https://www.youtube.com/watch?v=v6FrGTF731o
Method for finding the operating frequency of a high-voltage system

0:00 Good time everyone, today I will show you an interesting thing with which you can
0:08 check to what frequency you need to tune Tesla coil in relation to
0:16 grenade, because this frequency is impossible
0:21 determine using a signal generator, for example, if we connect a
0:27 signal generator to this antenna and we will apply this frequency
0:37 we may not see the effect, we can't see it because we need to check this coil
0:43 under load, we see that we have a hot end of the coil,
0:49 cold end, we are starting and the load, for this test hangs on it
0:55 we have a 15 watt lamp, we get a signal generator
1:03 of such types
1:08 different types, different people have different generators, but all of them can not give such a high potential
1:14 which can be traced to see in reality, how
1:19 our coil reacts to an electric field, the essence of this
1:27 designs, I think many of you who build and adjust the frequency have remained
1:35 cut pieces of wire, usually they lie dead weight, sometimes used
1:42 on the jumper wire, but in general there is a collection of these pieces
1:48 here you can see such a design, it is all assembled from pieces of
1:53 same wire, then how much I cut it to adjust the frequency and somehow I got bored
2:00 with this whole thing, in general step between taps
2:05 about 0.8 centimeter to 1.5, average step about
2:13 centimeter, we make taps about 20 taps and fill the frame
2:21 we have a frame of cardboard, so that there is a higher quality factor for the coil and a larger spectrum
2:28 frequencies that we can capture, the winding direction both in this system and in the working
2:36 system, when we assemble the it, the direction of winding the tesla is already to the left, that is,
2:43 counterclockwise, as we have a rule that is known
2:50 I repeat it again that the left-hand winding counterclockwise you have for
2:55 electric field right-hand winding, clockwise for
3:00 magnetic field, we need to obtain an electric potential on this antenna
3:07 so we wind it to the left, here about 20 pins, circuit
3:14 I gave a kacher schematic in the previous video, we will not dwell on it, inductor
3:19 we make it movable, so that it can be moved and it is also clear that here we have
3:25 alligator clip wire, wire goes to the base of the transistor, that is, it will allow us to move
3:32 along this wire, a movable inductor is needed in order to smoothly adjust
3:39 frequency, that is, when we moved between one other tap, a smooth adjustment
3:45 between them, we can produce a little by moving the inductor to the right and left
3:50 thus, the frequency is adjusted if we need a range of these frequencies
3:58 if shift in the lower frequency needed then we can enter
4:04 ferrite rod who has what you can set of rings inside this
4:09 coil and frequencies will be reduced if we need to increase the frequencies, on the contrary, we can
4:18 use the option of moving along the taps and if we do not have enough of this frequency
4:24 we are already reducing the number of turns; we are changing the geometric dimensions from
4:29 of this antenna, a system with a wide range is obtained by starting the system
4:37 we connect the grounding, same grounding which will be used on the installation
4:46 because if we change grounding frequency will change a little bit, we will also change the frequency in
4:53 certain limits for this coil, so it is advisable to use exactly same grounding

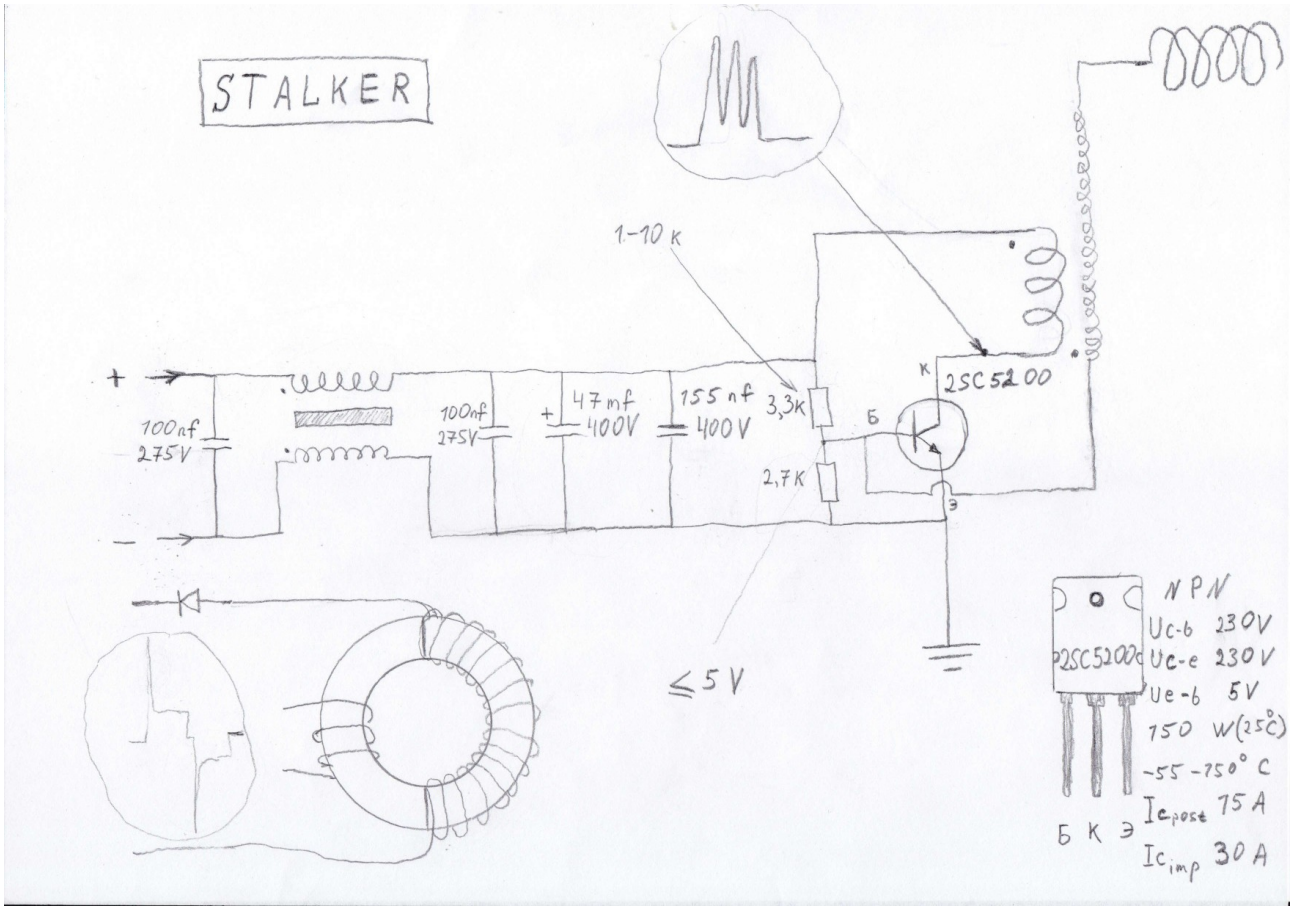
4:58 that will be used, in this case here 20 meters cable wire is connected to it
5:06 how it ends with a alligator clip which we will connect to the
5:12 coil taps, turn on the oscilloscope, put the probe at a distance of about 15 centimeters, so that
5:20 we can effectively track the frequency of a given coil and
5:26 magnitude around the antenna electrical
5:31 fields, so we start the system, we will use power from
5:37 laboratory power supply, voltage about twenty
5:43 four volts, standard what they can be tuned to
5:50 now 24 volts, one ampere with a few milliamps
5:57 consumed and now we see that now the lamp is on
6:03 we have oscillograms frequency 1
6:08 megahertz, but before starting the test we need
6:14 eliminate the influence of the inductor on this coil, because the inductor is
6:20 directly between the antenna and the resonator itself, its influence must be excluded
6:25 here you can see that now there are powerful
6:30 pickup on the inductor, in what way is it
6:37 you can do - you can use a capacitor which will be later on the oscillatory circuit
6:42 installed somewhere in the region of 0.1 microfarad to 1 microfarad
6:51 or equivalently, let's say a particular high-voltage, connected capacitor
6:59 you can see that the load is not lit, we remove the capacitor, lamp is lit again, but the best
7:05 way is just short the inductor to remove its influence, we see that
7:11 the inductor is shorted, the load does not react in any way, the next step we connect
7:18 grounding to this coil, connect it to the cold end
7:25 we connected the ground, we see that we have some glow, we observe
7:34 such a moment for which we will monitor, see this value with the connected
7:41 pike reacts with grounding, now you turn off, we see the amplitudes
7:46 our task is to find the frequency at which the maximum absorption of electrical
7:53 the field of a given coil, that is, the minimum amplitude on scope, probe location is unchanged
7:58 it is also possible to track this moment with the help of a neon lamp, here we see it begins
8:06 glow at a distance of about 18 centimeters and if I disconnect
8:12 ground wire, then the glow is really here 40 centimeters from the antenna, that is
8:21 you can see that it is equivalent and the glow of the neon lamp, returned to the ground and we begin the transition
8:29 at the construction, we begin to move along the taps
8:36 move see the first output
8:43 connected from the glow of the lamp now moving let's say the fourth output
8:49 here connected, the glow increased, means that we reduce the amount of wire
8:57 the frequency rises, one more moment it is necessary that
9:02 antenna connected to the hot end, we move not the hot end
9:08 but move the ground point otherwise if you try to do
9:14 on the contrary, this part, let's say we will move the antenna connection, it
9:20 you will play a role as an additional vibrator and will introduce a distortion, that is, a signal
9:27 should be sinusoidal without any distortion, this is the most
9:36 quality way, for safety, you can also use these ends that will be
9:43 free or even solder, connect again to this wire all this completely eliminate all influence
9:50 so on, the load is lit, which means we can move it and move our inductor a little more
9:58 and move on now I switch the gradually to them for the load I switch the fifth
10:07 output glow increases, 6 output, 7, 8
10:17 we see that the brightness increases 9, 10, 11 tap
10:26 that is, we have a tendency to increase the frequency in this case, we can
10:31 fix what frequency is now
10:37 is megahertz here on the antenna

10:43 and the load is already shining well with us, we will test further, we will move our
10:48 inductor, let's see if we can find another place on which the load
10:55 will glow even brighter by moving the leads even brighter and mind
11:05 the glow here is bright enough rising
11:11 brightness further movement, we get 16 output out of 20 already
11:20 the brightness decreases, so you can see that is, we can stop 15 16 output in this
11:29 case, it is clear that I went through the tap before
11:35 here and now
11:43 play around with the inductor itself between
11:50 conclusions, here we move the inductor and find
11:55 the maximum glow of our load, this glow is the maximum we can also
12:03 notice that our consumption also decreases when the system works in harmony with my
12:11 coils found the optimal point where the system is connected
12:17 frequency corresponds to
12:23 1.35 megahertz and then further to
12:29 this system also you can do this load visualization can be done
12:36 directly put the rectifier here and put the device and let's say
12:41 you can put a voltmeter on this setup and track not by eye how
12:49 the lamp is lit, but track the voltage when the voltmeter
12:54 will show the maximum voltage on the load and it will correspond to the frequency that is necessary for this
13:03 I also recommend fix the result on the frequency response for this coil after measurements with one
13:12 antenna and connect another antenna with a smaller number of wire, to change in general our
13:19 dimensions from the previous one and also check the frequency of it, on which frequency given
13:26 antenna we will have the effect of maximum absorption by our
13:32 resonator, and yes indeed we will notice it is clear that I hung much smaller antenna in
13:41 length of the antenna, with a much larger step, I had to
13:49 move on the one tap below, move in inductor load is equivalent glowing and
13:56 we can also fix this frequency, you can play around with
14:05 this system at lower frequencies to the inserting of the ferrite, that is, this layout
14:12 allows you to capture the full frequency response of the resonator
14:20 you can play at higher frequencies, for this to hot end you connect
14:30 no longer an antenna but equivalent only one turn of wire
14:37 we look, we test, we can drive it, we can see what dependencies
14:42 occur, that is, everyone will already do it himself, he will choose, I advise you to make a diode bridge filter and
14:52 put an voltmeter on which you will judge
14:57 voltage about the accuracy of the settings changed, when we check our antenna
15:03 also the effect is such that we observe when changing the ground point between cold and
15:10 hot end, our power consumption should not change too much, that is
15:15 consumption from now to cold
15:47 grounded which perceives the electric field from the antennas is closer, that is, from the surface
15:55 therefore, our consumption is slightly increasing, in general, we can observe that we have
16:01 consumption changes slightly, which means that this is the frequency that is most
16:07 suitable for this coil and tuned with it now let's move on to
16:15 questions that, in my opinion, are relevant and the most interesting, question 1
16:24 Is there relationship between the wire length of the high voltage coil and the wire length
16:32 of resonator coil, the question is correct, of course, there is some dependence on the wave
16:39 distribution, that is, we wind the length of the high-voltage coils equal to the length of the

wire in the resonator
16:46 or if our resonator needs a higher frequency, then we wind the length
16:55 wires of a high-voltage coil equal to half the length of the resonator, there is also another interesting point
17:02 this thing that we all cling to called it an antenna, it is in
17:11 some dependence with the capacitance is formed between its surface and
17:17 grounded coil, which also affects the frequency
17:23 but the point here is not only the length of the conductor of this antenna, it should
17:31 correspond to an effective, so to speak, effective study of the frequency at which it works
17:39 a high voltage coil i.e. an antenna rule fits here, these helical resonators and they should
17:47 effectively work, that is, in principle, a quarter-wave radiate either three-quarters five-fourths, that is,
17:55 then we can customize in the simplest way of course is
18:02 adjustment by cutting off the length of the conductor and achieve around
18:10 this antenna of maximum electric field, that is, it can really work as an antenna
18:18 this system will repeat under the frequency on our tests
18:25 which is formed this applies already to
18:30 antenna theory, that is, the meaning is such that the wire has a physical length with us
18:37 diameter and also it is in our coil just
18:42 for antennas here you can calculate and even on some online calculators you can
18:47 calculate, but when it is placed exactly on the coil
18:52 and is dependent on it as a capacitive coupling and the coil is grounded here these calculations are a bit inappropriate
19:00 they don’t even fit strongly enough and it turns out such a moment that you have to
19:06 in practice, adjust the length of the wire, since the length of the high-voltage conductor
19:13 we have a fixed coil, therefore we carry out frequency adjustment
19:19 by changing the geometric dimensions of the antenna, we compress and squeeze and and
19:24 turns we increase the diameters, that is, we carry out manipulations if we cannot
19:30 adjust the effective frequency that we found out using this layout then
19:37 then we change the winding diameter of this wire at the length that should
19:44 correspond to the length of the wire in the coil, the diameter of the frames varies from this
19:51 there will also be a departure of the frequency characteristics, question 2, where the main processes take place
20:00 in the grenade itself or in its inductor, but
20:06 here on the Internet the most common designs that will make it somewhere
20:11 just all the processes occur in the inductor and in relation to the inductor
20:16 the grenade itself is just a certain amount of wire on which
20:23 there is an effect of a magnetic field, the interaction occurs precisely between
20:29 antenna electric field a tesla and magnetic
20:34 field into the inductor and at the same time this coil is just a pickup coil, but this mode
20:41 very unstable, the mode when we make an intermediary, that is, we create in that
20:49 the same mode, we introduce the inductor into the resonator mode and we simply remove the mode
20:54 are not effective much more efficiently we introduce into the resonator mode exactly the main
20:59 coil a for the inductor to leave the role of pumping the rotating magnetic field and
21:07 already all the processes that took place in this particular coil, which is why we calculate according to the program
21:12 we wind with adjustment for a clear inductance, we get all the processes in
21:17 it, question number 3, in one of your videos you
21:24 namely, the frequency search technique for push-pull and you showed that for your
21:30 coil frequency is 90.8 kilohertz, why so high ?

21:38 because we all work at frequencies from 9 to 35 kilohertz
21:43 and our oscillating circuit system is successfully working, in this video I
21:50 showed the method of searching for exactly the frequency that is needed for this coil; I did not make a reservation about the frequency
21:56 this is exactly what we get, we all saw such a moment when
22:02 we tune the oscillatory circuit to any frequency that we like then
22:09 everything adjusts to almost what it turned out to be picked up
22:14 sequentially into the capacitor and set it up for this, we get the setting for the first
22:19 the main harmonic of the resonance, and when the load is connected, we see such a moment that the consumption of
22:27 push-pull falls, everything is fine, everything is fine with this
22:34 at the moment we are familiar that nothing supernatural is happening there, there is no there, it turns out at the moment when
22:41 the oscillatory circuit is not loaded for its maximum oscillation amplitude
22:48 requires a certain number of portions of electrical energy as soon as we connected the load we
22:55 upset the oscillatory circuit, its frequency left the main oscillations and
23:02 it turns out already for a smaller amplitude of oscillations in the circuit, and we need
23:07 less electrical energy, which is why there is a decrease
23:14 consumption, what we are doing is wrong setting adjust
23:23 circuit of the inductor we need necessarily 3, 5, 7 or 9 harmonics on the odd ones in this
23:31 case when tuning and the push pull to the harmonic that we are tuning
23:37 the osillator is insignificant much less than at the first harmonic
23:43 if you set it up, you will see that when you connect the load to the odd harmonics, you will either have same consumption of
23:52 push pull, or on the contrary, rise, that is, we have a osillator
23:58 turns out to be stable and thus we can achieve if we adjust the osillator
24:03 inductor to the harmonic of the frequency that we exactly need, but in this case it applies to my coil
24:10 the frequency for it should correspond to 90.8 kilohertz, I adjust
24:15 on the fifth harmonic for me on the 5th harmonic, my push-pull should work at 18 kilohertz
24:24 there are 18 kilohertz, another 1/10 kilohertz, but it turns out with fine tuning, that is
24:30 my push pull works like yours at 18.1 kilohertz at about this
24:38 in the oscillatory circuit of the inductor there is a frequency of 90.8 kilohertz nothing
24:44 there is no supernatural in this, just work on the harmonic, while you need
24:51 understand that in general an electric field from a Tesla cannot
25:00 influence the magnetic field rotating in the inductor at that
25:07 moment when push-pull is triggered, and that is, we must create in the circuit
25:14 free oscillations, compare this moment with the flywheel that we pushed and
25:21 it makes a certain number of revolutions with us, just working on a magnetic field with the help of an LC
25:30 the time of their free oscillations of the magnetic field and, consequently, of such a movement
25:36 the only way our system can’t work when we work on the first harmonic
25:43 we will not get anything like this, that is, 3rd,
25:49 5th, 7th or 9th harmonic, it’s no longer worth climbing the ninth harmonic will already be
25:57 the quality factor of the circuit drops, is not worth, question number 4, on the Internet has
26:04 appear information about glitches in chip TL 494 which
26:11 allows you to bring this system into operation, have you heard about it and what is it
26:17 we will analyze this process, yes indeed
26:24 people who manage to get a power increase on these systems
26:30 some working mode they use such moment as which
26:38 called “glitch of chip” but in this case it is not glitch,

26:45 as such, not here the process is very simple, feedback is formed between the master
26:56 chip, it is formed at the moment when we have an influence either on the pin 3
27:04 most often on the pin 4 or 5 frequency the setting pin,
27:10 due to the fact that this
27:16 the chip is not shielded and is close to the same antenna
27:21 well, either to the high-voltage Tesla coil, let's analyze it in more detail what is happening
27:29 when we have a circuit in inductor, we have
27:35 magnetic field this magnetic field has a certain diameter around this
27:43 system and directly above the inductor is the Tesla antenna
27:50 on which the electric field appears, then we turn on the electric field
27:57 tesla has a much larger diameter and that's the diameter of this can impact
28:03 chips and such an interesting phenomenon occurs, magnetic field
28:09 modulates the electric field and since the electric field from the tesla has
28:14 large diameter it is due to poor-quality of construction or long
28:20 wires can get such an effect that there will be some kind of pickup on
28:27 3, 4 or 5 pin of TL494, which can happen when
28:33 at the same time, the duty cycle at the output of the chip may change in some
28:41 within the limits, the frequency changes or it can stop working altogether.
28:48 an unpleasant feature when changing the duty cycle could be observed
28:54 streets of push-pull transistors, but because the chip starts to work unstably due to strong pickup and
29:02 to issue a duty cycle with overlap along the channel in most often this happens, but
29:08 this effect can be used, how to do it
29:14 that is, you need to understand that when we create an inductor and clean
29:21 sinusoidal oscillations they have the same amplitude
29:26 the positive half-cycle of the oscillation is equal in amplitude to the negative half-cycle of the period
29:31 oscillations of a sinusoid, then such harmonic oscillations as a constant
29:38 the current for the medium is a normal phenomenon; it is practically on it with us
29:44 there is a skew of magnetic fields, the various durations of which adjust
29:50 that is, the system goes into imbalance into an asymmetric system turns
29:55 it is precisely this anomalous behavior of the system that the environment regards as
30:01 a very large indignation that needs to be suppressed and it harshly responds to it, thereby
30:07 people manage to catch some power increase in this mode of operation
30:14 the increase will be significant even it can lead to a self sustain system
30:21 itself, the so-called when the system starts to work for itself, but this
30:27 the mode is very unstable is an uncontrolled process that is often
30:33 goes astray and leads to the failure of the electronics of the system, that is
30:40 can be used but not recommended
30:46 this process to make a more controlled system, actually it works like a living
30:52 body, therefore necessary to learn and tune properly, and who will go with “glitch” principle, for those I repeat: your Tesla
31:01 coil does not work as it should to obtain normal power, that is, the entire system
31:07 inconsistent and large capacities on it, you will not get far, you can see the power increase on this systems due to
31:13 distortion of magnetic and electric fields only
31:25 wish successful experiments for everybody, all the best



pic. Kacher schematic can be used to antenna tests