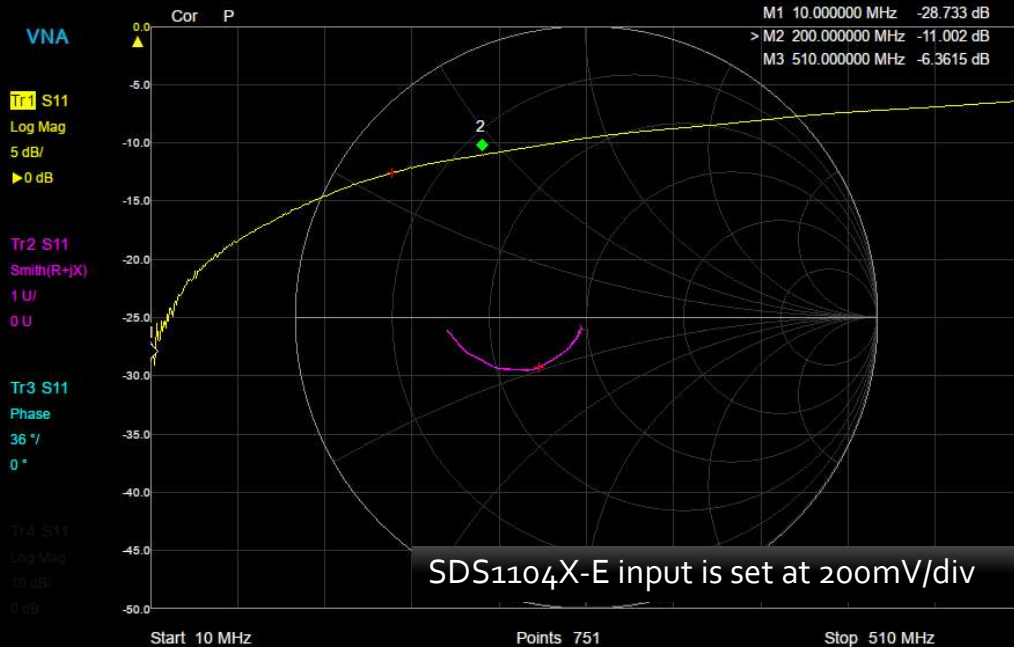
ChrisGrossman.com



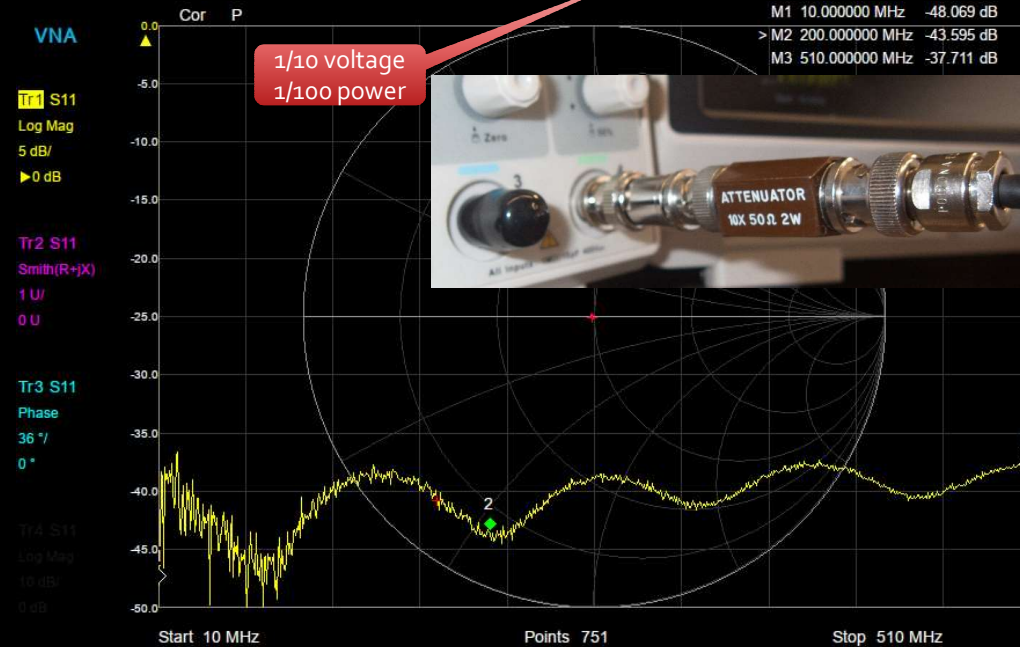
Improve your scope's input match with the use of an attenuator and a feed-through terminator



50Ω feed-through termination only

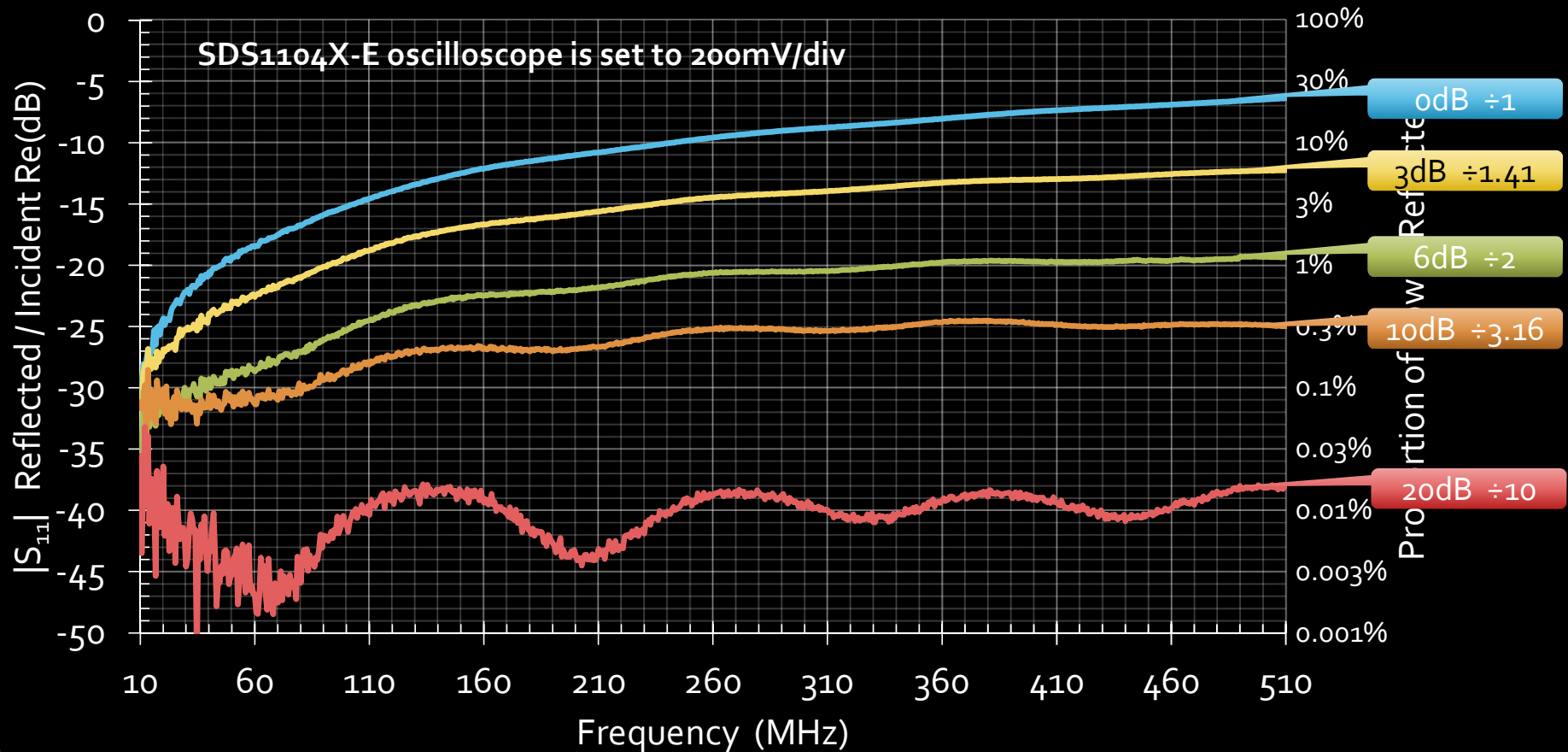
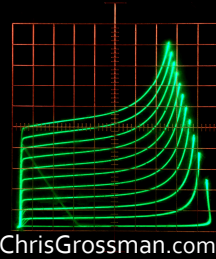


50Ω termination & 20dB attenuator

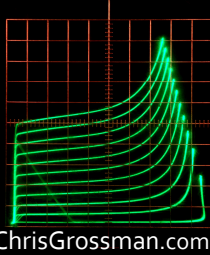


Use of an inline attenuator yields a better match but with a loss of signal magnitude

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



Conclusion

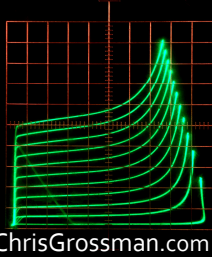


- All of the tested feed through terminations yield an equivalent ($|S_{11}|$) match when connected to a high impedance oscilloscope input
- The main consideration on which one to use is power handling capability
- The low-cost Chinese “copper” feed through terminations work great if you can live with the $\frac{1}{4}W$ power capability
 - $\frac{1}{4}W = 24 \text{ dBm} = 3.5 V_{\text{RMS}}$
- You can improve the input match to your oscilloscope (or almost any load) with the use of a fixed inline attenuator

A dark grid with a vertical line down the center. Several green curved lines are drawn across the grid, starting from the left edge and curving towards the right. The word "appendix" is written in white, lowercase letters in the center of the grid.

appendix

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



range ≤ 100 mV/div

range ≥ 200 mV/div

