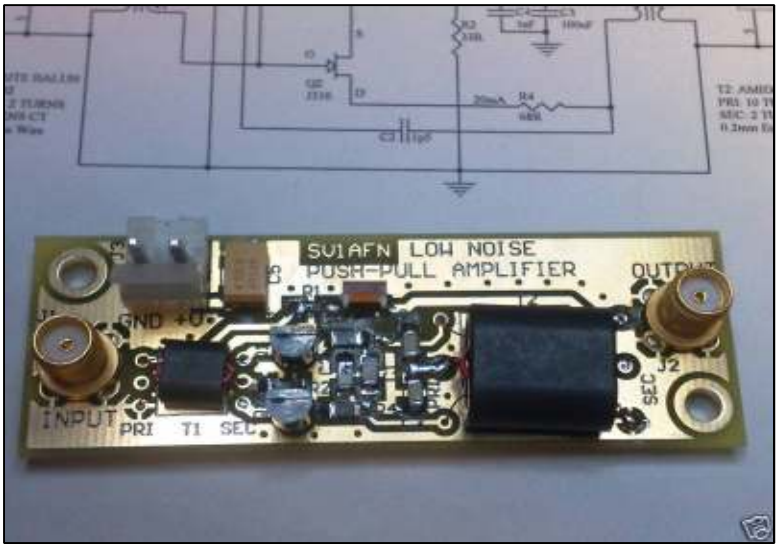
J310 Low-noise, Push-Pull Broadband HF Pre-amplifier



Thank you for choosing my KIT for building a very nice HF pre-amplifier.

This pre-amplifier is broadband from about 0.5 to more than 30 MHZ with 15 dB of stable gain and very good linearity. It can produce +15dBm of output power, while still in linear operation. It is usable up to 50 MHZ where the gain drops to around 8 dB. If you change the ferrite material (for example to BN73-202) you can extend the low frequency end down to less than 100 KHZ.

Although an experienced ham may not need any additional advice other than the schematic, here are some instructions for helping the less-experienced or a novice one.

Happy soldering!

Kind 73 de Makis, SV1AFN

Start by soldering all SMD capacitors and resistors.

C1	1.5 pF
C2	1.5 pF
C3	100nF
C4	1nF
C5	10 uF / 25V tantalum. Watch the polarity, the line on the capacitor body indicates the plus terminal.
R1	475R (475 Ω)
R2	33R2 (33.2 Ω)
R3	68R1 (68.1 Ω)
R4	68R1 (68.1 Ω)

Then solder the 3.9 µH SMD inductor. The PCB is designed for a 1206-sized inductor but if your KIT has arrived with a slightly bigger inductor, then it is needed to mount it differently (as shown in ***Photo 1***).

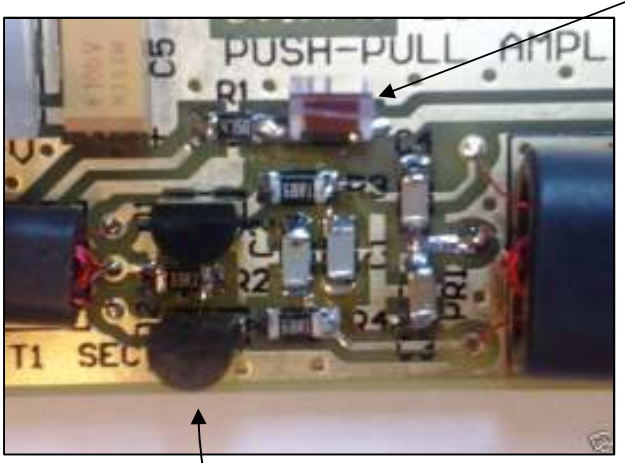


Photo 1: *See the vertical mounting of inductor L1 and the orientation of Q1 & Q2.*

L1	3.9 µH

You can now solder the two J310s JFETs.

Q1	J310 - Watch orientation (Photo 1). Keep the leads short by pushing it down on the PCB.
Q2	J310 - Watch orientation (Photo 1). Keep the leads short by pushing it down on the PCB.

Now it is time to prepare the two transformers, T1 and T2.

T1 Preparation:

Place a small marking dot (using ink or correction fluid) on to the top of the small binocular core (BN43-2402), near the edge, for indicating the primary winding side of the transformer.

Wind the 2-turn primary winding first. One turn is considered a complete turn when the wire forms a U entering from one hole of the binocular core, from the marked side, making a U turn, entering the

second hole from the opposite (unmarked) side and going out from the marked side again. Hold the wire tight, while observing not to scratch the wire insulation off by scrubbing it hard on the ferrite material. See ***Photos 2*** and ***3***. Repeat one time more and you have got the 2 turns winding done.

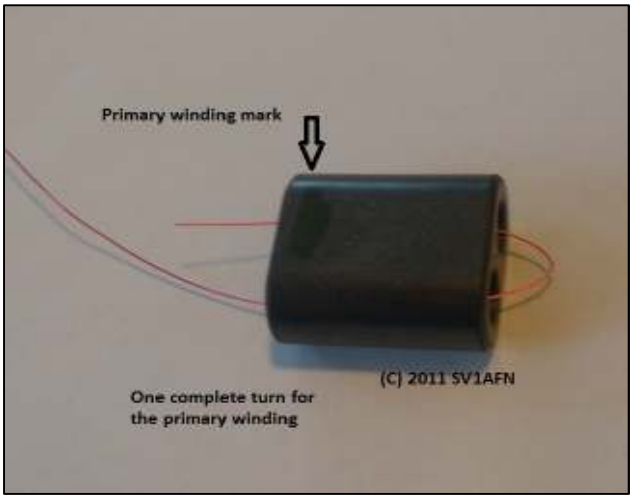


Photo 2. One complete turn is just one U of the wire inside both holes

Cut the excess wire off, leaving 1-2 cm of wire for soldering later on the PCB and tin or scrub 5 mm of the wire insulation off with a blade-knife or sandpaper to allow for a good soldered joint. The copper should reveal clear and shiny under the insulating enamel or varnish.

Photo 3. The completed 2-turn winding.

The secondary has 4 + 4 turns, or 8 turns center-taped. Begin the winding of the secondary, this time, from the unmarked side of the core and count 4 turns. Don't cut the wire. Check again that both the start and end of the winding, is from the unmarked side of the core. Leave about an inch (2.5 cm) of wire loose, forming a loose loop (see ***Photo 5***) and continue winding 4 turns more in the same direction. When the 4th turn comes out from the unmarked side of the core, leave about 1-2 cm and cut. See

Photo 5. Separate the starting and ending leads away and cut the loose wire in half. Cut in 1 cm length, tin to clear-off insulation, twist them together for 3-4 times and solder together. This makes the center tap of the secondary winding.

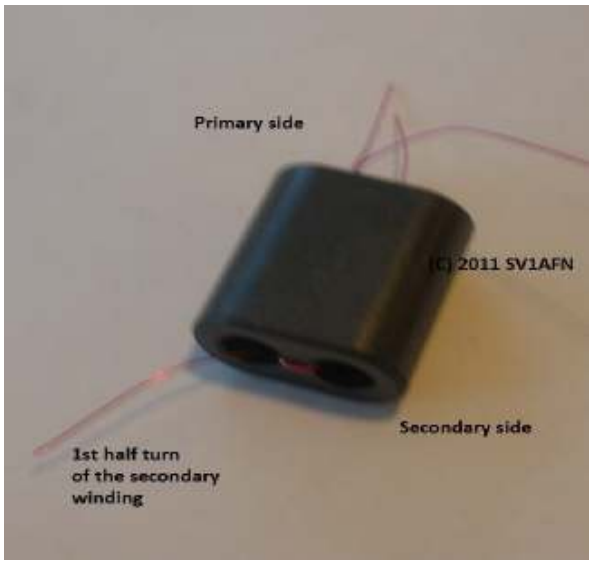


Photo 4: Starting the secondary winding.

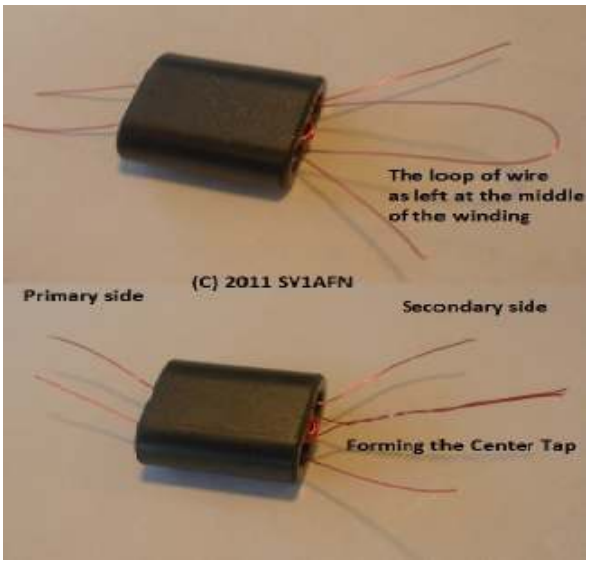


Photo 5: Making the Center Tap.

T2 Preparation:

Place a small marking dot (using ink or correction fluid) on to the top of the small binocular core (BN43-2402), near the edge, for indicating the primary winding side of the transformer.

Wind the 2-turn secondary winding first. One turn is considered a complete turn when the wire forms a U entering from one hole of the binocular core, from the marked side, making a U turn, entering the second hole from the opposite (unmarked) side and going out from the marked side again. Hold the wire tight, while observing not to scratch the wire insulation off by scrubbing it hard on the ferrite material. See ***Photos 2*** and *3*. Repeat one time more and you have got the 2-turns winding done.

Cut the excess wire off, leaving 1-2 cm of wire for soldering later on the PCB and tin or scrub 5 mm of the wire insulation off with a blade-knife or sandpaper to allow for a good soldered joint. The copper should reveal clear and shiny under the insulating enamel or varnish.

The primary has 5 + 5 turns, or 10 turns center-taped. Begin the winding of the secondary, this time, from the unmarked side of the core and count 5 turns. Don't cut the wire. Check again that both the start and end of the winding, is from the unmarked side of the core. Leave about an inch (2.5 cm) of wire loose, forming a loose loop (see ***Photo 5***) and continue winding 5 turns more in the same direction. When the 5th turn comes out from the unmarked side of the core, leave about 1-2 cm and cut. See ***Photo 5***. Separate the starting and ending leads away and cut the loose wire in half. Cut in 1 cm length,

tin to clear-off insulation, twist them together for 3-4 times and solder together. This makes the center tap of the primary winding.

For use in a mobile or portable environment, consider placing a double-sided sticky tape between the ferrite core and the PCB in order for the core to stay firmed onto the PCB and any vibrations will not risk cutting-off those thin wires which otherwise actually support the whole transformer on the PCB. For the same reason, also consider placing 2 pieces of Teflon or PVC tubing before winding the wire, inside the core holes, cut in length for fitting inside the holes, in order for the wire ends not being cut by the friction touching the ferrite material while vibrating and/or not producing transient effects during operation.

There is another method (better) for winding the transformers. First it is necessary to prepare the two-turn winding as described above. Then you need two lengths of wire, twisted together with a small hand operated or electric mini-drill to about 3-5 turns per inch. Using the twisted pair of wires, you can now wind the 4 turns on transformer T1 (or the 5 turns on transformer T2) over the 2-turn winding. Then, separate the 4 individual ends of the wires, remove insulation and with an ohm-meter find and mark the two separate wires i.e. which end connects with which end. You must find 2 pairs that connect. Wrap together (short) the 2 ends that don't connect and you have the center tap. The other two ends are the start and the end of the winding. This method ensures better balance and better inter-winding capacitance but it is not much of importance for this application.

Solder T1.

T1	BN43-2402 binocular core, 2 turns for primary winding and 4 + 4 turns (Center Taped) for the secondary winding. Watch the orientation of the primary winding.

Solder T2.

T2	BN43-202 binocular core, 5 + 5 turns (Center taped) for the primary winding and 2 turns for the secondary winding. Watch the orientation of the primary winding.

Solder the RF-input and RF-output SMA connectors.

J1	SMA female for PCB vertical mounting
J2	SMA female for PCB vertical mounting

Solder the 2-pin DC Power input connector

J3 MTA 3.96mm 2-pin male header for PCB vertical mount

This completes the assembly of the pre-amplifier. Watch the polarity of the applied DC power (+12VDC) and enjoy a low-noise stable and clean pre-amp.

Good DX and kind 73s de Makis, SV1AFN

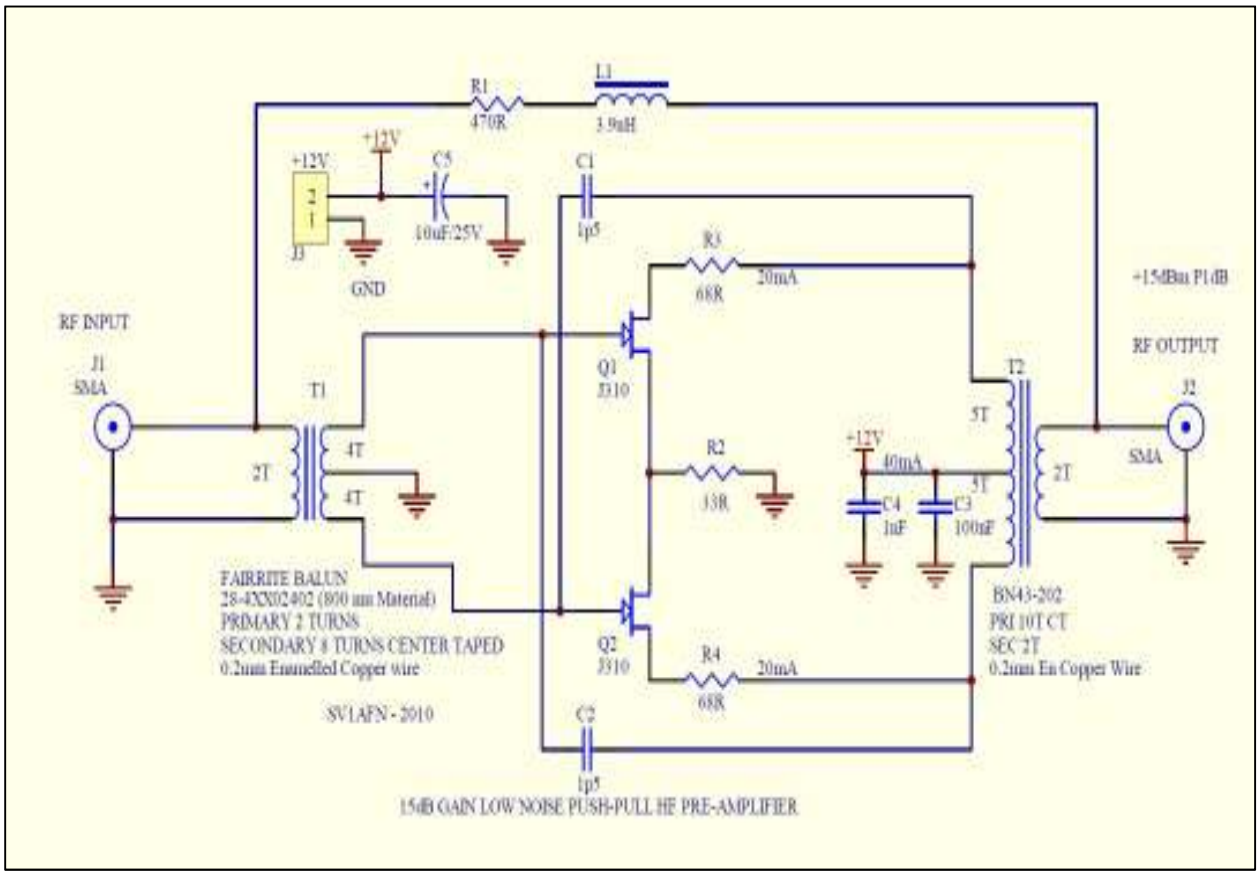


Fig. 1. *Amplifier Schematic Diagram*