

Nature of Hum

By: Michael J Hebert, NH7SR

Credit Line: Forum QRP- L

Some 10 years back I was doing a lot of spherics recording using both E-field probes and loops. The VLF spectrum is, of course, absolutely saturated with hum from the power grid. There were some interesting things I learned about the nature of electrical grid hum during that time. More or less as follows in no particular order....

1) The primary frequency (60Hz in the US) and the third harmonic have roughly the same "signal" strength since we use 3-phase power distribution. 2nd harmonic levels are considerable lower in level but sound much dirtier.

The next highest level that I encountered in my recordings was at 720Hz using either an E-field probe or a loop sensor. The fundamental sounds rough, the third harmonic sounds fairly clean and 720Hz sounds clean.

2) The E-field probe was more sensitive to the higher harmonics than the loop sensor... probably mostly due to circuitry differences in the amplifiers. The E-field probe became less sensitive to the fundamental and lower harmonics they higher it was held.

Note from VA3ZNW:

Just my 2 pens added. In the 80- 90-s I actively explored simple DC and regenerative receivers. Main luck of the receivers was the hum. The receivers pick up the hum (50-Hz in Russia) ever without an antenna. Ever the receiver was fed from a battery. Any one receiver- transistor or tube one.

It was impossible to eliminate the hum. I used rejected filters at input and between stages at Audio Amplifier. I used Audio Amplifiers that did not work below 300- Hz. No success! Receiver roared at the higher harmonics. It was in my city shack.

But when I try the receivers at a field conditions, far away from the city and any electrical distribution wires I was amusing.

3) Using the E-field probe I found the noise envelope surrounding tall buildings tended to have a radius approximating the height of the building. With a loop sensor I could be much closer to a building before the hum level equalled that picked up the E-field probe.

I attribute this to the fact that E-field strength decreases as the square of the distance from the source whereas the magnetic field decreases as the cube of the distance.

4) With the loop sensor I could rotate the loop to partially null hum pickup but only if the loop was mounted or held upright. If, OTOH, it was held or mounted with the turns parallel to the earth it was easily saturated by ground-conducted hum currents even when located several hundred feet from tall buildings.

In certain areas I could trace out the apparent paths being traversed by the earth currents.

73/72! NH7SR

The first my impression was- the receiver did not work. No any hum. But then when turn around tuning capacitor I heard stations. Lots stations that I cannot receive at the city. I understand, that the receiver works fine, just no any hum. No lots of intermodulation interferences.

It was very amusing! Receiver that at the city conditions roared and noised the same receiver in the field gave very good reception without any noise. However, as I noticed, at cloudy and rainy weather I could pick up the electrical hum. However the hum was not strong as it was in the city. As well it was appeared intermodulation interferences.

So, DC and regenerative receiver do not like city with the hum from main from electrical power equipment and modern electronic devices. My nostalgia is the times when I received interferences only from power tube horizontal generator of the TV.