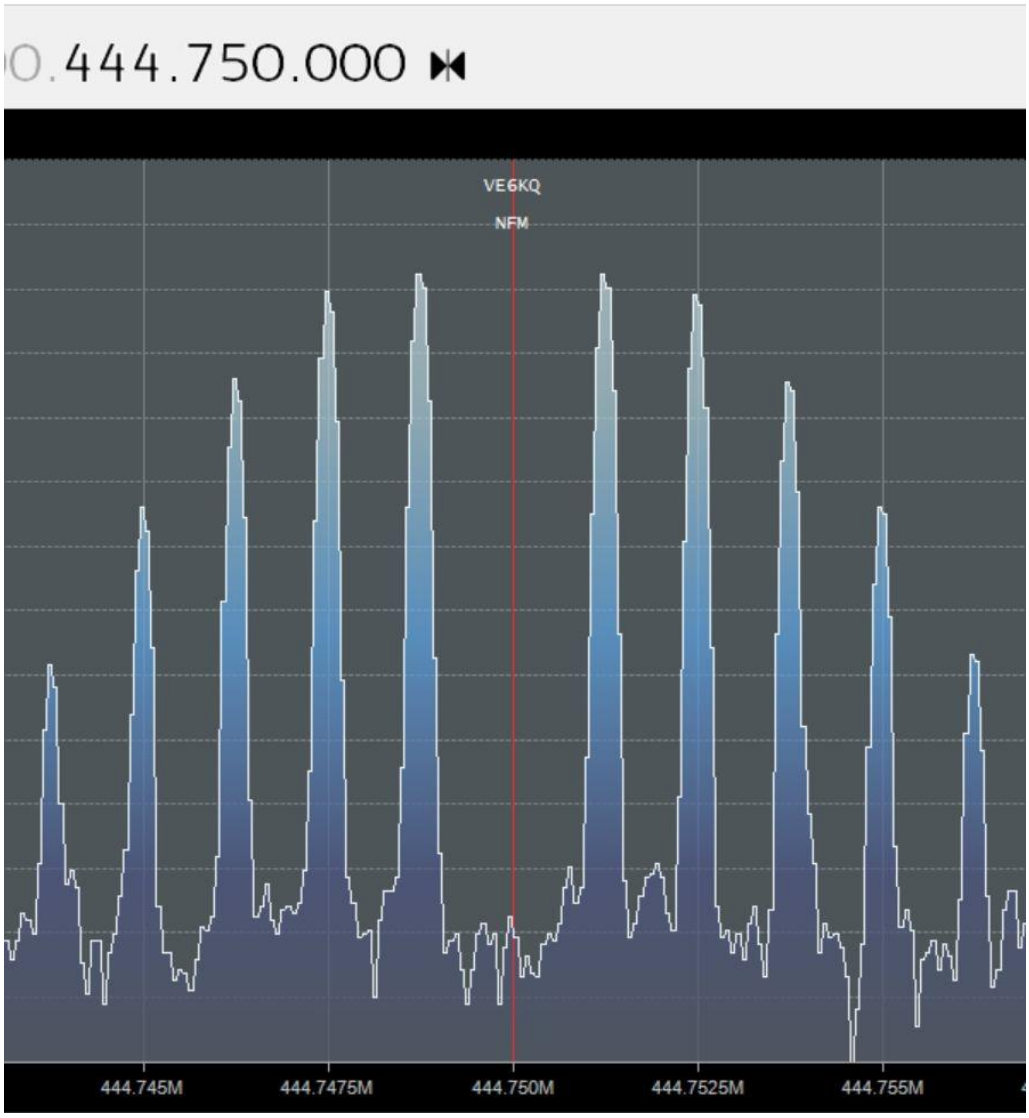
Setting Analogue FM Repeater Deviation

Here in North America a typical way of setting FM repeater deviation is simply applying an RF signal modulated by a 1000 Hz tone at +/- 3 KHz deviation to the repeater receiver. The repeat deviation is adjusted to +/- 3 KHz using some kind of deviation monitor on the repeater output frequency. I tried a different approach that seems to work OK using an inexpensive SDR dongle that plugs into a USB port on a computer. The one I use has the NooElec name on it and the model is NESDR Mini 2. There are probably many others out there that will also work. The software I use is SDR Sharp.

The approach I used is the Bessel zero method, that is, at certain modulating frequencies and at a certain deviation the carrier disappears and the energy is all in the sidebands. Since the software allows a spectrum display the carrier null can be seen. The problem is an RF signal modulated by a 1000 Hz tone at +/- 3 KHz deviation does not produce a carrier null. There is another frequency fairly close to 1000 Hz tone shown on the spreadsheet below at the bottom (1247 Hz) that does produce a carrier null at +/- 3 KHz deviation. This spreadsheet is available on this website. Look in the Odds & Ends tab.

Deviation Measurements Using Bessel Zero or Sideband Null Method		
Enter Modulating Frequency in Hertz	1000	Hertz
First Carrier Null	2405.0	Hertz Deviation
Second Carrier Null	5520.0	Hertz Deviation
Third Carrier Null	8654.0	Hertz Deviation
Forth Carrier Null	11791.0	Hertz Deviation
Fifth Carrier Null	14931.0	Hertz Deviation
First Sideband Null	3830.0	Hertz Deviation
Second Sideband Null	7020.0	Hertz Deviation
Third Sideband Null	10170.0	Hertz Deviation
Forth Sideband Null	13320.0	Hertz Deviation
Fifth Sideband Null	16470.0	Hertz Deviation
Enter Deviation in Hertz	3000	Hertz Deviation
Modulating Tone for First Carrier Null	1247.4	Hertz

The photo below shows a first carrier null with a 1247 Hz modulating tone indicating a deviation of +/- 3 KHz.



To set the deviation of a repeater using this method you will need an RF signal generator tuned to the repeater input frequency and a tunable audio source set to 1247 Hz to modulate the generator. With the SDR software zoomed in on the desired repeater input frequency slowly increase audio level into the generator until the first carrier null appears as above. Radiate or couple the RF signal generator to repeater receiver with a sufficient level (good signal to noise). Then tune the SDR frequency to the repeater output frequency. **Be careful here, you don't want to smoke the dongle. You want good isolation between the dongle and transmitter.** I used a small antenna on the dongle and sampled the transmit frequency. That way there was no direct connection to the transmitter. Adjust the repeat level for the first carrier null as shown above. Be careful not to adjust it for the second carrier null. That will be +/- 6.886 KHz deviation.

After the adjustment I checked the deviation the typical way with a 1000 Hz tone. The result was the same. I did have concerns that the repeater de-emphasis and pre-emphasis may have been an issue with the 1247 tone. It doesn't appear to be and don't think it is. I welcome feedback if someone sees a problem with this adjustment approach.

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