LEGEND:
The RED font denotes text that has **not** been corrected.
The BLUE font denotes issues and additions that require clarification, verification and acceptance of the author.

TUNING INSTRUCTIONS

These instructions are for a device based on the conical ferrite ОС-90.38ПЦ12 removed from an old TV Cathode Ray Tube (CRT) with 90° beam deflection angle. Other types of ferrite were not tested and may not work in this experiment.

In this device, resonance conditions must be satisfied at all times regardless of the input waveform parameters. The resonant output waveform always has the SINEWAVE shape and is independent of the input waveform parameters.

Each generator has feedback with 1 turn on coil and keeps own frequency no matter what changes inside of coil . This is where you get synchronization.
It is unclear here what is synchronized to what (please indicate which of the following points is **TRUE** and which one is **FALSE**):

1. The frequency of GEN1 is synchronized with the frequency of GEN2.
2. The phase of GEN1 is synchronized with the phase of GEN2.
3. The frequency of GEN1 is synchronized with the natural resonance frequency of the:
    a. The 15-turn Low Frequency (LF) primary coil
    b. The 51-turn High Frequency (HF) primary coil
    c. The 1-turn Transverse Coil (copper plates)
    d. The secondary bifilar coil
4. The frequency of GEN1 is synchronized with the resonance frequency **harmonic** of the:
    a. The 15-turn Low Frequency (LF) primary coil
    b. The 51-turn High Frequency (HF) primary coil
    c. The 1-turn Transverse Coil (copper plates)
    d. The secondary bifilar coil
5. The frequency of GEN2 is synchronized with the natural resonance frequency of the:
    a. The 15-turn Low Frequency (LF) primary coil
    b. The 51-turn High Frequency (HF) primary coil
    c. The 1-turn Transverse Coil (copper plates)
    d. The secondary bifilar coil
6. The frequency of GEN2 is synchronized with the resonance frequency **harmonic** of the:
    a. The 15-turn Low Frequency (LF) primary coil
    b. The 51-turn High Frequency (HF) primary coil
    c. The 1-turn Transverse Coil (copper plates)
    d. The secondary bifilar coil
7. Only 1-turn feedback winding exists
8. Two 1-turn feedback windings exist
9. The 1-turn feedback winding is electrically connected to and is a part of:
    a. The 15-turn Low Frequency (LF) primary coil
    b. The 51-turn High Frequency (HF) primary coil
    c. The 1-turn Transverse Coil (copper plates)
    d. The secondary bifilar coil
    e. Is not electrically connected to any of the above windings. It is a separate winding on:
        i. The ferrite half with the primary coils
        ii. The ferrite half with the secondary bifilar coil
10. GEN1 inputs a signal from the 1-turn feedback winding and alters its oscillation frequency in order to keep with the natural resonance frequency of:
    a. The 15-turn Low Frequency (LF) primary coil
    b. The 51-turn High Frequency (HF) primary coil
    c. The 1-turn Transverse Coil (copper plates)
    d. The secondary bifilar coil

11. GEN2 inputs a signal from the 1-turn feedback winding and alters its oscillation frequency in order to keep with the natural resonance frequency of:
    a. The 15-turn Low Frequency (LF) primary coil
    b. The 51-turn High Frequency (HF) primary coil
    c. The 1-turn Transverse Coil (copper plates)
    d. The secondary bifilar coil

The 50Hz low frequency was chosen in order to provide standard mains AC frequency out of the secondary winding.
Using the optional HV discharge into the Transverse Coil, in order to obtain maximum power output out of the ferrite core, is most likely to heat up the core and destroy it after 15-20 minutes.
If the core overheats then it is recommended to lower the HV discharge level or the amplitude of the waveforms delivered by the signal generators.

Q: WILL the device work if the low frequency (LF) 50Hz and high frequency (HF) 386kHz are NOT synchronized ?
A: IT WILL NOT… THE FREQUENCIES ARE NOT FIXED and may vary with the properties of the ferrite and windings.

Do not rely on fixed published frequencies. The whole tuning process is not as easy as it seems…

TUNNING PROCESS

1. Connect the 51-turn HF winding to Vector Network Analyzer output / Spectrum Analyzer input.
   Some VNAs have a separate tracking signal generator **output** and a separate Spectrum Analyzer **input**. Do you mean that BOTH of them need to be connected to the 51-turn HF winding?
2. Connect a signal generator to the Transverse winding (copper plates) and set it to output white noise.
3. Analyze the spectrum of the HF winding with the Spectrum Analyzer and note the highest amplitude peak between 1.2Mhz and 1.8Mhz
4. Connect a signal generator to the Transverse Winding (copper plates) and set it to output a square or sawtooth (ramp) waveform at the frequency of the peak discovered in pt.3, e.g.: 1.3MHz.
5. Tune the signal generator connected to the Transverse Winding from 0 Hz to 2Mhz in order to obtain maximum amplitude in the 51-turn HF winding (CONNECT OSCILLOSCOPE TO THE OUTPUT of the HF winding).
6. Find the lowest frequency subharmonic resonant frequency with highest amplitude in the 51-turn HF winding (CONNECT OSCILLOSCOPE TO THE OUTPUT of the HF winding).
7. Connect a signal generator to the 51-turn HF winding and set it to output a rectangular/square waveform at the frequency discovered in pt.6.

ALL OF THE ABOVE STEPS SHOULD BE DONE WITH ONE GENERATOR AT A TIME, ONLY !

8. Fine tune the frequency of the signal generator connected to the 51-turn HF winding in order to obtain maximum amplitude in the bifilar secondary output winding. (CONNECT OSCILLOSCOPE TO THE OUTPUT of the bifilar secondary winding . Use HV scope probe and set the initial amplitude of the signal generator to a low level)
9. Connect a second signal generator to the 15-turn LF winding and set it to output a 50Hz sinewave.
10. Fine tune the frequency of this second signal generator for a maximum amplitude in the bifilar secondary output winding. (CONNECT OSCILLOSCOPE TO THE OUTPUT of the bifilar secondary winding).
11. The correct fine tuning (+/- few Hertz) of the second generator connected to the LF winding will be manifested on the oscilloscope as the high frequency waveform, from the 51-turn HF winding, riding on top of the low frequency waveform of the second generator.
12. Connect flyback circuit with AV (please expand this acronym) diodes plug and a spark gap from the schematic provided in our first experiment, to the Transverse Winding (copper plates) and tune the variable capacitor attached to the Transverse Winding for maximum output power at the bifilar secondary winding. Judge the output on the bifilar secondary using an oscilloscope and/or a light bulb.
13. If the circuit fails to resonate then re-tune the two generators again.