W5HN

North Texas NTMS Microwave Society

Assorted Projects
N5BRG

May 18, 2024

Coppel, Texas

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Astrophysical Masers

- Emit radio waves at multiple frequencies
  - OH maser ~ 1.6 GHz
  - Methanol maser ~ 6.7 GHz
  - Water Maser ~ 22 GHz and 96 GHz
- Multiple sources to observe
  - Charts available with know sources and
  - Their locations.
- Week sources of energy requires skill
- See SARA at: Radio-astronomy.org

Dimitry Fedorov UA3AVR

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A small single dish maser telescope...

... is the scope of consideration

1.High T_{sys}, low sensitivity G (forward gain in K/Jy);

2.High SEFD= $T_{sys} / G \approx 250\,000$ Jy for the dish 1.8 m right →→→;

3.Long integration time ~ 2 hours, possible multiday observations.

Low S/N observations.
Much effort is needed to drag out a maser line from noises.

6.7 GHz methanol line telescope. The dish and downconverter outside, IF ≈ 969 MHz.

LO=5731

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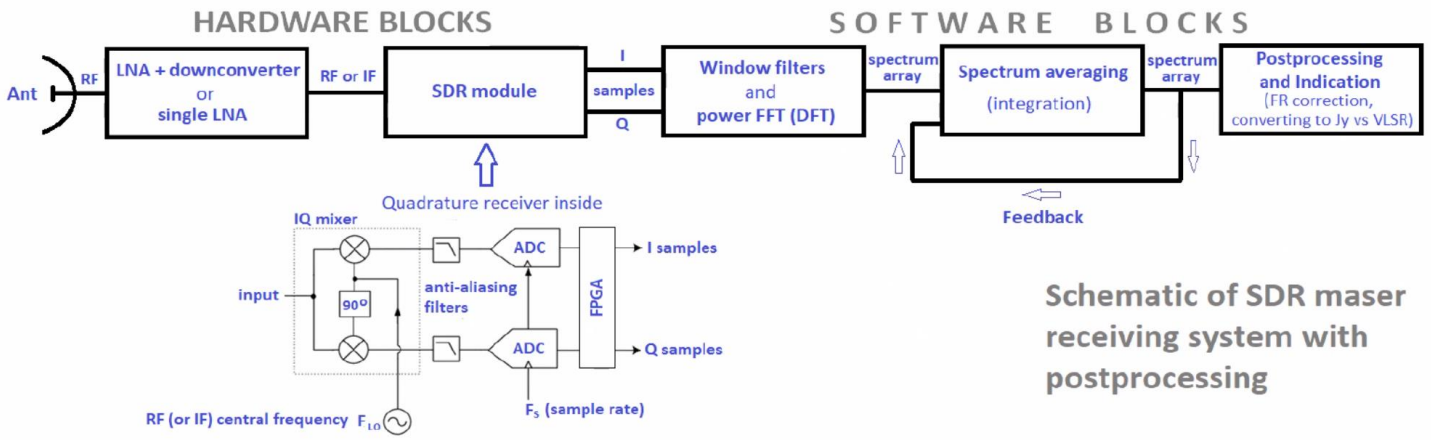
Dimitry's Receiver System

SDR in maser receiver systems (hardware + software)

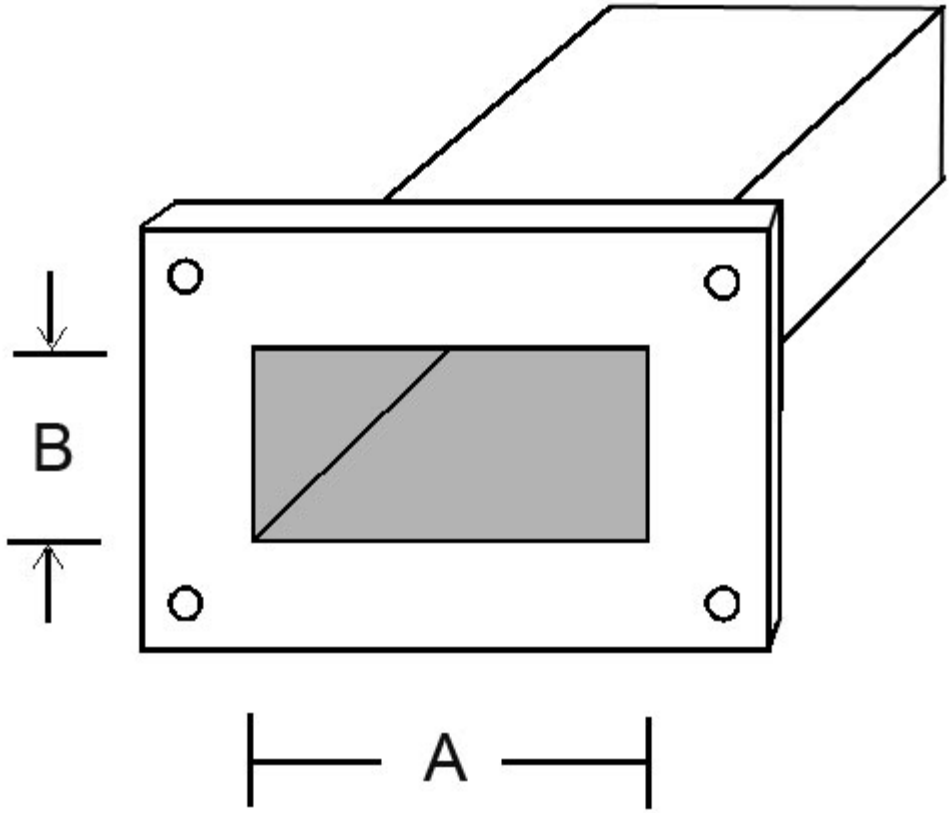


Schematic of SDR maser receiving system with postprocessing

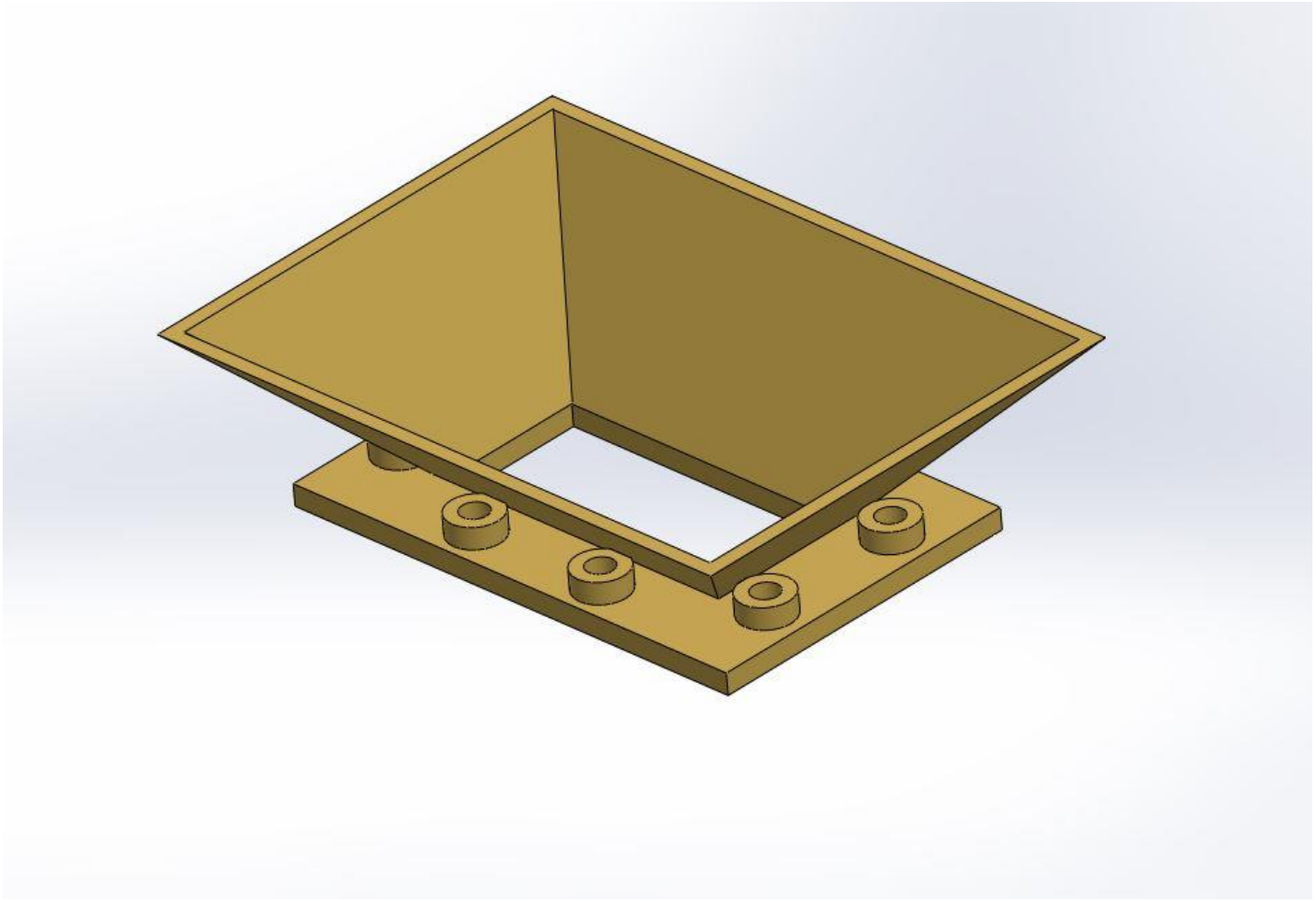
Needed number of averages in the feedback block:

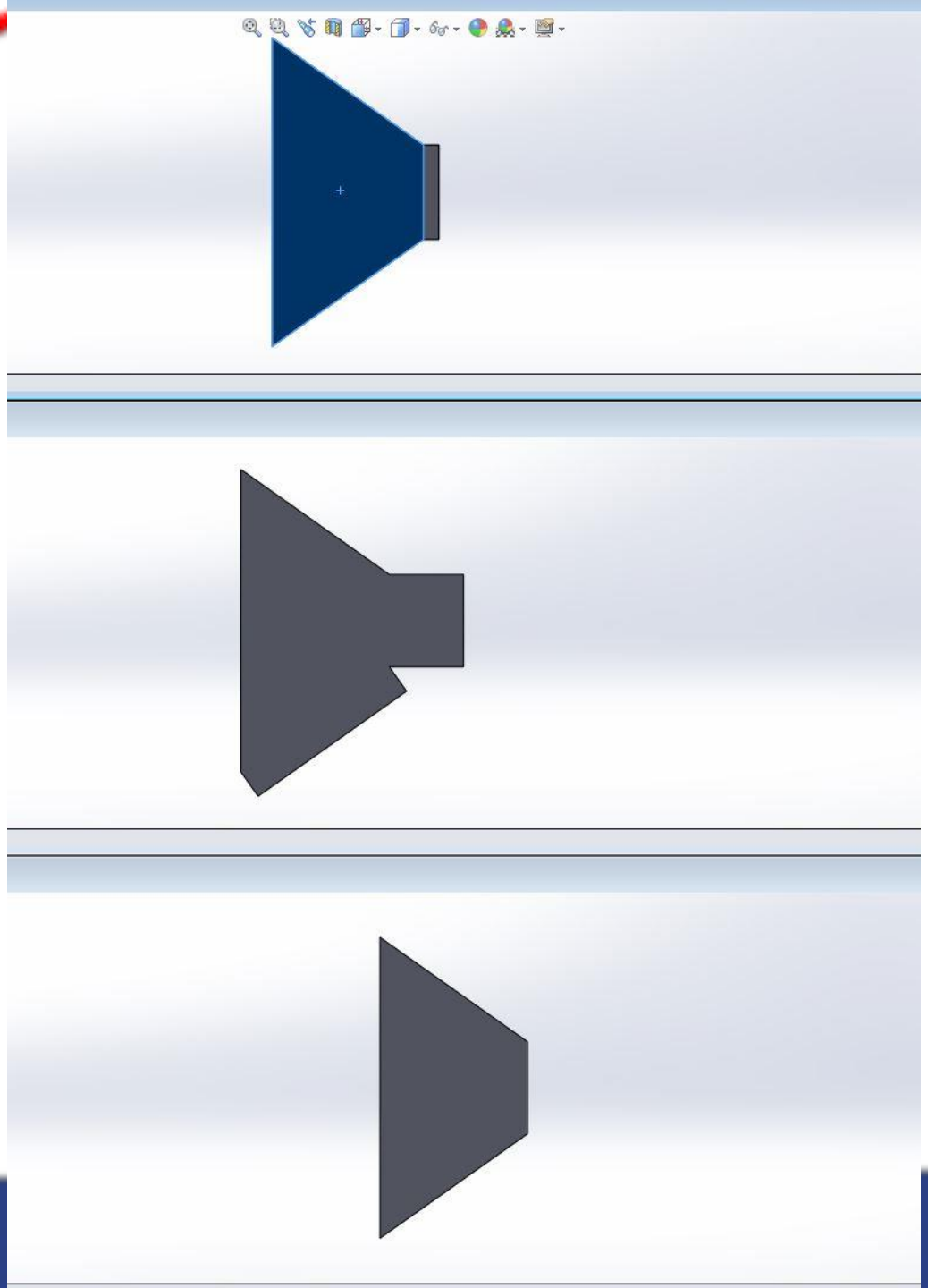
$$M = \text{round}\left(\frac{\Delta t\, F_s}{N}\right) = \text{round}(\text{RBW}\,\Delta t)$$

1. ***Fs*** – the sample rate (receiver bandwidth);
2. ***N*** – number of FFT points (bins in spectrum);
3. Δt – the integration time;
4. RBW – the Resolution Bandwidth.


B
A

WR 137 3D Printed Horn
5.85 GHz to 8.20 GHz





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Transverter 6 GHz Range

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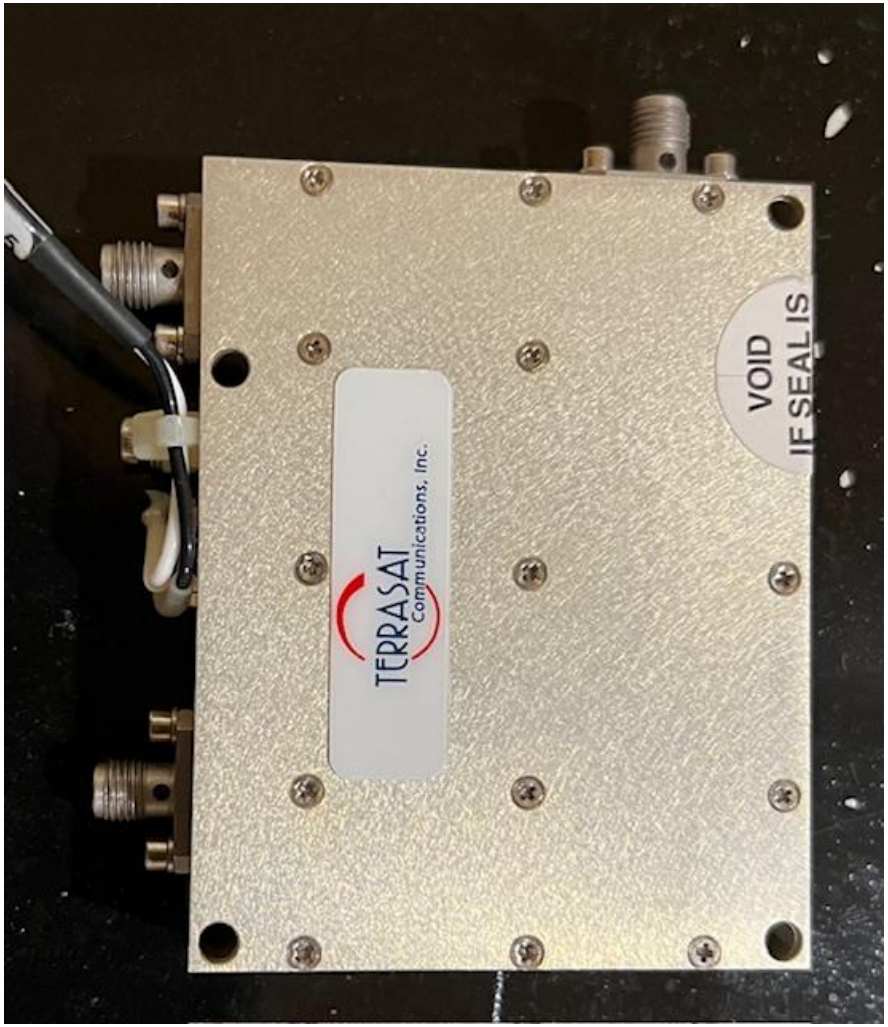

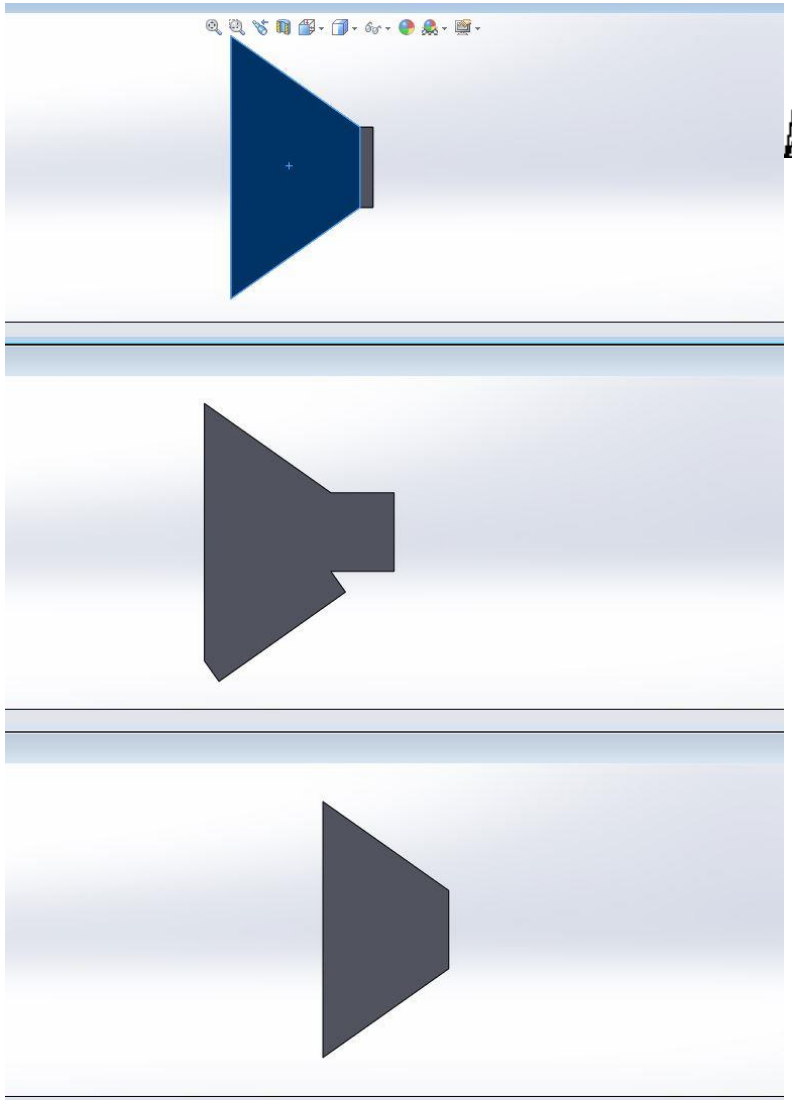

Personal Space Weather Station | HamSCI.org

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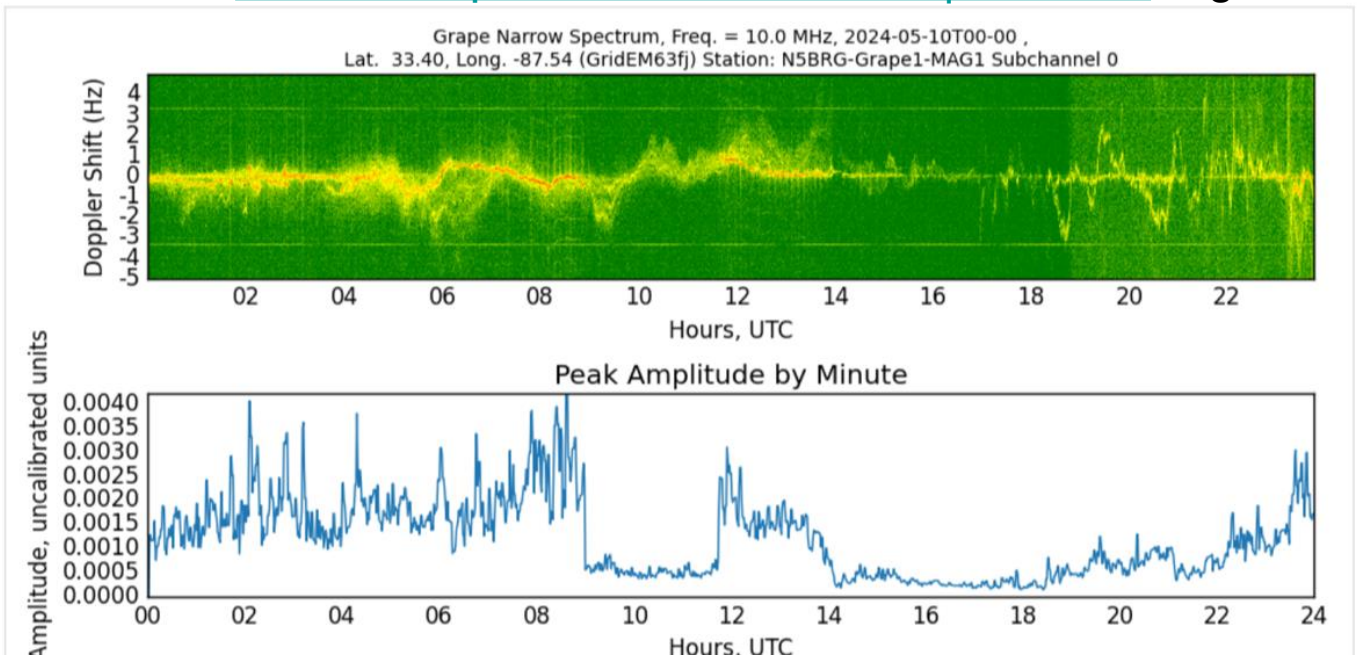

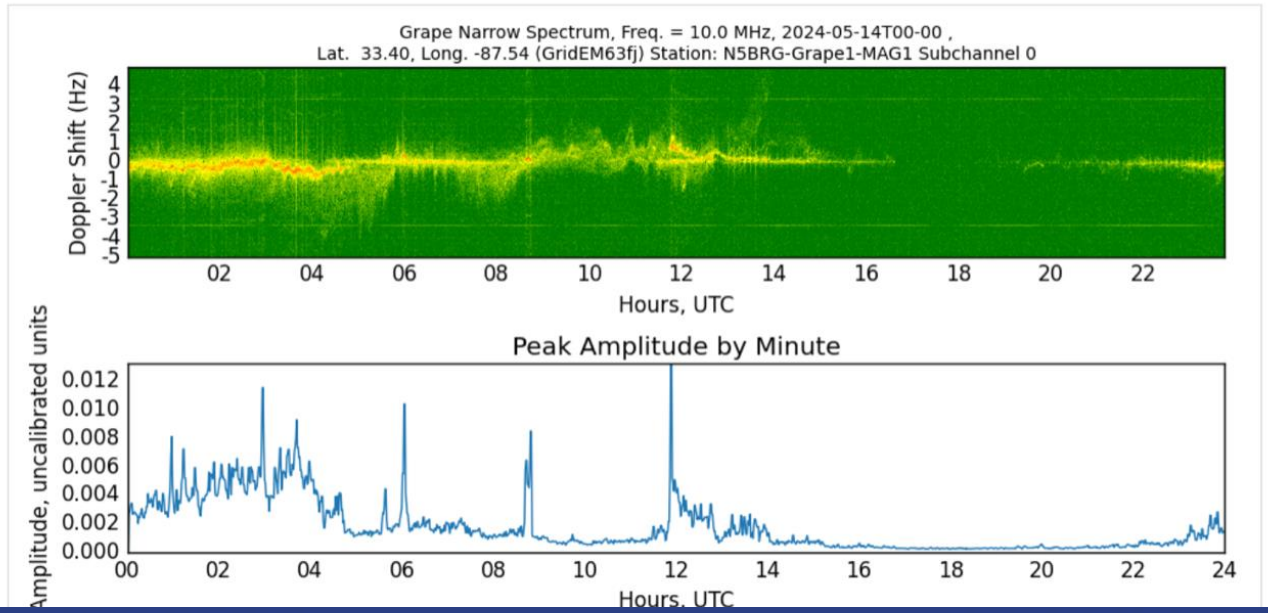

Photo take during 4/8/24 Eclipse using Detraction Gradient Filter

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Generate Negative Bias Voltage

Reduced Power Supply Noise – No Charge Pump

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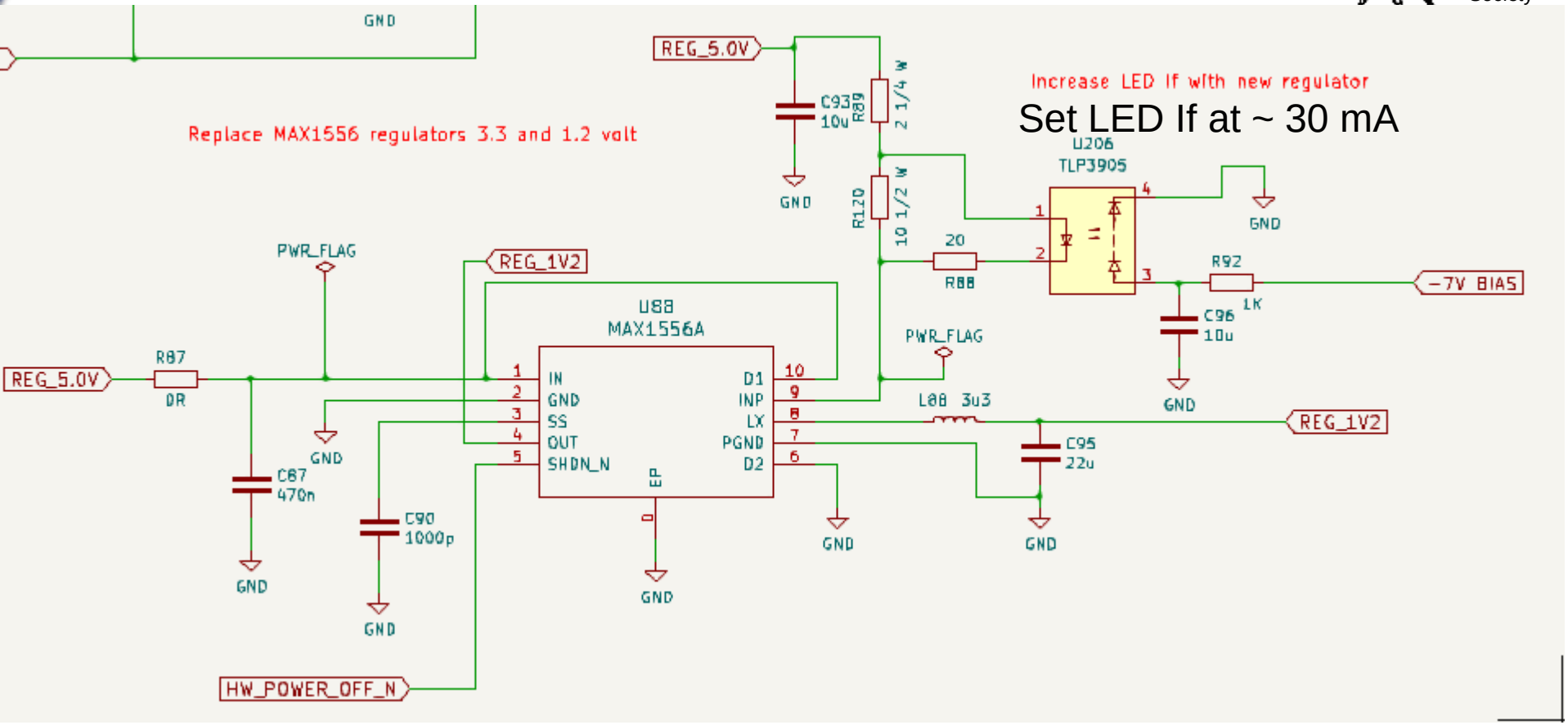
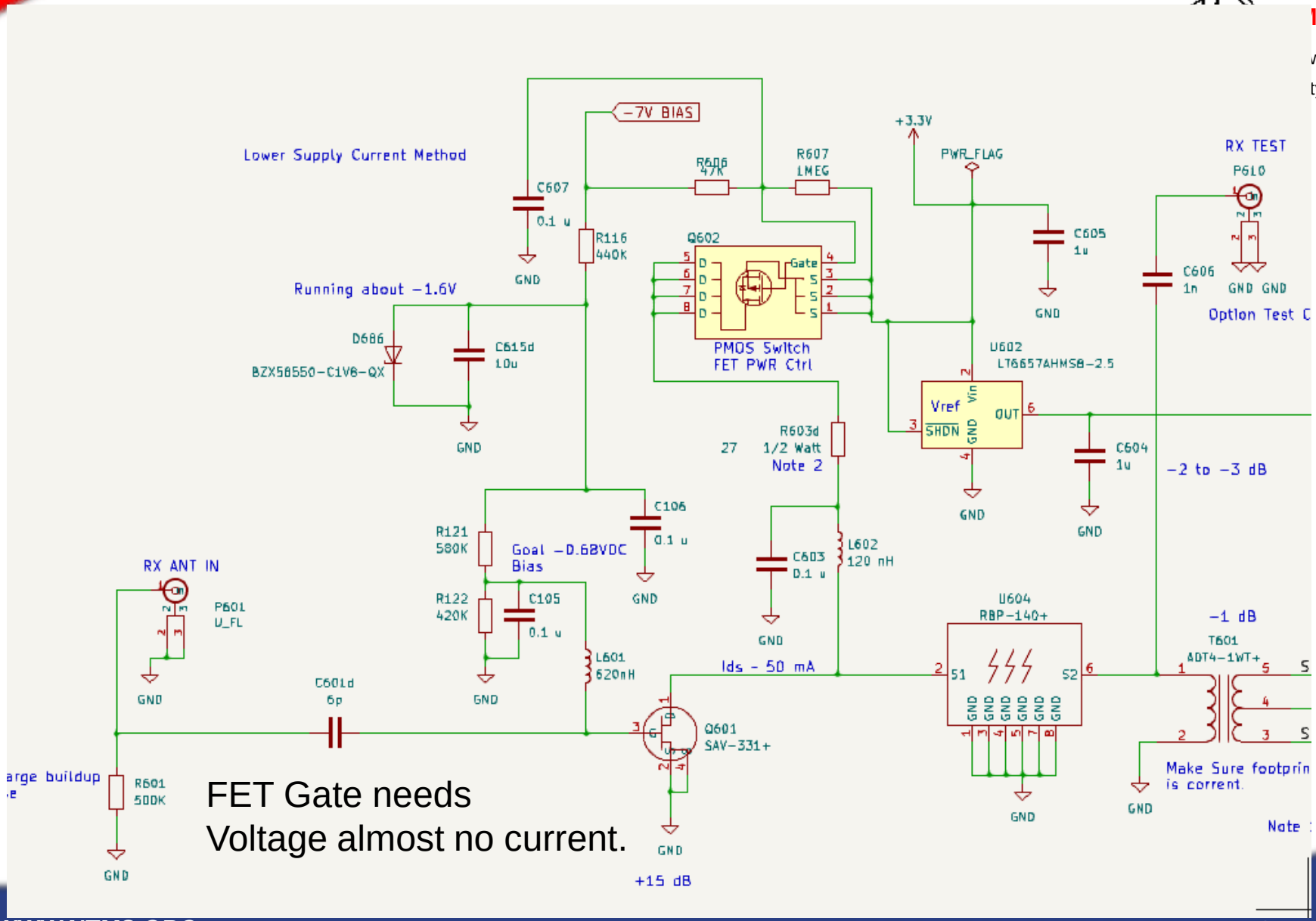


Negative Biasing FET Gates



FET Gate needs
Voltage almost no current.

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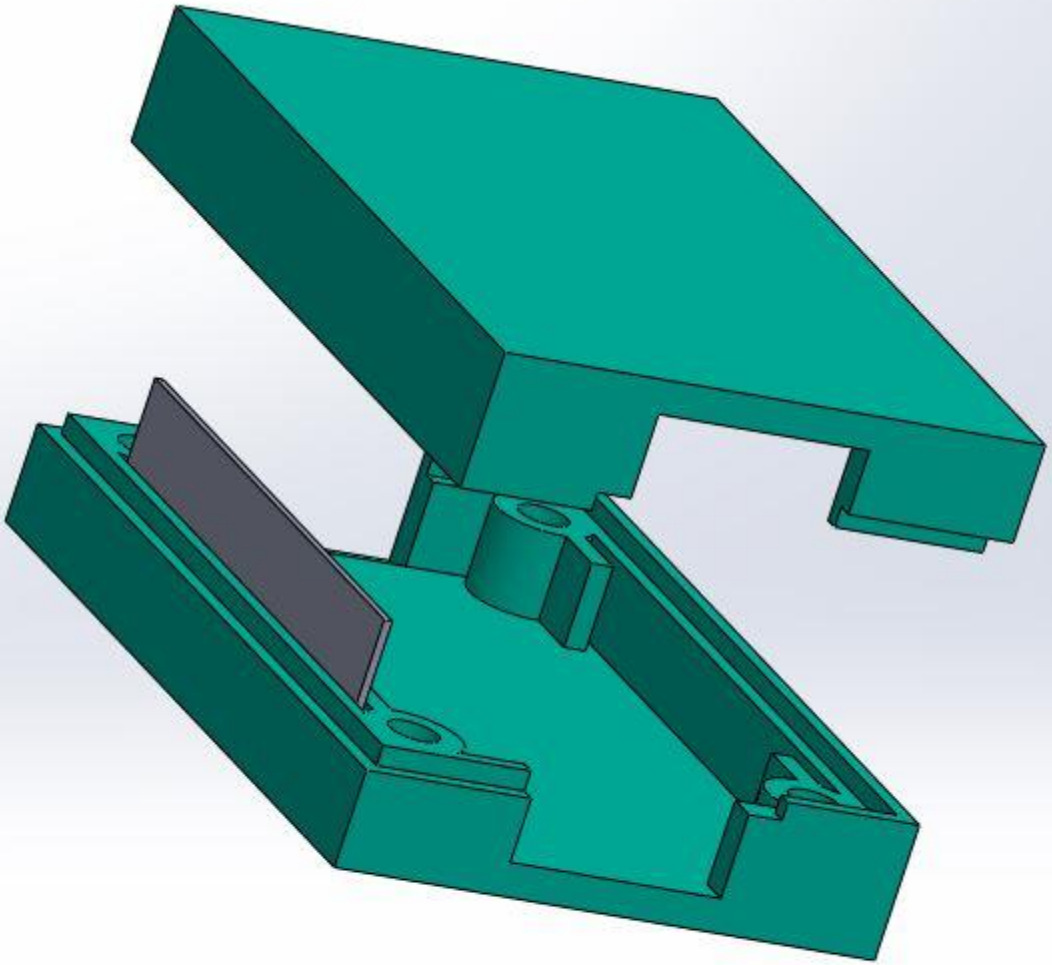
3D Prints
7” X 7” X 7”

3D Printing requires the use of CAD mechanical Design software and some knowledge of how to design A part.

I use Solidworks 3D CAD software which is available for Hubbie use with a reduced fee. This is the best software IMHO. There are free CAD packages available.

Operating the 3D printer requires a learning curve. Lots Of how to YouTube videos available. PRUSA is very supportive Of user base.



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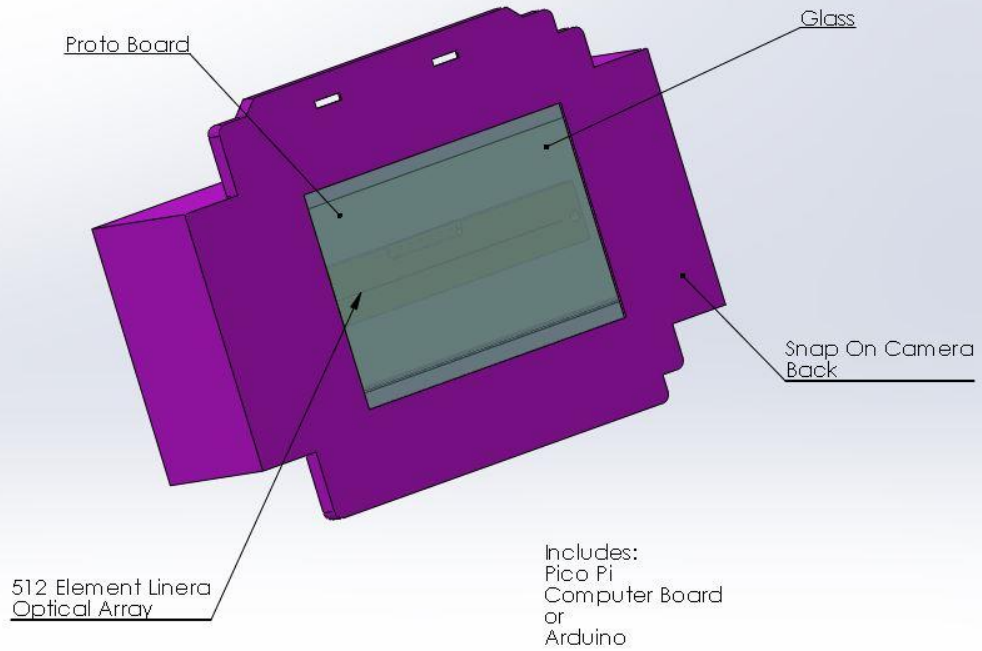
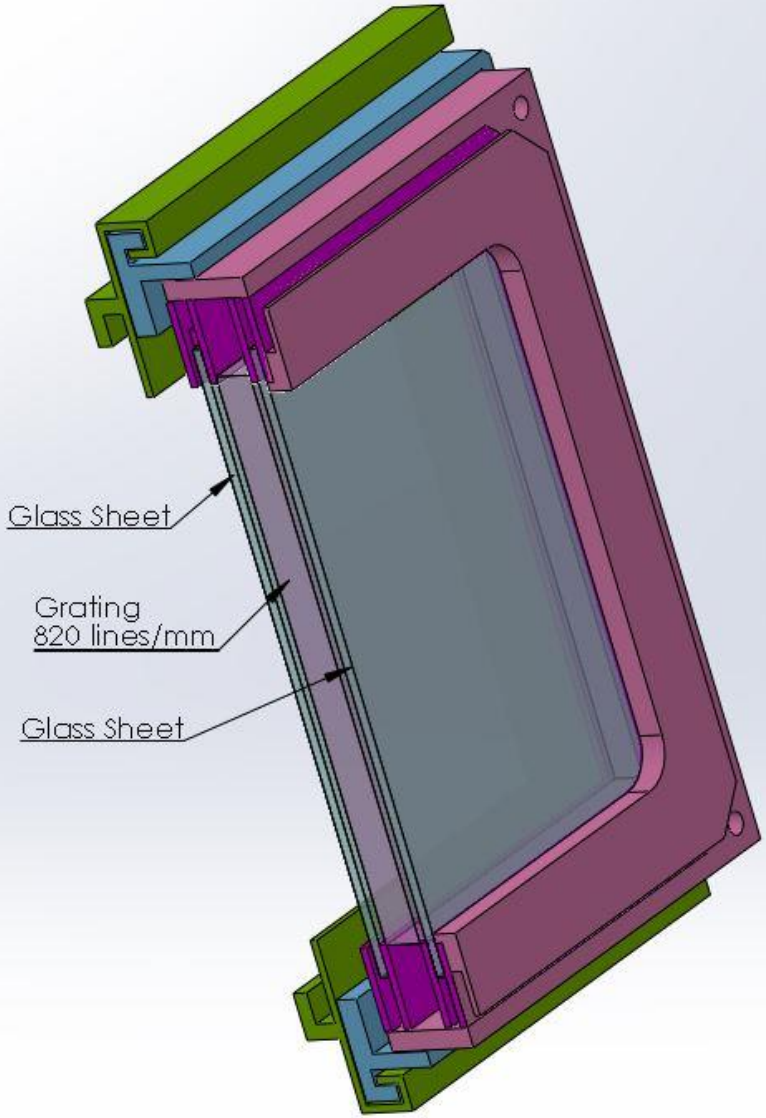
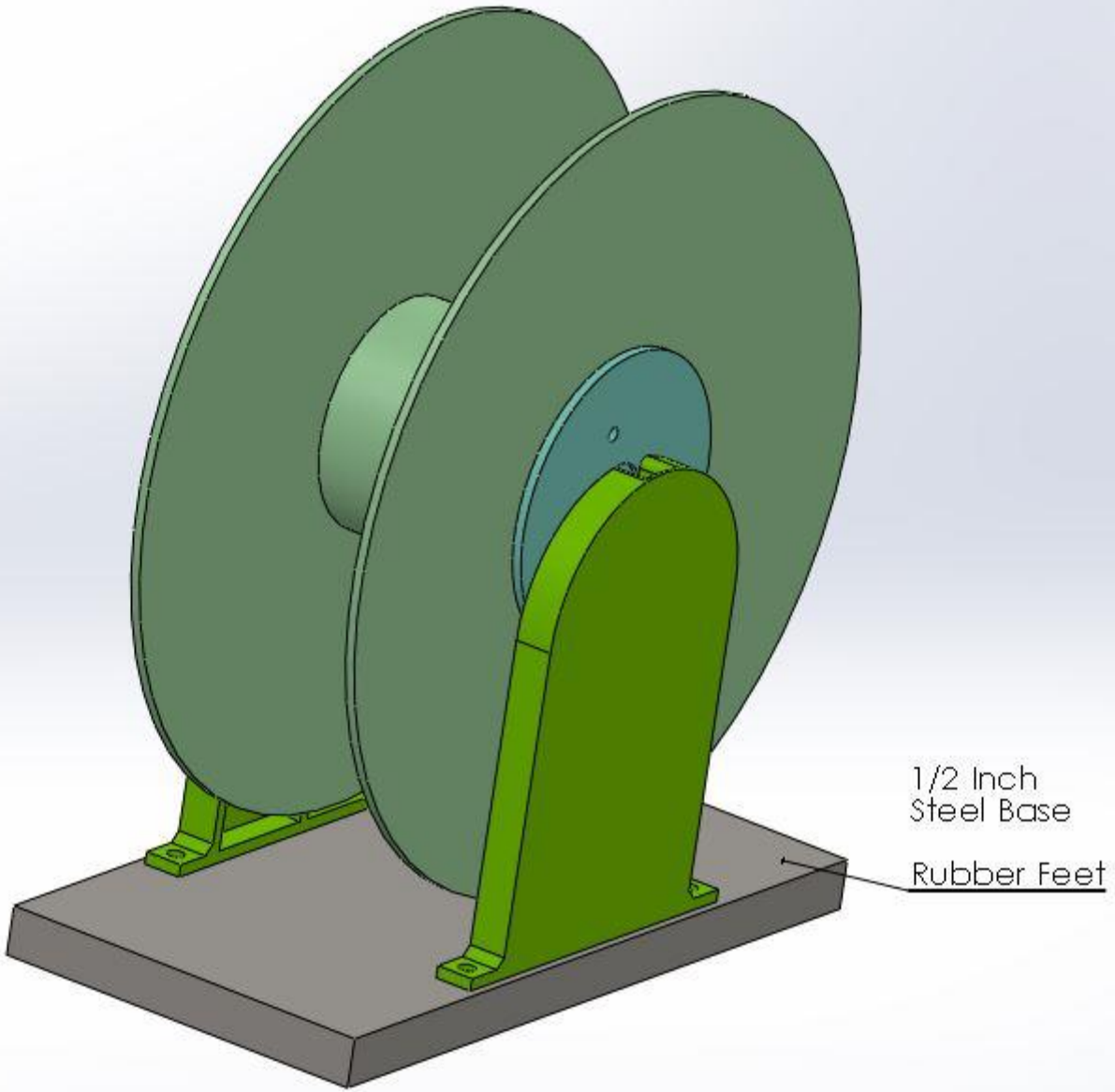


Includes:
820 line/mm
Detraction
Gradient

Temp, Humidity,
Pressure sensor
And
Light Calibrator
Red, Grn, Blu,
IR LEDs


Glass Sheet
Grating
820 lines/mm
Glass Sheet


1/2 Inch
Steel Base
Rubber Feet

Jose H Arreguin Martinez
KG5YQO

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Importance of Impedance Matching

- Needed for High Power Amplifiers
  - Example:
    - VDD = 50V, Pout = 100W
    - $\frac{VDD^2}{R}$ = 2 x Pout , Consider AB Class or "Greater"

f MHz	Z_{source} Ω	Z_{load} Ω
500	1.2 + j3.9	5.9 + j3.5
1000	1.0 + j0.3	5.5 + j2.9
1500	0.8 – j0.5	3.4 + j2.0
2000	1.2 – j2.0	4.7 + j0.3
2500	2.7 – j3.8	3.7 + j1.4

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.

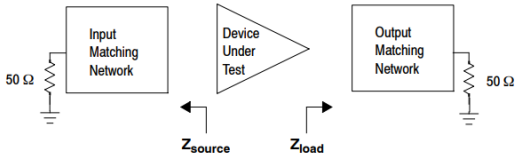

Figure 7. Narrowband Fixtures: Series Equivalent Source and Load Impedances

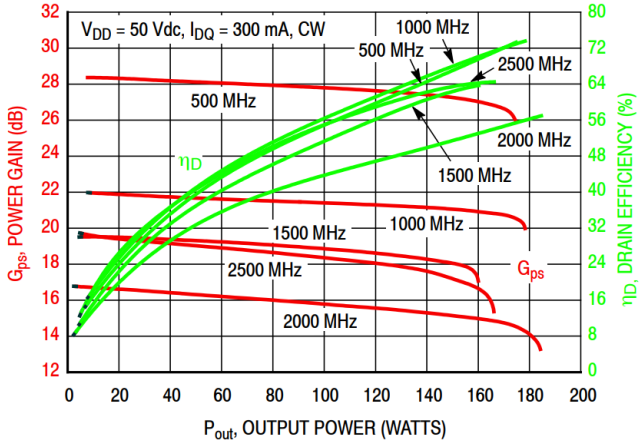

Figure 6. Power Gain and Drain Efficiency versus CW Output Power