HF "Go Box"

WITH ANTENNA ANALYZER/TUNER, PAN ADAPTER AND DSP POST PROCESSOR

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1-9-2020

Compact Portable HF Rig

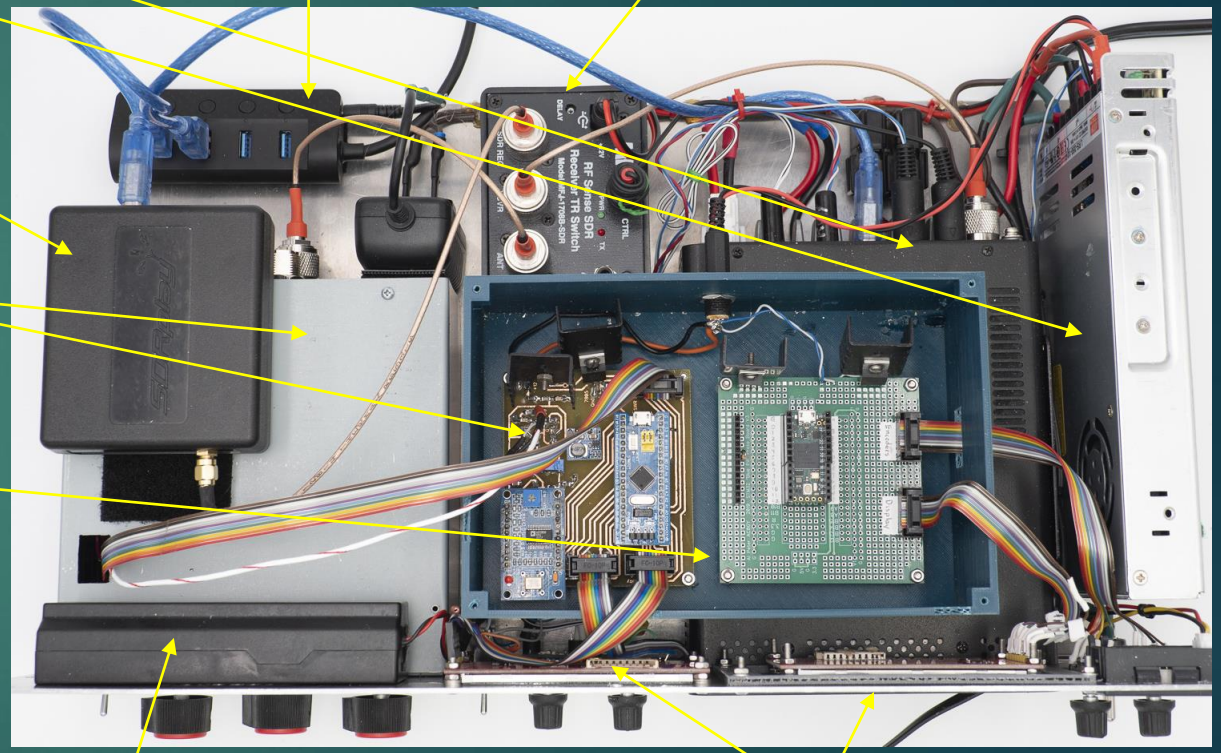
- Objectives
  - HF coverage
  - 100W
  - Self-contained,
  - Minimal external connections.
- Includes:
  - FT-891
  - Power supply
  - Antenna Tuner
  - Pan Adapter
  - Computer
  - DSP Post-processor
  - Protective case

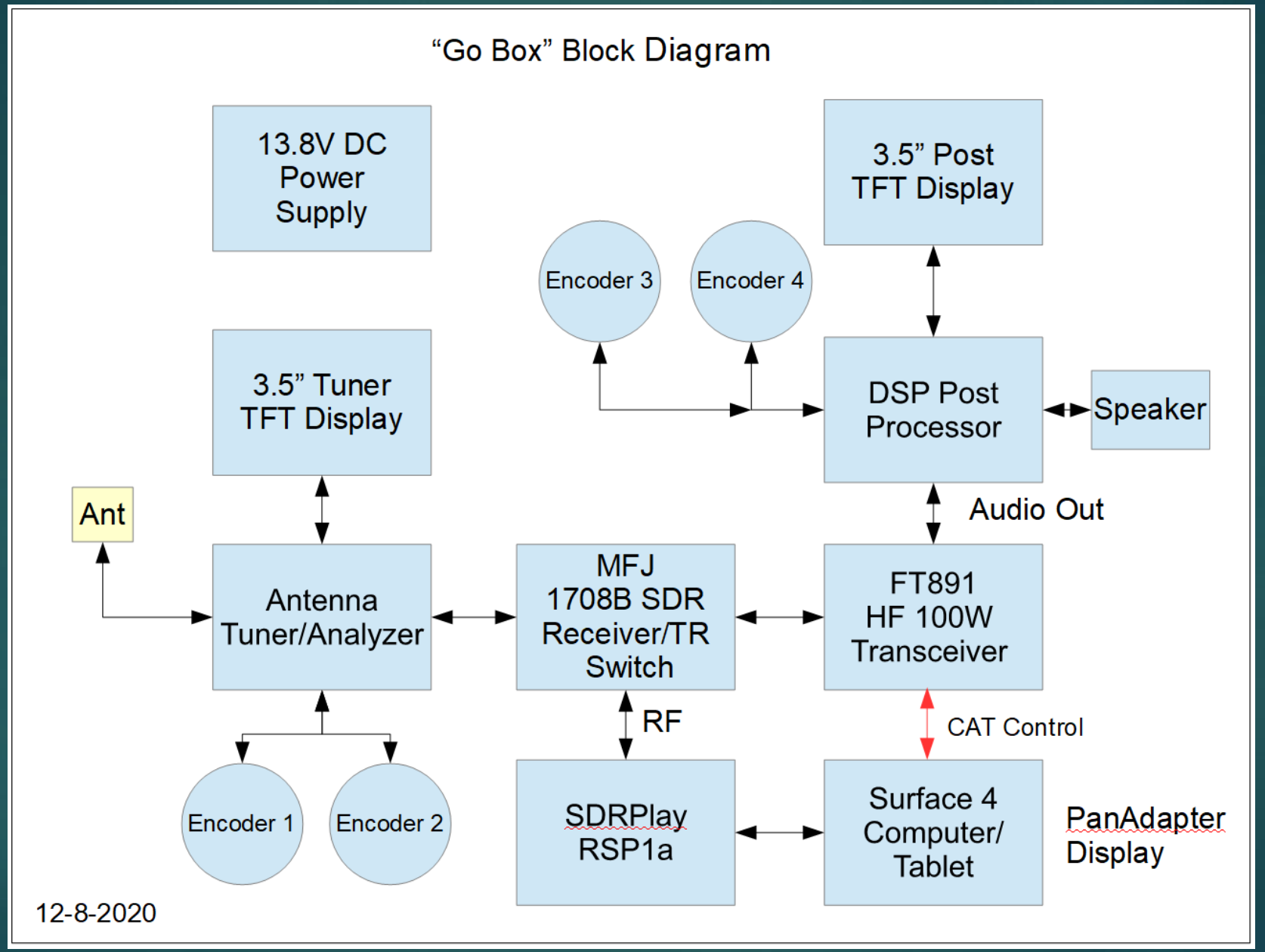
2019 Field Day Setup

- FT-950
- Clutter
- Lots of wires
- Many connections
- 30 min. + setup time

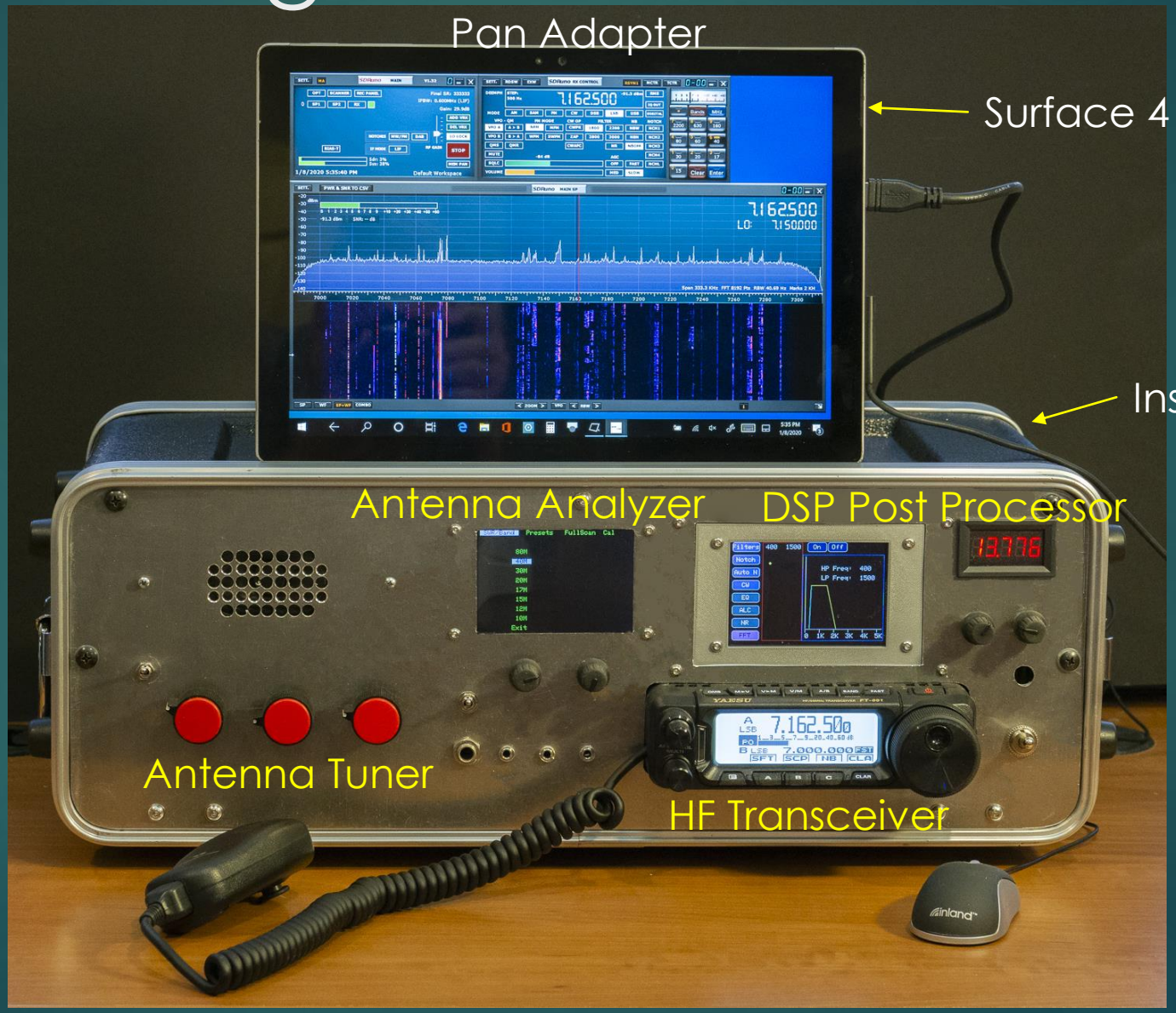
Portable Rig Components

- HF Transceiver – Yaesu FT-891
- Power Supply – Switching Mode
  - 12 to 15V @ 28 A
- Pan Adapter – SDRPlay RSP1a
- Computer – Microsoft Surface 4
- Manual Antenna Analyzer/Tuner
  - Graphical Display
- DSP Post Processor
  - Audio signal conditioning
  - Color TFT display
- Case – Hard-side instrument case
  - 20"x14"x7"
  - 24lbs. With all gear installed



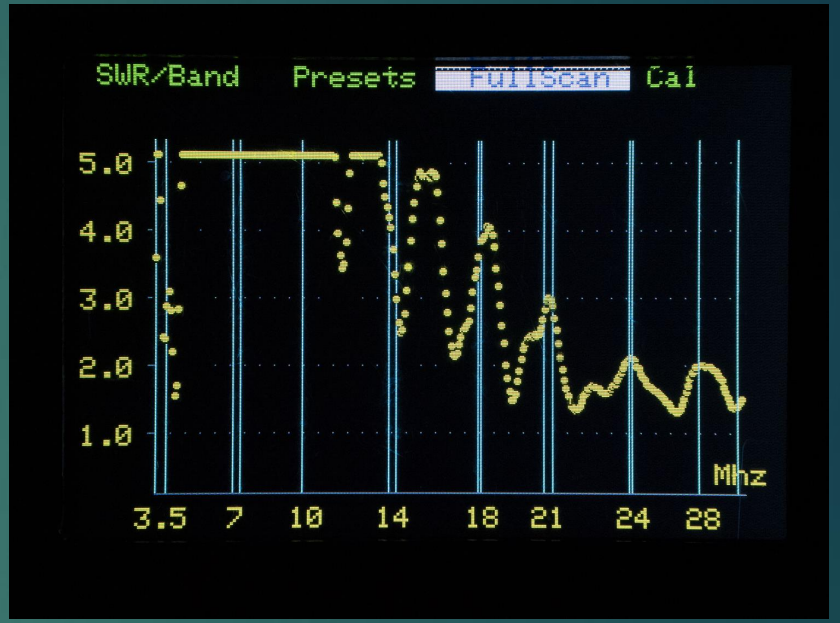

"Go Box" Block Diagram
13.8V DC Power Supply
3.5" Post TFT Display
Encoder 3
Encoder 4
3.5" Tuner TFT Display
DSP Post Processor
Speaker
Ant
Audio Out
Antenna Tuner/Analyzer
MFJ 1708B SDR Receiver/TR Switch
FT891 HF 100W Transceiver
RF
CAT Control
Encoder 1
Encoder 2
SDRPlay RSP1a
Surface 4 Computer/ Tablet
PanAdapter Display
12-8-2020

Portable HF Rig



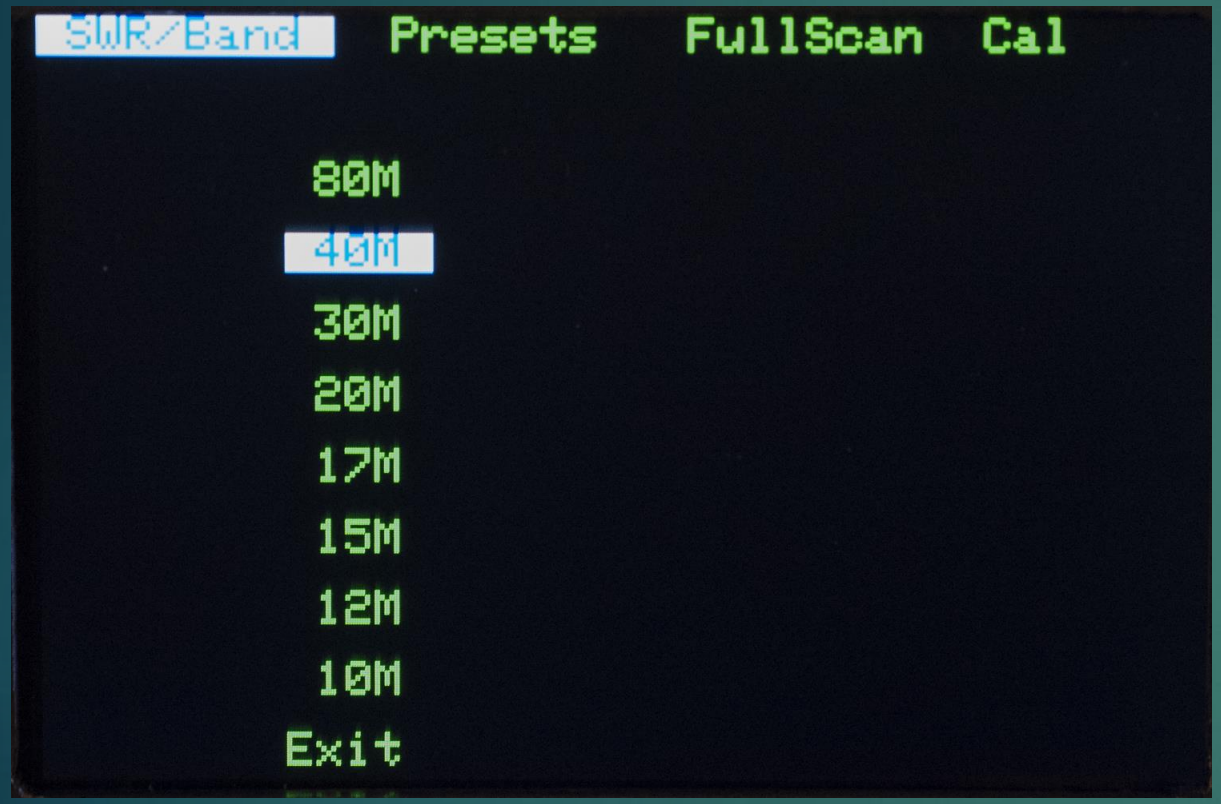
Antenna Analyzer/Tuner

- So what is new about this Analyzer/Tuner?
  - Real-time Graphical display of SWR
    - Full HF Bands Display
      - 80M to 10M
    - Individual band display
  - Fast/easy tuning –view HF bands in one sweep (50 ms refresh time)
  - Repeatable settings
- Why use a Manual Tuner?
  - Manual is inexpensive - $20 or 30 vs $200+
  - Auto tuning generally not needed with the antennas we use
- Small size – fits in the portable case

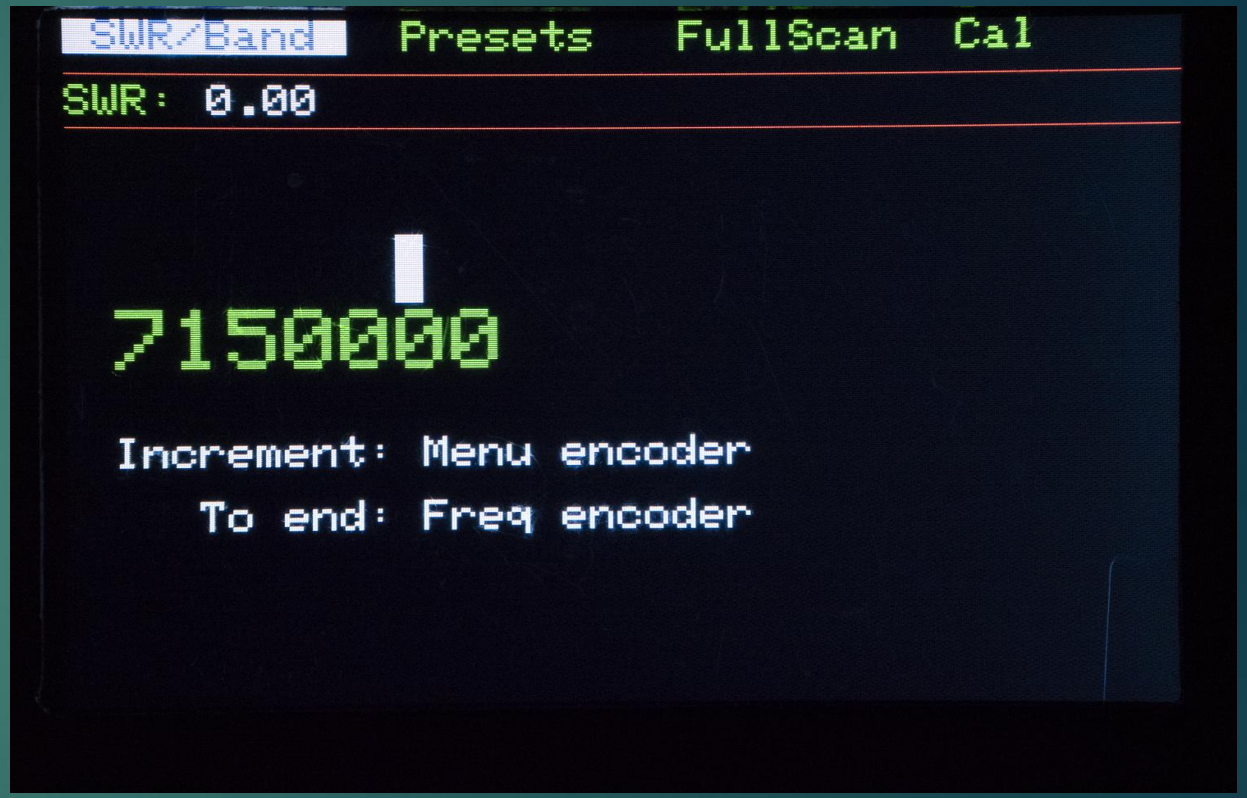


80M – 10M HF Bands

Analyzer Menu Screens

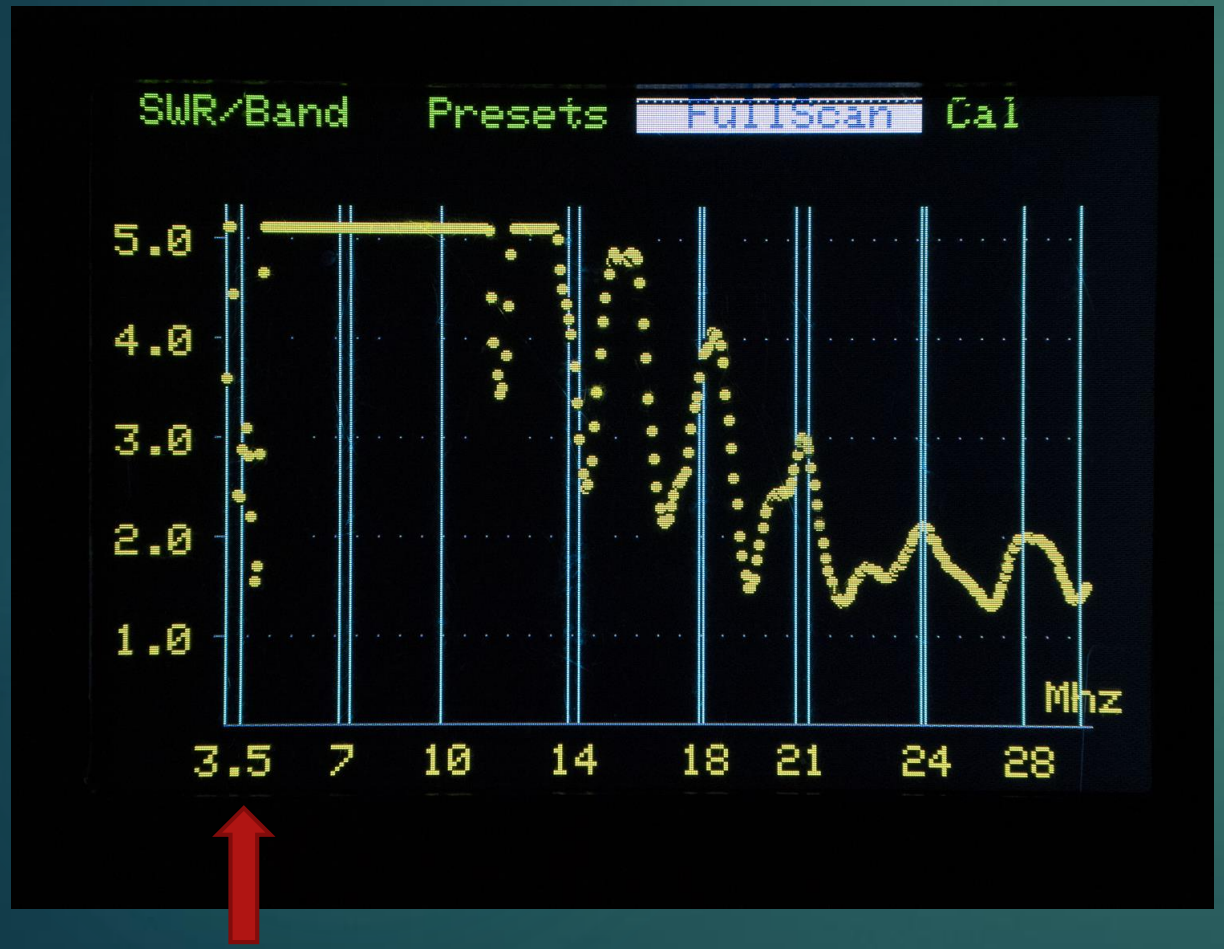


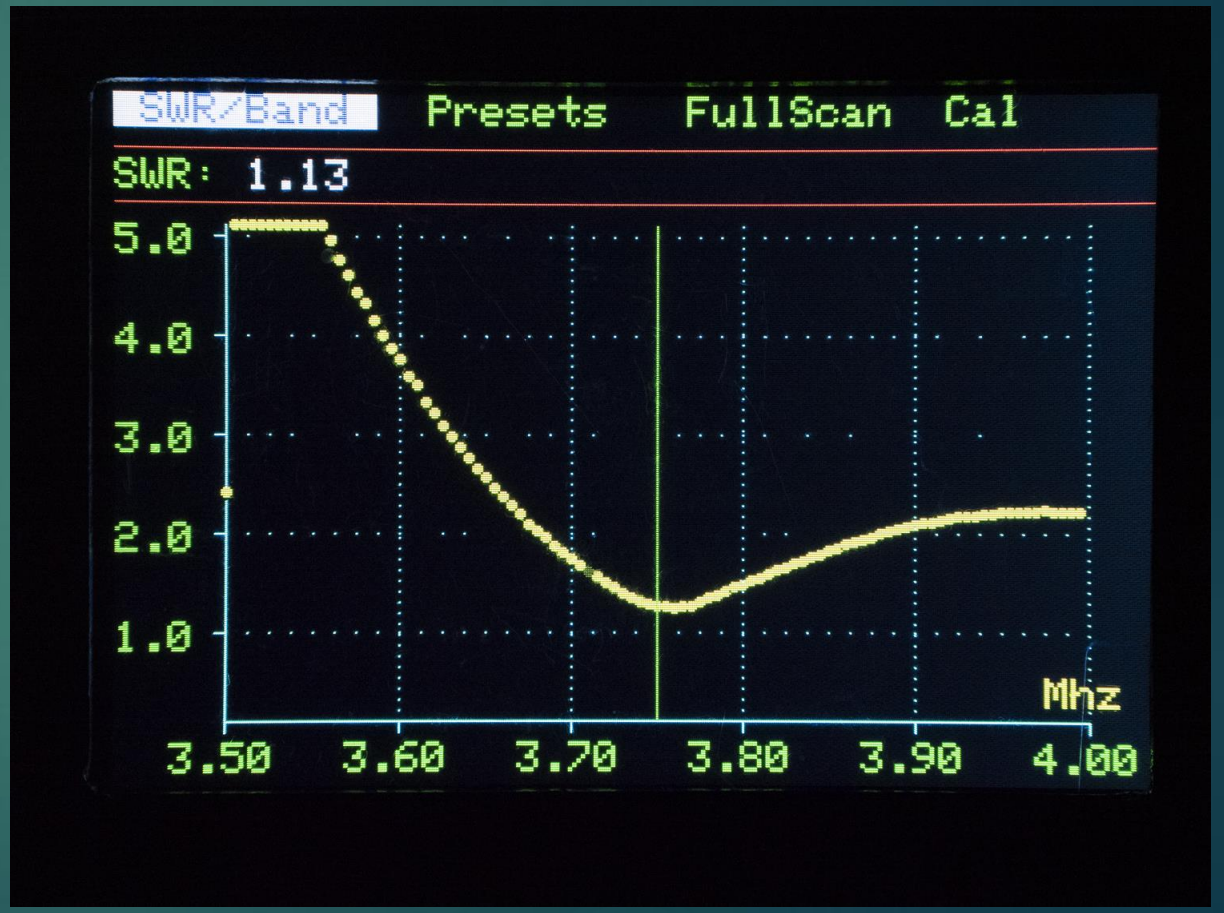
Select Band



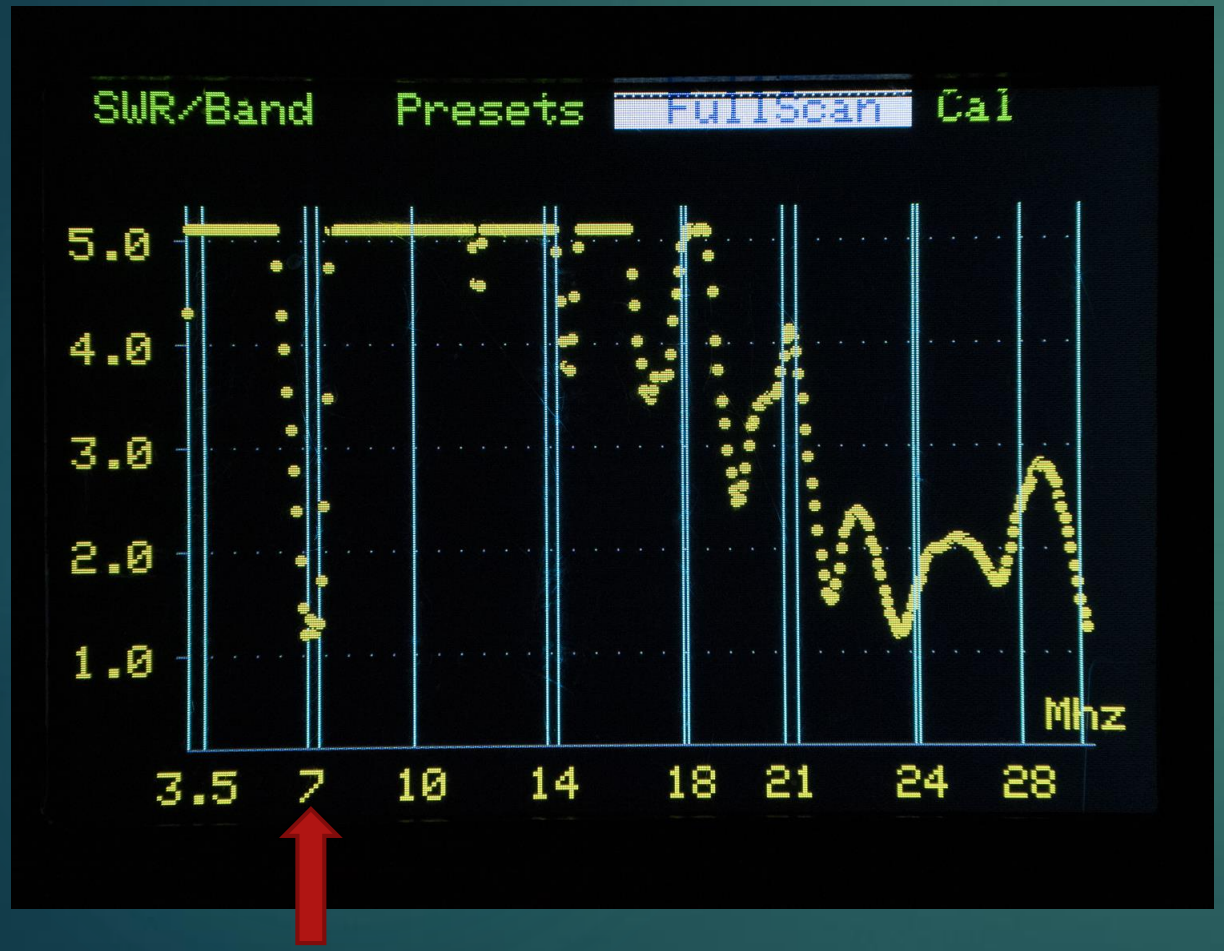
Set Target Frequency

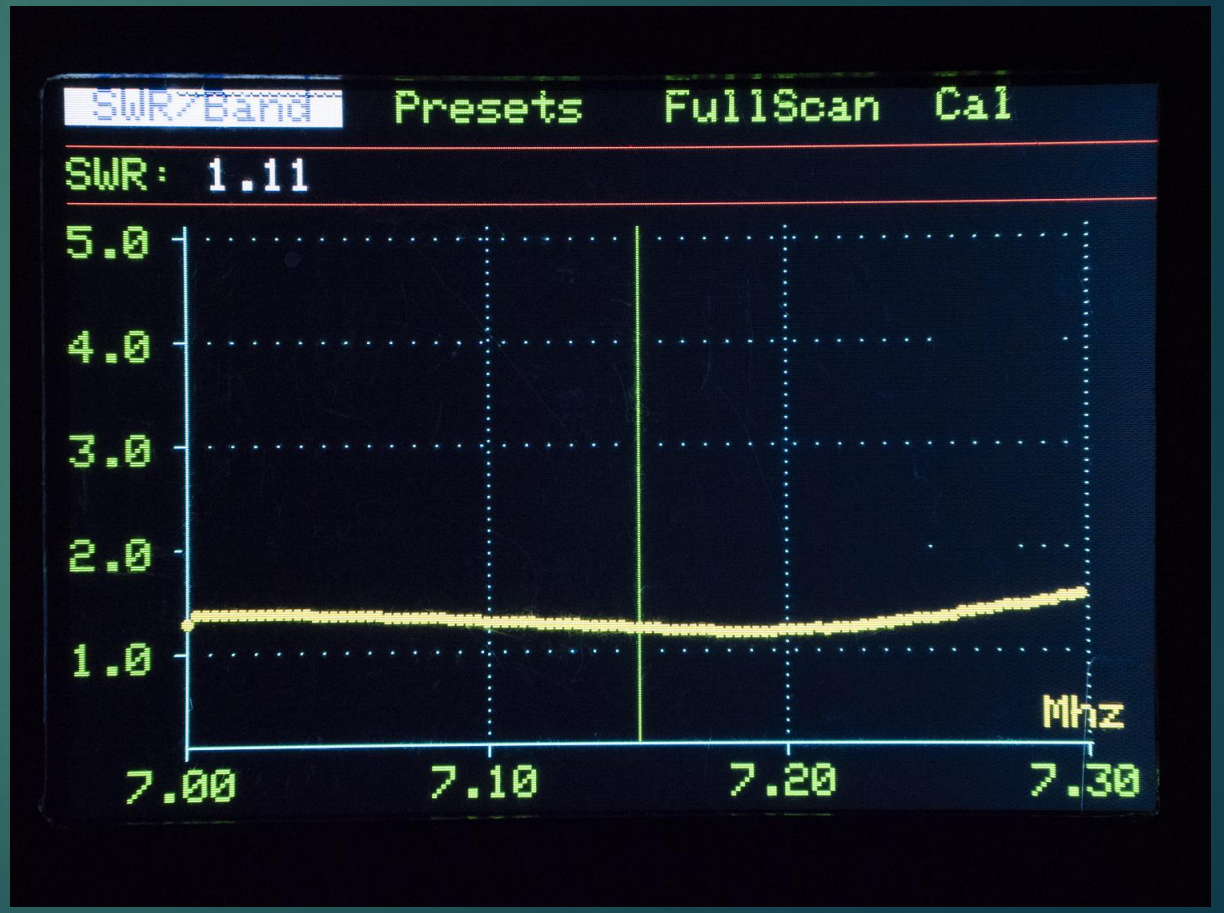
Real-Time Display of 80M SWR Plots



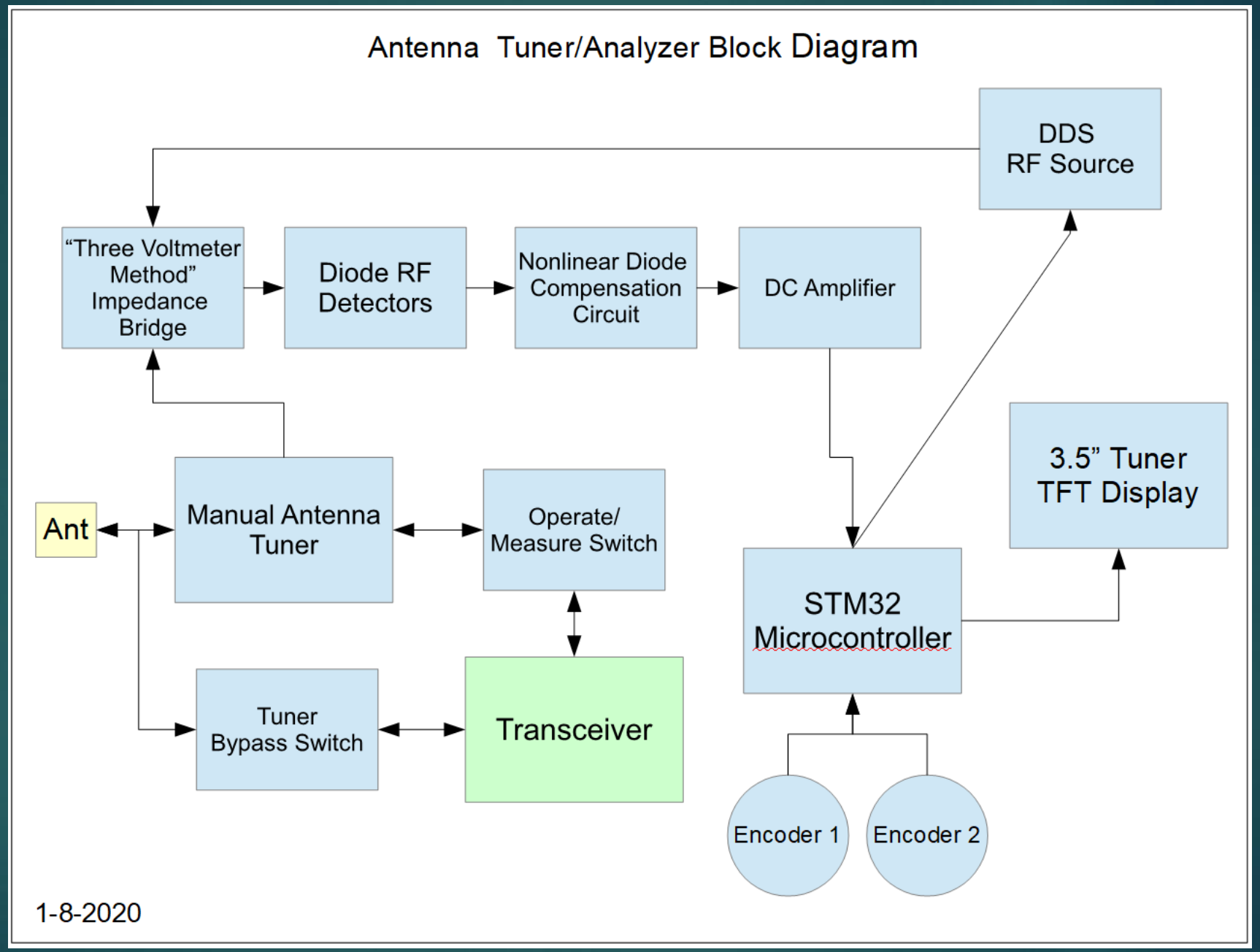


SWR Plots – 40M

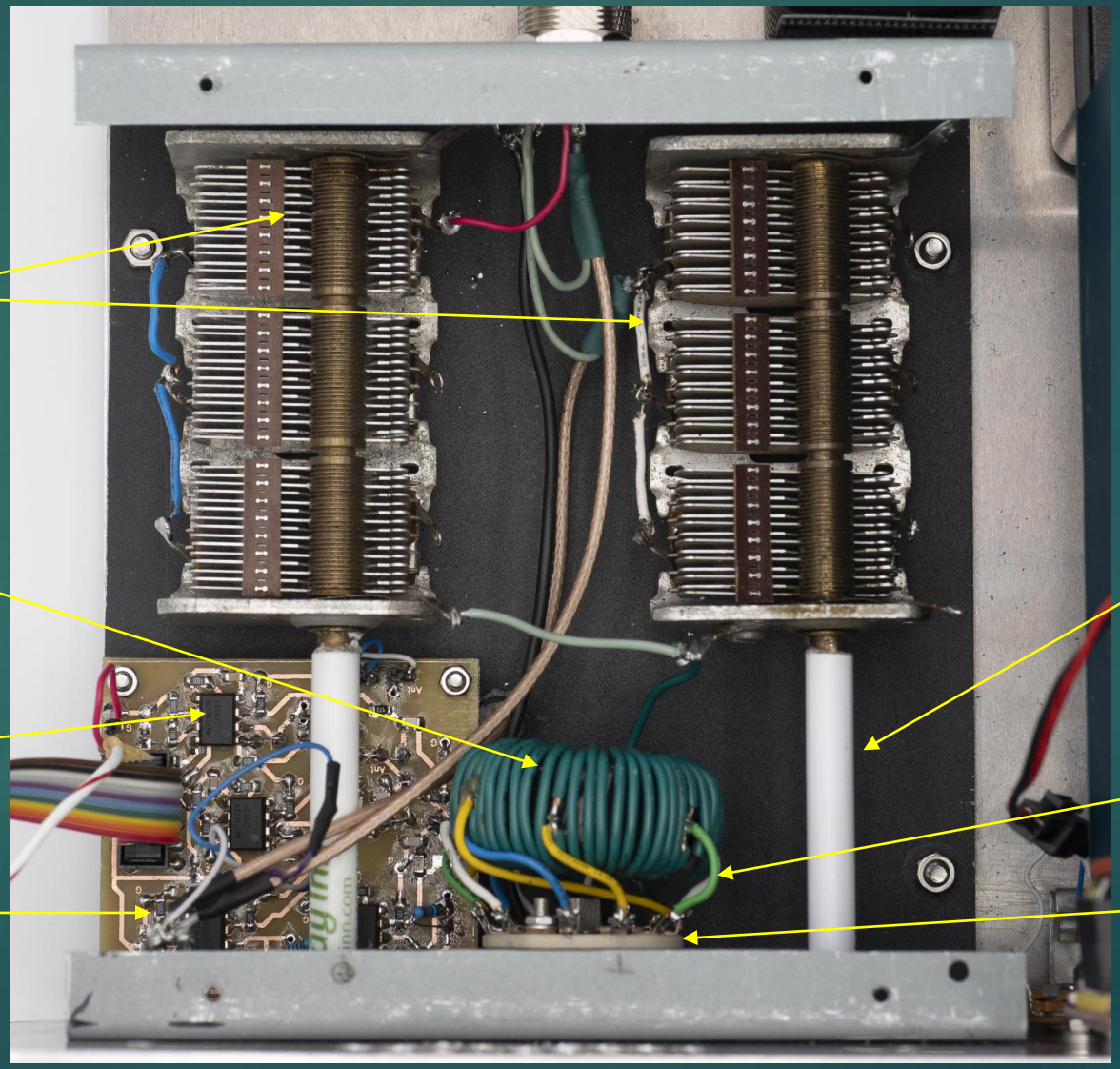





SWR/Band
Presets
FullScan
Cal

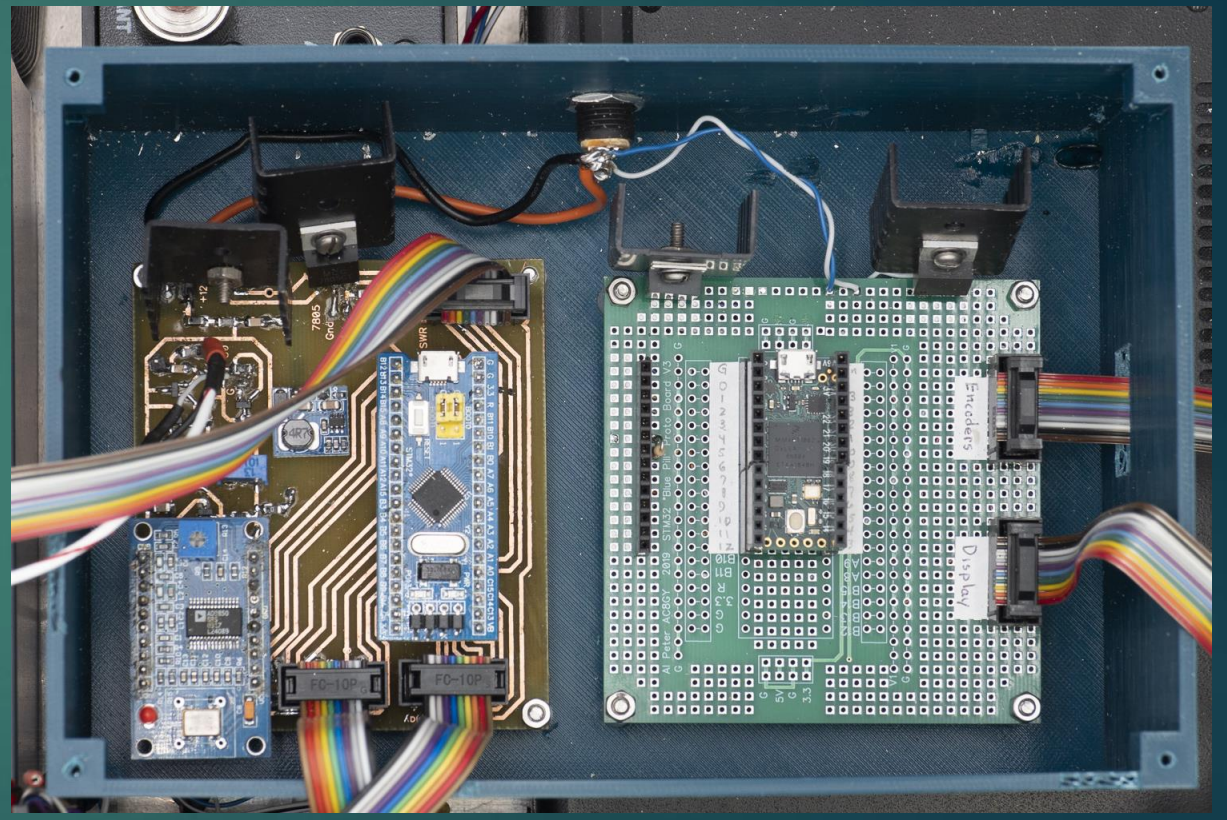

Antenna Tuner/Analyzer Block Diagram
DDS
RF Source
"Three Voltmeter Method" Impedance Bridge
Diode RF Detectors
Nonlinear Diode Compensation Circuit
DC Amplifier
3.5" Tuner TFT Display
Ant
Manual Antenna Tuner
Operate/ Measure Switch
STM32 Microcontroller
Tuner Bypass Switch
Transceiver
Encoder 1
Encoder 2
1-8-2020

Antenna Tuner



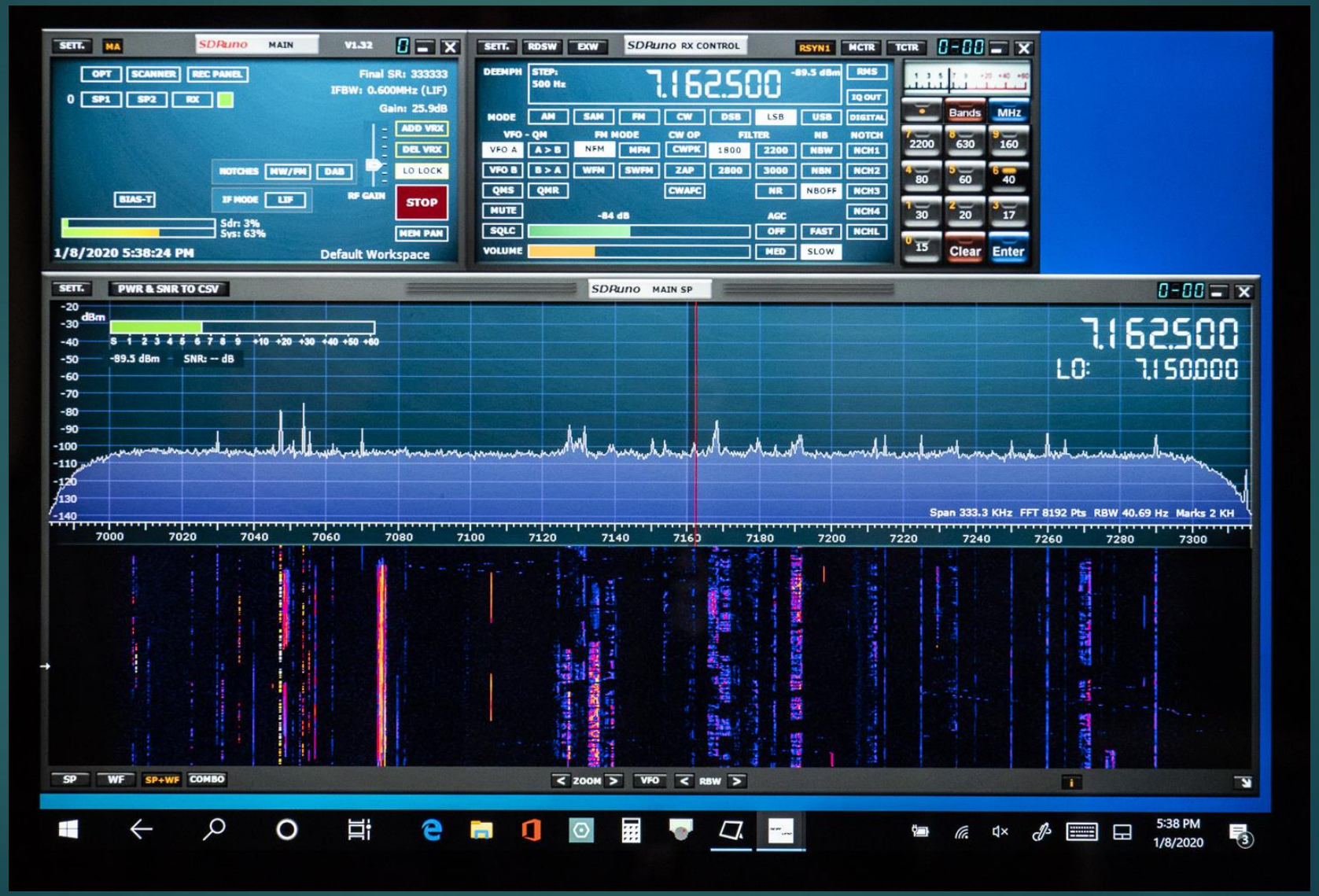
Antenna Analyzer Circuit features

- Real-time frequency sweeps
  - 50ms refresh
- Graphical display of SWR
  - All bands
  - Individual Bands
- More accurate SWR measurements
  - Measure impedance not just resistance
  - Compensate for non-linearities



Analyzer Board Post Processor Board

Pan Adapter


SDRuno MAIN
SDRuno RX CONTROL
SDRuno MAIN SP
7.162500
LO: 7.150000
Span 333.3 KHz FFT 8192 Pts RBW 40.69 Hz Marks 2 KH
1/8/2020 5:38:24 PM
Default Workspace
5:38 PM
1/8/2020

Pan Adapter

- Pan adapter
  - RSP1a from SDRplay
- Requires RF isolation during transmit
  - MFJ 1708B RF sense/splitter/switch.
- Computer and display
  - Microsoft Surface 4
    - Compact
    - Uses Windows 10
    - Runs the SDR software
    - CAT control of FT-891
    - Can run logging programs

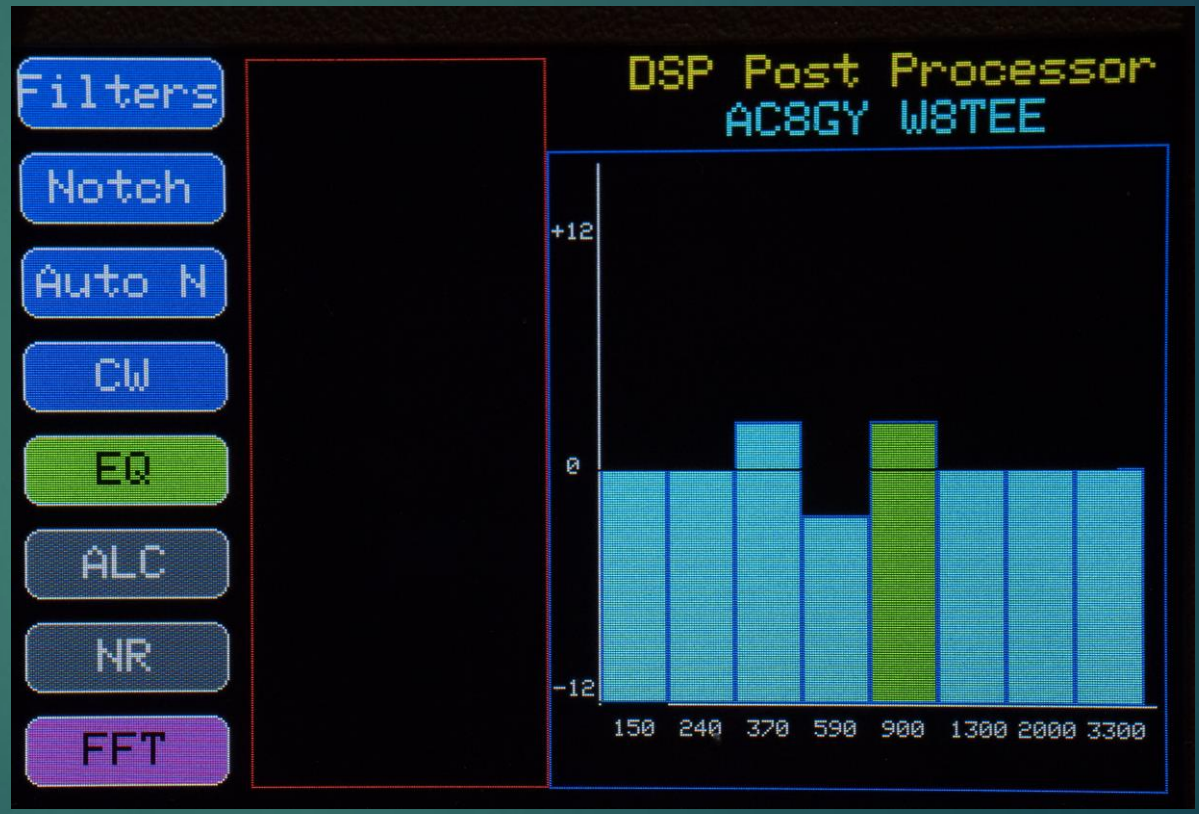
Transceiver/Power Supply/Case

- Any portable or compact HF rig will do

  Need small size for portable case
- YAESU FT-981
  - 100W
  - Small size
  - Reasonable UI and easy to use menus
  - No built-in ATU
- Power Supply - MEAN WELL LRS-350-12 348W
  - 12V to 15V DC switching supply @ 28 A
- Case - Seismic Audio - SALWR3S
  - Hard-side instrument case with removeable front and back covers

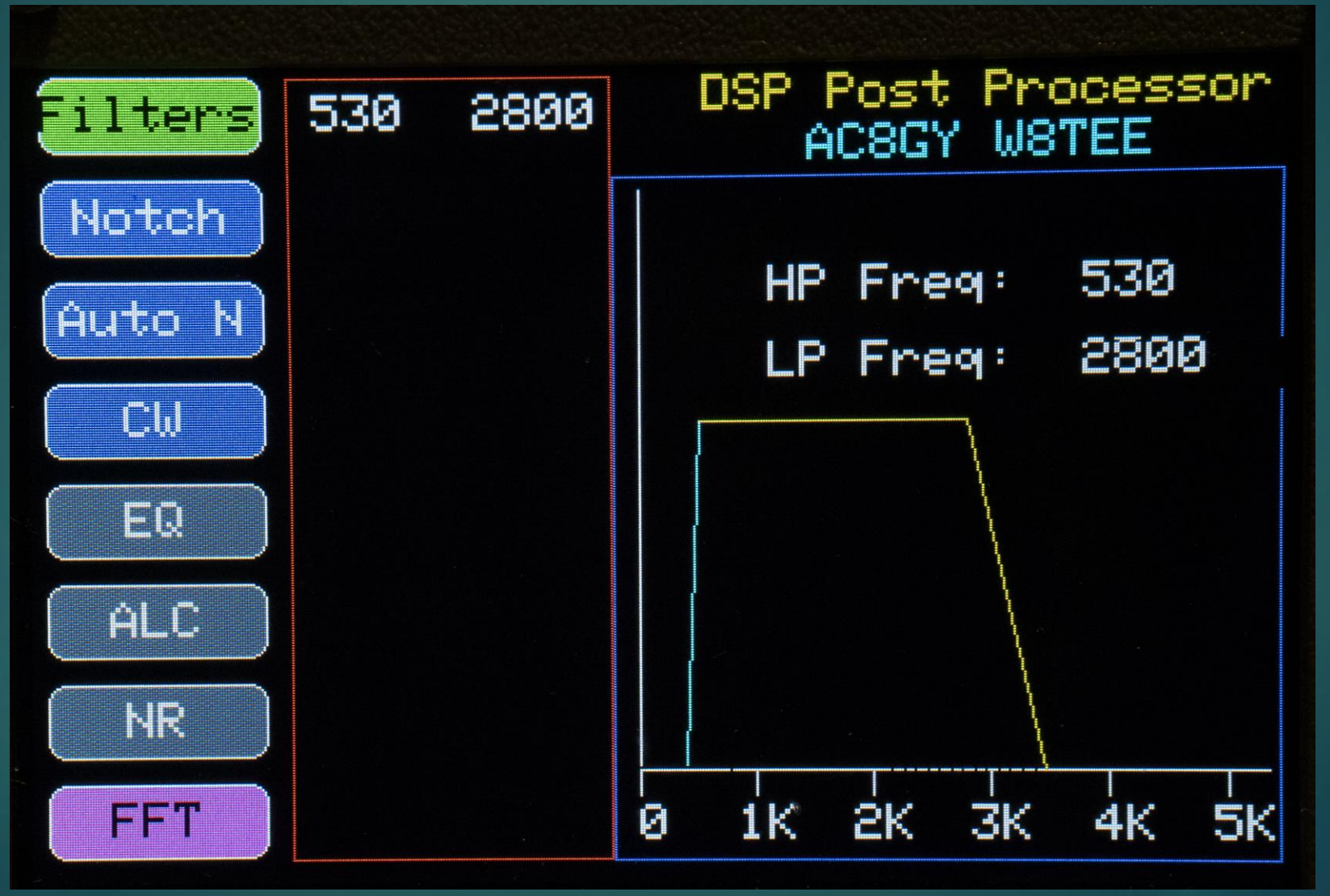
DSP Post Processor

- Audio out from FT-891
- Functions
  - Variable DSP Filters
  - 8 Band Graphic Equalizer
  - Notch Filter – Manual
  - Notch Filter – Automatic
  - Automatic Level Control
  - Noise Reduction
  - FFT display of audio
  - Audio Power amplifier

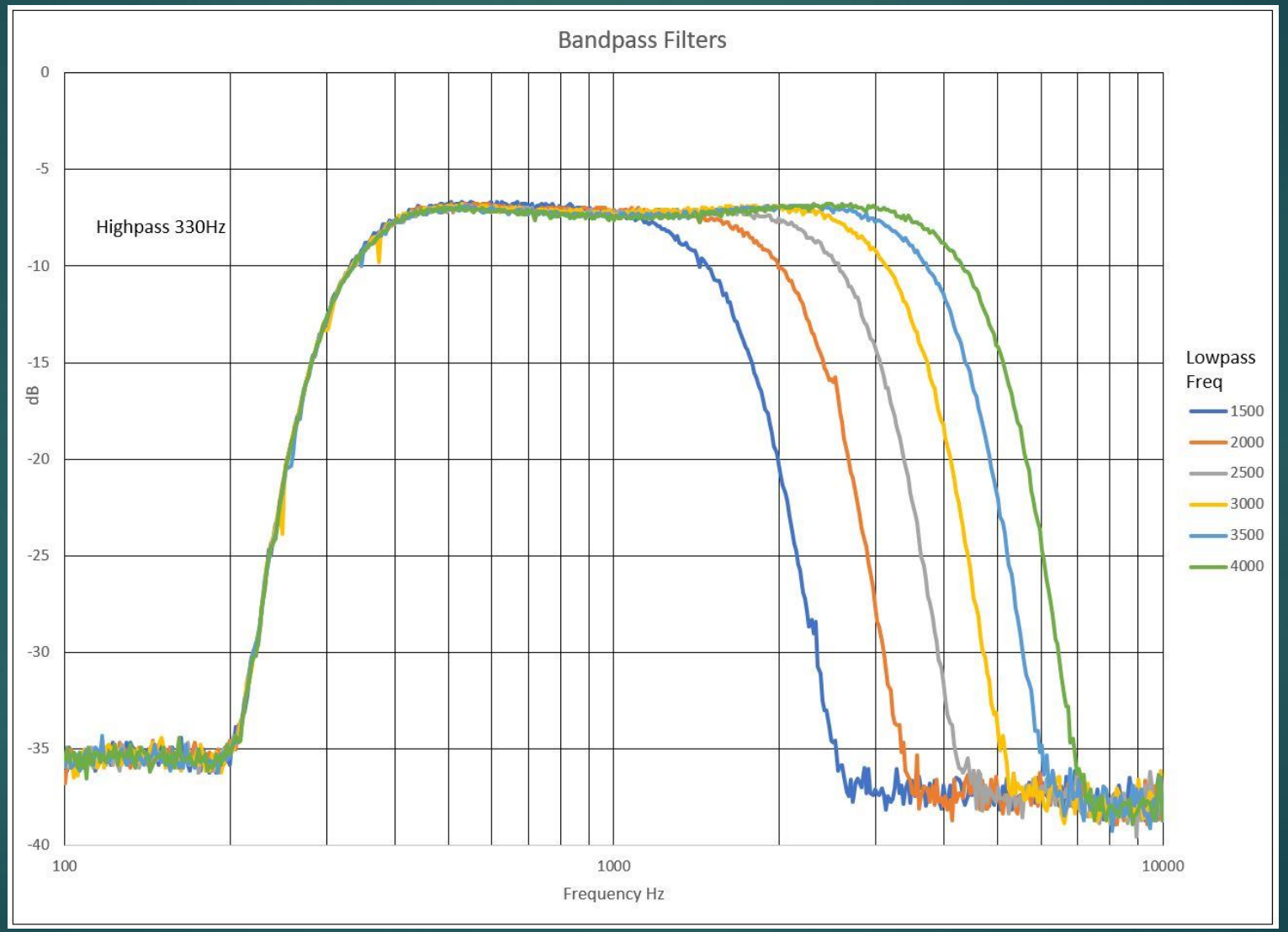


Graphic Equalizer

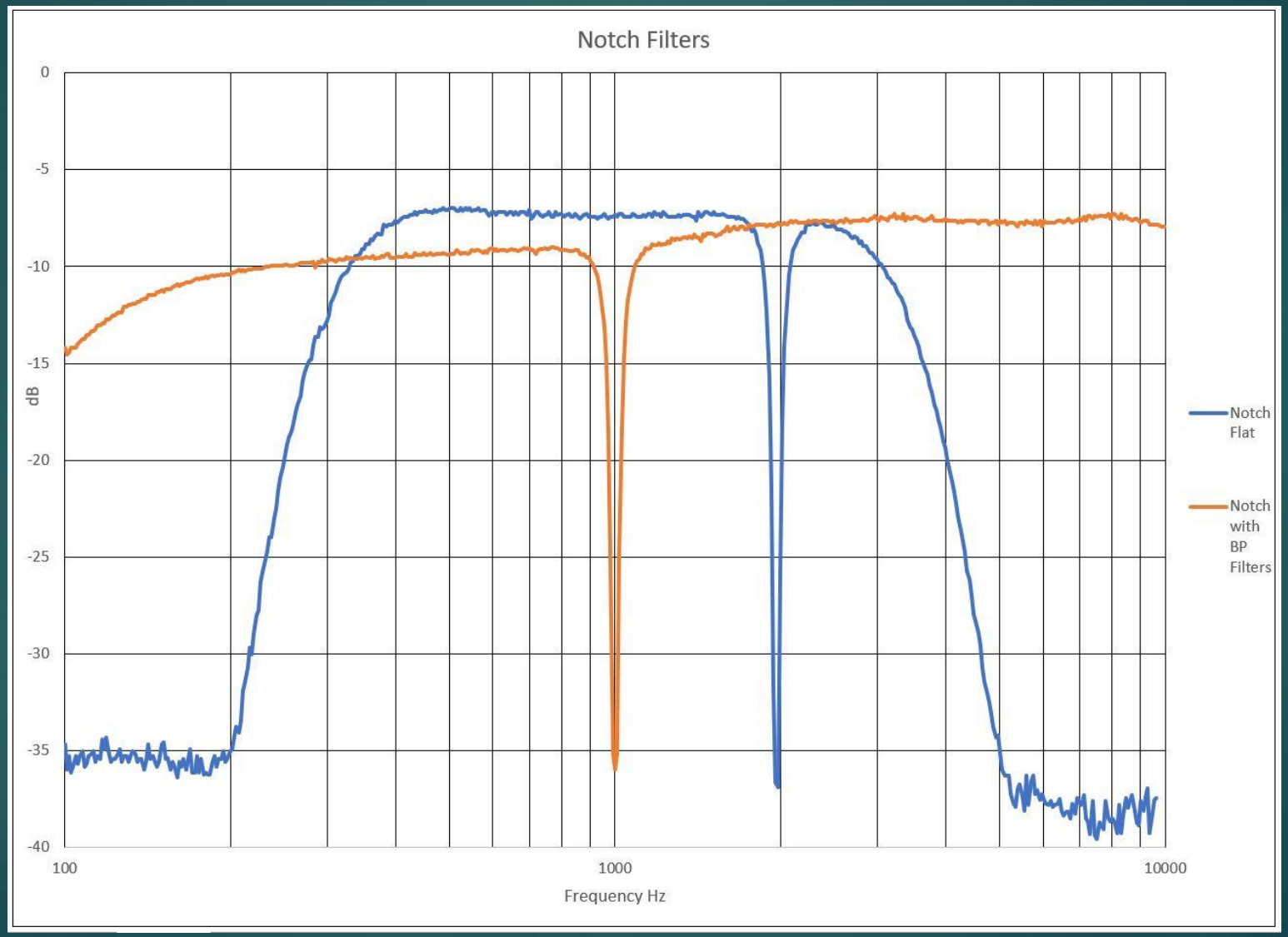
DSP Post Processor Filters



DSP Bandpass Filters



DSP Notch Filters



Summary

- Still a work in process
- To Do
  - Add some circuit details such as by-pass switch, audio power amp, …
  - Finish front panel with printed overlay
  - Complete some software details on Antenna Analyzer and Post Processor