

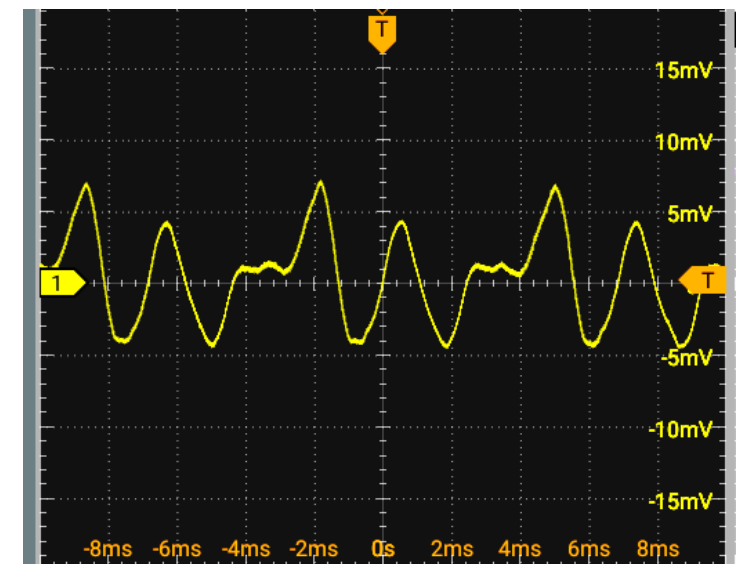
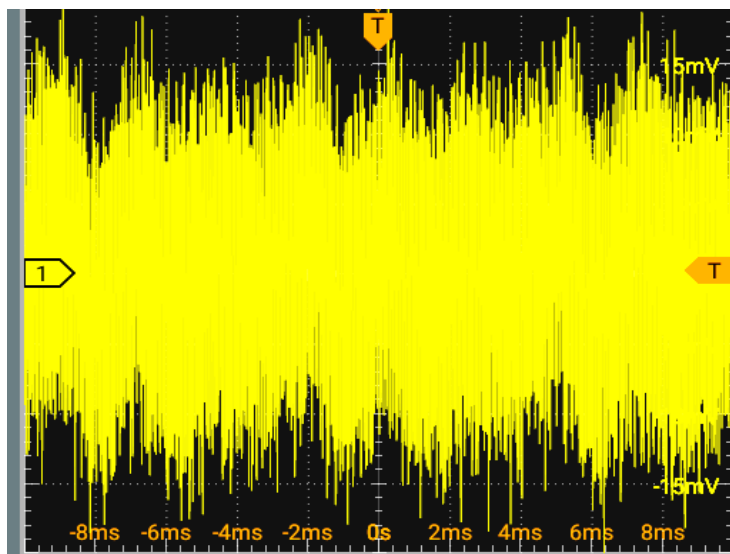
ECE Topic #5 – Oscilloscopes, Microphones, and Noise

Slides downloaded from: <https://ecefiles.org/ece-topics/>

Companion video at: <https://www.youtube.com/watch?v=-pm5ADJrKT4>

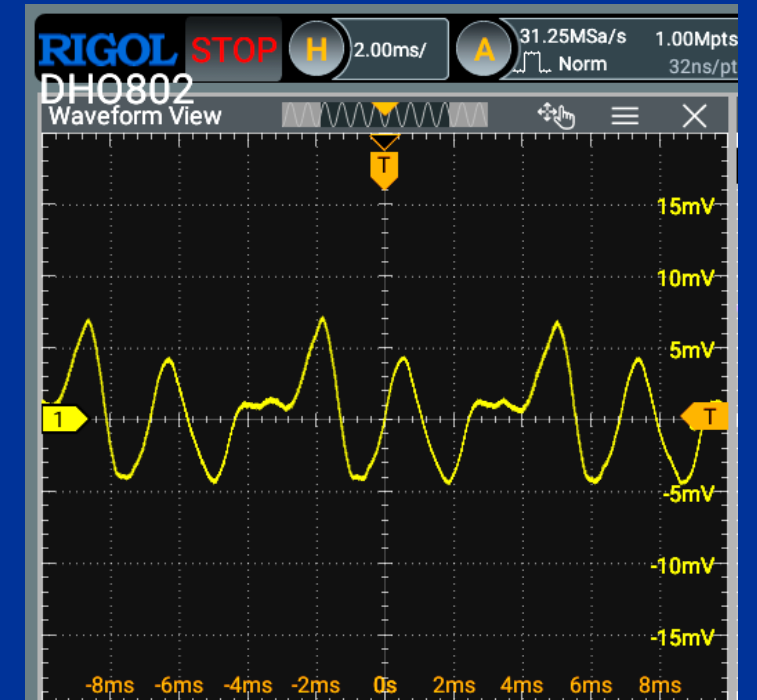
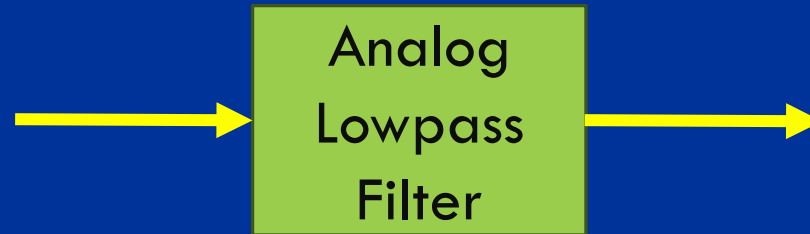
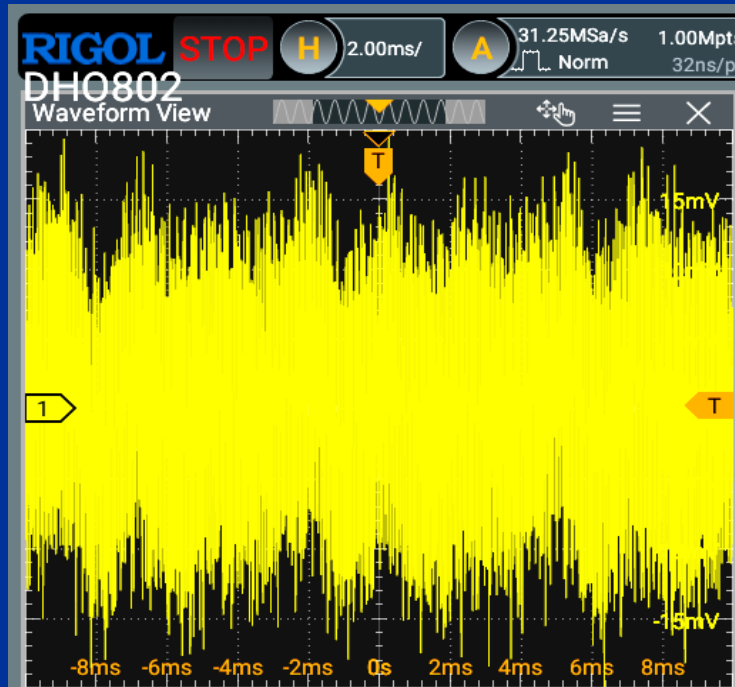
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How to use a high-resolution (12 bit) oscilloscope to look at microphone signals directly - without preamps / etc. In this video, we look in detail at the noise that typically makes direct measurement of microphone-level signals (e.g. 3 mV) impossible. The noise is traced to radio frequency interference (RFI) from switch mode power supplies (SMPS) and strong radio signals in the area. We show how to easily fix the problem.



Topics in ECE #5

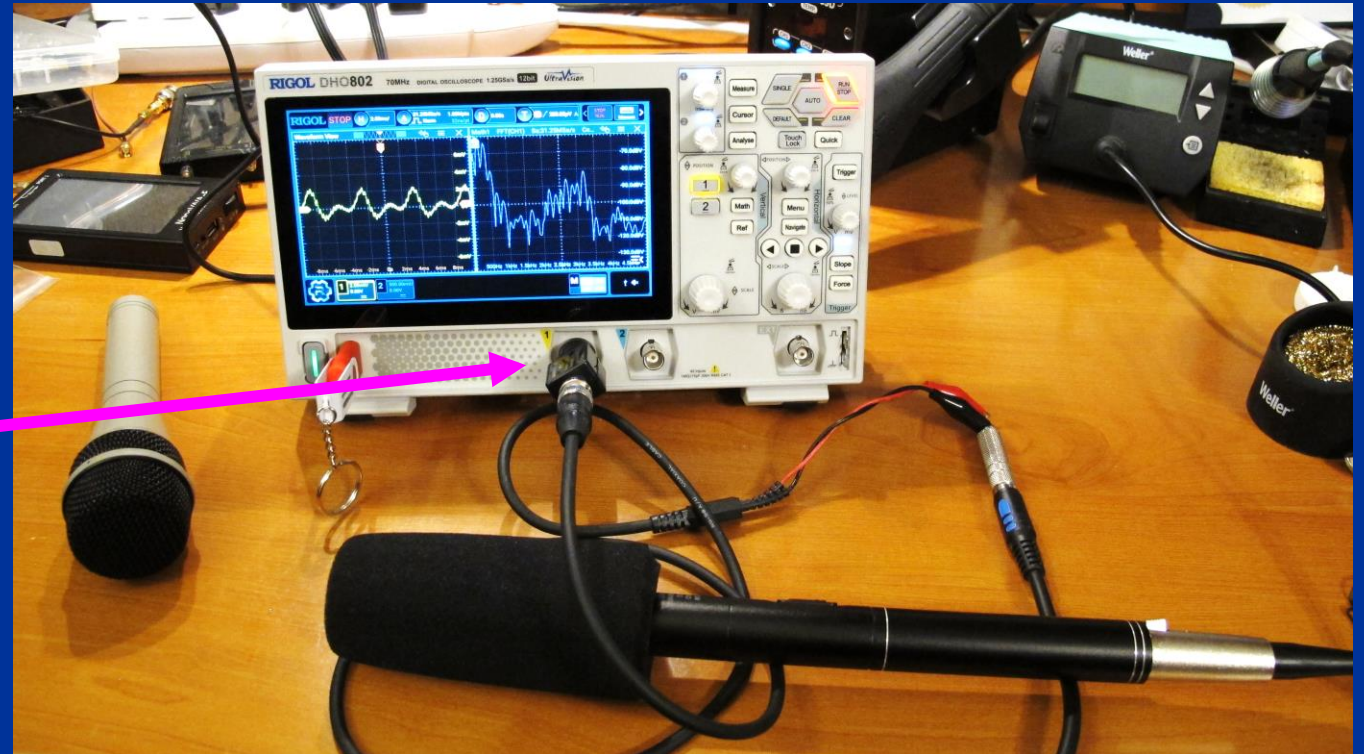
Oscilloscopes, Microphones And Noise



The Goal: Observe/Analyze Audio Signals from Microphones, etc.

Vowel Sound 'E' waveform
and associated spectrum

Filter In Use 😊

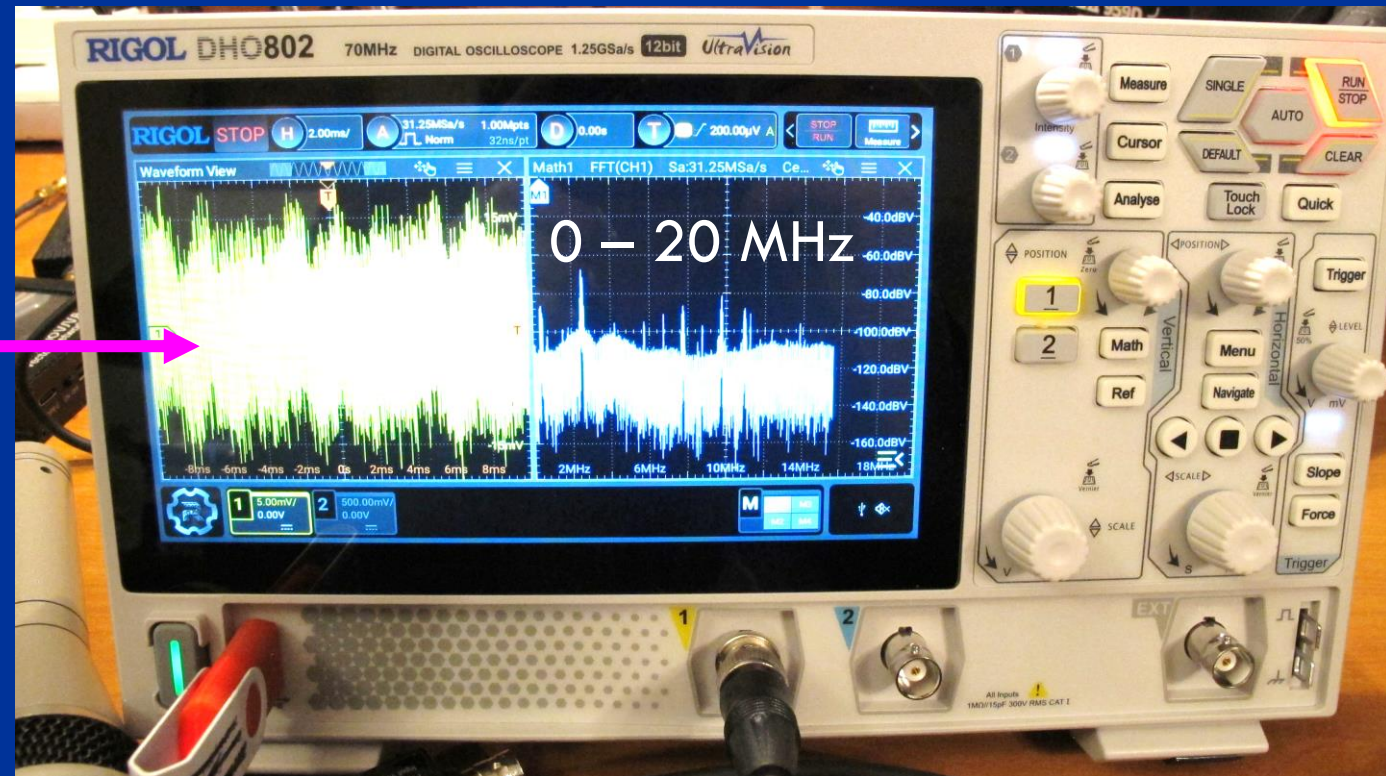


The Problem:

RF Noise From supplies, lights, etc. ☹️

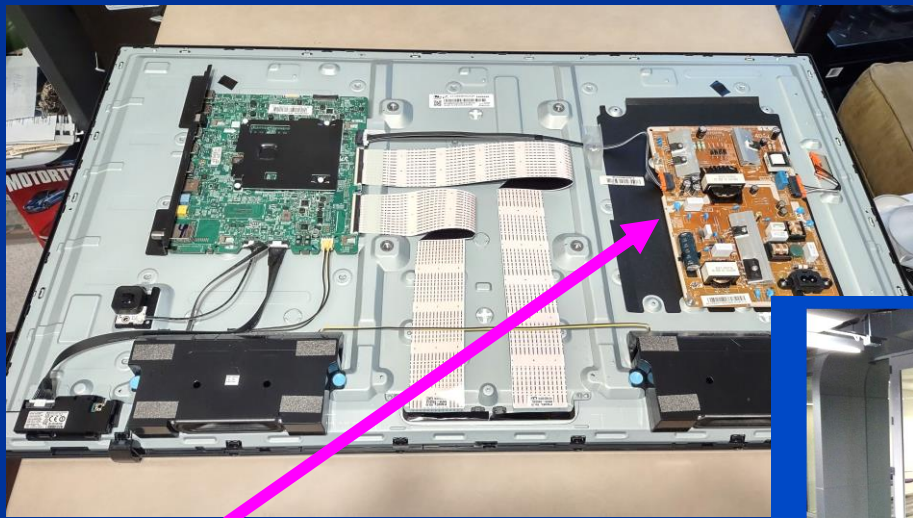
Filter Not in Use

3 mVpp waveform is impossible to see due to 30 mVpp high-frequency noise ☹️



Who's Making all this Noise ! ?

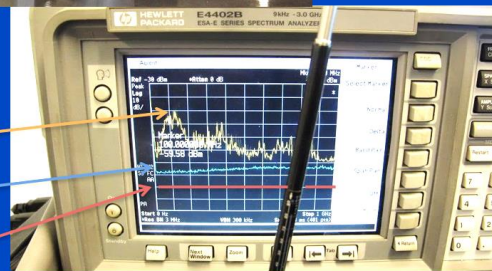
Switch Mode Power Supplies, Lights, and Radio Transmitters



SMPS in Television
(and everything else 😞)

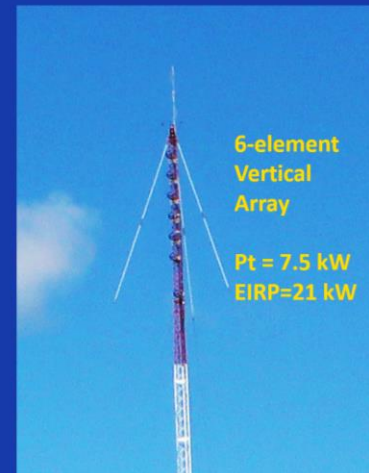


In-building RFI
Analyzer noise floor
Thermal floor



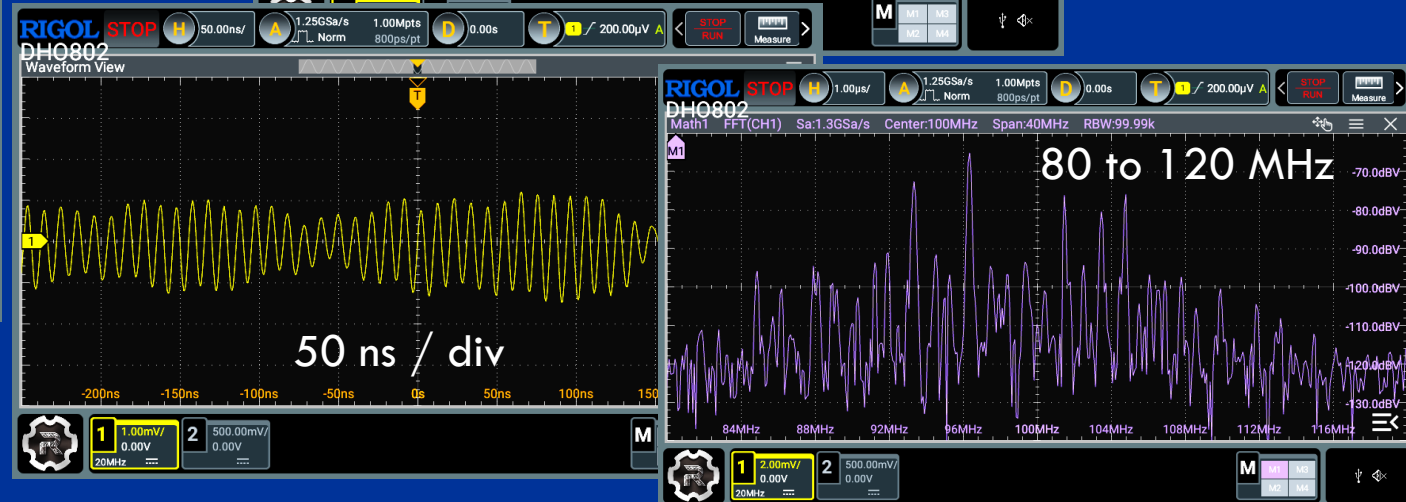
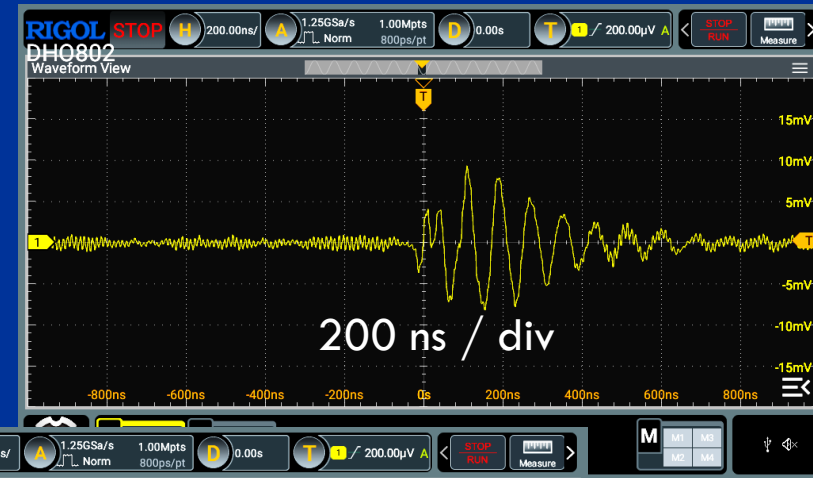
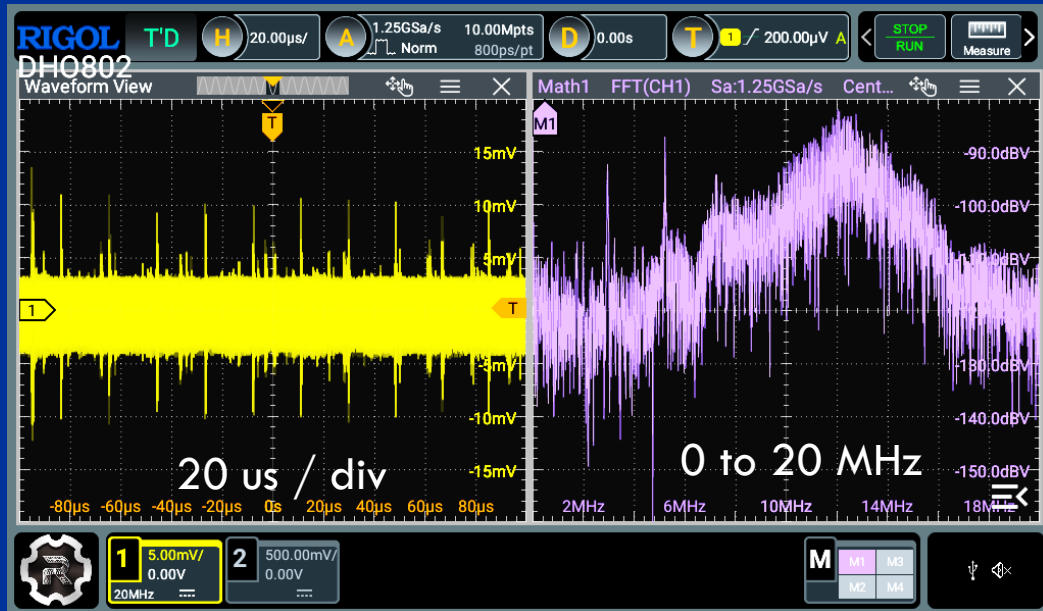
From Radio Design 101, Epilogue 1

What makes some signals so strong ?



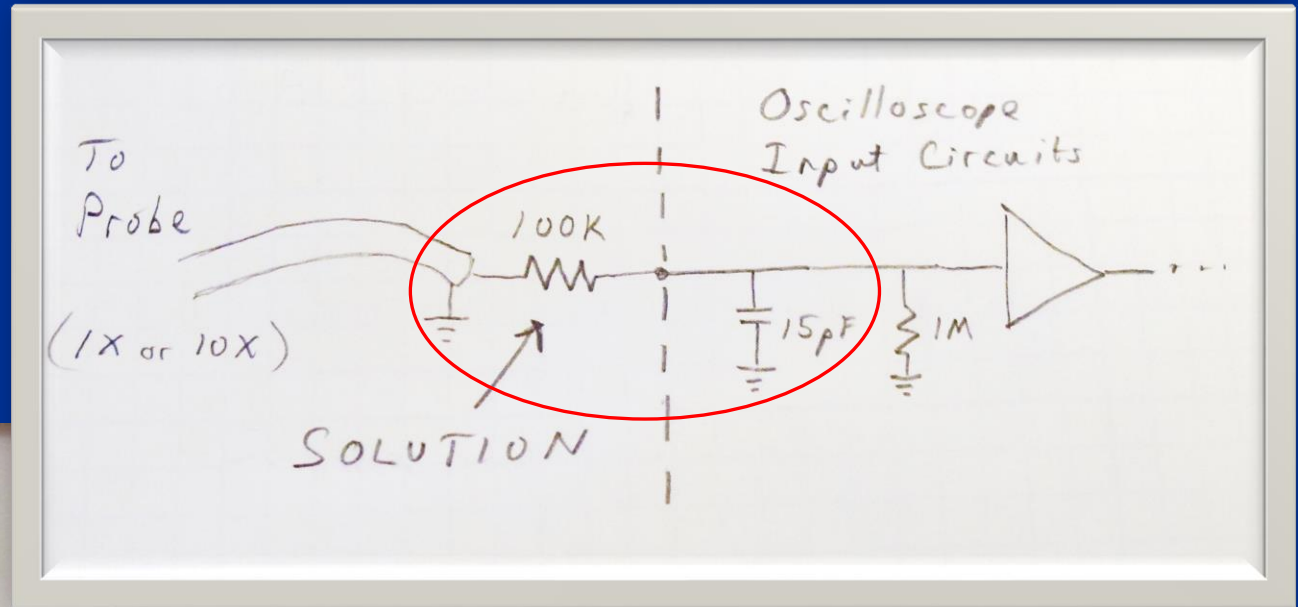
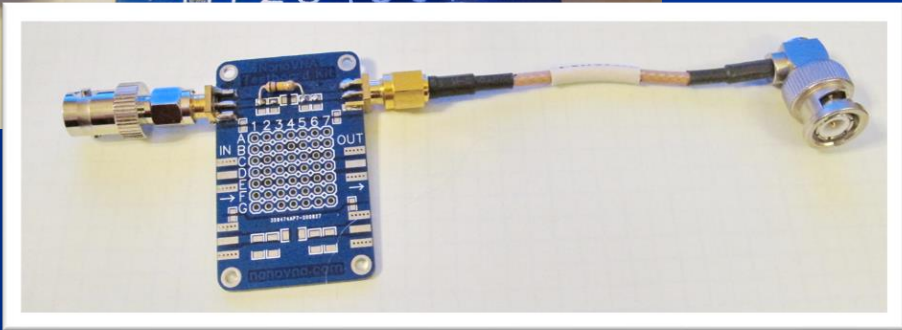
Why Doesn't This Noise Impact Audio Equipment ?

It's much higher in Frequency ...



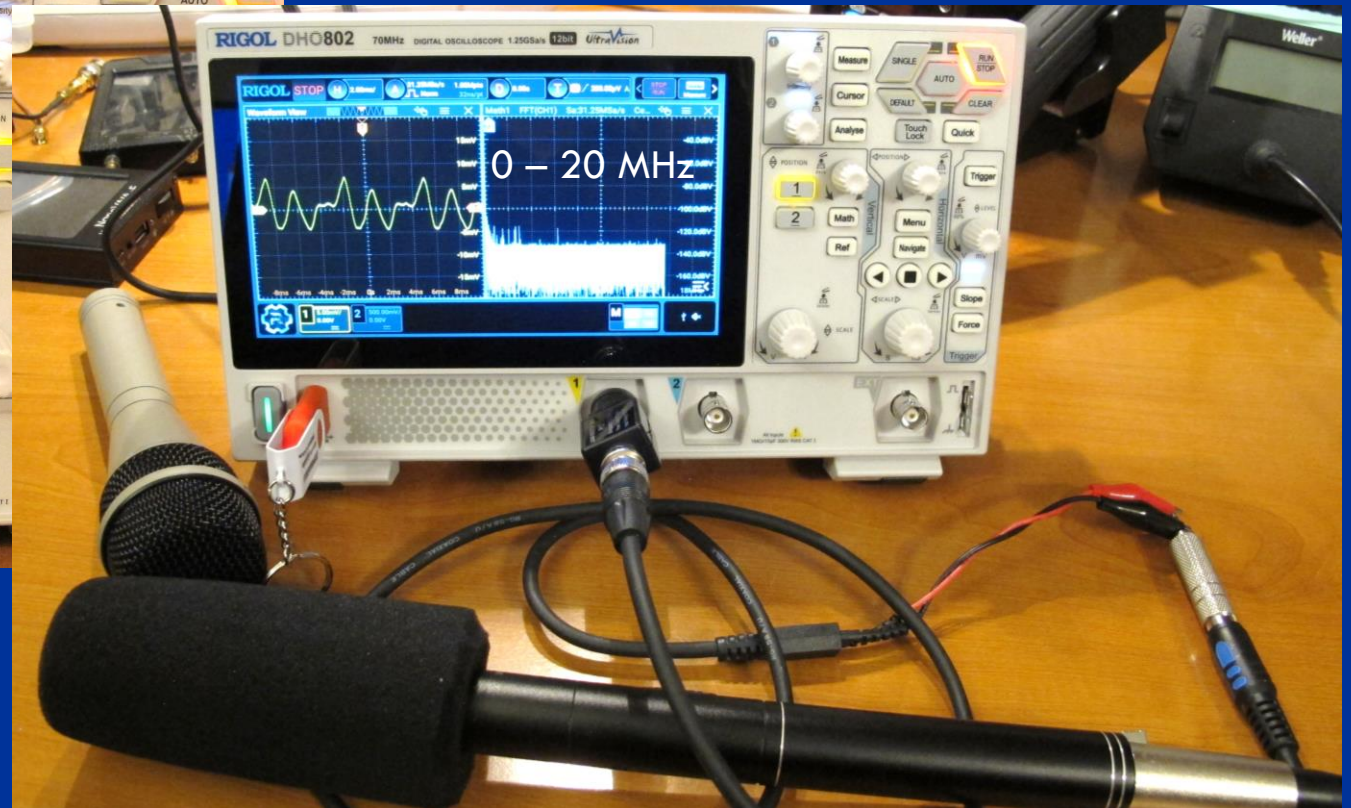
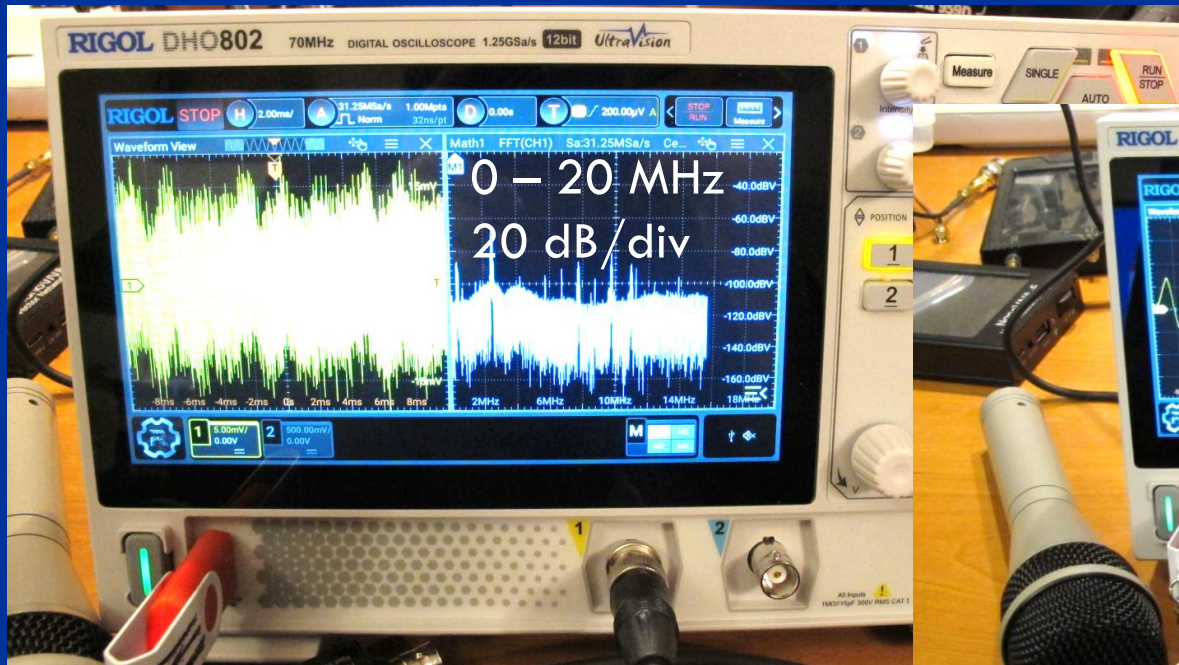
Audio is 20 Hz to 20 kHz.
So... filter the noise out !

Simple Solution: Add In-line 110K Resistor To Create 100 kHz 'ish Lowpass Filter ☺



Works well with a single 110 K resistor
(or 100K, or anything close ☺)

Comparison: Without and With Filter

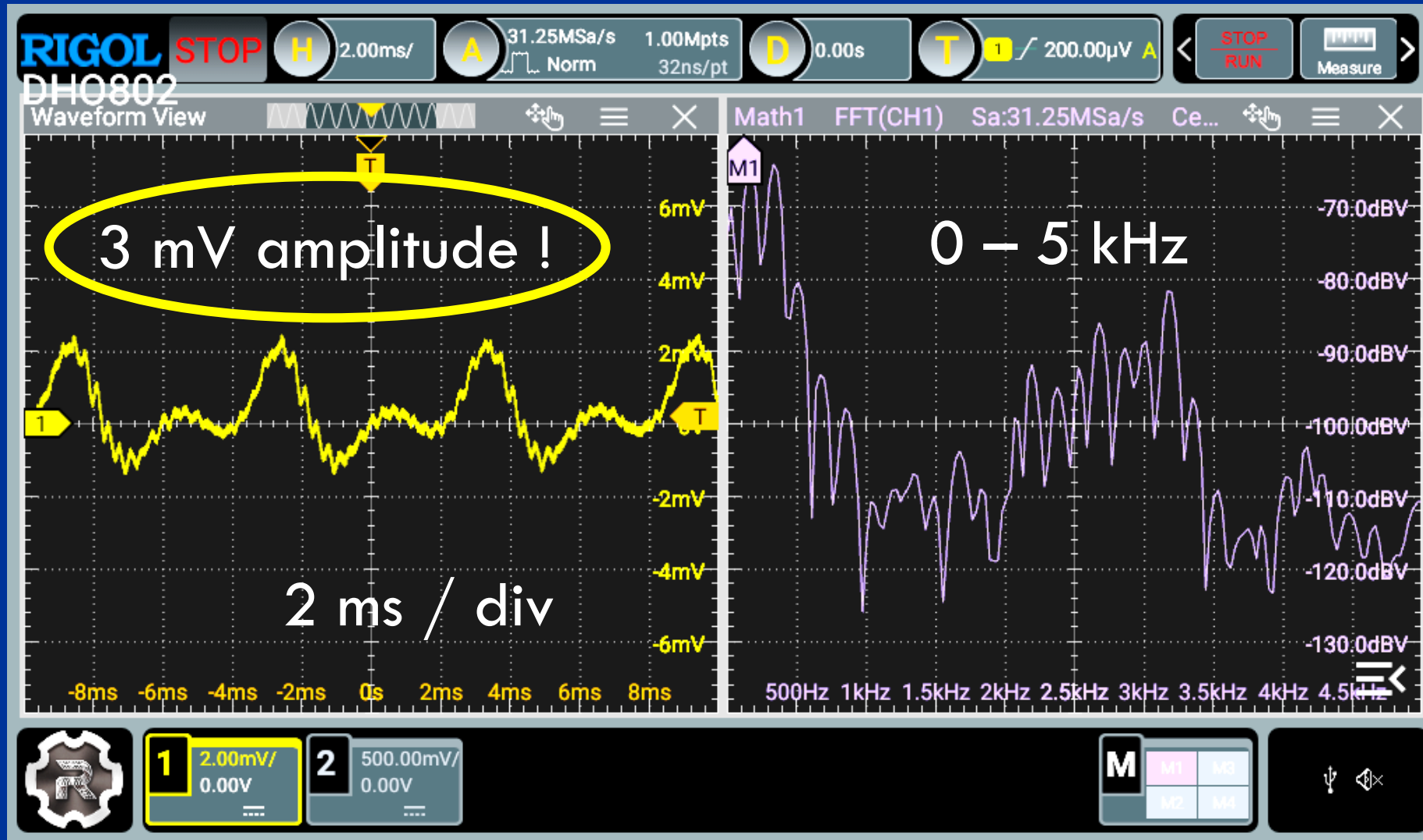


Refined Solution

- Purchased 50 Ohm Termination to use as housing (e.g. from Amazon or AliExpress)
- Removed components and installed 10K series R and 100 pF shunt C
- V-division decreased from 10% to 1% at input to scope
- Appears to work well on both 1X and 10X (if compensation cap on probe readjusted)



Vowel 'E' Waveform and Spectrum



Total Cost < \$15

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- [PORTABLE AND USER-FRIENDLY] With its compact body, our BNC Connector is incredibly easy to carry and operate. Perfect for on-the-go users needing quick and efficient connections.
- [PRECISE MEASUREMENTS] Accurate measurements are crucial, and that's exactly what our Load Resistor 50ohm P57 delivers. Benefit from our tool's high measurement accuracy that ensures reliable results every time.
- [LONG-LASTING] Enjoy the benefits of our BNC 50 Ohm Terminator for longer. Designed for a long service life, this coaxial cable adapter connector is a reliable long-term solution for your connectivity needs.

Customers usually keep this item

This product has fewer returns than average compared to similar products.

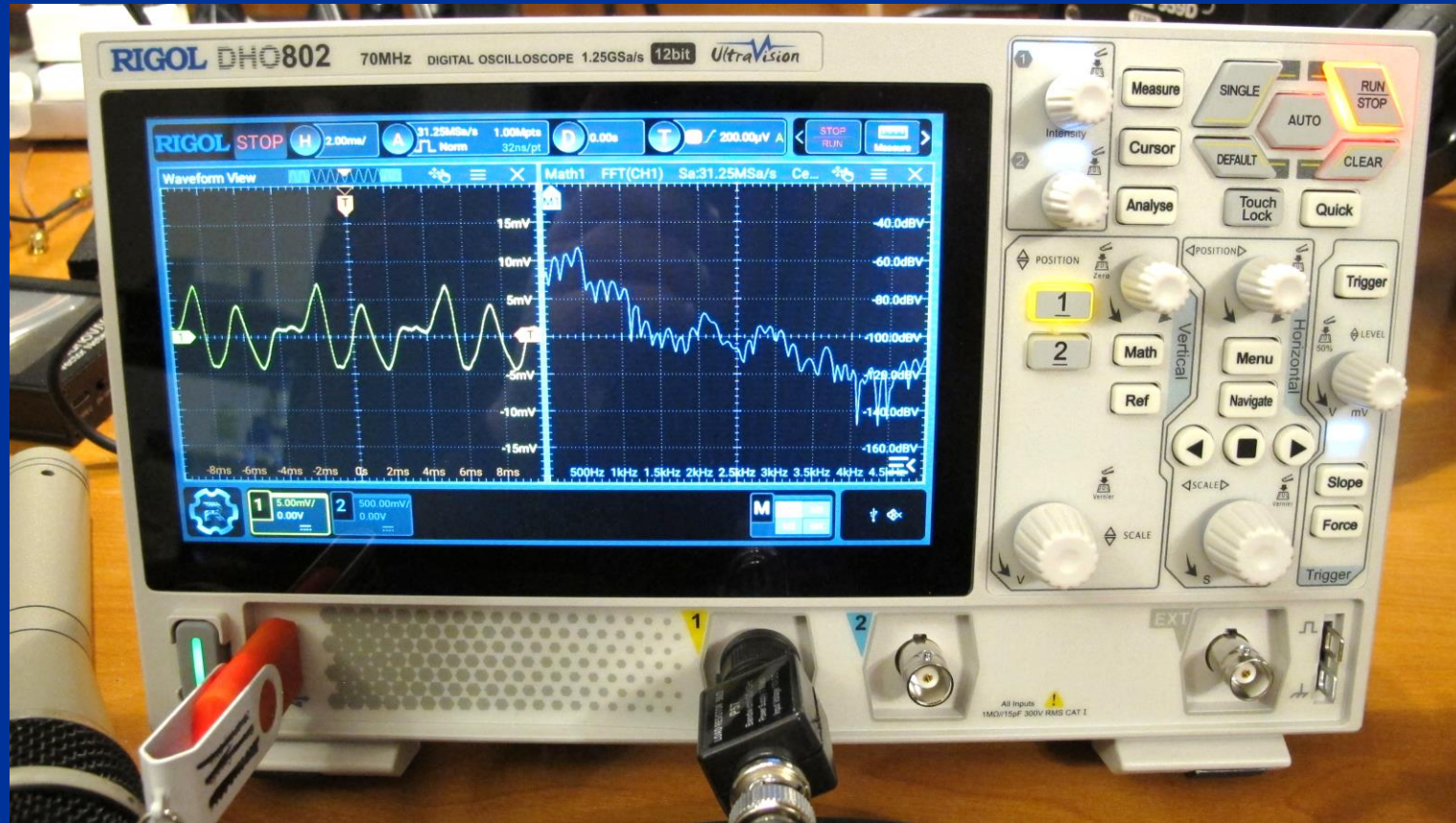
\$11.34 for housing

+ \$0.02 for SMD parts
(R and C)

Conclusions

- **This works amazingly well !!** (better than scope's built-in DSP filters)
- Restores ability of scope to display microphone signals without needing (audio) preamp
- Could be useful for other low-frequency, low-level signal probing as well
- Why isn't this commercially available ?
- Probe manufacturers could add it, or offer "audio probes"
- Especially valuable with newer 12-bit scopes ...

Thanks for Watching !



Which Vowel
Sound Is This ?