Ferrite Clips and RF Current Sniffer

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Practice shows that even in case of a well matched with coaxial cable antenna there is some RF current flowing on the outer braid of the coaxial cable. It is so called common mode RF current. Causes of the current are very different. It may be induced current from radiated antenna (in this case balun at the antenna cannot save the situation), it may be not correct placement symmetrical antenna in the outer space, it may be reason that the coaxial cable braid believe that it is a part of the antenna…lots of the very different reasons.

Anyway, the RF current on outer braid of the coaxial cable, at work on transmitting, going in to the shack and may cause lots of harm inside. It is RFI that may hinder any electronic equipment, transceiver may begin to bite... Transmitting signal may be go to worst at every pressing of the key. So in this case before a ham there is a task to eliminate the parasitic current as much as possible. Radical preventing measure to combat common mode current that is installing the coaxial cable underground in metal pipes, using symmetrical antennas and antennas that do not recognize the outer braid of the coaxial cable as part of the antenna, often is not available to the radio amateur. However there is a simple method that may work to prevent flowing of the RF current on the outer braid of the coaxial cable. It is using an RF- choke that installed on the coaxial cable before this one coming to the shack. **Figure 1** shows the simple RF choke. It is a coil wound by the coaxial cable. The coil may contain 5- 15 turns of the coaxial cable, diameter of the coil can be 10- 15 – cm.

Figure 1 Simple RF- choke

However this RF- choke is not enough to eliminate the RF current on the outer braid. Inside of the shack it should be installed several rows of ferrite clips on the coaxial cable. The first row is a long one- it may contain 10 clips. **Figure 2** shows ferrite clips on the coaxial cable. Through one meter it is possible install a second row in five clips, then through one meter one more row in three clips and then one- two clips on distance 50- cm along the rest of the coaxial cable length. The ferrite clips works good enough to kill RF current on the outer braid of the coaxial cable that removes RFI to other electronic equipment and eliminates the biting of the transceiver.

Figure 2 Ferrite Clips on the Coaxial Cable

However, before putting on the coaxial cable the ferrite clips I still have a question- how efficiency the clips are.

To clarify this method I made two RF Current Sniffers. First has LED for indication of the RF current. The second one has connection to internal meter to shows the RF current. **Figure 3** shows schematic of the RF Current Sniffer with LED indicator. **Figure 4** shows schematic of the RF Current Sniffer with meter indicator. Sniffer with meter indicator is more sensitive compare to sniffer with LED indicator.

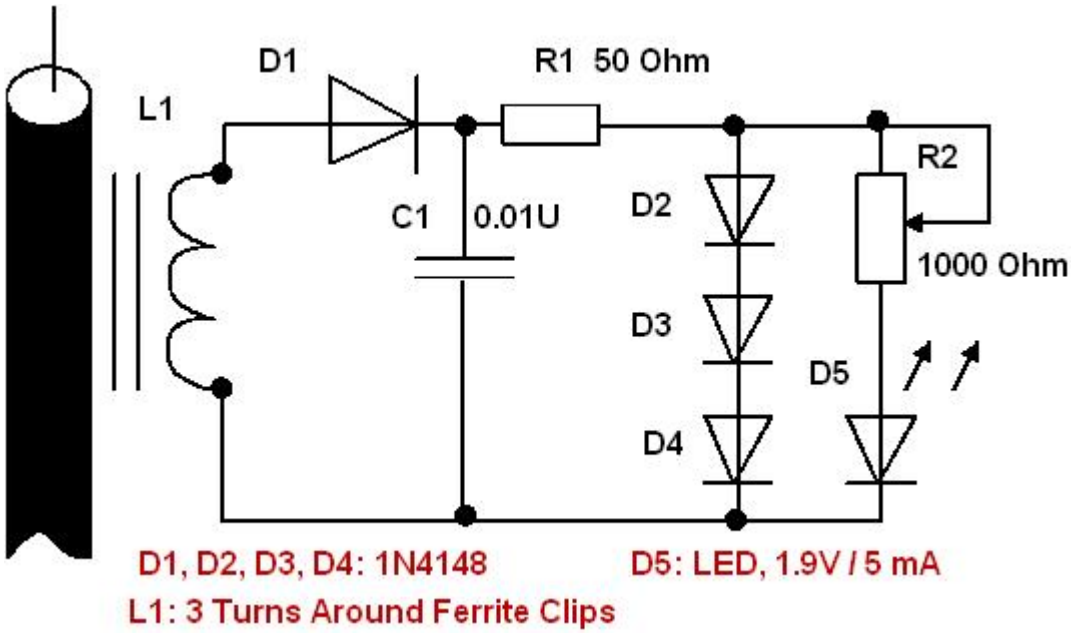

Figure 3 Schematic of the RF Current Sniffer with LED Indicator

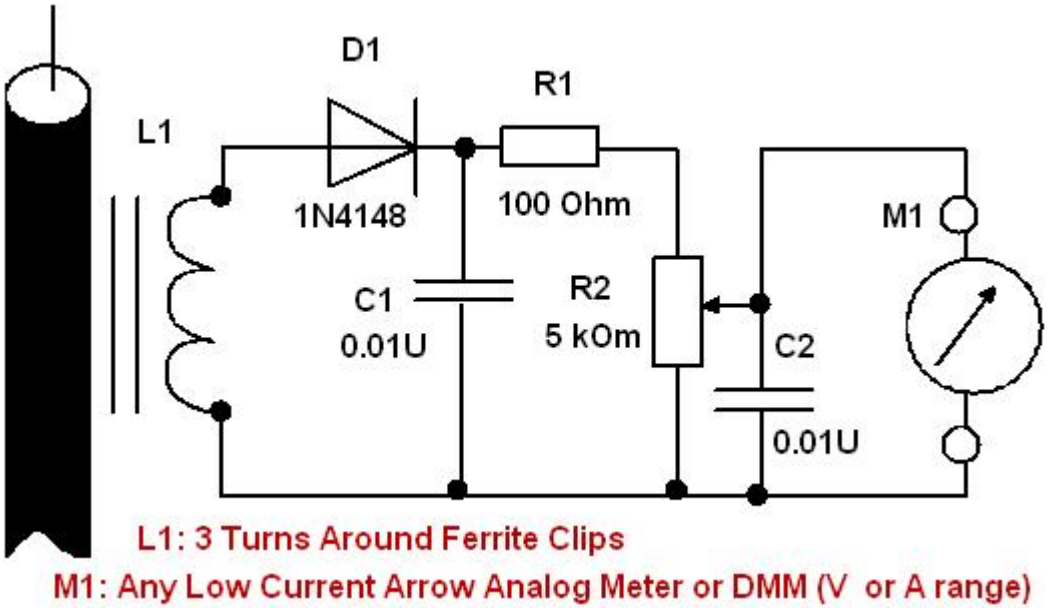

Figure 4 Schematic of the RF Current Sniffer with Meter Indicator

Take a look to RF Current Sniffer with LED Indicator. On the ferrite clips wound three turns of the copper wire in 0.7-mm diameter (diameter of the wire does not matter, may be any suitable). Detector diode is 1N4148. This diode works up to 100- MHz. LED is unknown diode from a child toy (now it is widespread source for the LED).

This diode at 1.9-V consume 5- mA and provides very good brightness. Three 1N4148 diodes connected to the serial protect the LED from overvoltage and limited voltage across this one to 2.1-V. POT allows adjust brightness of the LED. Lower part of the ferrite clips is glued to the PCB by epoxy. Upper part of the clips allows connect the clips to coaxial cable. **Figure 5** shows design of the RF Current Sniffer with LED Indicator.

Take a look to RF Current Sniffer with meter Indicator. (Of course, it is possible use or analog arrow meter indicator either usual DMM.) On the ferrite clips wound three turns of the copper wire in 0.7-mm diameter (diameter of the wire does not matter, may be any suitable). Detector diode is 1N4148. This diode works up to 100- MHz. Lower part of the ferrite clips is glued to the PCB by epoxy. Upper part of the clips allows connect the clips to coaxial cable. Arrow meter (or DMM) is connected to the device through wires in length of 70- cm. Ever widespread current arrow meter with full scale 1- mA allows make very sensitivity measurements compare to current meter with LED indicator. Instead of analog meter it is possible use a DMM that is turn on to voltage range. DMM may provide another kind of measurements and you do not need adjust the POT that limit the current through the arrow current meter. **Figure 6** shows design of the RF Current Sniffer with arrow meter Indicator.

So, with these two RF current meters I decided make measurements of RF current flowing on outer braid of the coaxial cable going from my Beverage Antenna (http://www.antentop.org/023/va3znw_beverage_023.htm). Of course, the measurement gives only quality result, not strictly science, but anyway I may judge how useful the ferrite clips are. The first measurements I made without RF choke (without ferrite clips on the coaxial cable). RF Current Sniffer with LED Indicator was installed on the coaxial cable coming from my Beverage Antenna and wiring in my shack. The LED may glow up at all bands- from the 160- to 6- meter. For glow the LED transmitter should run 80 W at 160 and 80 meter and 50- to 30 W at 40- 6- meter. **Figure 7** shows glowing LED on the RF Current Sniffer with LED Indicator.

Then, ferrite clips were installed on the coaxial cable (see **Figure 2**). The RF current flowing on the outer braid of the coaxial cable is greatly reduced. At 160 and 80 meters, the LED has already stopped glowing, at 40 and 30 meters the LED is barely glowed at power of 100 watts. The “glowing” power on the other high-frequency bands also has significantly decreased. After this experiment I ordered another batch in 40 ferrite clips (ebay, from China) and I hope to significantly reduce the remaining RF current on the outer braid of the coaxial cable.

I used the RF Current Sniffer with Arrow Meter Indicator to measure the RF current on the power cord of my radio station. After the installation of ferrite clips the RF current has dropped significantly. After the installation of ferrite clips, at my opinion, noise on the receiver mode as well goes down. So, the ferrite clips improve my radio at two positions- at transmitting and receiving mode.

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Figure 5 Design of the RF Current Sniffer with LED Indicator

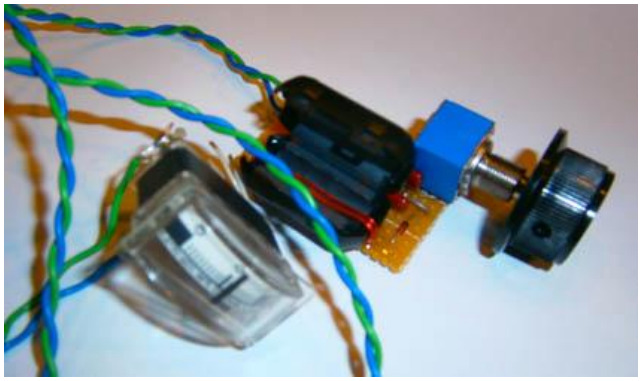

Figure 6 Design of the RF Current Sniffer with Arrow Meter Indicator

Figure 7 Glowing LED on the RF Current Sniffer with LED Indicator