
Elecraft EC1 Design Contest Entry

The following is an Elecraft EC1 design contest entry from Joe Loritz, N9ZIA.

Design Overview

This design is a low cost, easy to homebrew, 100 - 900 MHz antenna analyzer. A widely available TV/VCR/CATV tuner is used as a radio frequency (RF) signal generator to drive a return loss bridge. The local oscillator (LO) of the tuner module is tapped and amplified to the required drive level. One leg of the return loss bridge is connected to a 50 ohm reference, while the other leg is connected to the antenna system to be tested. A simple GO/NO-GO test is performed by looking for any change in the return loss bridge's direct current (DC) output, which is connected to an analog one-milliamp current meter. The antenna system can then be quickly checked or tuned for the requirement of a 50 ohm impedance.

Operation

1. Turn the unit on.
2. Leave the **Antenna** BNC jack on the back of the unit open.
3. Connect a frequency counter capable of measuring the frequency you desire to the **LO Test** BNC jack on the back of the unit.
4. Move the **Meter Select** switch to the **Volts** position.
5. Turn the **Band Select** switch to the desired frequency band of operation. Below is a list of the bands and their approximate coverage:
 - **VHF Low** 70 - 145 MHz
 - **VHF Mid** 128 - 265 MHz
 - **VHF Hi** 190 - 430 MHz
 - **UHF** 430 - 960 MHz
6. Tune the **Coarse** and **Fine** tuning controls until your frequency counter reading is at the frequency you desire for testing your antenna system. During this time, the meter will be displaying the tuning voltage between 0 and 30 volts. You should map out the voltage-to-frequency conversion to allow you to tune the analyzer's output frequency without having to use a frequency counter.
7. Flip the **Band Select** switch back into **Current** mode and adjust the **Sensitivity** control to make the meter's reading as high as possible. The return loss bridge is now operating into an *open* antenna system, a worst possible case. Save this reading as your starting point.
8. Connect a good 50 ohm dummy load to the **Antenna** BNC jack on the back of the unit. The meter reading should drop significantly. The return loss bridge is now operating into a *true 50 ohm* antenna system, a best possible case. Save this reading as your destination point.

9. Now you can connect your antenna system to the **Antenna** BNC jack. You should try to tune your antenna system to meet the reading that the 50 ohm dummy load gave you. *Important:* If you do change the analyzer's frequency, be sure to get a new starting point reading and repeat this entire process.
10. The meter reading is completely arbitrary (for the most part). It is not possible to directly transfer the meter reading into a SWR reading.

Frequency Converter Operation

The antenna analyzer is capable of operating as a quick frequency converter. Tuning coverage is approximately 25 to 915 MHz and is converted to approximately 44 MHz, the intermediate frequency (IF) used by televisions. Connect an antenna to the **RF Input** BNC jack on the back of the unit and connect a receiver capable of tuning 44 - 50 MHz to the **IF Output** BNC jack. Choose the band coverage by using the **Band Select** switch and **Coarse** and **Fine** tuning controls, just like you did in the antenna analyzer mode.

You may need to tune around the 44 - 50 MHz area to get the best IF output signal.

You should also note that the local oscillator output frequency is going to be approximately 44 MHz *higher* than the receive frequency.

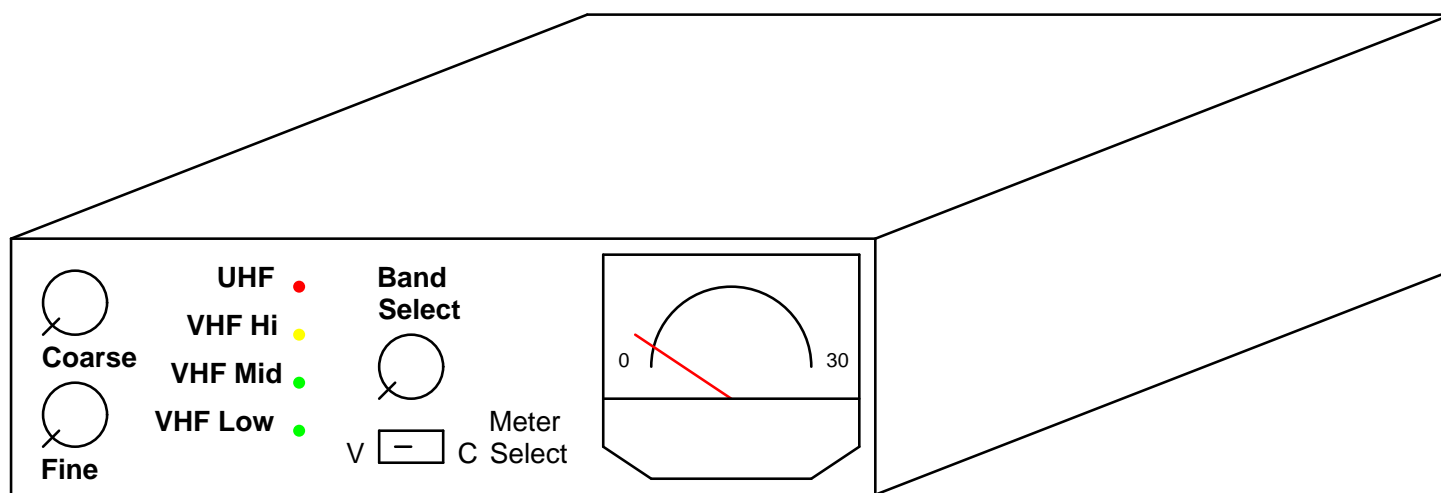
Attachments

The following diagrams are attached to this document:

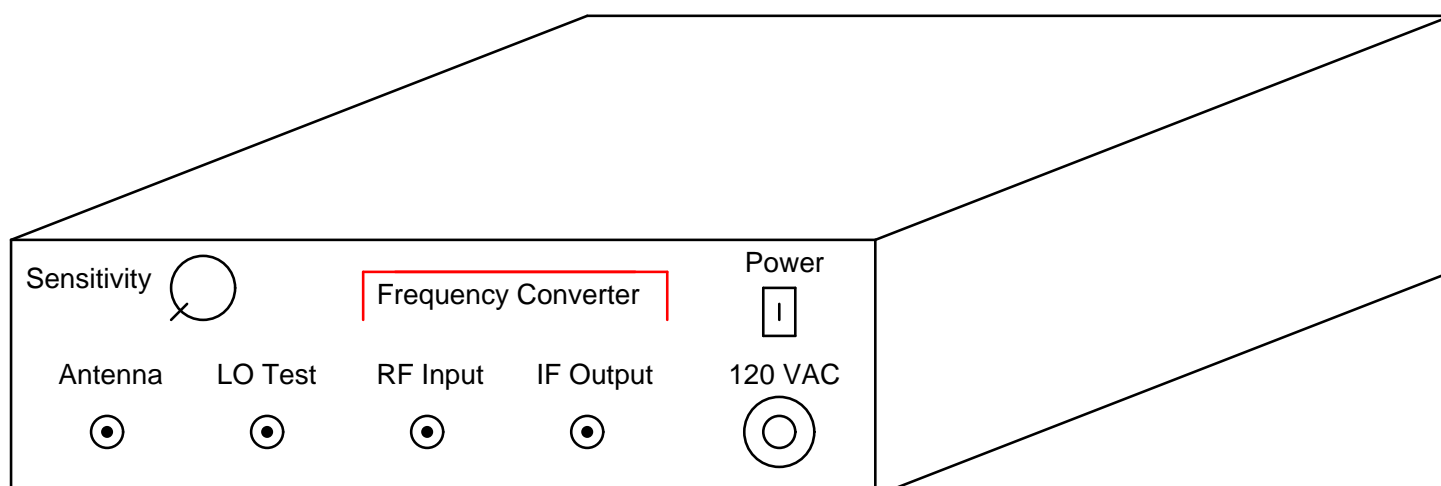
- **100 - 900 MHz Antenna Analyzer Layout** Brief overview of the estimated front and back panel layouts.
- **100 - 900 MHz Antenna Analyzer Drill Pattern** Layout showing the location of the holes required for the switches, tuning controls, LEDs, BNC jacks, power controls and meter.
- **100 - 900 MHz Antenna Analyzer Internal Layout** Internal diagram showing the layout of the analyzer's main components and interconnecting wiring.
- **100 - 900 MHz Antenna Analyzer Application Schematic & Block Diagram** Schematic to be used as a starting reference for construction.

100 - 900 MHz Antenna Analyzer Layout

Not To Scale



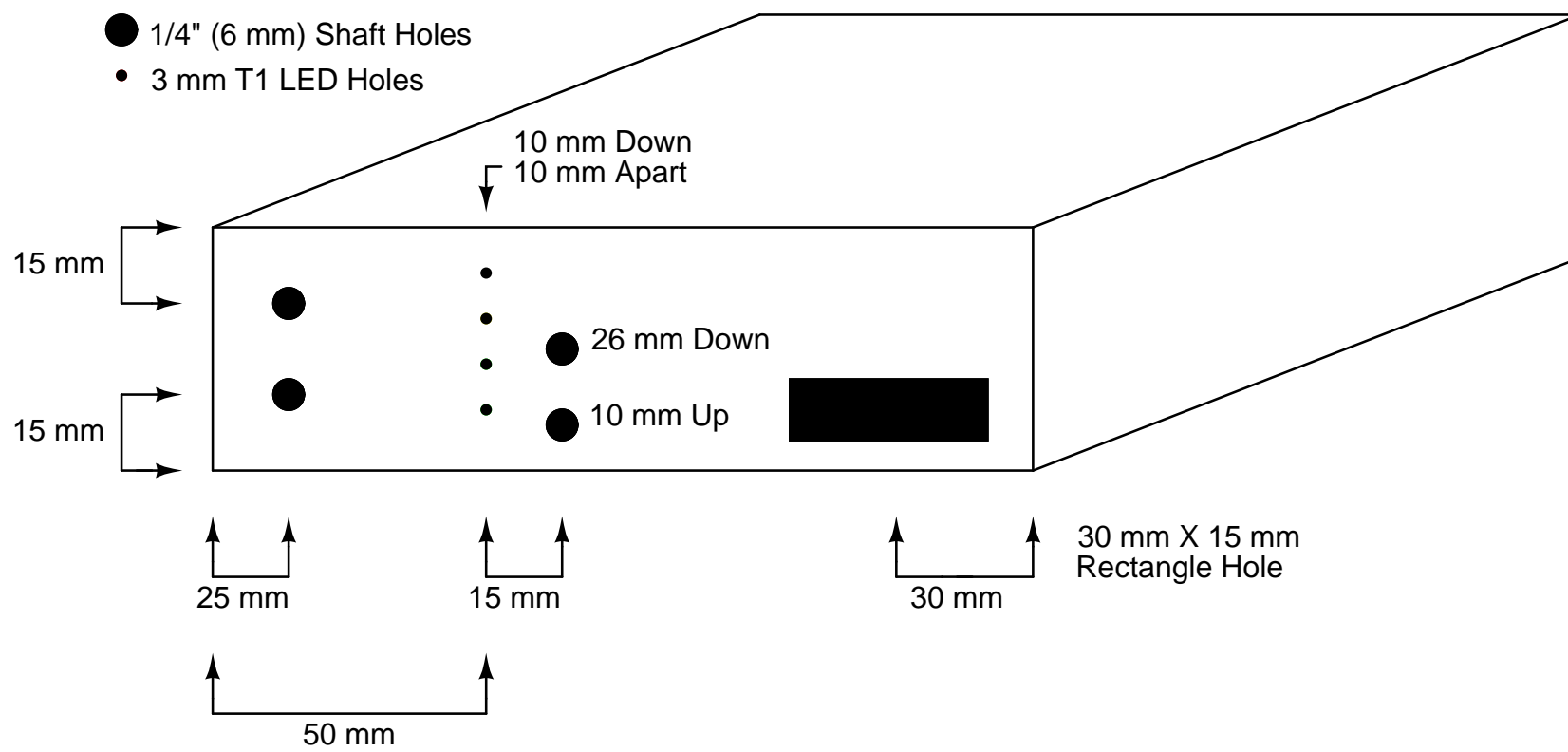
Front Panel Layout



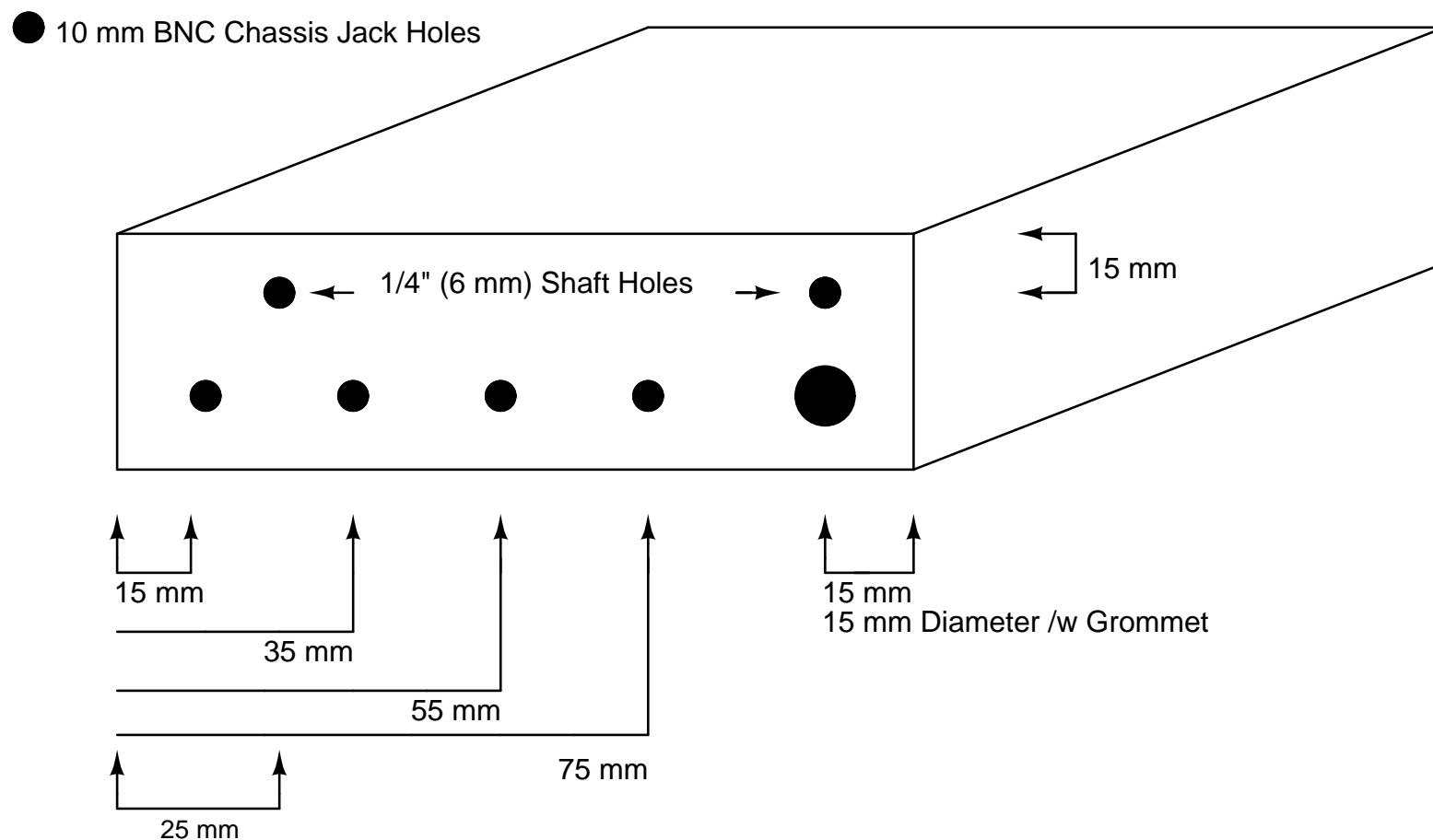
Back Panel Layout

100 - 900 MHz Antenna Analyzer Drill Pattern

Not To Scale



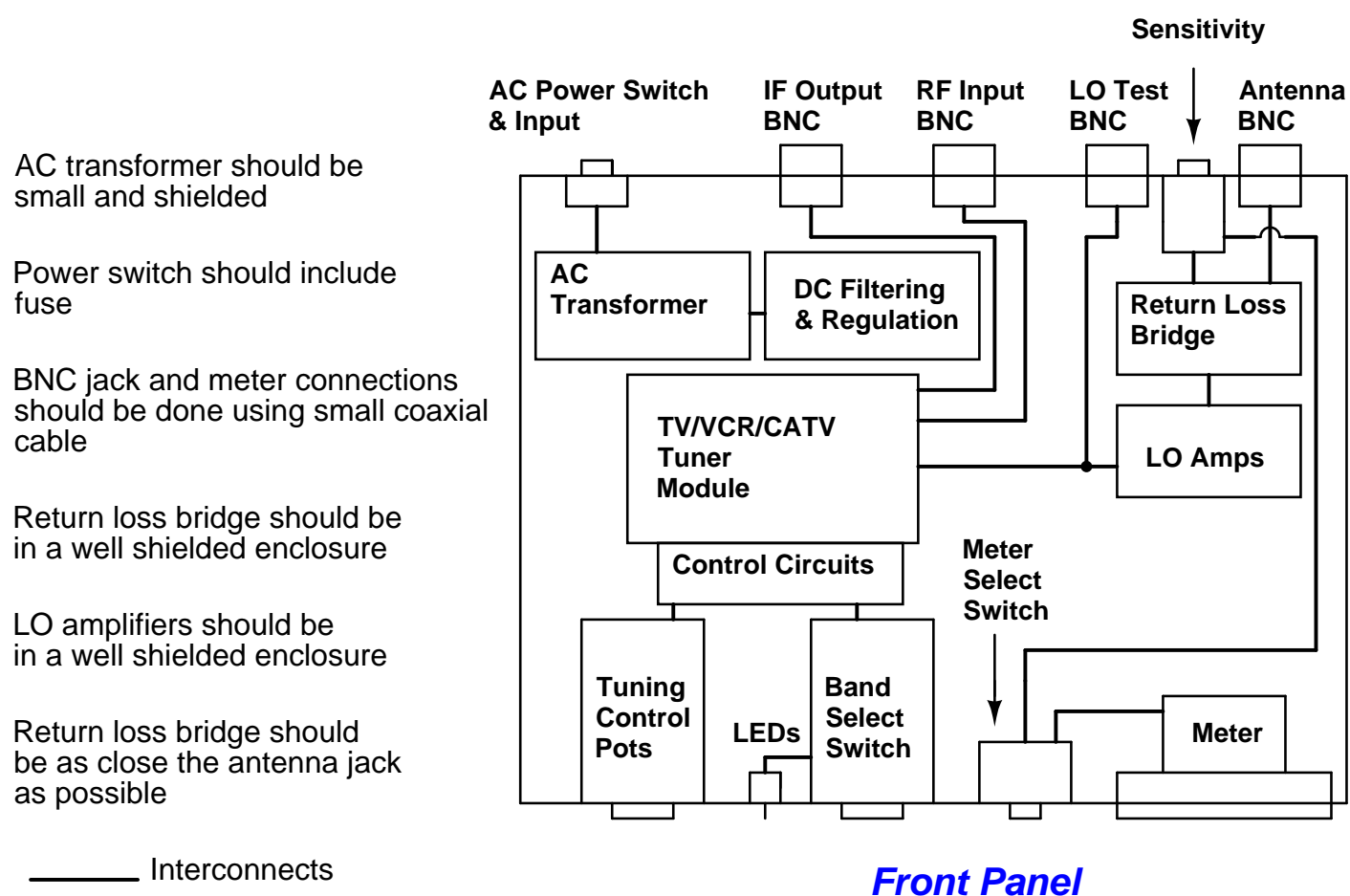
Front Panel Drill Pattern



Back Panel Drill Pattern

100 - 900 MHz Antenna Analyzer Internal Layout

Not To Scale



100 - 900 MHz Antenna Analyzer Application Schematic & Block Diagram

