

PESN OPEN SOURCE PROJECT TESLA WIRELESS POWER TRANSMISSION

APR 21, 2011

REPLICATION INSTRUCTIONS

steve.jackson@ieee.org

Our mission is simply to wind a single-layer spiral coil. That is the whole “secret” to Tesla's wireless power transmission. It is just a special kind of Antenna geometry. There are no active devices like Transistors or Tunnel Diodes. No mysterious Specially Conditioned Crystals are required. Just a length of ordinary insulated copper wire. “***How can it be so simple***”, you may ask. Well, simple is elegant.

Please read the 25 Steps which follow, before starting work. This will give you a good orientation for the tasks ahead.

Appendix 1 lists the materials required.

Appendix 2 gives a brief history of this project.

Appendix 3 is a NOTE TO DE-BUNKERS.

Appendix 4 is ERIC DOLLARD - SCALAR EXPLAINED

Appendix 5 is a link to the 1911 Steinmetz book that details Dielectricity

Appendix 6 is a link to Tesla Patent 645,576. You can see the winding directions.

Appendix 7 details the Hantek 3X25 Generator operation, and the Tuner Utility.

A NOTE ON WIRE AND DISC SIZE

The Instructions that follow will use #30 wire, which is very thin. This is much smaller wire than Nikola Tesla used, but he was the Master and we are Grasshoppers. We can learn a great deal about this new electrical physics, and accomplish it safely, using thin wire and low power levels. First steps first.

At this writing (April 21, 2011) we are still experimenting with different wire and disc sizes. The Replication Kit may end up using a different wire size and disc size than are described here. Check the Project website for news.

DISCLAIMER!

This Project recreates an invention that was Patented by Nikola Tesla over a century ago. It is new science which has not been tested and approved by medical authorities. ***Proceed at your own risk.*** Neither the author nor PESN can be held liable for any injury or damage, however caused.

STEP 2

Cut your sheet of 1/4" hardboard into squares measuring 4 1/2" on a side. The Big Box stores will give you two cuts for free so you can leave the store with strips measuring 4.5 x 24". You only need to slice off 4.5" squares.

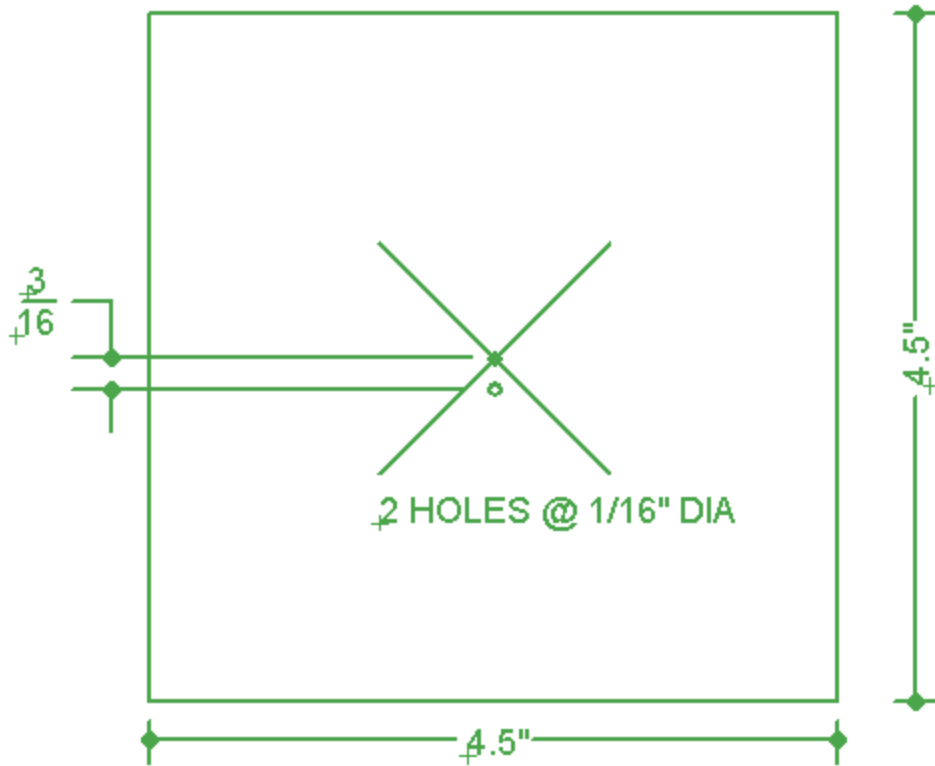
A friend with a fixed-blade saw in his basement will do this for a beer (but pay him after the cuts are made.)

Do not use 1/8" thick hardboard, because it warps. We need a perfectly flat base board surface.



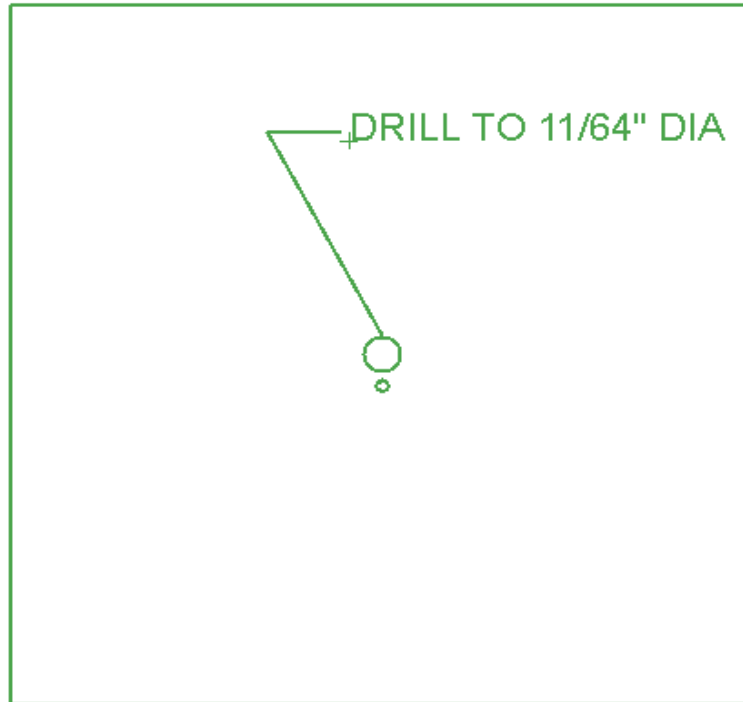
STEP 3

Mark the center of the base board with cross lines connecting the corners. Drill a center hole of 1/16" dia. Now drill a second 1/16" dia hole located 3/16" from the center hole.



STEP 4

Drill the center hole out to 11/64" dia. (to accept an 8-32 screw).



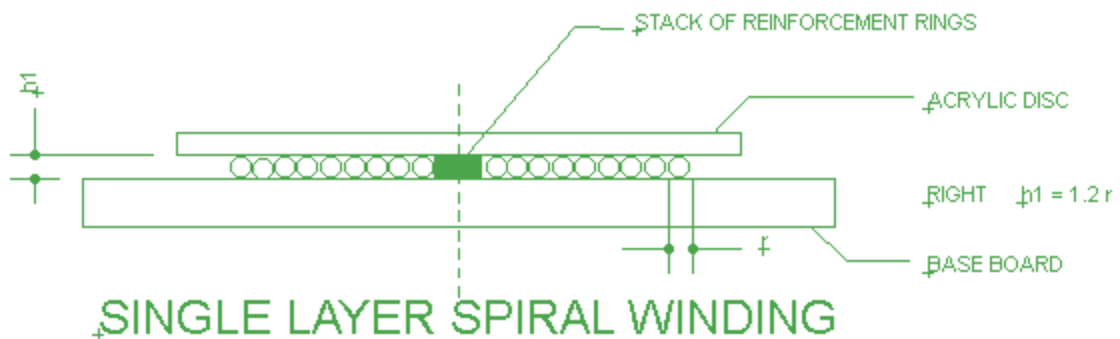
STEP 5

Measure the outside diameter of the wire you will be using. #30 Wire-Wrap wire is about 0.020" (20 thousandths).



STEP 6

Stack up 3-ring binder Reinforcement Rings until you measure a thickness about 0.005" thicker than the wire. For example, 9 stacked Reinforcement Rings are about 0.024" thick. This will create a generous space for our single spiral winding. But not so generous that the wire can double up to 2-high!



STEP 7

Use scissors to cut a 1/16" slot in the stack of Reinforcement Rings.

Stick the pile of Reinforcement Rings over the center hole in the base board.

Position the slot over the 1/16" hole.



STEP 8

Thread a #8 solder lug onto an 8-32 x 2" screw and push the screw through the center hole in the base board.

Feed your #30 wire through the adjacent 1/16" hole in the base board from the top, so the tail end of the wire is on the side with the solder lug and screw head.

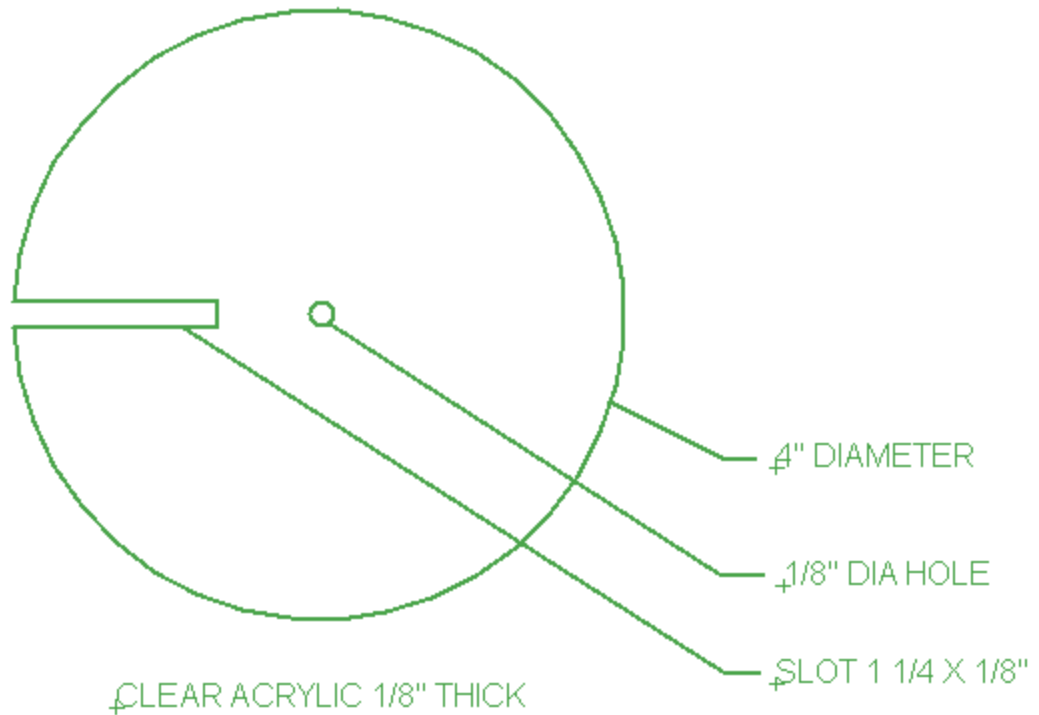
Now is the time to strip and solder this wire tail to the solder lug. Why? Because if you do it later and use up all the wire trying to strip it properly, you will be very sad! Leave 1" of slack in this wire, for future maintenance.

You should buy a stripper that is calibrated for #30 wire, like Paladin PA1118 shown below.



STEP 9

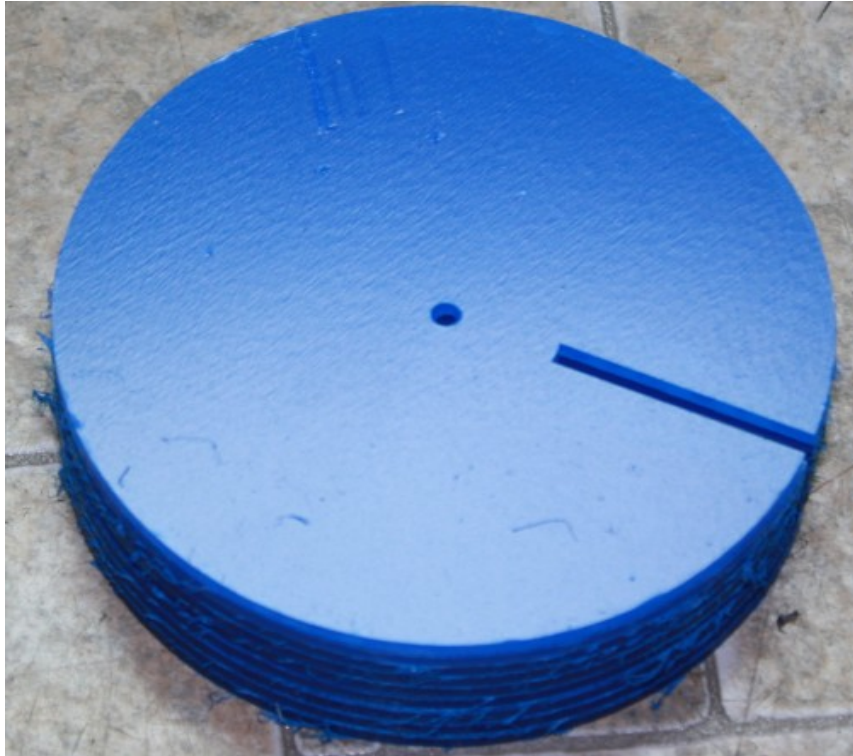
Here are the dimensions of the 4" acrylic disc that we will use. A supply of these is included in our Replication Kit, or you can have a local plastics fabricator make them for you.



Drill the center hole out to 11/64" diameter.



Sand one edge of the disc using medium grit sandpaper, to take the sharp edge off. This will prevent slicing the wire's insulation.



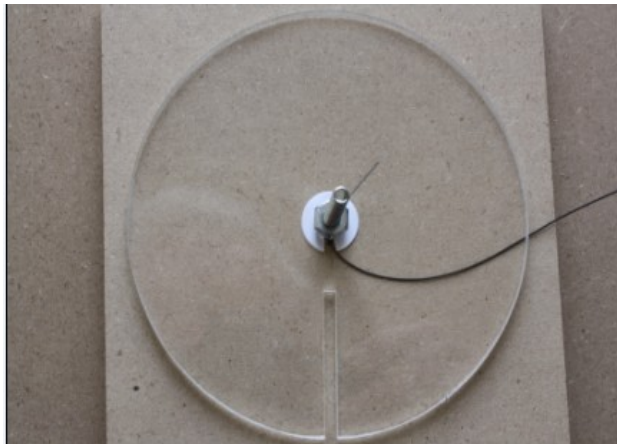
Now pull off the protective (blue) layer from both surfaces of the disc.

STEP 10

Wipe the board surface and disc surface with a cloth to remove all dust.

Install the 4" disc (sanded edge facing the base board) onto the 8-32 screw.

Feed on a #8 lockwasher and an 8-32 hex nut. Be sure that the wire has passed through the slot in the stack of Reinforcement rings. Now tighten the nut snugly. See that the gap between the disc and the base board is uniform all around the perimeter. Rotate the disc so that its slot aligns with the slot in the Reinforcement Rings. Then you can count Turns as the wire passes the disc slot. And the Turns will be precise integers from the winding starting point.

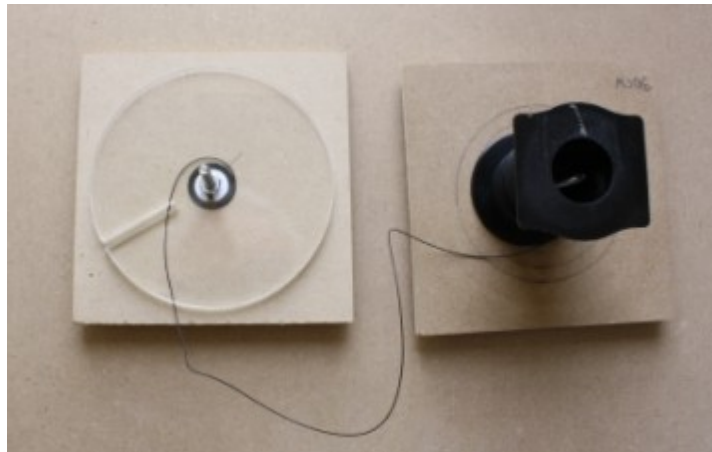


STEP 11

Now you are ready to start your Secondary spiral winding of 70 Turns. Choose your direction - Clockwise (CW) or Counter-Clockwise (CCW) as seen from the top. For this Project, we will need to wind at least one CW coil to use as the Transmitter, and one CCW coil to use as a Receiver. If you are ambitious then wind two CW and two CCW for a total of 4 coils. This will allow you to experiment with multiple Receiver coils, and to test the effects of the winding direction. If you live in the Southern Hemisphere, these rules might be reversed. Try it and let us know!

Wind 4 turns with loose tension - just enough to keep the spiral tight with no gaps. You may need to remove the disc and add or subtract a Reinforcement Ring to get the correct gap for your wire thickness.

Let the wire spool turn on a peg so as to avoid wire twists, as shown here:



Now we will need to use a 2" ABS Pipe Cap to hold the disc down during winding. Otherwise the winding will rise and we will get doubled turns. The cap is just a temporary aid during winding.

Drill an 11/64" hole in the center of your 2" ABS Pipe Cap. Guide the cap onto the screw and secure it with a lockwasher and hex nut. Tighten the nut so that the wire has clearance all around the disc perimeter, but is not too loose. **Too loose** means that 2 wire diameters can fit into the gap!



Now continue to wind a total of 70 turns on this Secondary winding.

Check frequently to see that the wire has not doubled up. Your clue will be that one side of the disc has a larger gap than the other sides. Take care that the wire insulation is not cut or nicked as it passes by the slot in the disc.

STEP 12

When finished winding the 70 turns, feed the wire up through the slot in the disc and pull a 2" loop in it. (Meaning about 2" up and 2" back to the slot. This wire will later be soldered to the terminal strip lugs.

Now continue winding your Primary winding, making 5 turns continuing in the same direction that you chose for the Secondary.

Tape the wire end to the disc, so the winding does not unravel.

Now you can remove the pipe cap, and marvel at the beauty and uniformity of your perfect spiral coil!

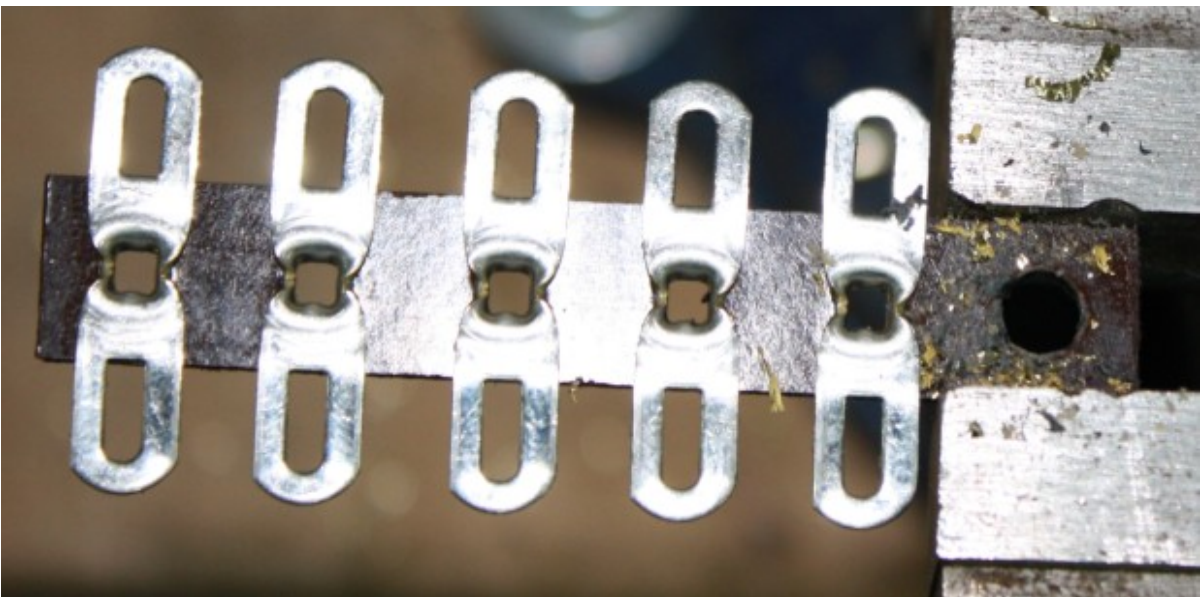
If you are not satisfied, then unwind the wire down the hallway, and start again.

Doubled turns are not good - we really do need Perfection. We need to meet the high standards set by Nikola Tesla.

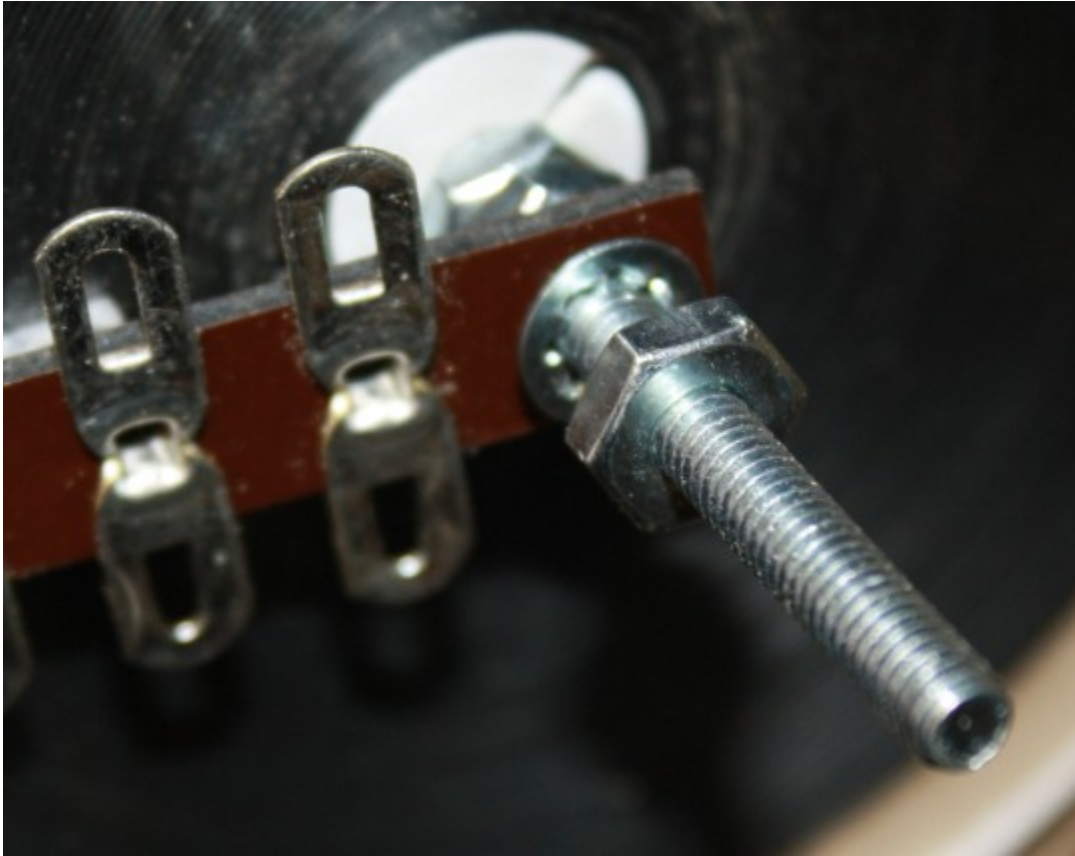
STEP 13

Place a Terminal Strip in your bench vice and use your drill to remove the brass right-angle mounting foot bracket. Use our favorite 11/64" drill bit.

See the second photo below - the bracket is GONE.



STEP 14

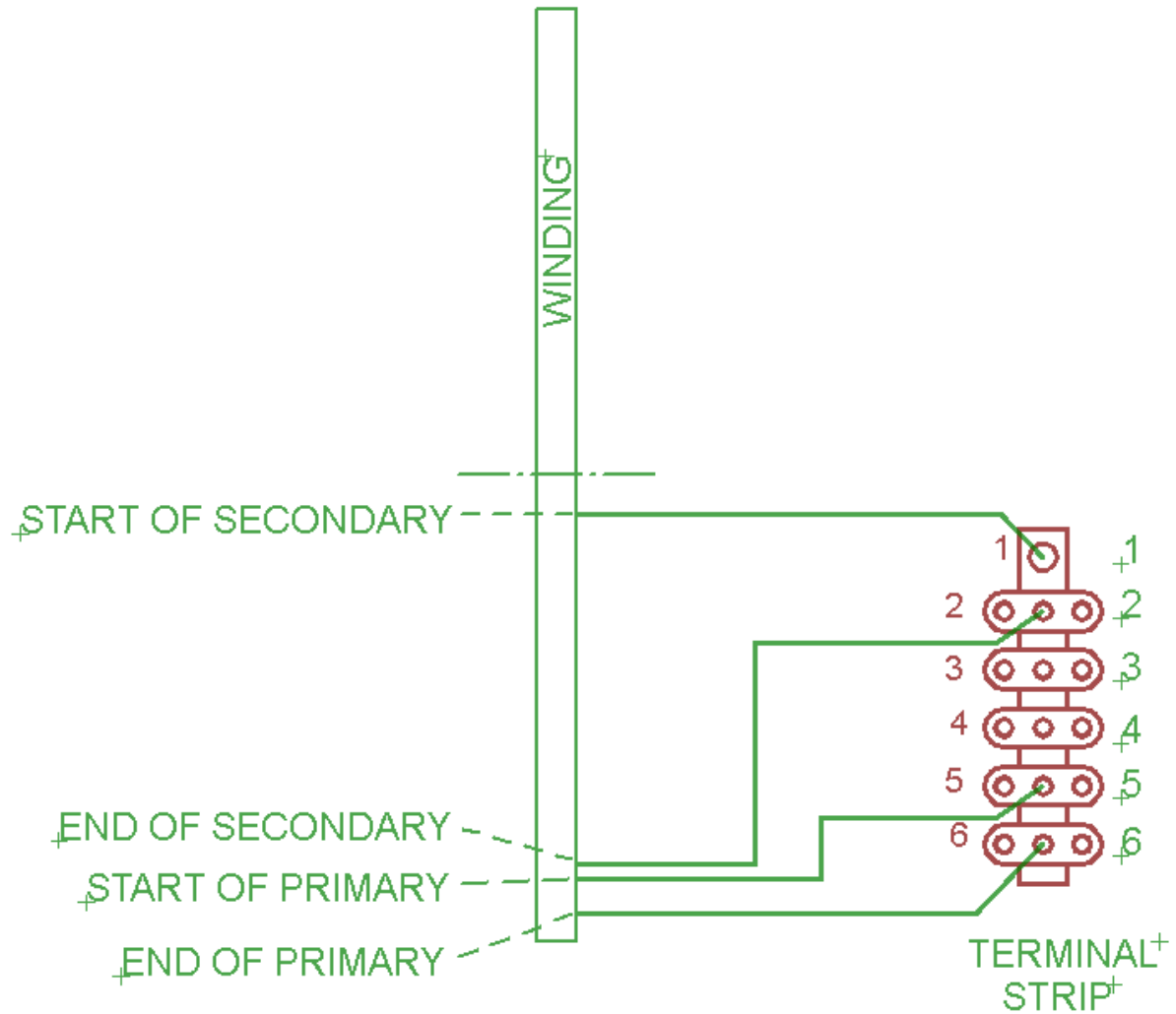


Turn a second 8-32 hex nut onto the screw protruding from the center of the coil that was just wound, and turn it so it sits on top of the first nut. Tighten this nut with pliers. This second nut is just to act as a spacer for the terminal strip, to lift it clear of the disc.

Now place the terminal strip on the screw and add a lockwasher and start another 8-32 hex nut. Leave the terminal strip loose on the screw for now. Do not tighten the nut until after we have soldered the wires to the terminal strip. This makes it much easier to fish the fine #30 wires up into the terminal strip holes from below.

STEP 15

Now we are ready to strip the insulation from the #30 wire ends, and solder them to the correct terminal lugs. This is a bit tricky - so have a look at this connection diagram:



The center end of the Secondary winding goes to the solder lug on the bottom of the board - this is Pin 1.

The outside end of the Secondary winding goes to Pin 2 on the strip.

The inside end of the Primary winding goes to Pin 5.

The outside end of the Primary winding goes to Pin 6.

I feed these #30 wires up from below the strip into the center hole of each lug, and solder them there. This will protect these fragile wires from physical damage, since we plan to clip leads and solder parts to the lugs in the future.

This photo, for example, shows Pin 2 of the terminal strip, and you can see that the “outside end of the Secondary” wire is soldered to the center ring (at the 5 o'clock position) of this lug.

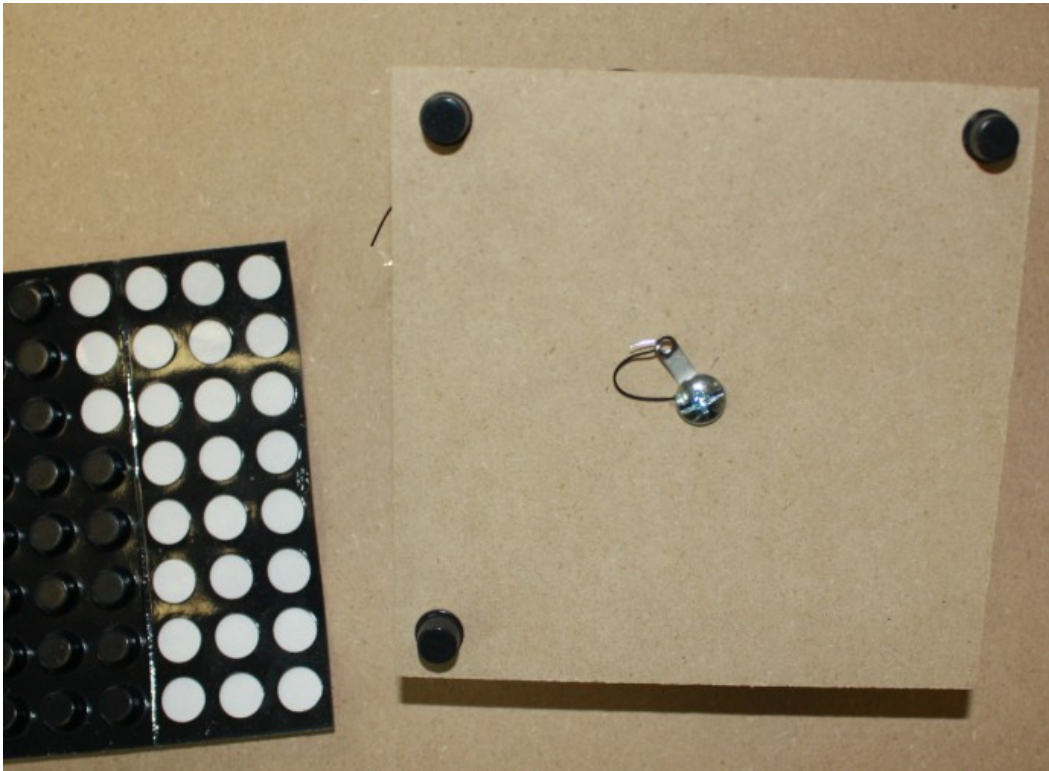
BTW: There is no need to fill the center hole up with solder.



If you are new to soldering, this Project is an opportunity to grow! I use 63/37 solder with rosin core flux, and a 30 Watt iron.

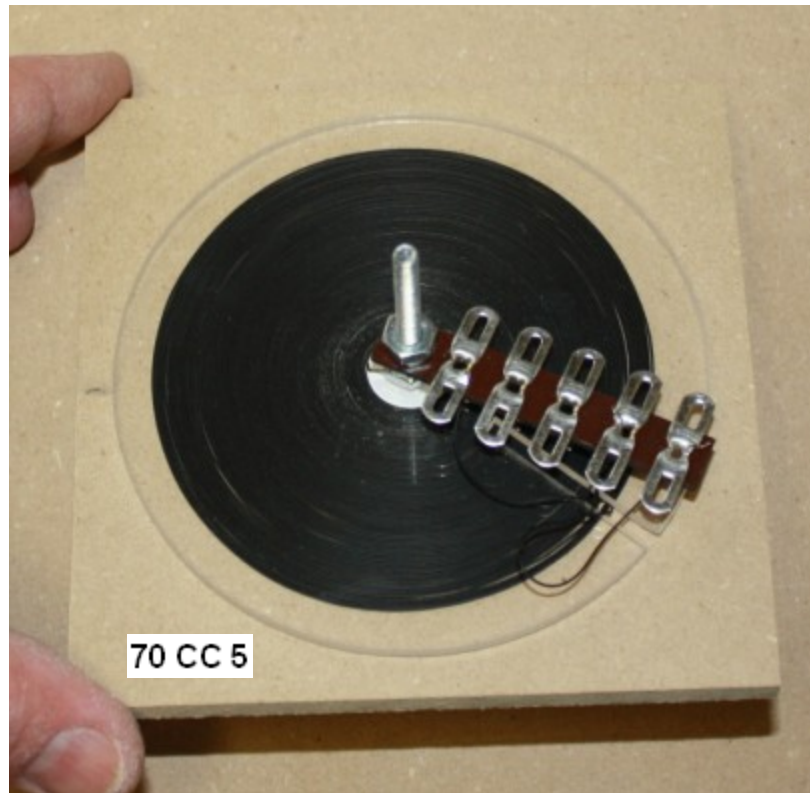
STEP 16

Install 4 adhesive-backed feet to the bottom of the base board. This will keep the base board level, and also lift the bottom solder lug free of the table surface.



STEP 17

Mark your coil with pencil - **70 CC 5** for 70 Secondary Turns, wound CCW, and 5 Primary Turns. You may want to use clear adhesive tape to tape the fragile #30 wires to the top of the disc surface, to prevent them from being snagged in the future.



STEP 18

Here is the Schematic Diagram of our new coil. The “core” is drawn as *vacant* (Solid lines would signify an iron core, and Broken lines would signify a ferrite core material). *Vacant* lines call for a core material of “air”.

Pin 1 is the center screw, which is the inside (core) end of the Secondary winding.

Pins 2 through 6 are on the terminal strip.

Pin 2 is the outside of the secondary winding. It must be connected to Pin 2 of each companion coil. We call this the “Earth” connection.

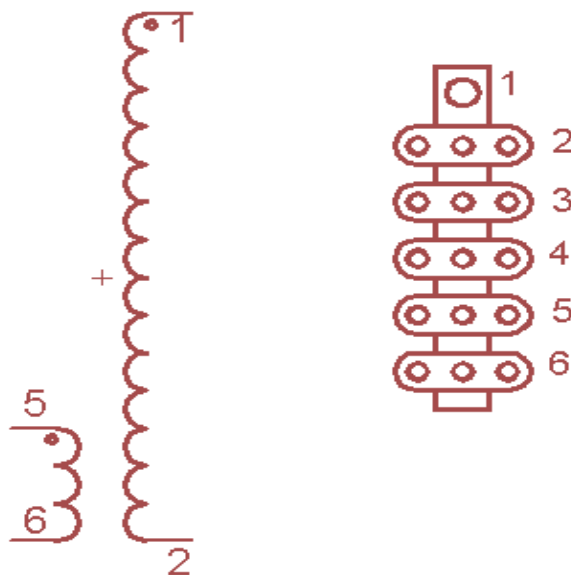
Pins 3 and 4 are available for your custom use - a convenient place to solder diodes, LEDs, etc.

Pins 5 and 6 of the Transmitter Coil go to your signal generator. Pin 6 is GND.

Pins 5 and 6 of the Receiver Coil(s) go to your loads. Connect your scope GND to Pin 6, so you can compare the phase with the Signal Generator waveform.

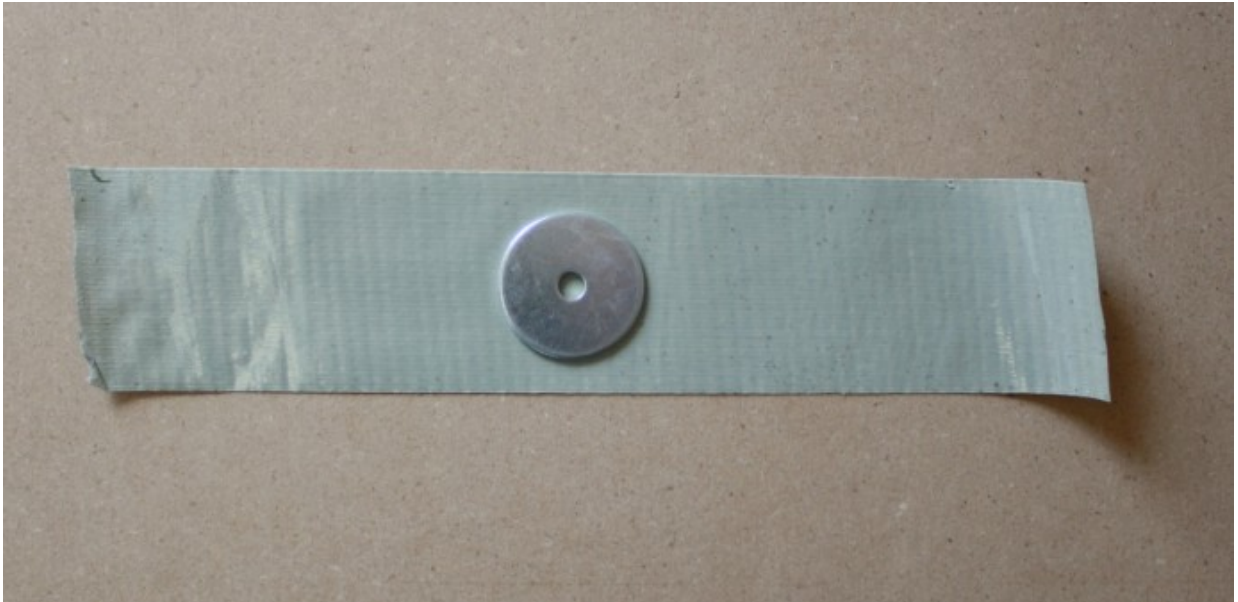
I recommend that the Transmitter be a CW wound coil, and all Receivers should be CCW wound. But you should experiment with this and draw your own conclusions.

Can you prove to yourself that it matters? This may be opposite “Down Under” - we're anxious to hear!



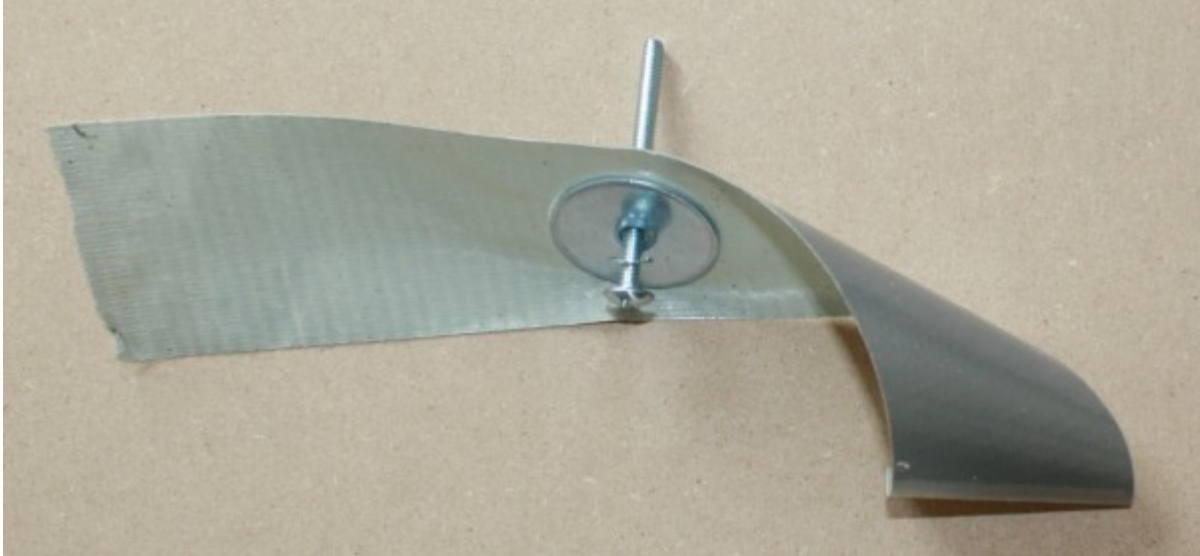
STEP 19

Cut an 8" length of **Duct Tape** and place a fender washer on the sticky side.



STEP 20

Pierce the tape and insert an 8-32 x 2" screw and a #8 lockwasher, entering the washer from the sticky side of the tape. This puts the lockwasher and screw head in contact with the fender washer.



STEP 21

Stick the tape to a light-weight inflated ball of your choice. Attach a second piece of tape at right angles to the first, making an "X" on the ball surface.

Size matters. Bigger seems to work better. I have used balls as large as 10" diameter. Balloons can also be used. You can get these from a local Party Supplies store. There is no need for helium gas - just inflate with your breath.



STEP 22

Cut a piece of Aluminum foil that is large enough to circle your ball.

Pierce the foil in the center with a screwdriver, and then impale the foil on the screw.

Add a lockwasher and hex nut, and tighten. These parts ensure that the screw is in good electrical contact with the foil.



CORROSION NOTE

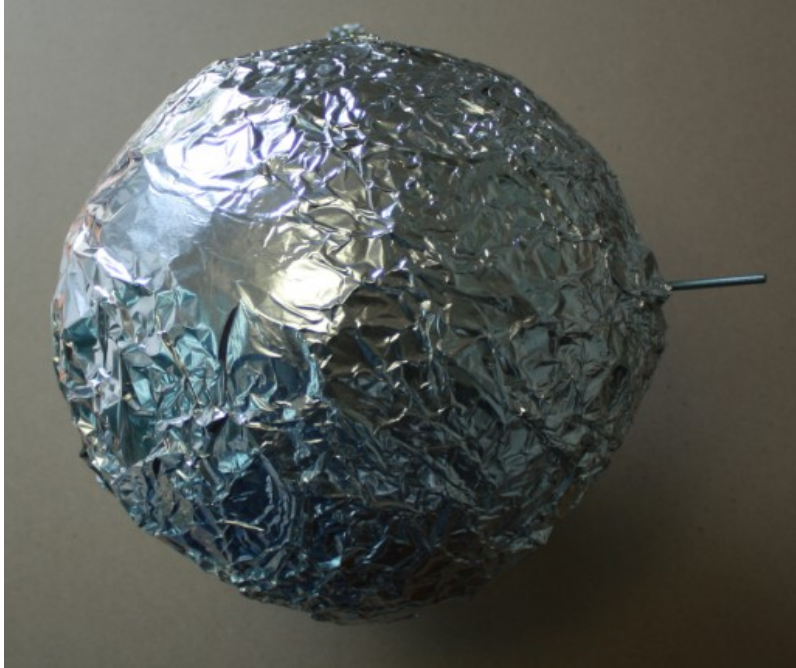
We expect that an insulating oxide layer will form between the Aluminum foil and the plated steel washer.

On the positive side, the voltage is stepped up in the Secondary, and I think the dielectric effect will pierce a thin oxide layer.

We will need to stay alert for this possibility. It would likely manifest as a deteriorating efficiency and on inspection we would find an oxide.

STEP 23

Form the foil over the surface of the ball, making it as smooth as you can (not very, and this seems not to matter much). It's OK to use foil patches as needed to cover the whole ball surface. These patches can be secured with clear adhesive tape.



Some folks may want to use a large ball, floating high above the earth. Your local Party Supply store can sell you Helium filled Balloons. These will need to lift the extra weight of the foil covering.

Let us know how this works!

STEP 24

Attach your new conductive ball to your newly wound coil, using 8-32 x 1/2" F-F threaded spacers and 8-32 x 6" threaded rod sections.

Transmitter coils and Receiver coils both need conductive balls attached, although they can be different diameter balls.

SIZE MATTERS - Tesla and Prof. Meyl both say so. The base board makes quite a stable support for large balls. The threads do not need to be tight, since the Dielectricity is just being guided, not conducted. We are leaving Current Electricity behind.



STEP 25

Now repeat Steps 1 - 24 to make a second coil assembly. This time use the opposite winding direction, so you will have one CW Transmitter coil and at least one CCW Receiver coil.

Now your ***TESLA WIRELESS POWER
TRANSMISSION COILS*** are ready for use!

COMMISSIONING PROCEDURE

I recommend that you solder a 1,000 ohm (non-inductive) resistor across Pin 5 and 6 of each Receiver coil. This will ensure that you are measuring real power and not just noise. One Volt RMS across 1,000 ohms must dissipate 1 mw of real power (V^2 / R), and 3 VRMS must dissipate 9 mw. This real power must have come from some energy source. Transverse EM waves cannot deliver energy of this magnitude through the air.

You may want to solder two Red LEDs across pins 5 and 6 of the Receiver coil. Solder the cathode of one LED to pin 5 with its anode to pin 6, and the cathode of the second LED to pin 6 with its anode to pin 5. Now these LEDs will illuminate when the Receiver is receiving energy and you can use this to guide your search for resonant frequencies.

Use several clip leads in series to connect the Earth lug (pin 2) of all Transmitter coils and Receiver coils together. The path of this connection does not seem to matter.

Now connect your signal generator to the Primary lugs, with Signal to Pin 5 and GND to Pin 6. You can use any signal generator, but the Hantek USB Arbitrary Function Generator is quite handy.

Connect your Scope Channel 1 to Pin 5 of the Transmitter, with GND to Pin 6. Set your signal generator output amplitude to 3.5v peak (approximately 2.5 V RMS).

Connect your Scope Channel 2 to Pin 5 of your Receiver coil. Connect the scope GND to Pin 6.

Now tune slowly from 1 MHz to 10 MHz while looking for a signal on Channel 2. This signal will peak at the Resonant frequency of the pair of coils (and the coils are to be identical except for winding direction). All coils that were wound the same will have the same resonant frequency. You will probably find two resonant peaks from the Receiver. The higher frequency is said to represent superluminal wave velocity - faster than the speed of light.

When you are ready to carry the receiver far away from the transmitter, connect a long Earth wire to Pin 2 of both Coils. We have gone 70 feet and more, with no diminishing of the LED intensity!

EXPERIMENTS

Generally we will be interested in the power balance, which is the ratio:

$$\frac{[\text{Total power taken from the Receivers}]}{[\text{Total power fed to the Transmitter}]}$$

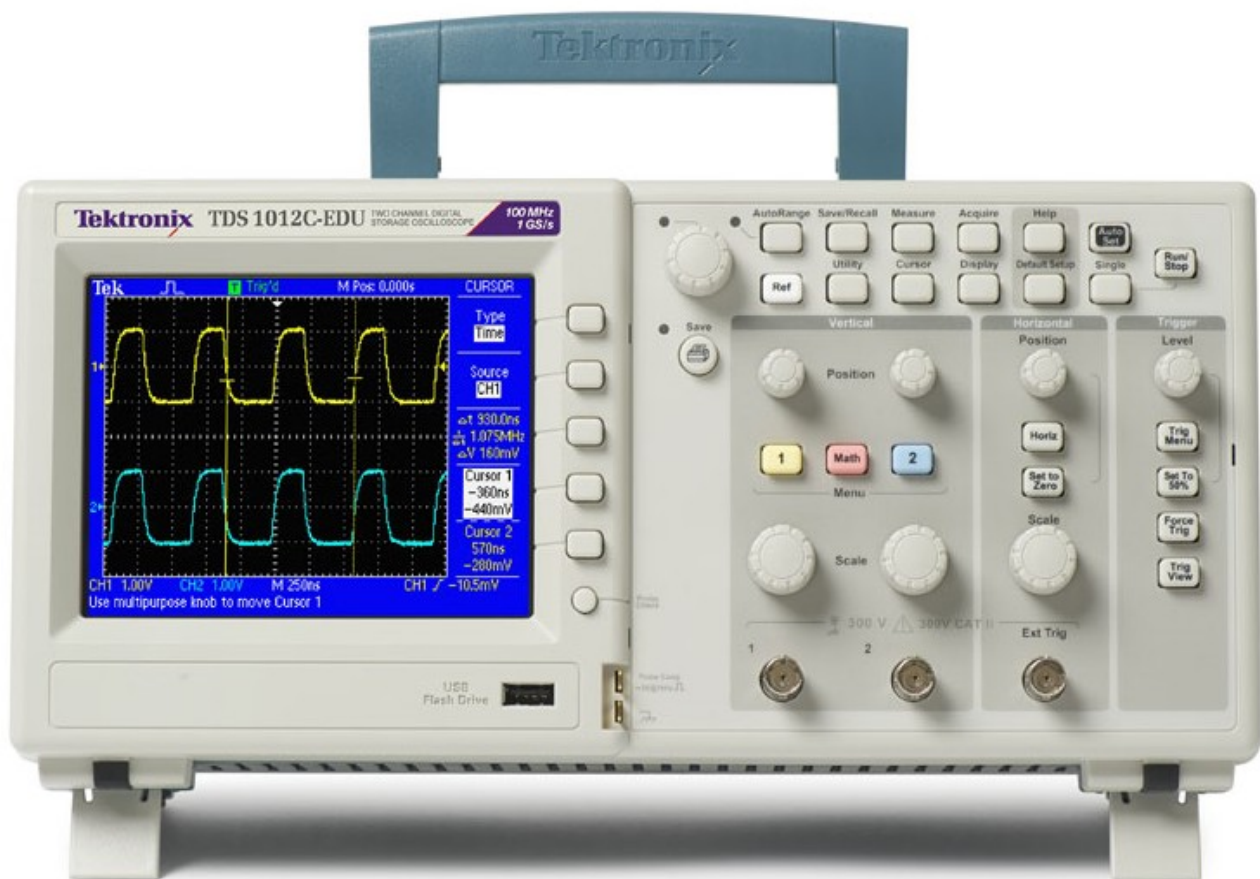
What is the effect on the supply power as you alter the load power drawn from Pins 5 and 6 of the Receiver?

POWER MEASUREMENTS

You can power the Transmitter from any sine wave signal generator, of course. A big benefit of using the Hantek Arbitrary Function Generator (AFG) is that it is USB-powered. So you can insert a DC ammeter into the RED wire of the USB cable and very ***conveniently measure the total power supplied.***

This is the total of the signal power delivered to the Transmitter coil plus the AFG's internal losses. Current varies from 200 to 400 ma. Power $P = I * V$, and V is a steady 5 volts DC. So power in mw is just 5 * Current in ma. This is known to be steady power flow because there are large filter capacitors on the USB power wire. Transient currents will be fed via these filter capacitors.

The load power is harder to measure, because the phase angle between voltage and current must be known. If you have a scope with Waveform Math functions (like the TEKTRONIX TDS1000C-EDU series) then you can use CH1 and CH2 to multiply load voltage x load current and display the mean value of this waveform as a digital readout onscreen. Current can be transduced by a small series resistor. Best to use “non-inductive” resistors in the range of 1 to 100 ohms, say. The TDS20XXC also supports export of waveforms to a USB stick, which is great for documenting your findings.



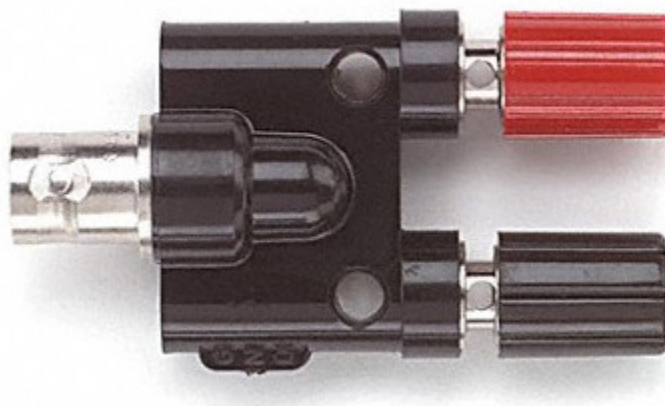
To calibrate the AFG current you can connect a 50 ohm BNC Terminator Plug such as the Amphenol 202103. Here the goal is to measure the USB supply current flowing into the AFG while it is driving the 50 ohm load, and then connect the Transmitter coil for comparison.



You will need a few BNC adapters - Emerson CP-AD-555 ADAPTER BNC JACK TO JACK 50 OHM.



Pomona 1452 ADAPTER BINDING POST-BNC RECEIPT is nice to have around.



TPI 58-012-1M CABLE MOLDED RG58/U 12"



APPENDIX 1

PART #	QTY	DESCRIPTION	MFG	MPN	VENDOR	TOTAL
1	10	THREADED ROD 8-32 X 6 IN. UNC STEEL	HILLMAN	H880997	LOWE'S	\$16.00
2	60	MACHINE SCREW 8-32 X 2"	HILLMAN	126478	LOWE'S	\$7.00
3	30	FENDER WASHER 3/16" X 1 1/4"	HILLMAN	126512	LOWE'S	\$6.00
4	100	NUT HEX 8-32 ZINC PLATED	B&F FASTENER	HNZ832	DIGI-KEY	\$1.95
5	20	STANDOFF HEX 8-32THR .500" L BR	KEYSTONE	1474C	DIGI-KEY	\$7.09
6	20	SOLDER LUG #8	KEYSTONE	917	DIGI-KEY	\$3.30
7	100	WASHER LOCK INTERNAL TOOTH #8 ZINC	B&F FASTENER	NT LWZ 008	DIGI-KEY	\$1.20
8	1000	WIREWRAPE KYNAR 30AWG BLACK 1000'	OK INDUSTRIES	KSW30BLK-1000	DIGI-KEY	\$94.88
9	10	TERMINAL STRIP STD 5 POSITION	KEYSTONE	836	DIGI-KEY	\$14.10
10	96	BUMPOCYLINDRICAL 0.375X0.250 BLK	3M	SJ61A3	DIGI-KEY	\$23.96
11	1	WIRE TEST LEADS 27AWG 15" 10PCS	GC ELECTRONICS	12-1650	DIGI-KEY	\$7.26
12	10	1,000 OHM 1/2W NON-INDUCTIVE RESISTOR	STACKPOLE	RC12JB1K00	DIGI-KEY	\$4.00
13		1/4" HARDBOARD 24" X 24" CUT INTO 4.5" X 4.5" SQUARES			LOWE'S	\$5.00
15	1	WHITE REINFORCEMENTS (FOR 3-RING PAPER) PACK OF 200	STAPLES	636156	STAPLES	\$3.00
16	10	ACRYLIC DISC 4 IN DIA. 1/8 IN THICK 1/8 IN DIA CENTER HOLE	PRO-FAB PLASTICS	IT100		\$30.00
17	4	BALLOONS			DOLLAR STORE	\$4.00
18	1	ROLL OF ALUMINUM FOIL			DOLLAR STORE	\$2.00
19	1	ROLL OF DUCT TAPE			LOWE'S	\$2.00
20	1	2" ABS PIPE CAP			LOWE'S	\$2.00
						\$234.74
21	1	USB ARBITRARY FUNCTION GENERATOR	HANTEK	DDS-3X25	online	\$150.00
22	1	4-CHANNEL STORAGE OSCILLOSCOPE 200 MHZ 2 GS/s	TEKTRONIX	TDS-1012C-EDU	testequity.com	\$1,070.00

APPENDIX 2

A BRIEF HISTORY

Steve Jackson

Here is a brief history of the chain of the events that led to this Tesla Wireless Power Transmission Replication exercise -

1. Nikola Tesla heard whisperings from the Universe, and developed Patents like 649,621 circa 1900. Tesla never claimed to be the Inventor of his works - only the conduit.
2. Prof. Dr. Ing. Konstantin Meyl worked long and hard to re-create Tesla's work in modern times, circa 1990. He succeeded first at his desk, and then in his lab. He has proposed key modifications to Maxwell's Equations (which Maxwell himself may have reached had he lived beyond age 48).
3. I met Prof. Meyl at TeslaTech in Salt Lake City, Utah in 2007 and observed his wireless boat demonstration.
4. I purchased Prof. Meyl's demo kit and worked with it in various ways.
5. IEEE Hamilton invited me to speak on these matters at McMaster University on March 24, 2011.
6. Sterling Allen's PESN published this IEEE event news and the video of my Talk, and agreed to host an Open Source project to advance these matters publicly.
7. You have read of this, and are more or less intrigued.

This technology is an idea whose time has come. Welcome to the Future, for which Dr. Nikola Tesla worked.

APPENDIX 3

TO THE DE-BUNKERS

I fully expect that PhD academics will publish papers to the effect that,

“This fellow Ing. Steve Jackson is just as wrong as was Prof. Dr. Ing. Konstantin Meyl before him, and so there is nothing here to see, folks. We see no reason to revise our textbooks.”

Well, here is the hurdle that De-Bunker Papers must leap: Explain the ***Elephants in the Room***, some of which are:

1. Transmission of non-negligible levels of power over 1 - 100 meters
2. Operation inside a verified Faraday cage (where a radio plays only static)
3. Absence of $1/r^2$ reduction of received power
4. Communication link from Receivers back to Transmitter
5. Communication link between Receivers

If you are a De-Bunker, and you cannot explain these ***Elephants in the Room***, then please refrain from commenting on these significant and verifiable phenomena.

Better yet, please join the ranks of the Replicators!

What shall the Professors say when their classes are filled with student Replicators, who know the truth that $(-\mathbf{v} \operatorname{div} \mathbf{B})$ belongs on the right side of Faraday's Law, and that ***Scalar Elephants*** are sitting in your lecture hall?

Resistance in the face of these Tesla inventions seems pointless.

Academia must acknowledge the work of
The Greatest Engineer That Ever Was
at last.

APPENDIX 4

ERIC DOLLARD - SCALAR EXPLAINED

<http://www.energeticforum.com/90344-post94.html>

Scalar explained . . . for those who's minds have been polluted by the prevalent quantum goddess reality:

Let us turn to the Heaviside Equation which is the most fundamental equations in all of Electrical Engineering:

$$(\mathbf{RG} + \mathbf{XB}) + j (\mathbf{XG} - \mathbf{RB}) = \text{propagation constant squared}$$

where:

R resistance	in Ohms
G conductance	in Siemens
X reactance	in Henrys per second
B susceptance	in Farads per second

Therefore:

- RG** is the scalar or DC component that is NOT A WAVE,
- XB** is the longitudinal or AC component and is an alternating electric wave
- XG** is the transverse or OC component and is a **forward** moving oscillating electric wave.
- RB** is the transverse or OC component and is a **reverse** moving oscillating electric wave

This equation allows for all electrical conditions in time and or space and combinations thereof. The example equation is the dimensions of time (see: Steinmetz Theory of Transient Electric Waves and Phenomenon and also my paper: Symbolic Representation of the Generalized Electric Wave.)

Example:

The air in the room; the room is filled with air and has atmospheric pressure of 2998 mB, your stereo is blasting away, the speakers are creating longitudinal waves having length and frequency and exert an oscillating force centered on 2998 mB (+ or – 10 mB)

RG is the air pressure, a scalar

XB is the sound of the stereo, a longitudinal wave

XG = RB, thus no transverse waves exist $(XG - RB) = \text{ZERO}$

Hence $(RG + XB)$ is what is going on in the room, ***the disinformers have convinced you that this whole quantity $(RB + XB)$ is scalar***, RG is the only scalar component. It is DC and has NO FREQUENCY, no WAVELENGTH and thus NO WAVE! SCALAR = NO WAVE - GET IT???

If people don't get this fundamental concept – my time is better spent talking to my pet Coyote... I have nothing further to say...

APPENDIX 5

STEINMETZ ON DIELECTRICITY

<http://www.scribd.com/doc/50631885/Electric-Discharges-Waves-and-Impulses-Charles-Proteus-Steinmetz>

18 ELECTRIC DISCHARGES, WAVES AND IMPULSES.

TABLE II.

Magnetic Circuit.	Dielectric Circuit.	Electric Circuit.
Magnetic flux (magnetic current): Φ = lines of magnetic force.	Dielectric flux (dielectric current): ψ = lines of dielectric force.	Electric current: i = electric current.
Magnetomotive force: $F = ni$ ampere turns.	Electromotive force: e = volts.	Voltage: e = volts.
Permeance: $M = \frac{\Phi}{4\pi F}$.	Permittance or capacity: $C = \frac{4\pi v^2 \psi}{e}$ farads.	Conductance: $g = \frac{i}{e}$ mhos.
Inductance: $L = \frac{n^2 \Phi}{F} 10^{-8} = \frac{n\Phi}{i} 10^{-8}$ henry.		Resistance: $r = \frac{e}{i}$ ohms.
Reluctance: $R = \frac{F}{\Phi}$.	(Elastance ?): $\frac{1}{C} = \frac{e}{4\pi v^2 \psi}$.	Electric power: $p = ri^2 = ge^2 = ei$ watts.
Magnetic energy: $w = \frac{Li^2}{2} = \frac{F\Phi}{2} 10^{-8}$ joules.	Dielectric energy: $w = \frac{Ce^2}{2} = \frac{e\psi}{2}$ joules.	Electric-current density: $I = \frac{i}{A} = \gamma G$ amperes per cm ² .
Magnetic density: $\mathfrak{B} = \frac{\Phi}{A} = \mu \mathfrak{H}$ lines per cm ² .	Dielectric density: $D = \frac{\psi}{A} = \kappa K$ lines per cm ² .	Electric gradient: $G = \frac{e}{l}$ volts per cm.
Magnetizing force: $f = \frac{F}{l}$ ampere turns per cm.	Dielectric gradient: $G = \frac{e}{l}$ volts per cm.	
Magnetic-field intensity: $\mathfrak{H} = .4\pi f$.	Dielectric-field intensity: $K = \frac{G}{4\pi v^2}$.	
Permeability: $\mu = \frac{\mathfrak{B}}{\mathfrak{H}}$.	Permittivity or specific capacity: $\kappa = \frac{D}{K}$.	Conductivity: $\gamma = \frac{I}{G}$ mho—cm.
Reluctivity: $\rho = \frac{f}{\mathfrak{B}}$.	(Elastivity ?): $\frac{1}{\kappa} = \frac{K}{D}$.	Resistivity: $\rho = \frac{1}{\gamma} = \frac{G}{I}$ ohm—cm.
Specific magnetic energy: $w_0 = \frac{.4\pi \mu f^2}{2} = \frac{f\mathfrak{B}}{2} 10^{-8}$ joules per cm ³ .	Specific dielectric energy: $w_0 = \frac{\kappa G^2}{4\pi v^2} = \frac{GD}{2}$ joules per cm ³ .	Specific power: $p_0 = \rho I^2 = G^2 = GI$ watts per cm ³ .

APPENDIX 6

TESLA PATENT 645,576

No. 645,576.

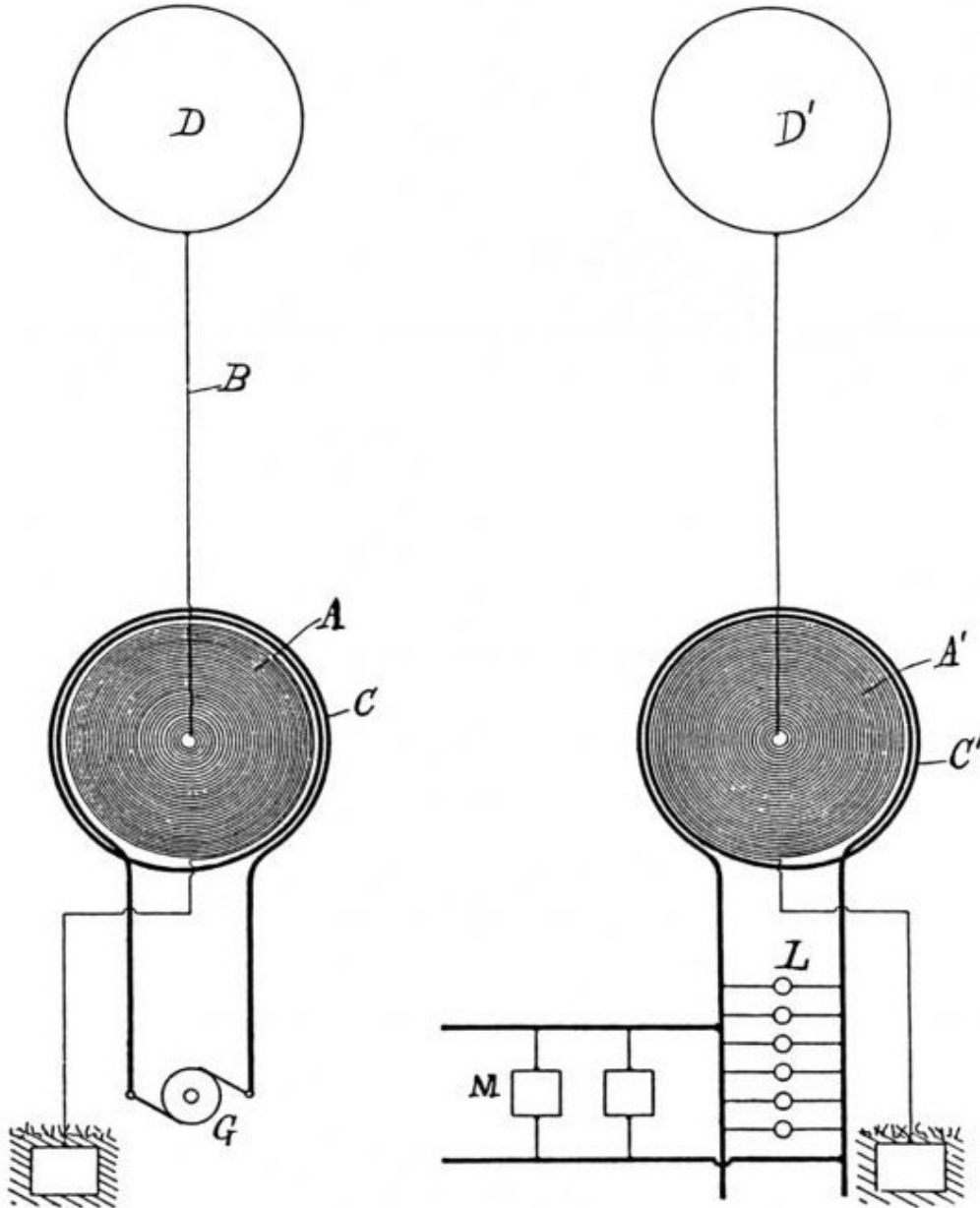
Patented Mar. 20, 1900.

N. TESLA.

SYSTEM OF TRANSMISSION OF ELECTRICAL ENERGY.

(Application filed Sept. 2, 1897.)

(No Model.)



WITNESSES

Dwight N. Cooper
M. Lawrence Hyatt

INVENTOR

Nikola Tesla
BY
Herbert Curtis & Sage
ATTORNEYS.

This website has a nice magnifying glass so you can examine the winding directions.
<http://www.teslauniverse.com/nikola-tesla-patents-645,576-transmission-of-energy>

APPENDIX 7

GUIDE FOR HANTEK 3X25 ARBITRARY FUNCTION GENERATOR

Install the Hantek 3x25 software as per the Hantek “User Guide” from the disk that came with your Hantek unit.

Plug in the Hantek 3x25 unit into the PC and Windows should prompt to install the USB drivers.

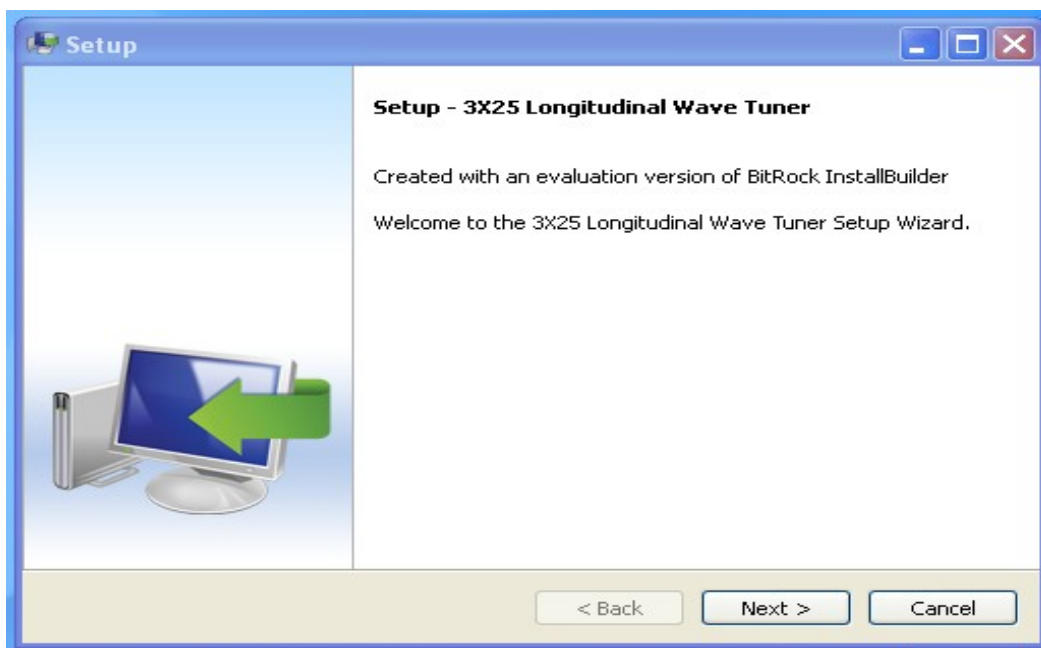
Note: The USB software drivers that are provided by Hantek are copied to the location C:\Program Files\DDS-3X25 USB\Driver

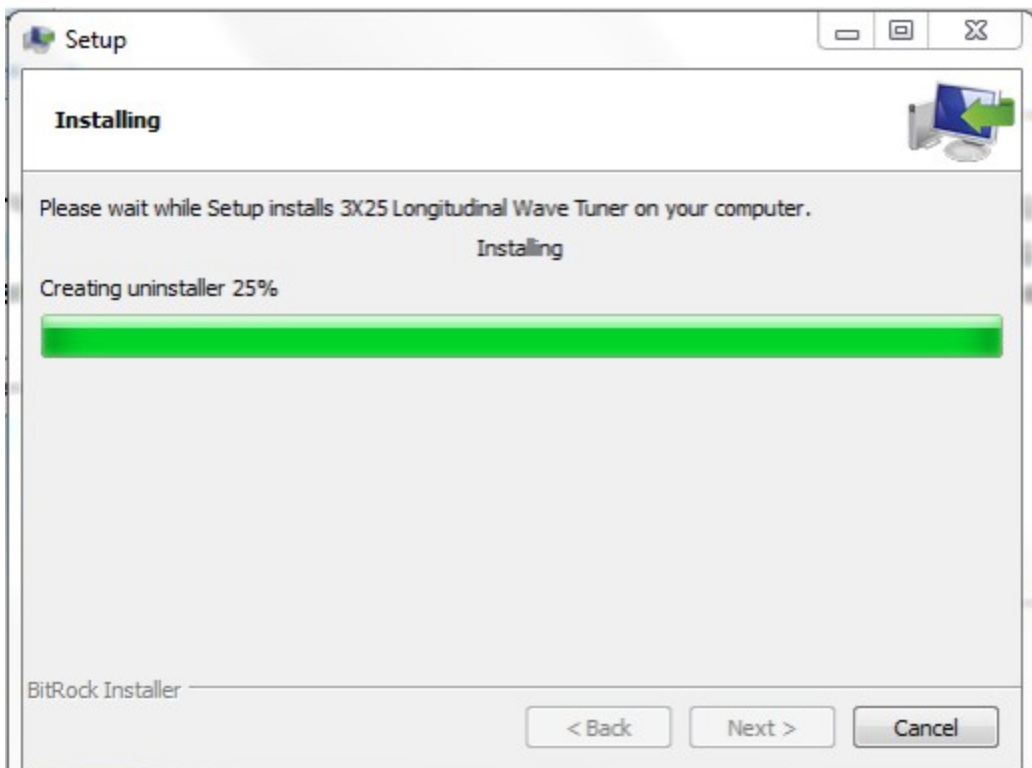
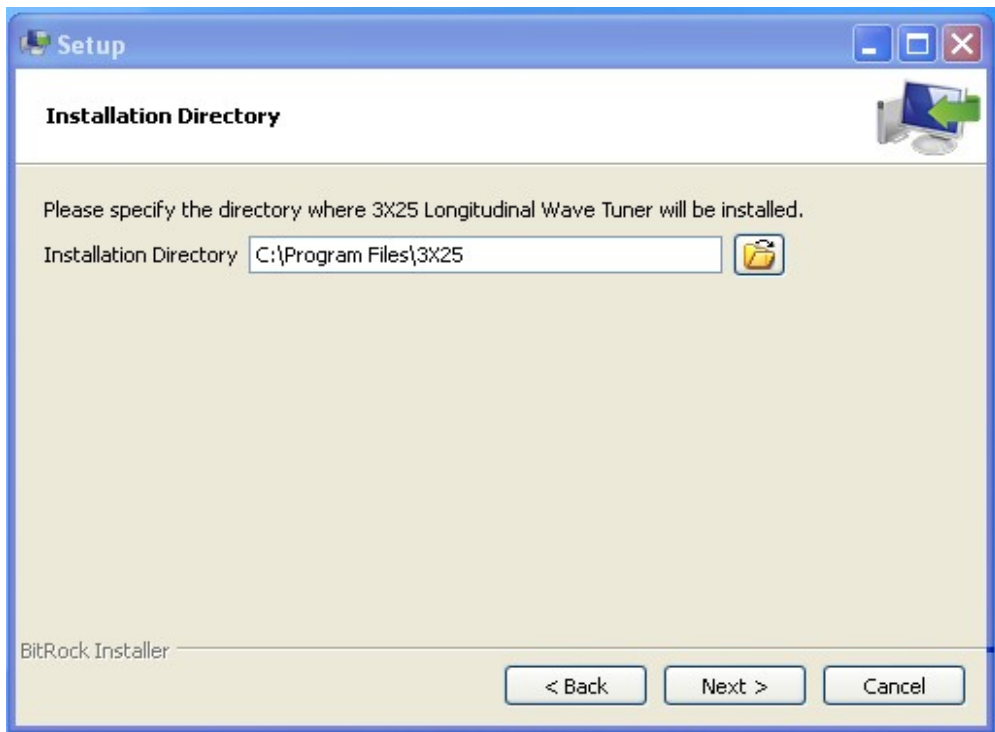
Use the Hantek “DDS-3X25 USB” software to insure the generator is working properly.

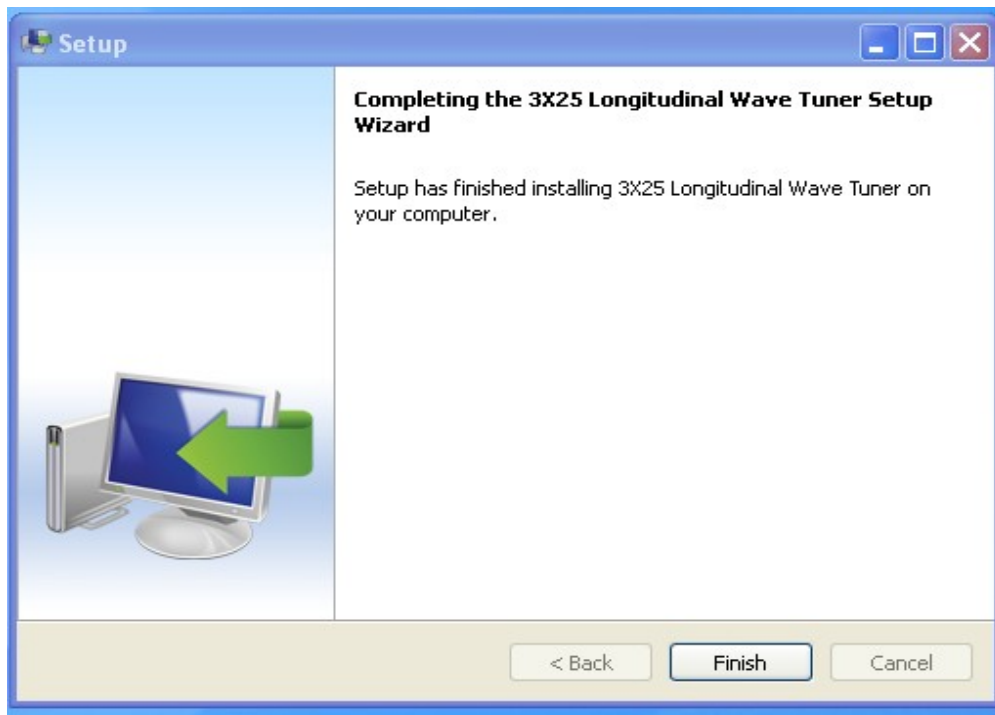
3X25 LONGITUDINAL WAVE TUNER UTILITY

For our Scalar Field project we felt the need for a more flexible mode of tuning the frequency as we search for resonance. So we created the **3X25 LONGITUDINAL WAVE TUNER** utility. Its claim to fame is that you can use your mouse wheel or SCROLL UP & SCROLL DOWN keyboard buttons to increase or decrease the frequency by a chosen Step value. This utility only supports only the SINE waveform. For other waveforms please use the Hantek software.

Install “3x25 Longitudinal Wave Tuner” software by running the file 3x35-1.0-windows-installer.exe This will install the software in the directory \\Program Files\ Longitudinal Wave Tuner

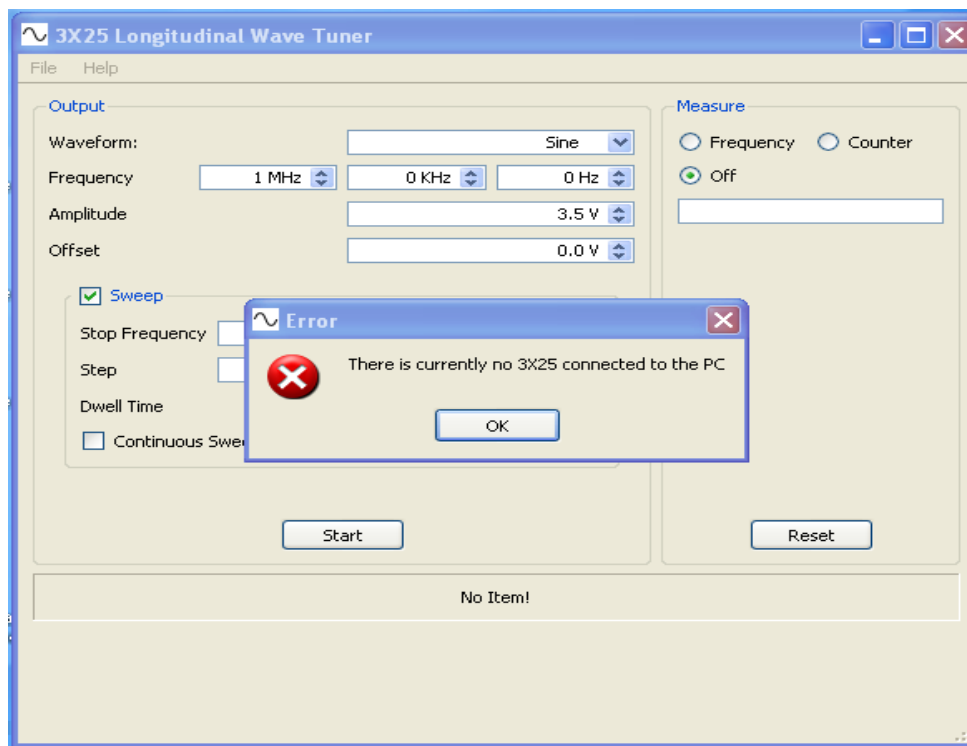




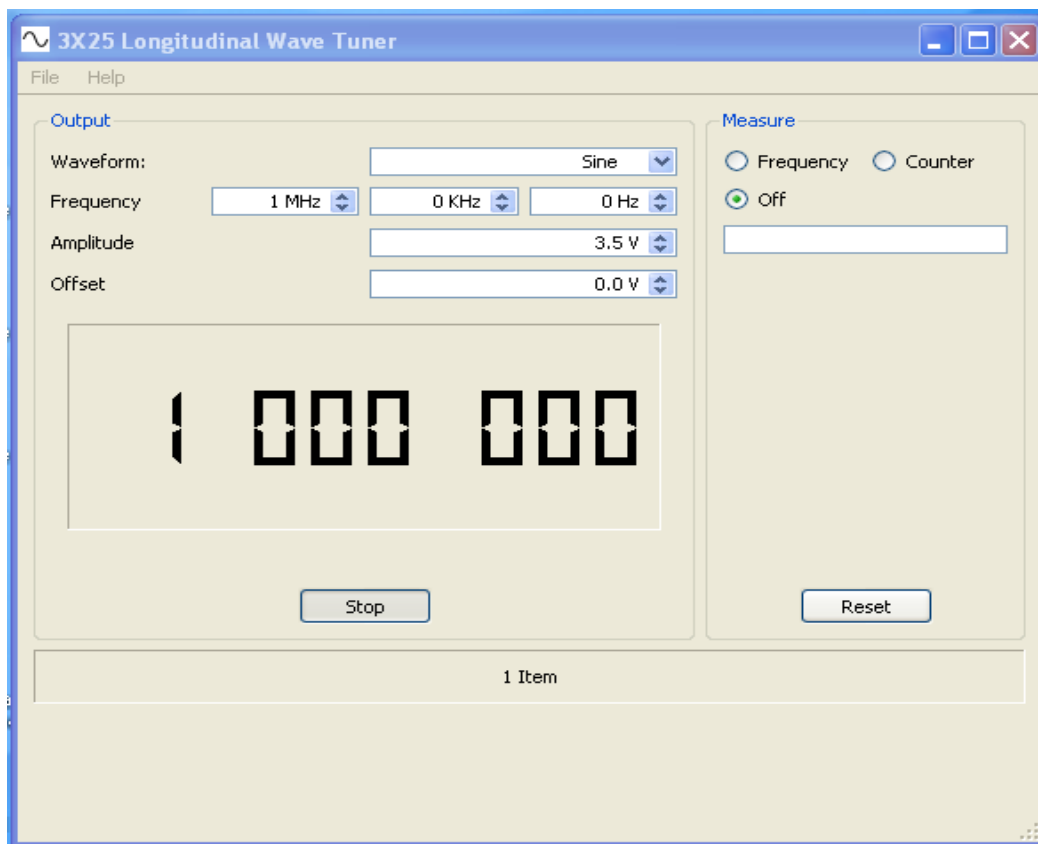


The program will now be installed. You can run the program “**3X25 Longitudinal Wave Tuner**”

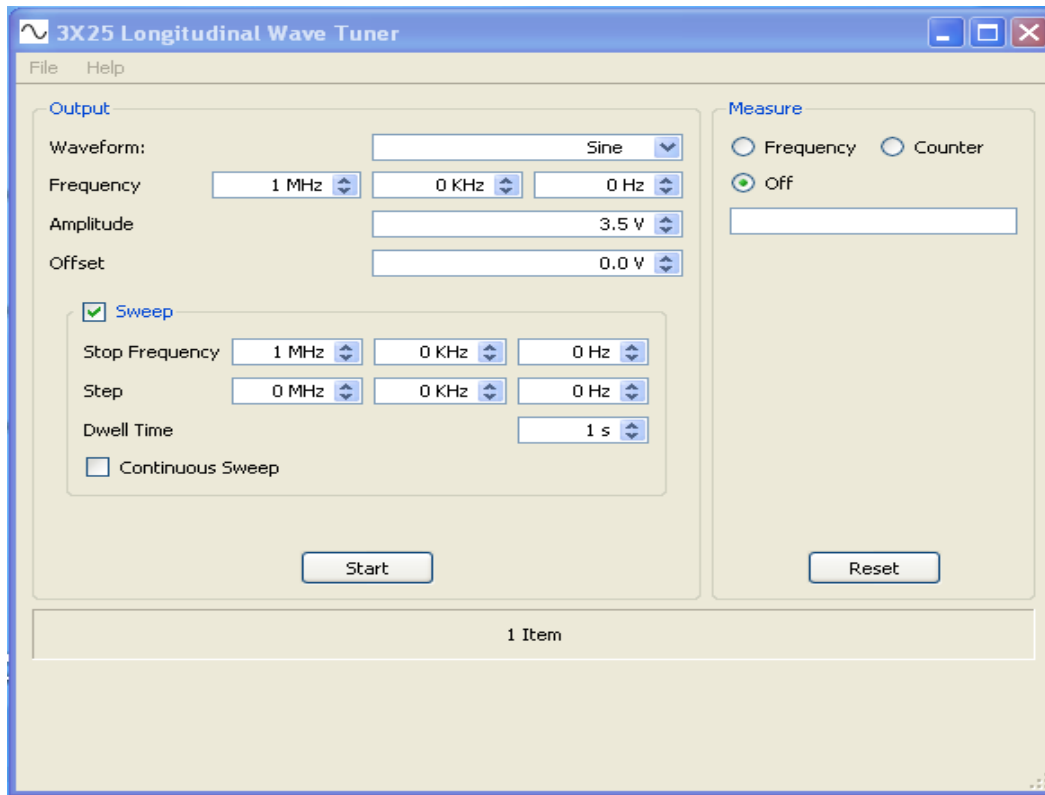
If your Hantek generator is not plugged in you will see this Error message.



Here is the Frequency Display that pops up when you click **Start**. (There are spaces instead of commas.)



When you click **Stop**, the control panel returns to this view.



- You can set the Frequency by clicking on either the MHz, KHz or Hz box. Then press the UP ARROW or DOWN ARROW keys on your keyboard, or rotate the wheel on your Mouse, to increase or decrease the frequency.
- If you **Right click** on either of the MHz, KHz or Hz boxes, you can **choose a new Step value** from the settings offered. This allows you to choose how rapidly you step up or down in frequency. As you approach closer and closer to resonance, you may want to choose a smaller step value.

Offset sets the DC bias level of the sine waveform. You will normally leave this at 0.

Once you have selected your **Frequency**, **Amplitude** and **Offset**, pressing the “**Start**” button will download these settings to the Hantek generator.

SWEEP FUNCTION

Sweep is not a smooth change in frequency. It is a step-wise advance of the output frequency from the **Start** frequency to the **Stop** frequency. The **Step** value sets the increment for each frequency change. The **Duration** value sets the duration time of each step. This is a minimum of 1 second. In our Project we will need to hold a stable frequency long enough for the vortex to respond and establish itself.

To *enable* Sweep, enter a non-zero **Step** value. To *disable* sweep, enter a **Step** value of 0.

Normally you will want the Sweep to repeat over and over again, so you will click the **Continuous Sweep** box.

Click **Start** to begin generating the sine waveform. The “**Start**” button will change to a “**Stop**” button once the Hantek 3x25 Arbitrary Function generator is running.

To interrupt the generator, click the **Stop** button.