How to make a very cheap VHF receiver

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What is the cheapest receiver you can make for VHF? Here is a candidate where all you need to do to modify a small FM headphone receiver is to desolder one end of two capacitors, and connect a short cable with an antenna connector.

1. Find a simple pocket-size headphone FM receiver with tuning wheel (not push-button search). I found mine at a flea market for 10 NOK (less than 1 £) and it is designated "HS-822, UK design," and runs from two 1.5 V AAA batteries.
2. Open it and check the FM receiver chip. Mine has KA22429 which is equivalent to a TDA7021. It is a 16-pin surface mount device with an FM receiver with a 76 kHz intermediate frequency. Although the TDA7021 is specified for 1.5-110 MHz, don't let that scare you.
3. The oscillator tuned circuit from pin 5 to Vcc (pin 4) consists of 56 nH in parallel with a fixed 22 pF capacitor + a tuning capacitor. Unsolder and lift the hot end of the 22 pF capacitor (the end connected to pin 5).
4. This receiver uses the headphone cable as the antenna. There is a coupling capacitor from the RF input on pin 12 which is connected to the headphone socket. Unsolder and lift the headphone side of this capacitor, and connect the RF input via the capacitor to a BNC antenna connector. Connect the BNC ground to ground (pin 3) or Vcc (pin 4), whatever is more convenient.
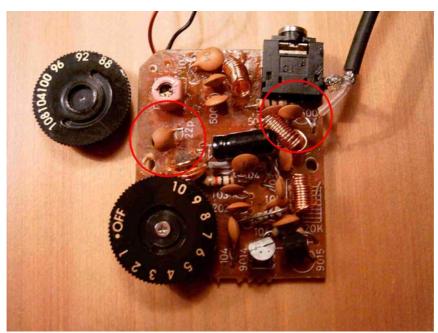

Figure: One 22 pF capacitor lifted on the right-hand side near the headphone connector for connection to the external antenna, and another one lifted on the left-hand side, above the volume control for increasing the tuning range (The receiver IC is on the foil side of the board).

5. Performance:
    o   The tuning range was 88-108 MHz. Now it is approximately 112-163 MHz. Mine receives airport communications (AM), amateur repeaters in the 2m band

(144-146 MHz), and some public service transmissions in the 150-160 MHz range. If I connect my TV cable, channel S9 (sound 161.25 MHz) will be received at a setting of 108 MHz.

- o It receives wideband FM, as well as AM and narrowband FM with somewhat reduced output level.
- o Don't except miracles in terms of signal handling. If there are two active repeaters in the 2m band, only the strongest will be received.
- o Compared to wideband FM, narrowband FM/AM requires more accurate tuning, and the receiver is somewhat sensitive to the placement of your hands.

I have not tried this with other chips, such as the SC1088 = TDA7088, or the TDA7000. Both the Philips chips are specified for 1.5-110 MHz, but who knows how high in frequency they will cover? I would be interested to hear from others who try to convert other single-chip FM receivers.