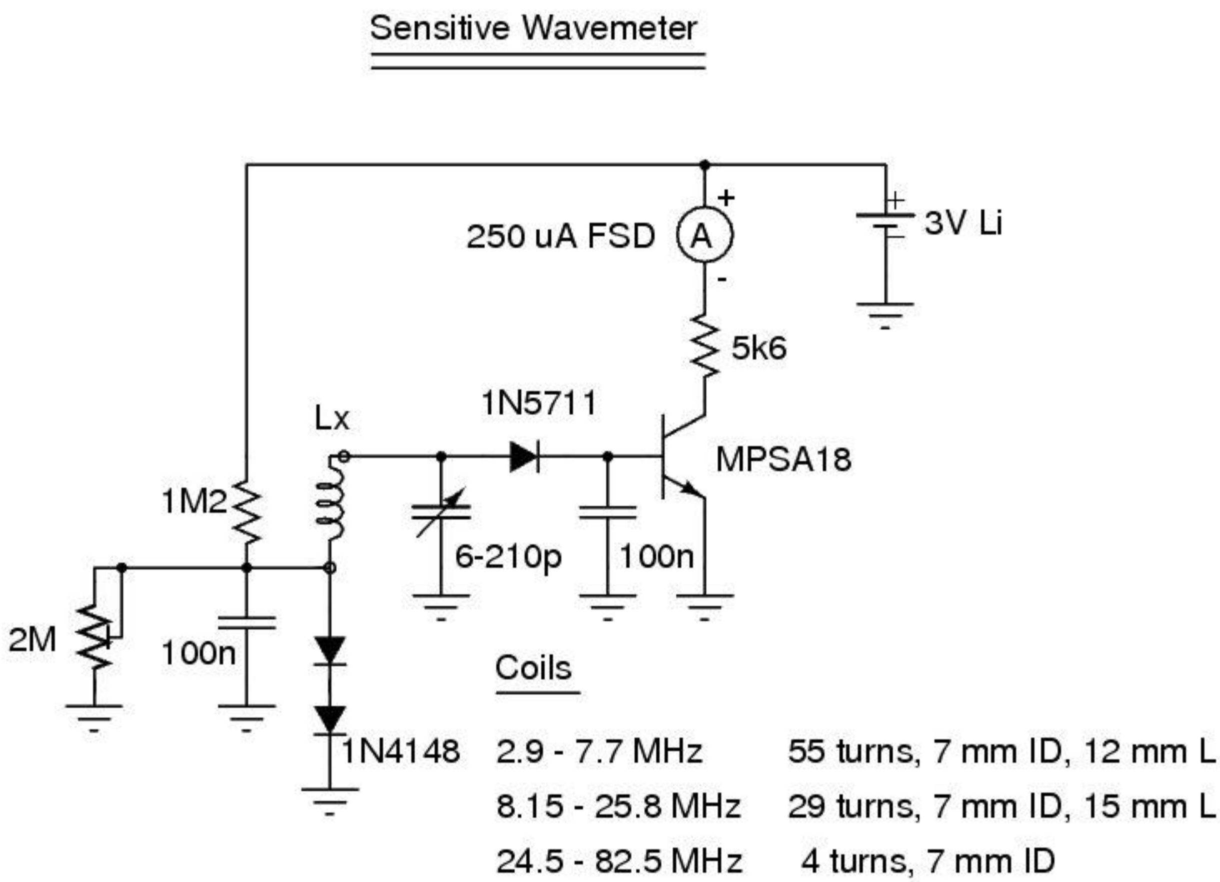
HF Wavemeter

Why build a wavemeter in these days of frequency counters, CROs and spectrum analysers? Well it is a lot cheaper than a spectrum analyser, easier to build and can still tell you if you have significant harmonic energy in your signal or that you've tuned up to the right harmonic or mixing product. It also doubles as a field strength meter, RF current probe/sniffer, etc. It is a fun, if somewhat retro way of seeing what RF something is pumping out, be it your prototype on the bench, or a proximity smartcard security reader in the field.

The circuit is heavily inspired by Charles Wenzel's field strength meter. It uses a diode dropper arrangement to provide a stable forward bias for the 1N5711 detector. The pot shown in the circuit diagram was replaced in the practical circuit with a fixed resistor, but using the pot offers the ability to set the quiescent current. The exact amount is a trade off between sensitivity and moving the meter pointer too much. Mine sits on about "1" on the scale when a coil is plugged in.



The unit is constructed in a small jiffy-box, the 250 uA FSD VU meter taking most of the box volume. The meter comes from eBay seller KW Tubes, I bought a box of them. They are excellent, except they are glued shut so you can't (easily) change the scale, also the solder tags are nearly impossible to tin without filing them back to what appears to be a rather light on the copper brass. The power is supplied by a 3V lithium cell (CR2025). Current consumption is only about 10-15 uA when a coil is plugged in and no signal is being detected, it drops to less 2 uA when there is no coil plugged in, so no battery switch is required. The few components are mounted on a postage-stamp sized scrap of PCB using my usual technique. A polyvaricon tunes the coils and is fitted with a calibrated dial produced with the help of XYLs laminating machine. The PCB is mounted on the back of the polyvaricon internally with the common leg soldered directly to the board. The coil plug is an RCA, internally to which a short "transmission line" of magnet wire twisted pair runs from the detector board.

The coils are wound on 7 mm OD clear plastic soda straws (from Subway, they make great coil formers). Three coils are used to cover from 2.9 MHz to 82.5 MHz. There is a small gap near 8 MHz due to an excessive change in distributed capacitance when I potted the lowest frequency coil in wax. I had anticipated the problem and spread the turns out a little before potting, but the magnitude of the change exceeded the headroom I gave it. This could be easily corrected by removing a few turns.

The unit was calibrated using my signal generators and a frequency counter. Because of its fairly small size, the dial accuracy/detail isn't especially good, but for the purpose of checking harmonics, spurs and sniffing circuits this is of little consequence.

A better layout is recommended for extending the frequency coverage into higher VHF and UHF. Try forming the inductor as a thick loop that sticks out directly from the circuit board. Such a device could be custom built on a piece of PCB (and not much else except for the meter). In the opposite direction a larger capacitance cap would be useful, but there is nothing stopping MF coverage with the polyvaricon cap. In the picture the 4th coil actually plugged into the unit is a MF coil which covers down into the MW broadcast band (but the dial is not calibrated for it), it is about 150 turns over 10 mm on the 7 mm OD straws. You'd probably need at least two coils to cover all of MF nicely, and LF probably several more unless you get a better cap. A straight-line frequency cap (log cap) is strongly recommended for easiest use, unfortunately my stock of polyvaricons are straight-line capacitance (linear) so frequencies bunch towards the top-end. A larger knob or even a reduction drive improves the usability of the unit.

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