INKITS

Building Easy Bitx 2 0mt

80MT/40MT/20MT

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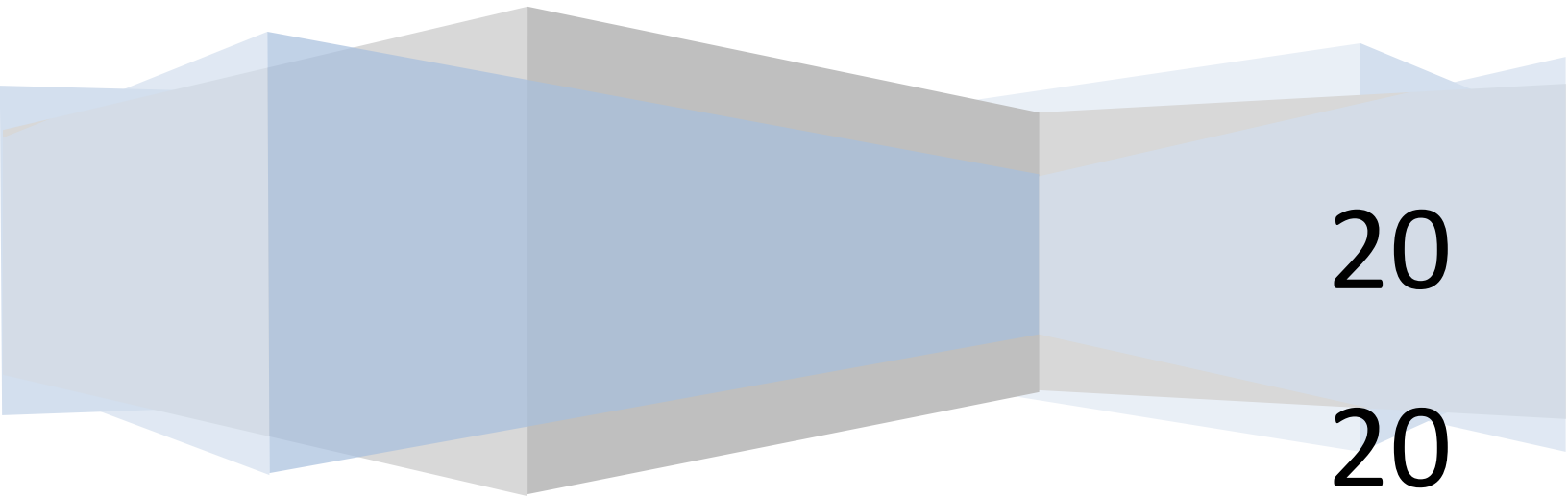
Our sincere condolence to the people who passed away due to Covid19-
Prayers for the departed souls

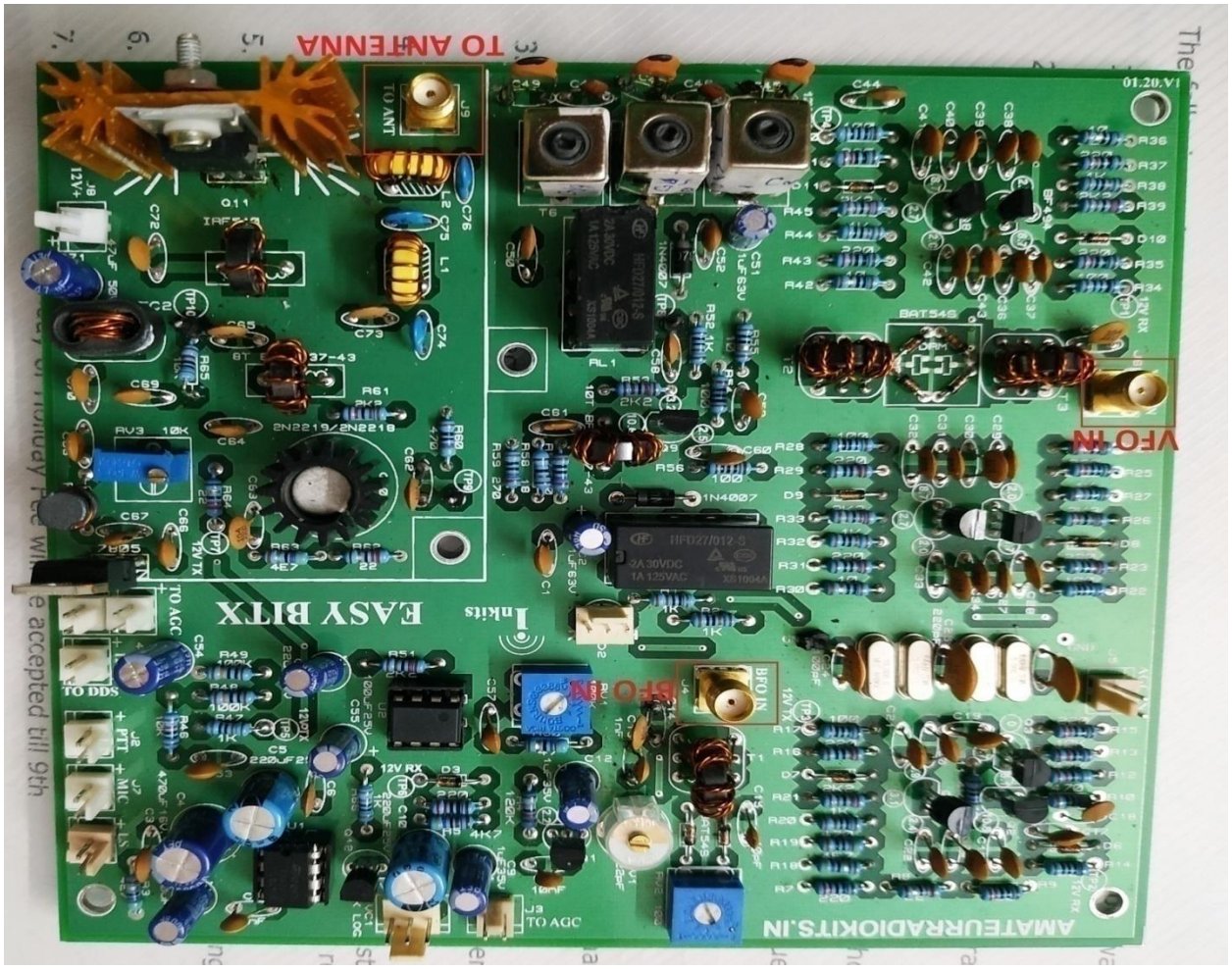
Website: **https://amateurradiokits.in**



2020

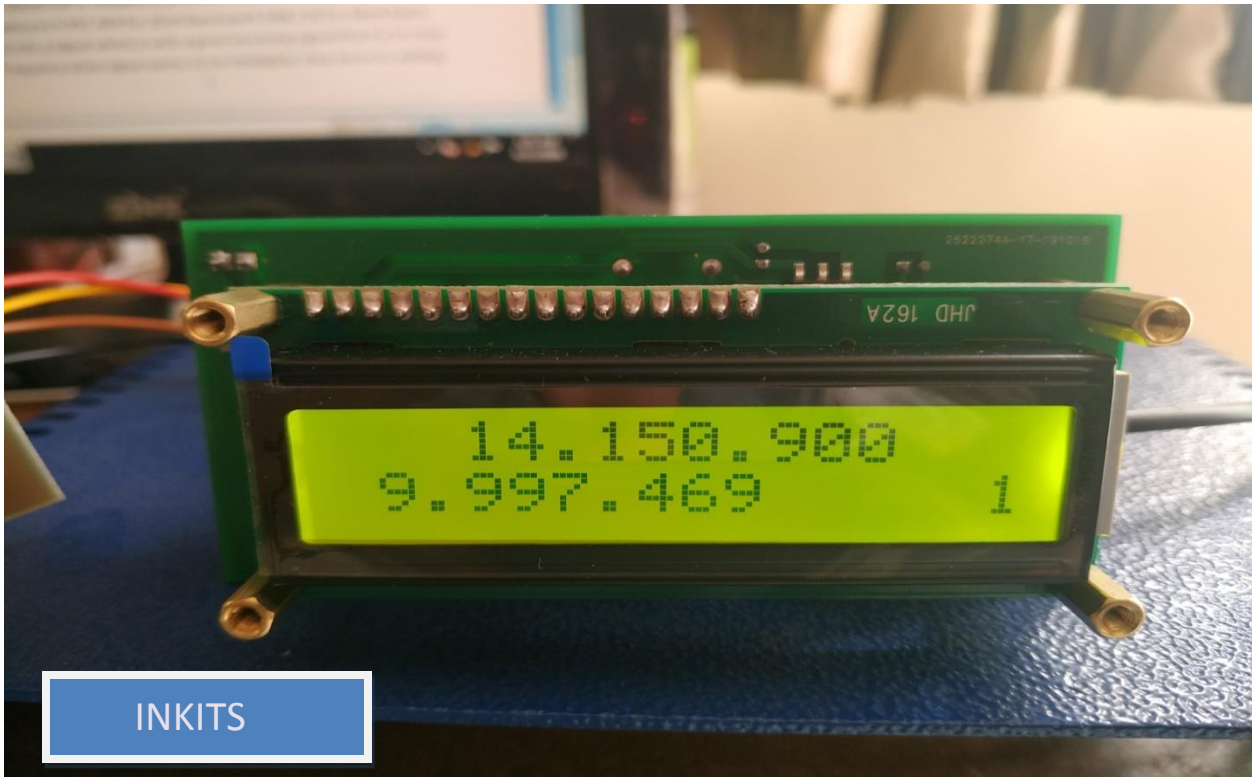
Building the Easy Bitx

Version 1 for 20Mt Band

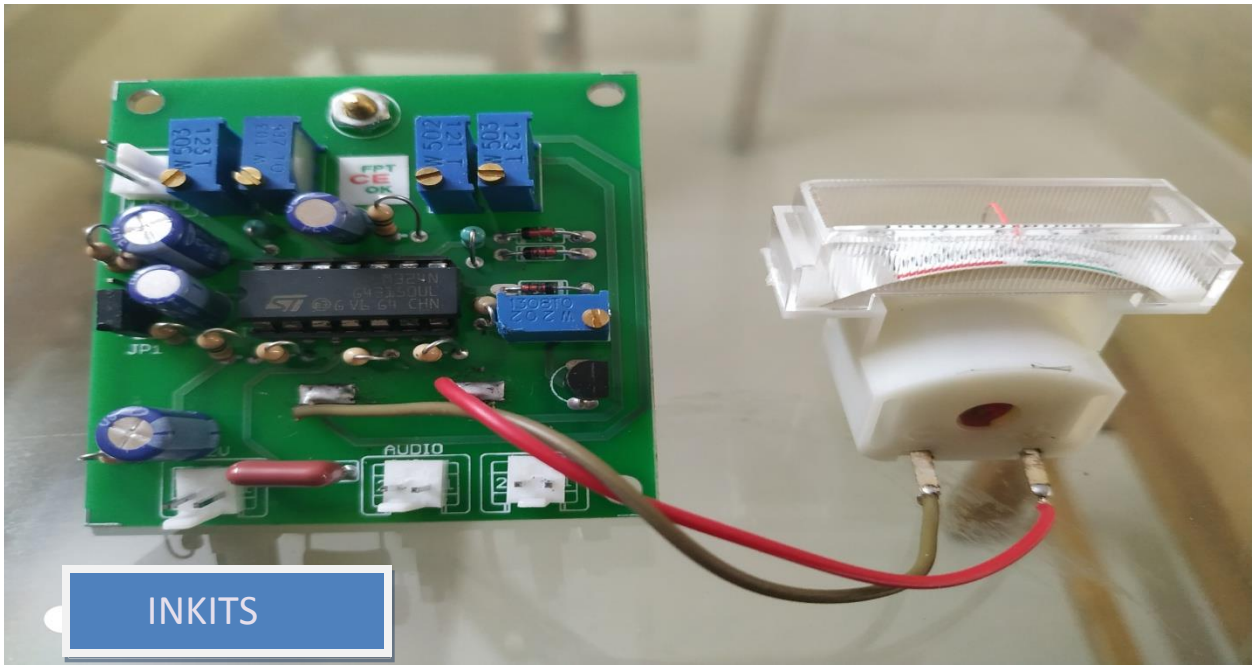


Easy Bitx 20Mt Exciter

NOTE : Kindly double check all resistors value's with a multi meter before mounting them on the pcb, and also all other components too, this is to avoid any damage to the board since it is a double sided PTH board, it would be very difficult to repair the tracks if they get damaged.



Easy Bitx VFO BFO



AGC with Vu Meter

Warning do not use power supply without a fuse,

The PCB can be damaged if there is any short circuit in your connections or wrong wiring, so to avoid shorts please use a 2 amps fuse in your power supply.

Introduction to Easy Bitx

This new easy bitx version 1 ssb transceiver is made for old timers and new hams who wish to learn homebrew an ssb tcvr.

All attempts have been made to provide maximum information relating to the construction of the project.

The full kit contains PCBs, parts, VFO BFO module and chassis. Basic kit is also available.

During assembly you should review the photographs of the completed

Boards (part of the kit documentation) to verify your build and answer questions you may have during your build.

This is a mono band transceiver that can operate on any 3 band 80mt 40mt and 20mt. Relevant information has been provided for specific requirement for filters and coils required to work on any of the three bands. The tcvr is not limited to the mentioned 3 bands; it can even operate on higher bands by using a better final RF MOSFET in the final amp and changing band pass and low pass filters accordingly. It can even be used as a multiband tcvr by using external switchable band pass and low pass filters.

We have upgraded the Easy Bitx tcvr from our earlier project Bitx Ver3B which was adapted from the original design Bitx20 by Om Ashar Farhan.

There has been a constant effort to bring this tcvr out with improvements.

1. Improved Audio Amp TDA 7231

The Easy Bitx uses a Low noise audio amp TDA 7231
Which has an output of 1.6 watt, the IC is has a very low noise feature.
There is one absolute important point for installation of the TDA 7231
If installed in the wrong direction the IC will **be burnt, or roasted,** so be very careful and see the correct way to install it.
If however somehow it's burnt you would need to buy a new one. If it is not available in your country then you would have to build a LM386 external amp and mount on the front panel or any other audio amp.
We would provide the details how to build and mount it.

2. Improved Microphone Amp TL071

The microphone amp of Easy Bitx has a TL071 Low Noise JFET-Input general purpose amplifier. The gain is good and there is no need to shout in the microphone.

3. Audio Mute

Audio mute function has been provided with a single 2N3904 transistor that mutes the audio while in transmit mode, so no more mods for audio mute.

4. TOKO Type Coils

The band pass filter coils have to be wound on TOKO type coils, we have provided complete winding details for the winding turn's inductance etc
Toko type coils are very good in performance; this could be a difficult task for some builders to wind coils, those who are not confident enough could mount readymade BPF and LPF from qrplabbs.com to simplify the process.

Link

https://www.qrp-labs.com/bpfkit.html

An inductance meter would be very useful in measuring the inductance. If you do not have then just follow the number of turns as we have calculated for you.

One important point about inductance meters is that there are several ones available but very few will give correct reading.

If possible try to build an inductance meter from open source design of Vk3BHR.

Link https://sites.google.com/site/vk3bhr/home/index2-html

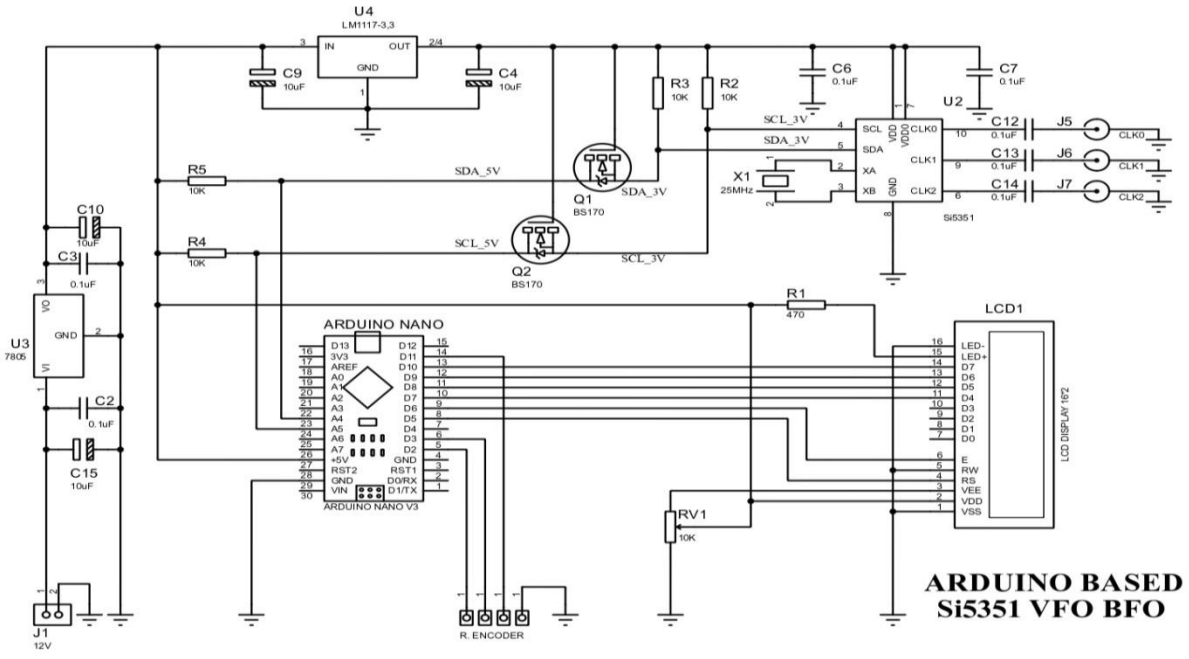
We are using the same design for our test the measurement is just about perfect.

The TOKO coils will tune on all the 3 bands 80mt 40mt 20mt, details on the number of turns has been mentioned in the chart provided with the documents of Easy Bitx.

The default filters are provided for 20mt so you would only need to change the number of turns on TOKO coils and value of the tuned capacitors, on other bands. Also change the toroids in Low Pass Filter for 40mt or 80mt.

Capacitors used in low pass filter also to be changed according to the values provided in the chart.

VFO BFO Si5351 Schematic VFO BFO



1. The Easy Bitx uses an open source sketch for VFO BFO.
   The sketch we have used is of AK2B which can be found on.

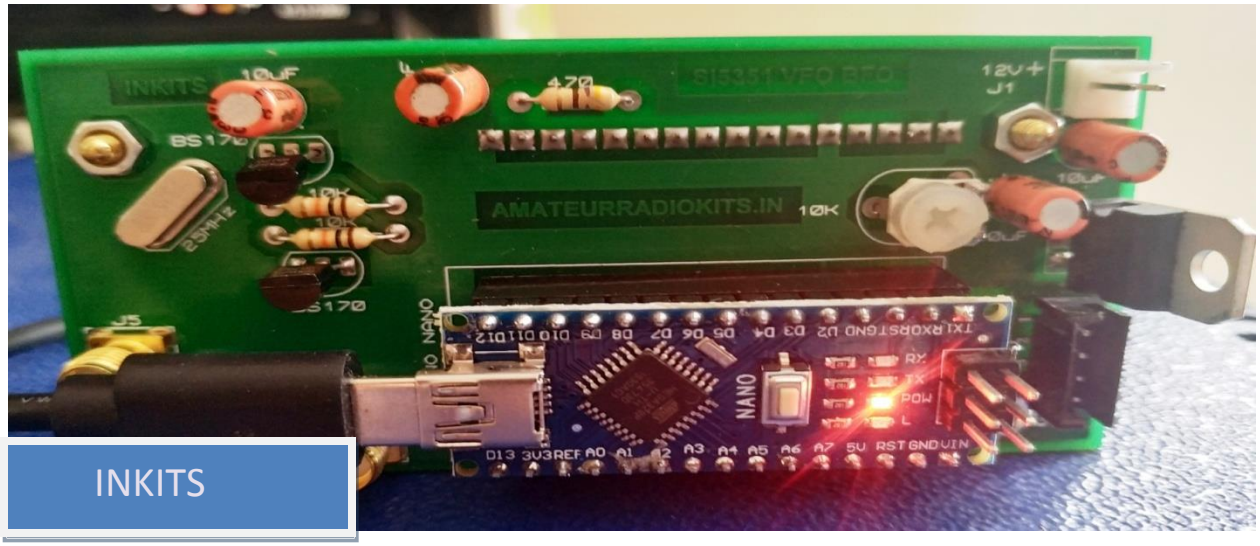
   http://ak2b.blogspot.com

   The sketch can use any IF so it is quite a suitable VFO BFO to use.

   There are many designs available open source which could be used, even

   Some of you may already be having some sort of VFO BFO with Si5351.

Si5351 VFO BFO



Improved Power Output

The final amp with IRF510 puts out an impressive output of 3 Watts with 12 Volts DC and much higher output if 18V is used on the PA on 20mt.or other bands too.

On 40mt the power output is 5 watts with 12V DC, again with 18V it will be much higher. The objective of the project is to provide a qrp tcvr and not a qro one; an external linear amp can be added to get a higher output. We will be providing a new PCB and kit for the WA2EBY amp soon.

There is a provision of to install SMD capacitors where NPO are required as an extra option.

VFO Mixer and Balance Modulator

The VFO Mixer and Balance modulator have the option to use the regular IN4148 diodes as well as BAT 54S, the decision depends upon the builder, for a new builder it would be better to use the IN4148 by matching them as some extra have been provided. In our build we have used IN4148 to illustrate for beginners.

Step By Step Kit construction in15 Steps

The Easy Bitx comes in 15 packets as a kit and few other packs for cable etc.

Each kit needs to be assembled with step vise.

Sometime it may be necessary to jump in some other step to operate some stage which we shall mention in the notes.

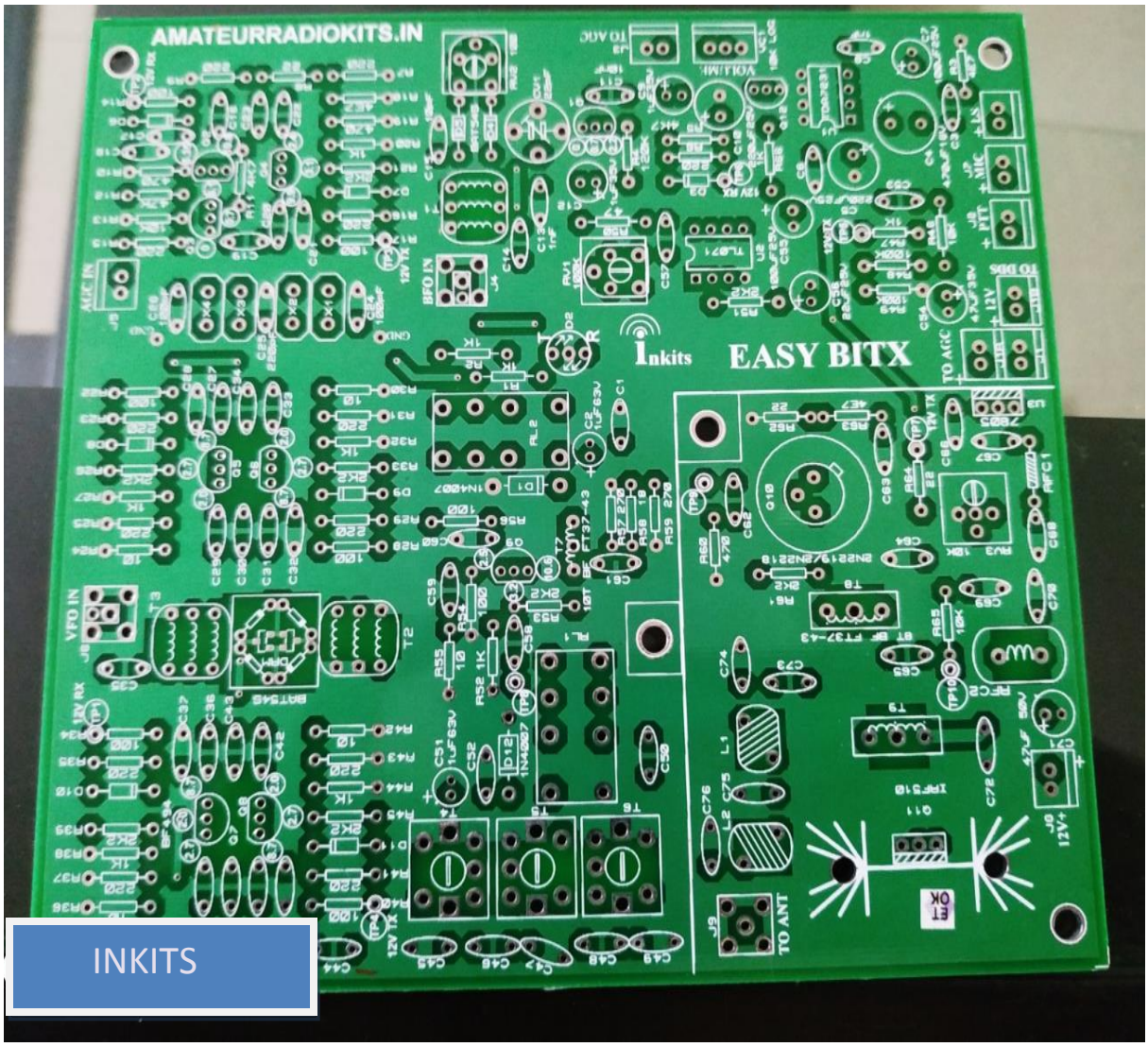
1% Metal Film Resistors

The kit has 1 percent metal film resistors; it is of outmost importance that the resistor value is read with a color code chart and a multi meter.

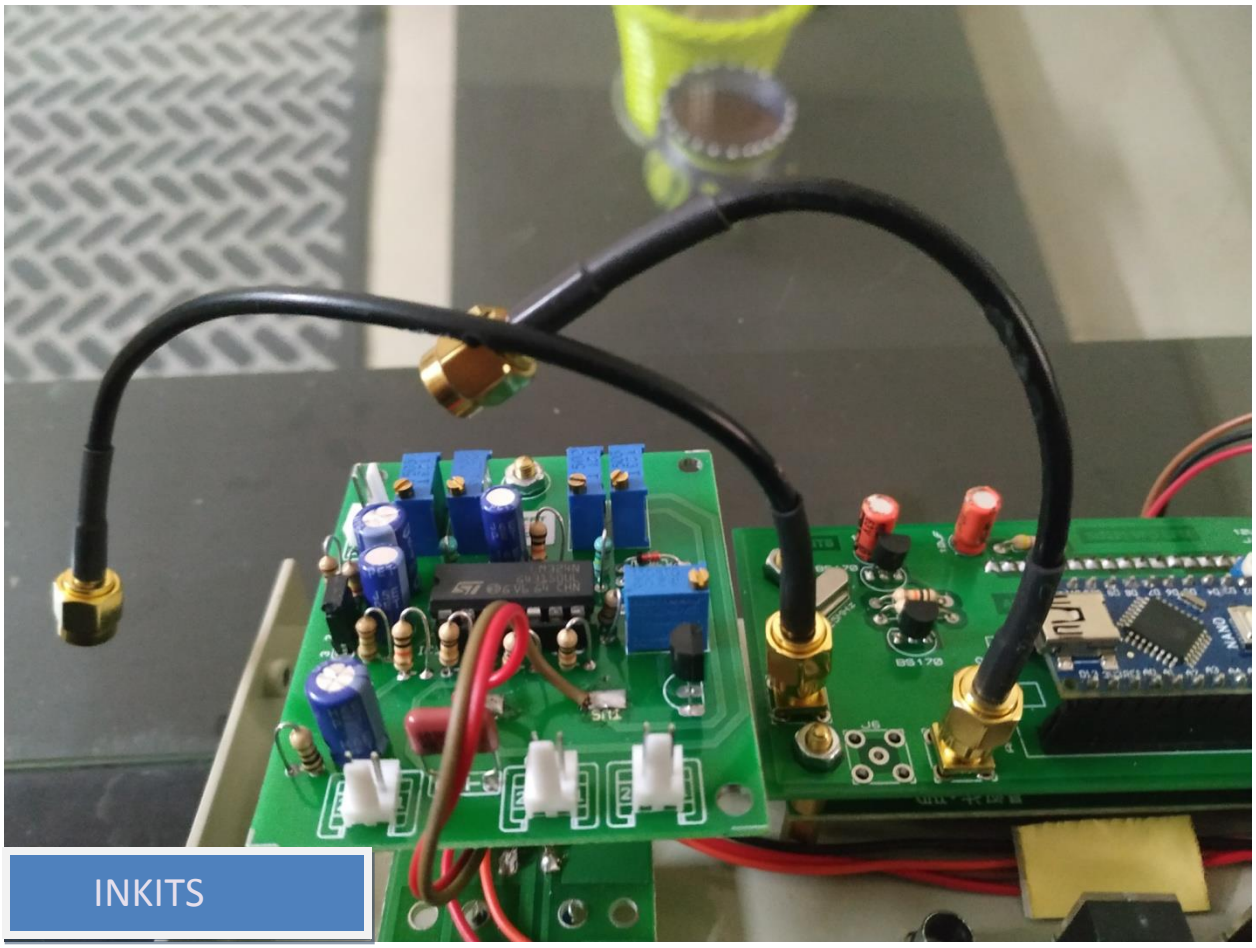
If you install a few wrong resistors then your project could not be working as expected and it would be very difficult to find the wrong resistor installed, so take it very easy and install resistors by double checking them with a proper multi meter.

Printed Circuit Board

The printed circuit board is double side PTH through hole one, so care is needed in soldering components so that wrong components are not soldered where they are not supposed to be placed, study the schematic and orientation of component placement on the printed circuit board which has been marked for all components makings and also voltages for various stages.



Easy Bitx Printed Circuit Board Double PTH through hole



SMA Connectors and RF Cable

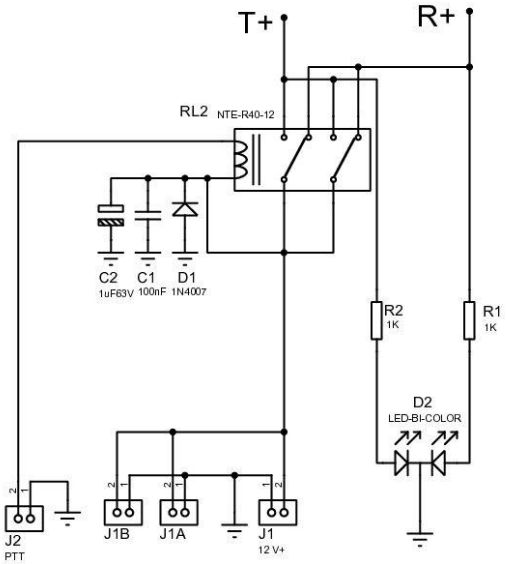
The biggest improvement was to use SMA connectors with RG17U RF cable for VFO BFO, And Antenna. This has made connecting the BFO VFO much easier and much reliable. The cables are custom made in India for this kit.

There are total 3 RF SMA RF connectors using Rg174U. For the BFO, VFO and the Antenna.

Step 1 Power Supply

Warning do not use power supply without a fuse,

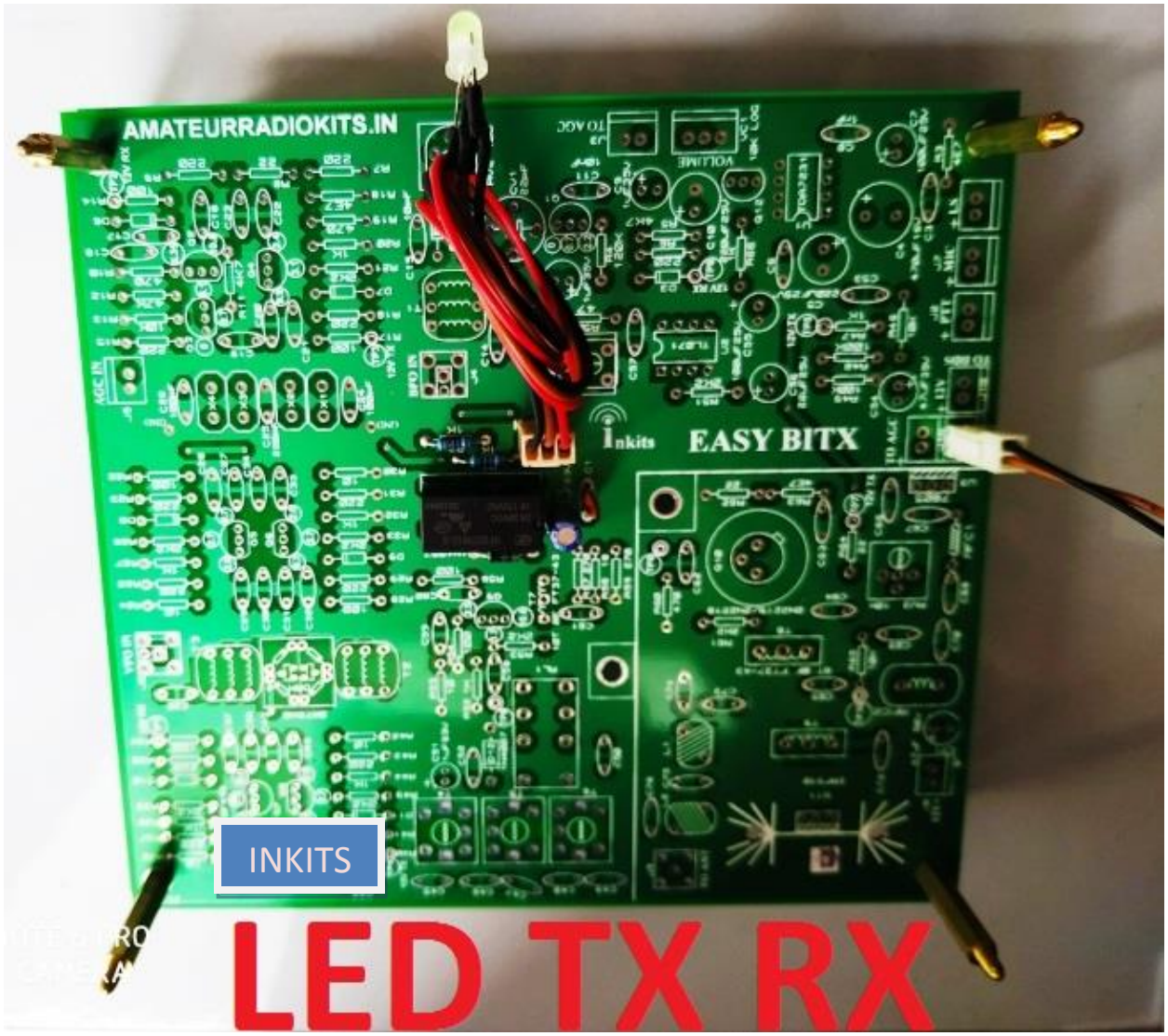
The PCB can be damaged if there is any short circuit in your connections or wrong wiring, so to avoid shorts please use a fuse 2 amps in your power supply.



Schematic Power Supply TX RX

The

Components placement for Step 1 Power Supply



Picture of constructed Power Supply stage TX RX

The power supply voltage for Easy Bitx is 12V and 2 Amp requirements.

The relay RL2 which is a 12V double pole relay its function is to provide +12 Volts to RX and +12 Volts to TX. Usually the relay is in non operation mode and provides +12 Volt to the receiver section in default, on pressing the PTT the relay will provide +12 Volts to the transmitter section and cut of the receive section.

Carefully open packet of Step 1 and check all the components as per the BOM provided in the documents. Some 2 pin PCB mount connectors may be in another packet collect them and prepare to solder one by one as in the schematic.

There is a provision for LED for showing TX and RX mode.

You need to take a 3 PIN wire connector and solder the wires on the LED, the led has anodes on left and right and cathode in the center. Use a multi meter to check led in continuity position for which is red and which is green, accordingly solder wire on the Led leads, now you could plug in the 3 pin wire connector on board marked with a symbol as Led TX RX.

Anodes are positive red and green led. The center common pin is cathode which

Is negative.

Once you have placed all components with 2 pin male connector pin at J1 and 3 pin male pin at TR led sign marked on board with a circle, as in schematic and components placement document provided, check them again.

On satisfaction that your placement is correct for all parts components mounted on the PCB installed apply +12 Volts at J1 and switch power on to the board.

You should see the green led light up, if it's the red one, then maybe you need to interchange the led wires soldered on the anodes left and right pins of led.

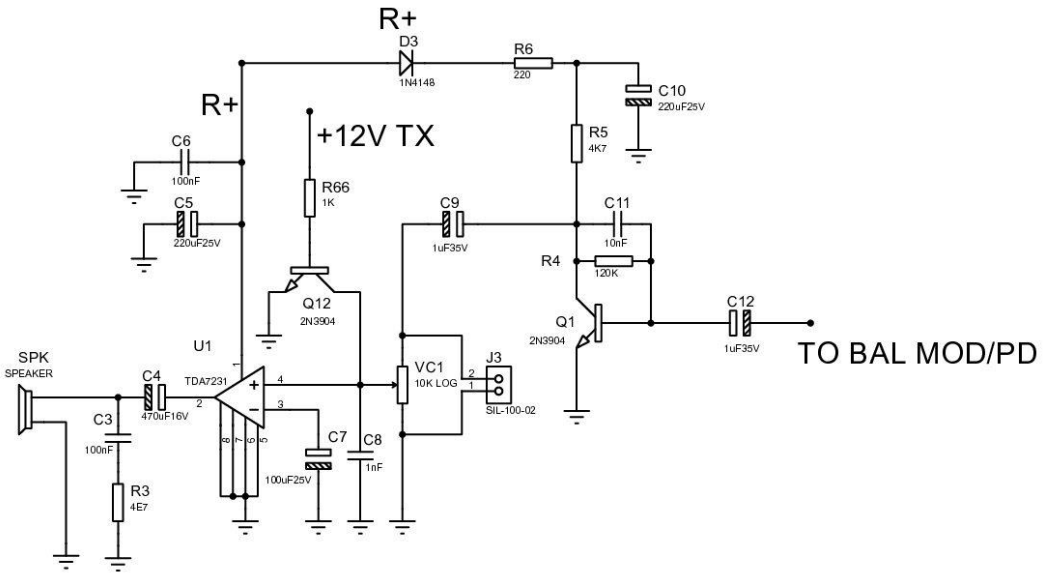
Press the PTT you should see the red Light come on and a click from the relay confirming that the stage is working well.

Kindly check out with the picture and also video in the Video files for easy Bitx

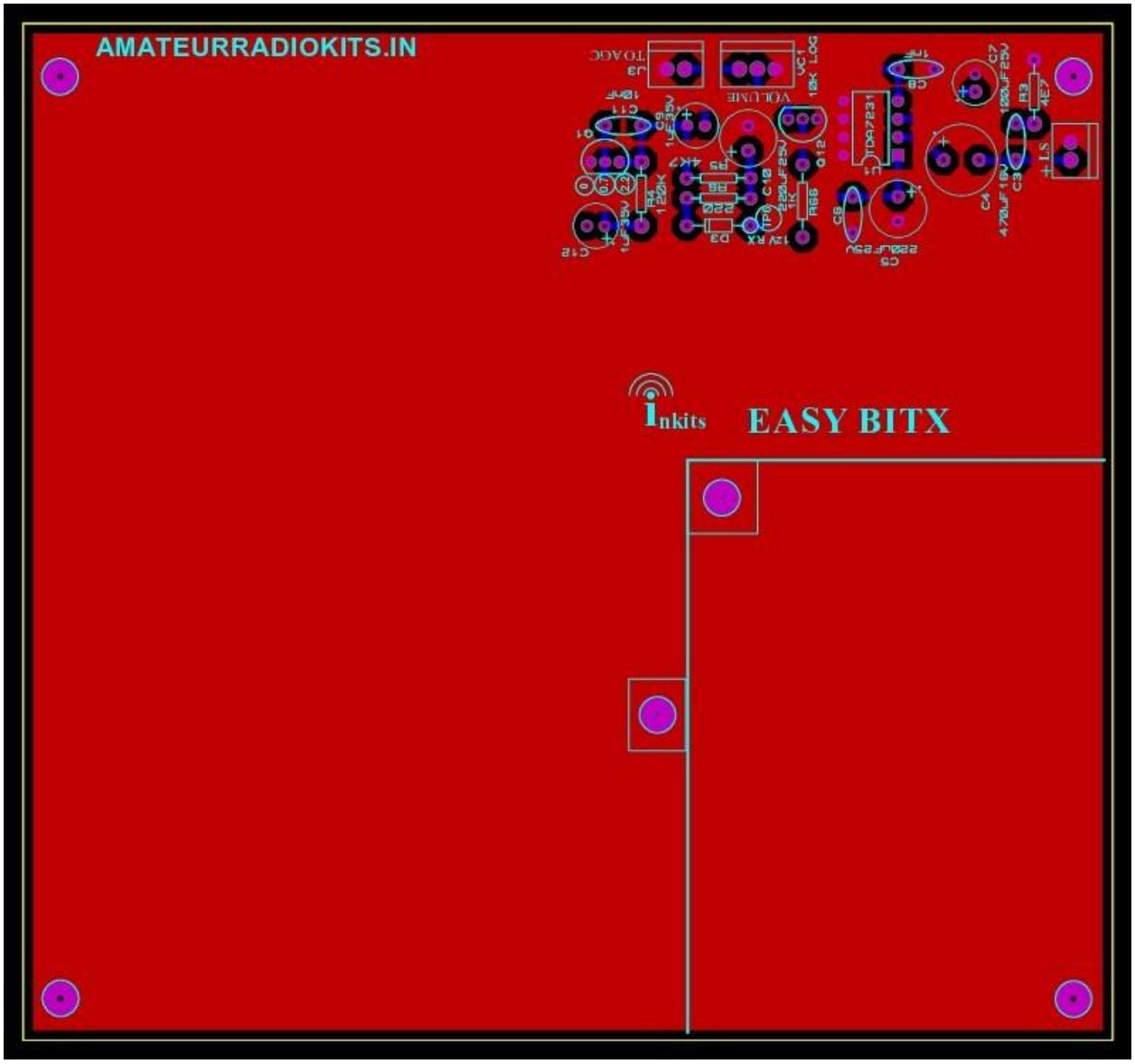
This completes the step 1 Power Supply.

We move to the next step.

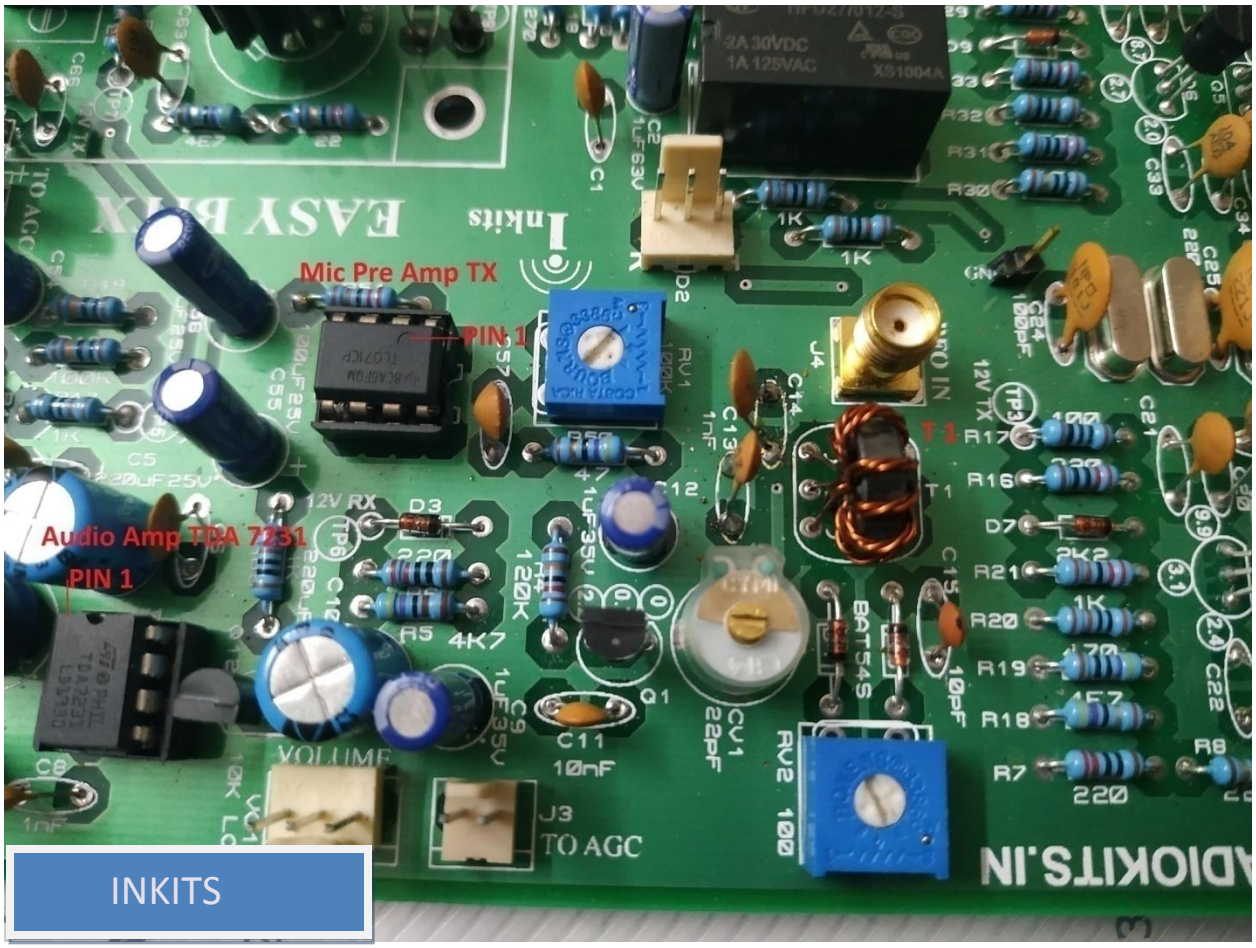
Step 2 Audio Amplifier



Schematic of the audio amplifier TDA 7231



Components placement of Audio Amplifier



The audio amplifier used in Easy Bitx is TDA 7213 Low Noise Amplifier.

The audio amplification output is 1.6 watt.

Extreme care is required in placing the TDA 7231 correctly on the base provided, if the IC is placed in the wrong direction it would burn out and it may be difficult getting a replacement in these times.

Kindly see the pictures careful while mounting the base and IC correctly.

We shall start step 2 audio amplifier with checking all components in the packet with Bill of material.

First take the 8 Pin base of TDA 7231 and place it carefully in the correct position on the board marked U1 do not place the IC TDA 7231 as yet we shall do that

later, so now you have mounted the 8 pin base and checked that the base is mounted spot on in the correct direction, good!

Now we start by placing resistors very carefully with checking their values with a multi meter. We cannot afford installing wrong values so be very careful take your time.

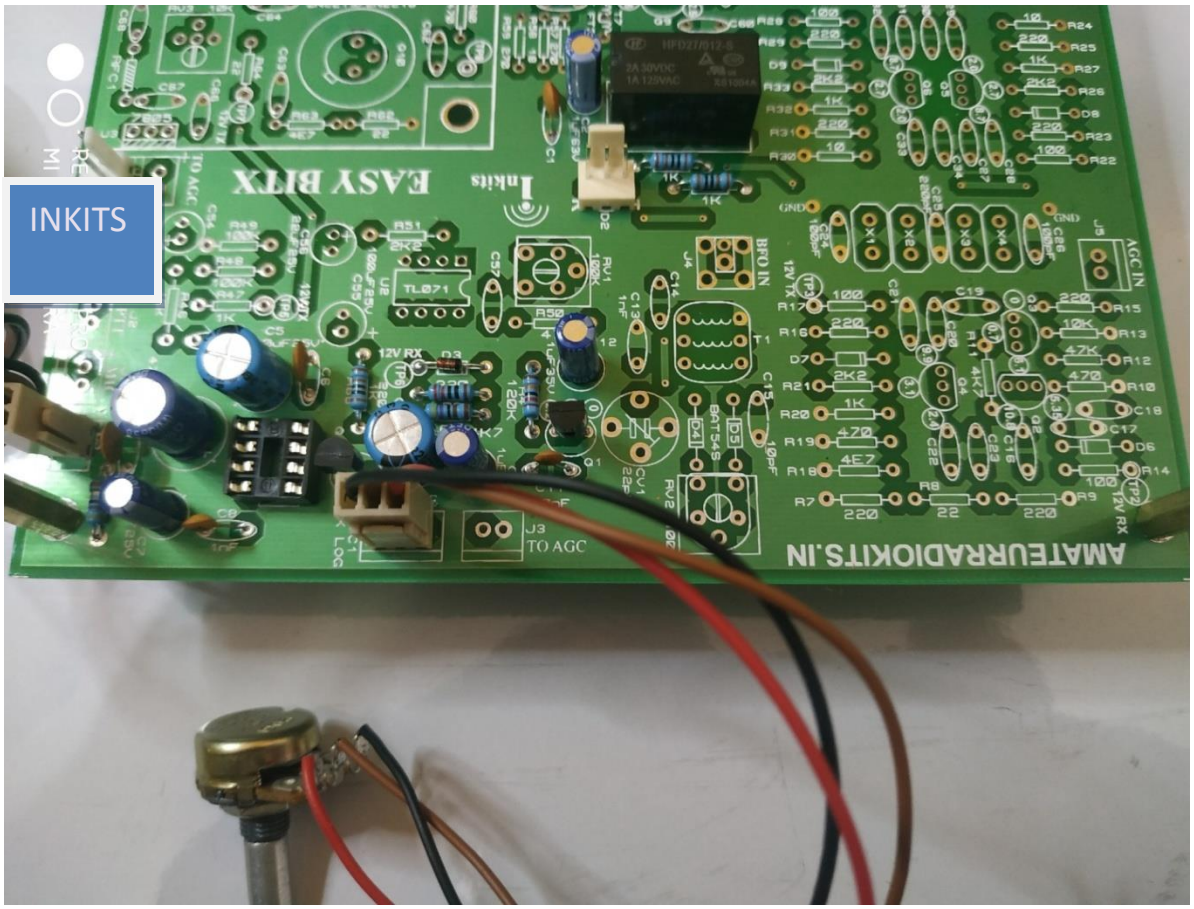
After installing all the resistors start with the capacitors disc and then the electrolytic condensers. Now install Q1 and Q12.

Q1 is an audio preamplifier stage and Q12 is the audio mute part of circuit, this mutes any noise the tcvr picks up on Tx mode. Now install the D3 diode too. So now all the components are installed and soldered.

We need to install a 3 PIN connector at VC1 and also wire a 3 Pin relimate wire and solder to 10K Potentiometer. Plug one end to board VC1 and other to 10K potentiometer.

The speaker would also need to be connected with a 2 pin connector at LS with a 2 PIN relimate wire plugged into board LS and other side soldered to the speaker terminals.

Re check your board if all solder joints are good, the resistors are placed correctly with correct values in place and the transistors are mounted in correct position.



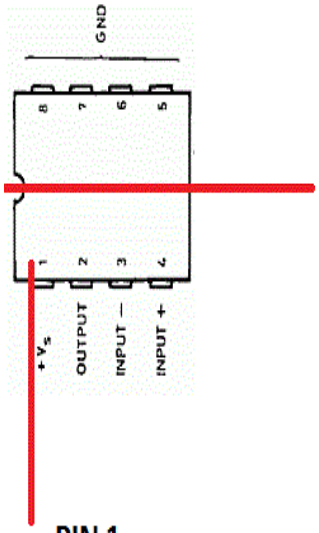
Audio amp stage all components mounted leaving TDA 7231

Once you are satisfied that all seems well it is time to apply power +12V, take note the IC is still not installed we shall install it once we check the power at Input pins of base of TDA 7231.

On powering the audio amp use the multi meter and check voltage at PIN 1 at base it should be +12 Volts.

Now switch off the tcvr audio amp.

Now it is time to place the TDA 7231 into the 8 pin base, with carefully placing in the correct position. Do not hurry in powering up the tcvr; recheck with the picture below.



Look for this cut on the easy bitx board and place the chip in same direction then only apply not more than 12 volts to the exciter easy bitx board.

PIN 1

NOTE: It is outmost important to place the TDA 7231 in correct position. if you place it in the wrong direction then you may blow the chip. So be careful !!!

The TDA 7231 could use some repalcement IC or use a small veroboard Lm 386 Amplifier mounted on the front faceplate of the tcvr

Continuing with Audio Amp TDA 7231

Once the TDA 7231 is placed in the eight pin base it, see that that the 10K volume control and speaker is connected. Switch on the power to the TCVR, increase the volume control to maximum position clockwise, see that the speaker is connected, now take a tweezers and place the tip at the input of the audio amplifier C12, you should hear a loud Buzz from the speaker. Also check the voltage chart to cross check the voltages on the PINS of TDA 7231.

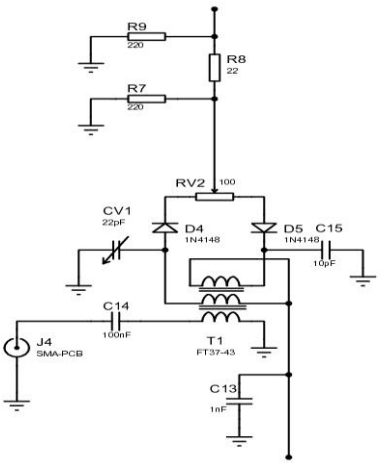
There is a video also which shows a demo of the amp being tested in the video folder.

This completes the audio amplifier stage.

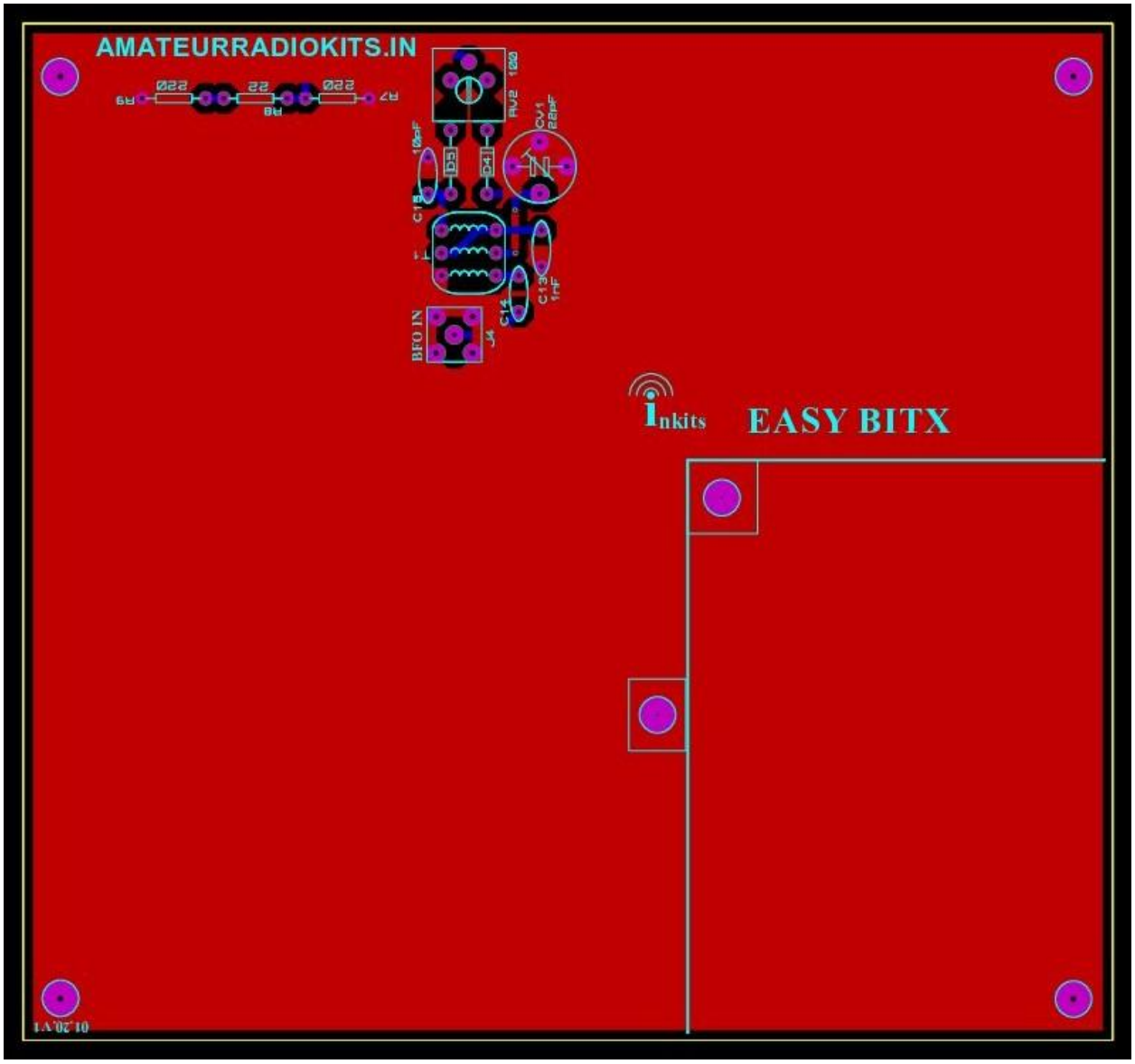
Switch off the power.

We move to the next step.

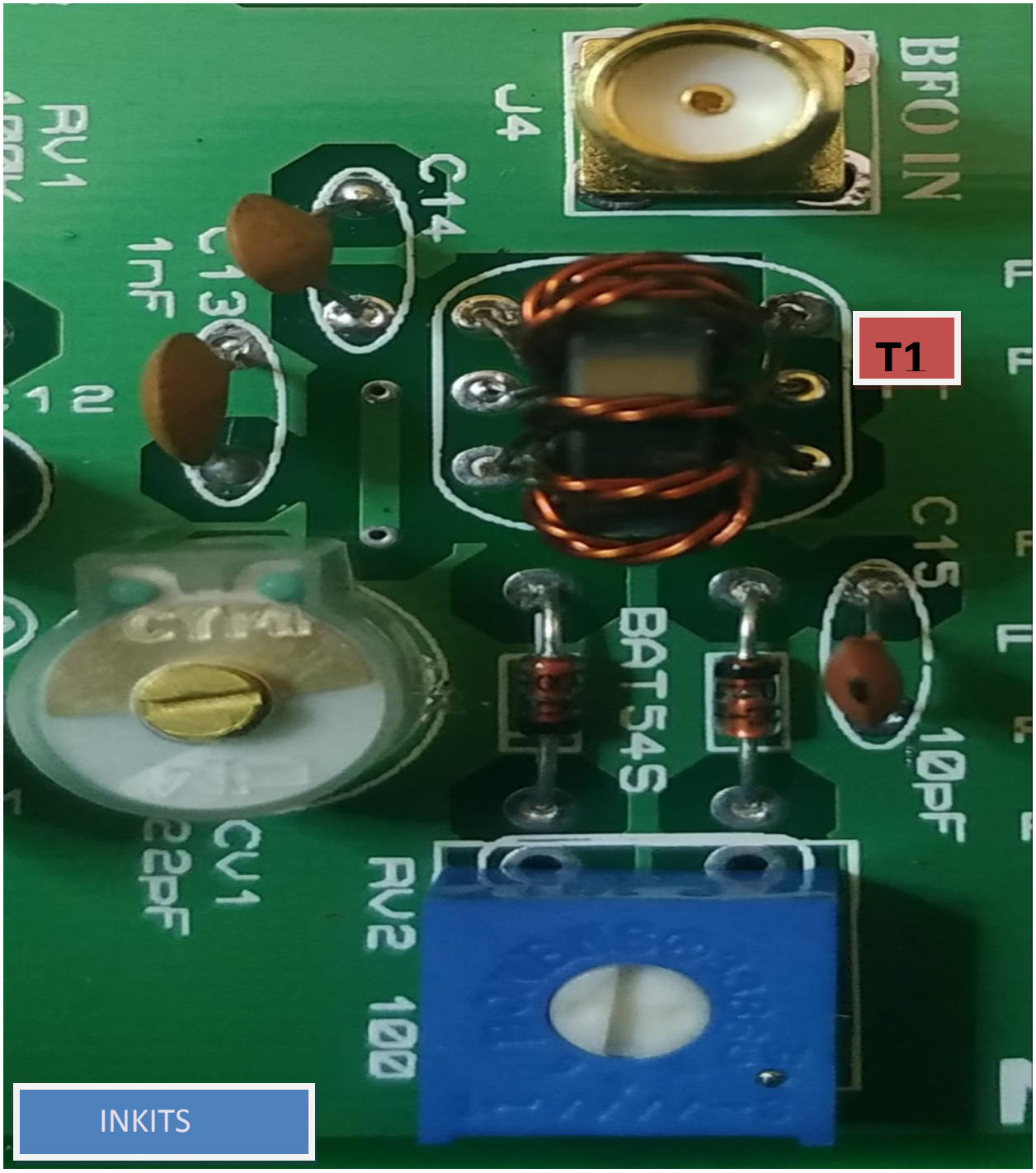
Step 3 Balance Modulator/Product Detector



Schematic of Balance Modulator/Product Detector



Components placement of Balance Modulator/Product Detector



Balanced Modulator / Product Detector

T1: 8 turns trifilar wound on #28 SWG magnetic wire

Now we start building the Balance Modulator /Product detector stage.

Open the Step 3 packets check all the components.

T1 has to be wound 8 turns trifilar wound on T37-43 with #28 SWG, the magnetic wire has been provided in the kit.

See picture above for T1

If you do not know how to wind trifilar wound coil then look at link below for help.

Link to wind coils on Toroids.

https://www.youtube.com/watch?v=4A05-JBrPmY

For Bifilar use 2 wires

For Trifilar use 3 wires

It is assumed you have wound the T1 Coil and check it with a multi meter then mount T1 on the board.

Now mount all the components as in schematic and BOM which has complete list of parts for each stage.

The 100 ohms and 22PF green trimmer would need adjustment later.

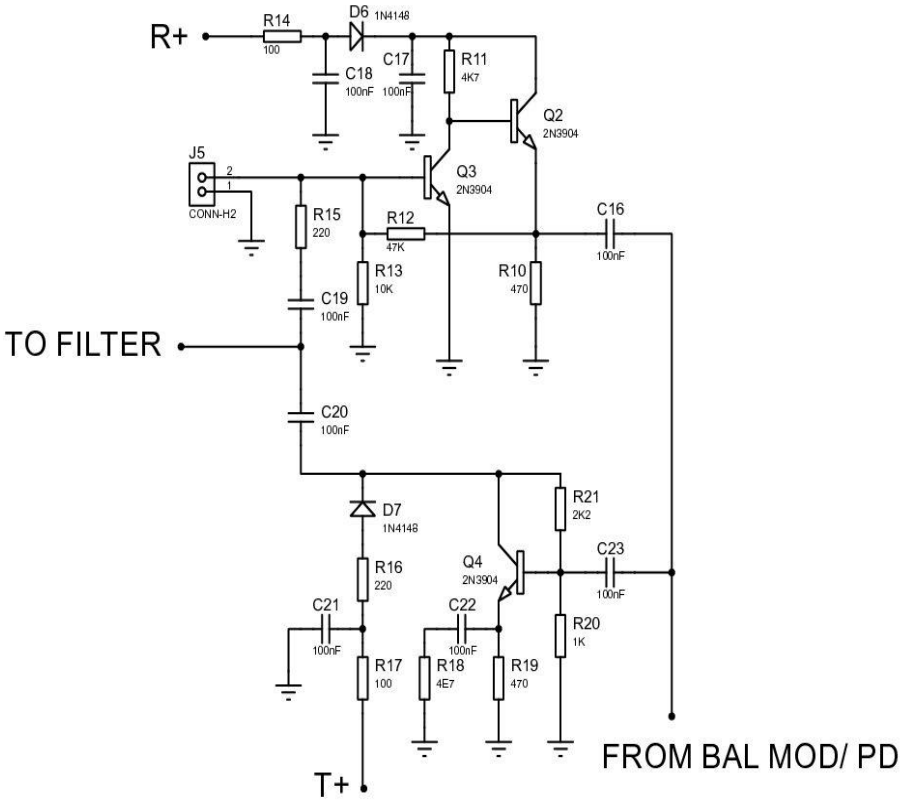
Check the toroid coil with multi meter if the winding is correct.

Also mount the SMA connector on the board for BFO input.

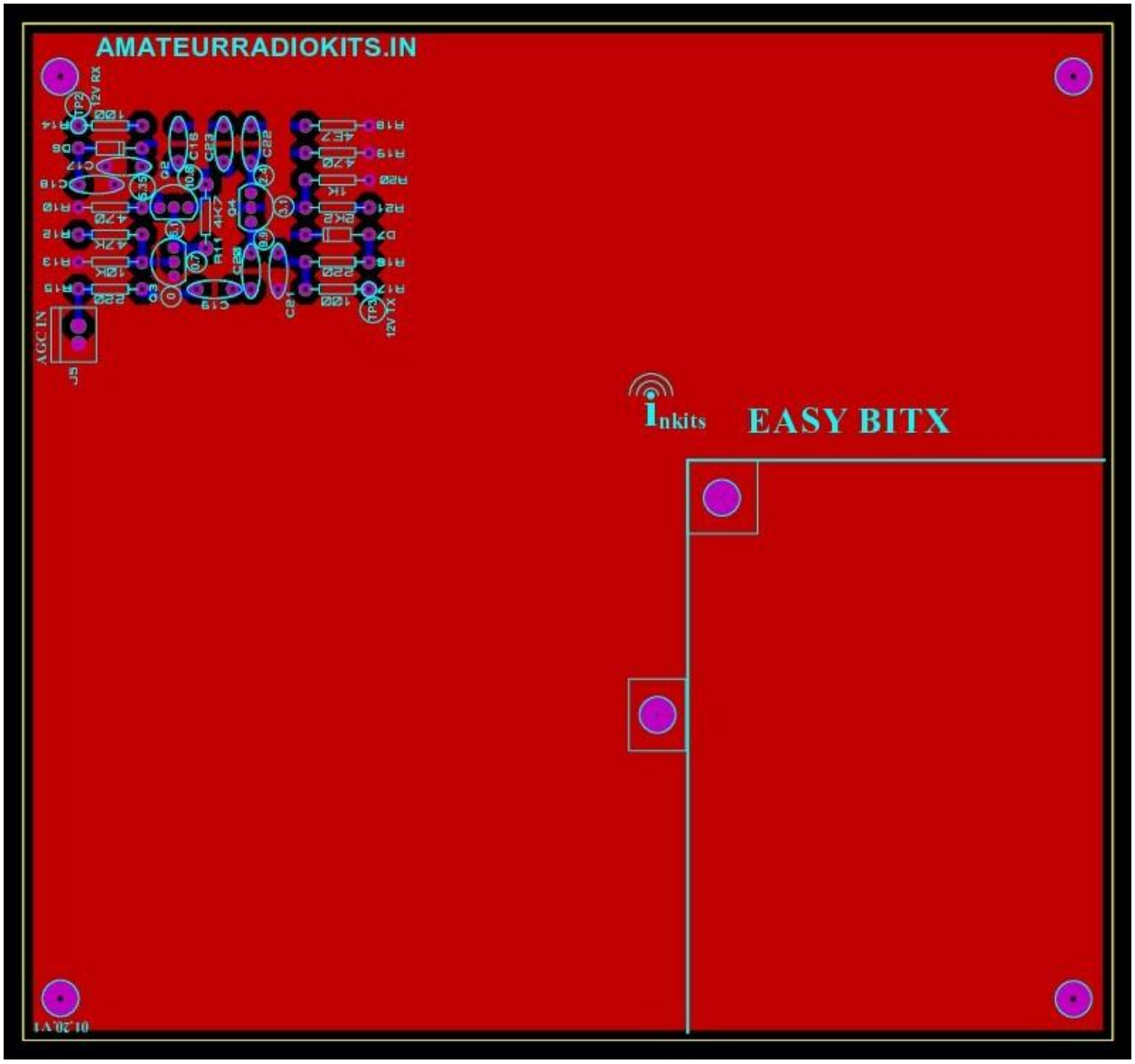
This completes the BM/PD stage.

We move to the next step.

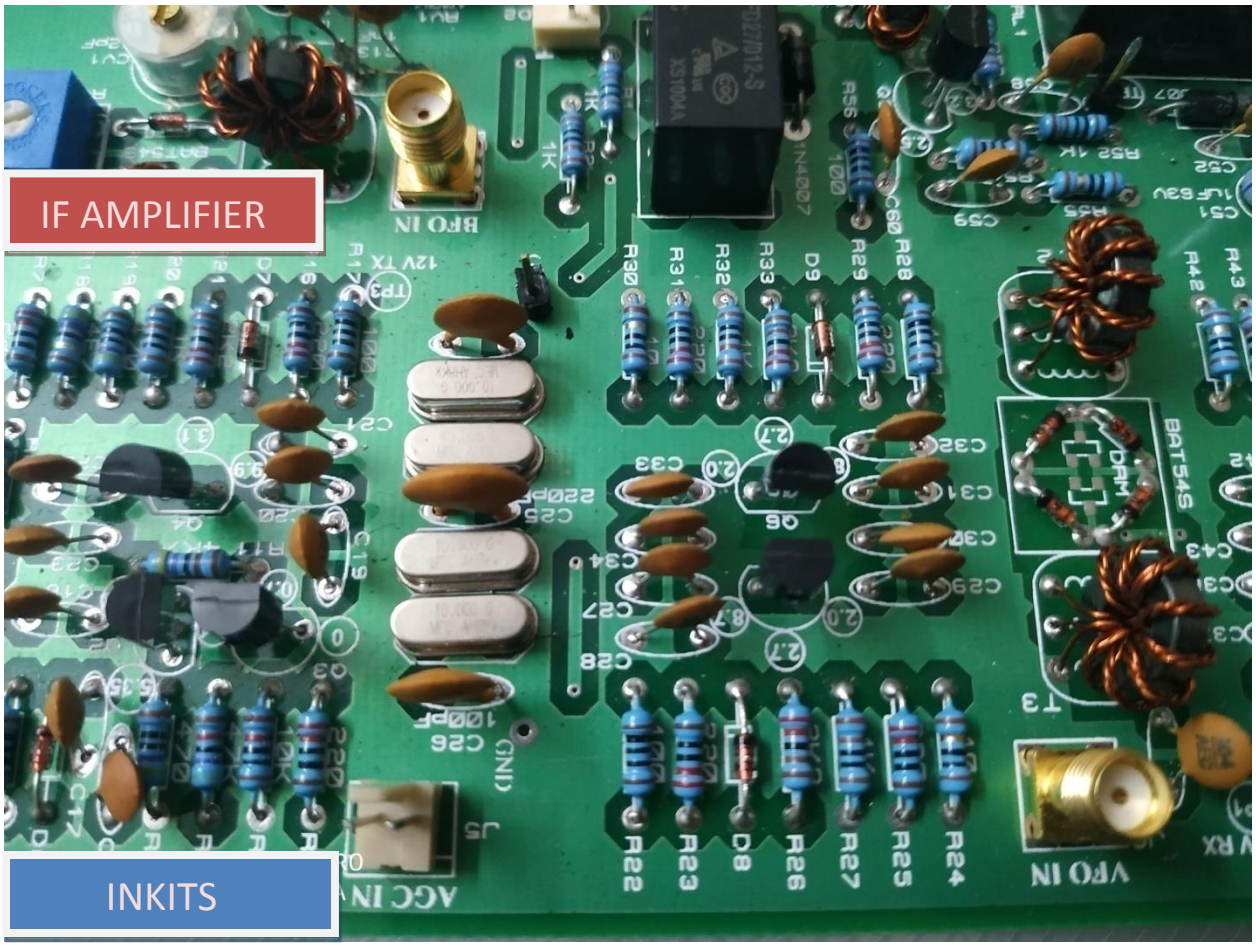
Step-4 IF Amp



Schematic of IF Amplifier



Components placement of IF Amplifier



IF Amplifier Q2 Q3 Q4

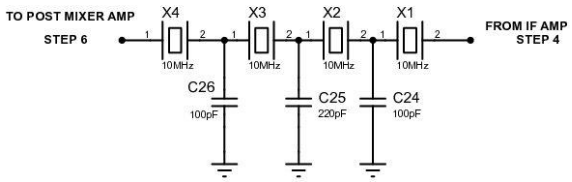
The IF Amp consists of Q2 Q3 Q4 which amplifies the signal of the transceiver as bidirectional amplification for Rx TX stages.

Open packet number 4 check components and mount and solder them observing the correct polarity for installing transistors and checking each resistor value with a multi-meter. When all components have been soldered, switch on the tcvr and in receive mode check the voltages on Q2 Q3 transistors and on transmit Q4 with the voltage chart provided in the documents.

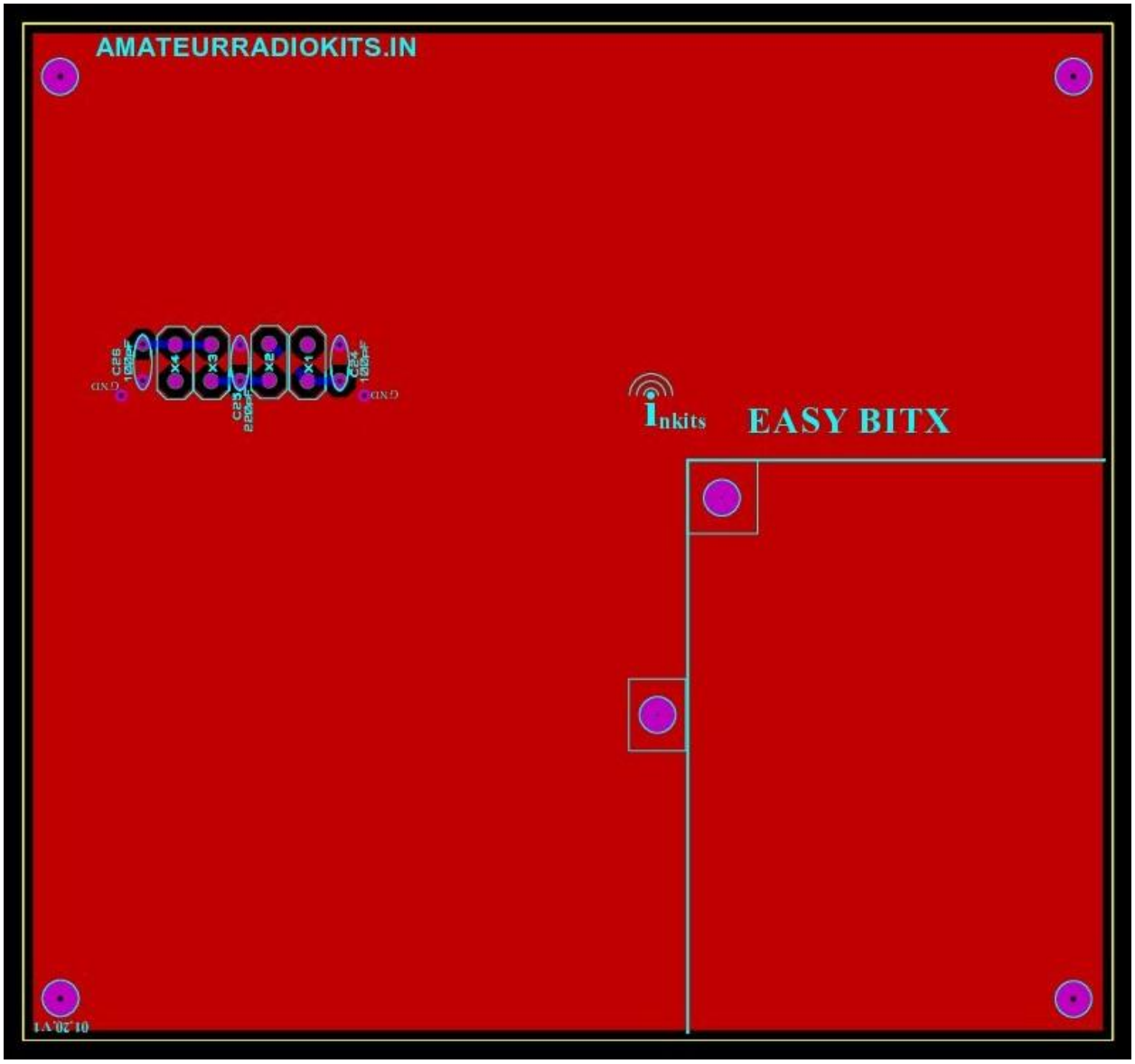
This completes the IF Amplifier section.

Now we move to the next step.

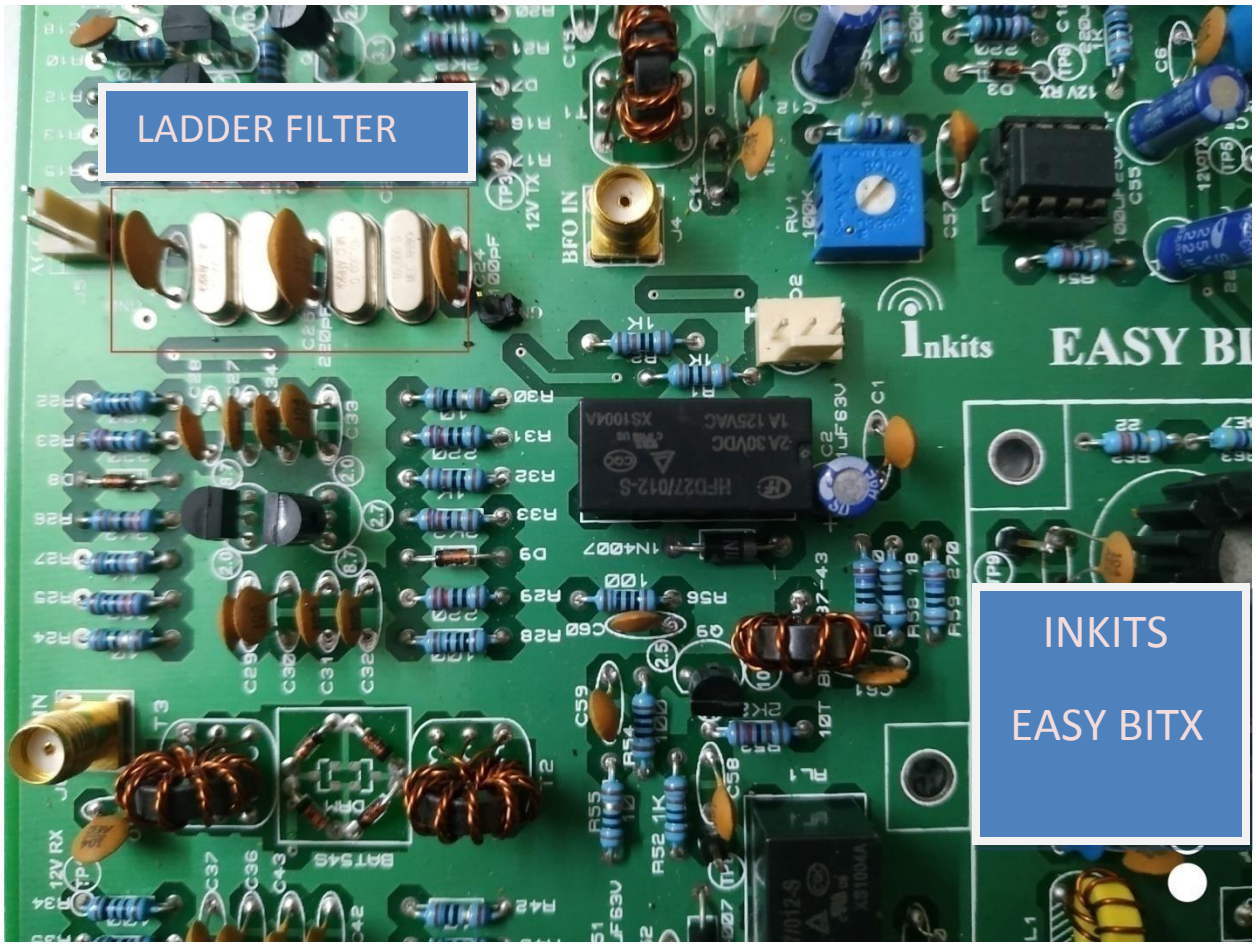
Step 5 Ladder Filter



Schematic of Ladder Filter



Components placement of Ladder Filter



10 MHZ Ladder Filter

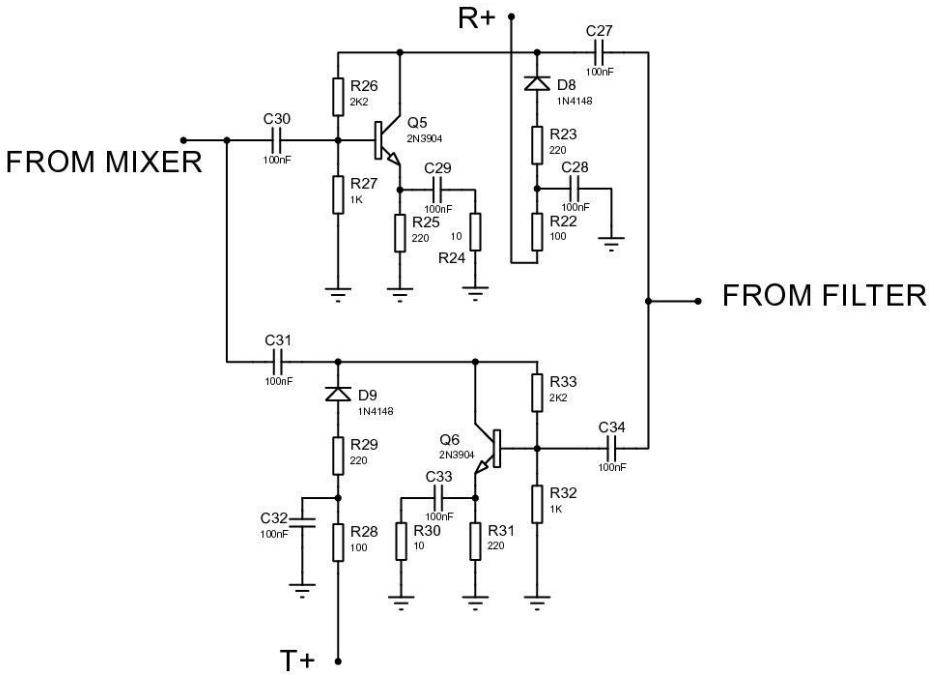
Open the packet Step 5 with the matched crystals 4 no and capacitors 220PF and 100PF.

Mount all components carefully the Easy Bitx board has value of capacitor and crystal marked on the board. Solder them and do a double check if installed correctly. This completes Ladder filter. There is a ground connection on the board if you wish to ground the crystals.

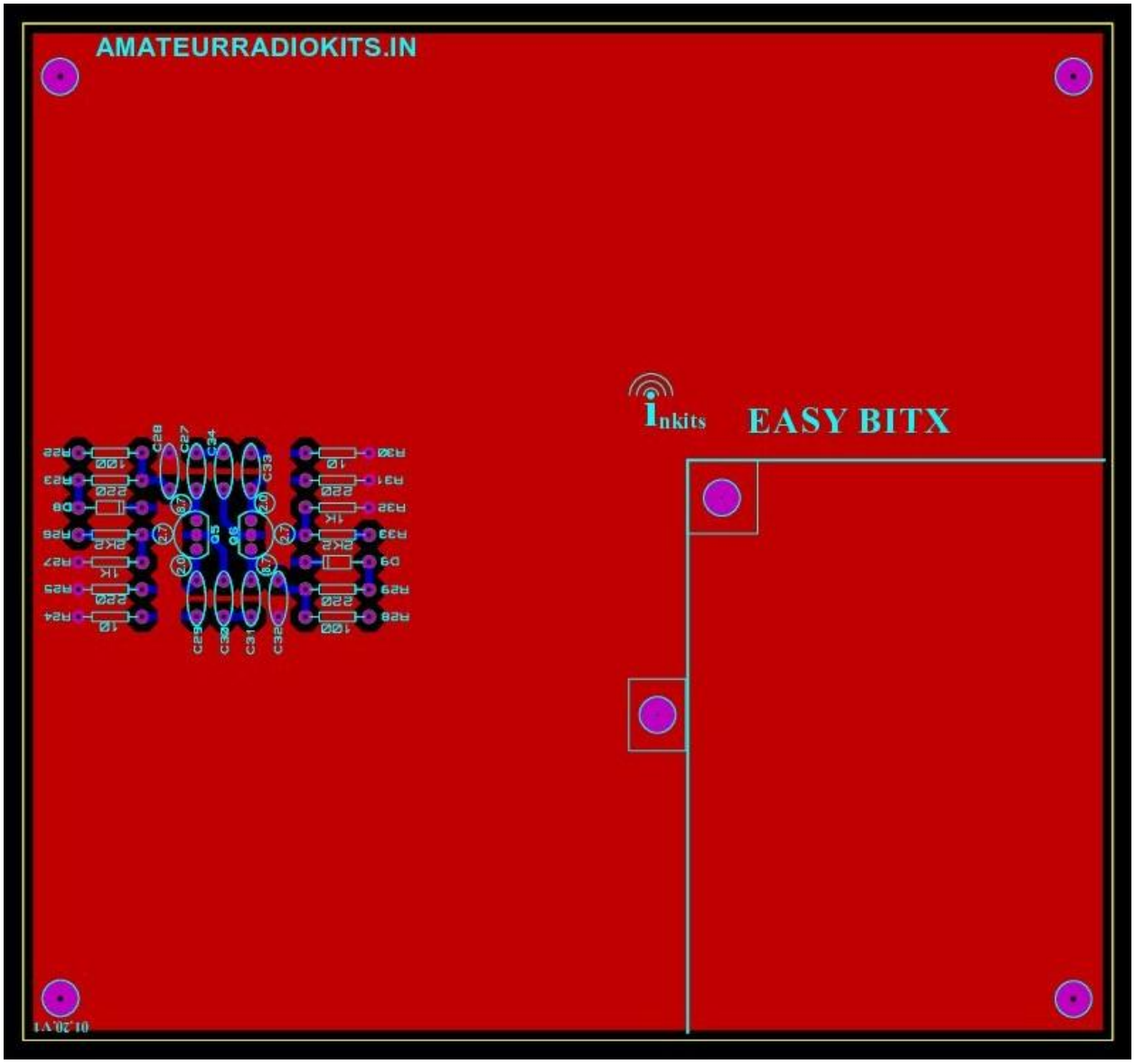
These crystals have been pre matched.

The Ladder Filter is complete now, we move to the next step.

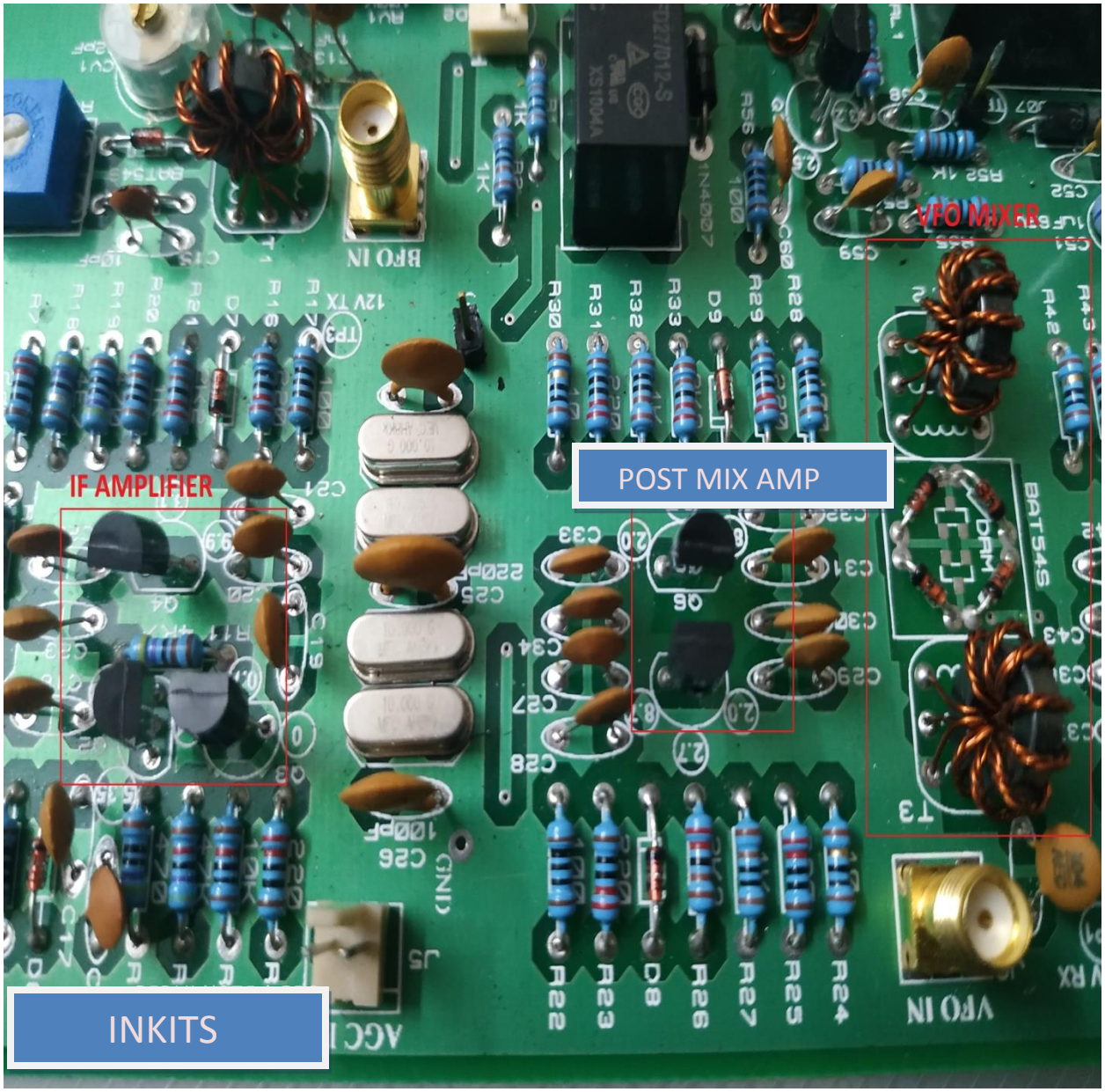
Step 6 Post Mix Amp



Schematic of Post Mix Amp



Components placement of Post Mix Amp



Post Mix Amp

Now we start building the Post Mix Amp.

The Post Mix Amp has two transistors 2N3904. Q5 which amplifies the signal from the mixer and Q6 which amplifies the signal from the ladder filter.

Open Step 6 packet and check all the components with BOM. Now mount all the components which resistors, capacitors and transistors. Use a multi meter to check the 1 percent resistors value before mounting them.

You should not mount all the components at one go, start say with resistors carefully checking their values, then capacitors and finally the transistors.

Having soldered all the components re- check the joints for any cold solder.

Take another look if all components are installed at the right place.

In fact this method of mounting and soldering and checking should be followed in all the stages.

So now we need to test the voltages at Q5 and Q6.

Check Q5 voltages on receive and Q6 voltages on transmit.

The voltage can be cross checked with the voltage chart provided.

The voltages want be exact as in chart, they could differ a bit due to the multi meter make etc. So until it is not a major difference in voltages your construction is good.

Now it is possible to check the complete working chain from post mix amp, ladder filter, IF amp, Product Detector to the audio amp.

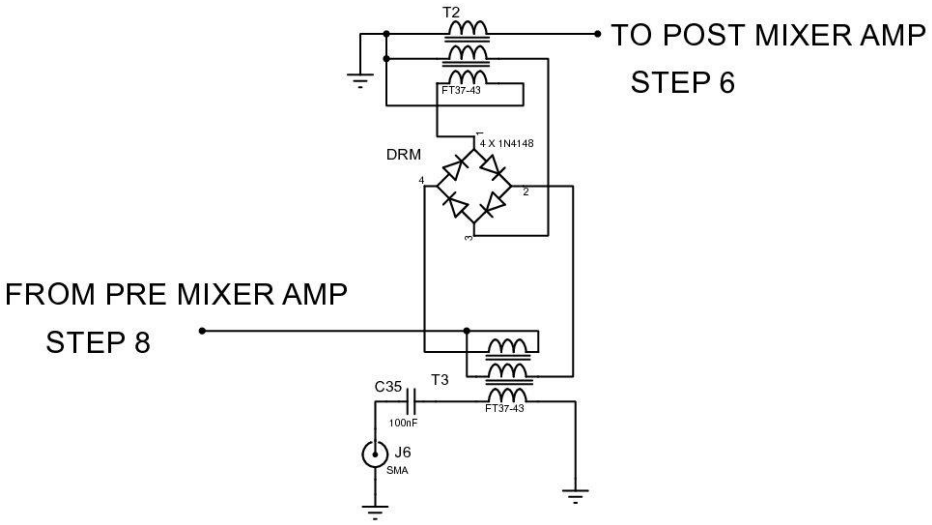
Switch on the receiver with speaker and 10K volume control potentiometer connected, pick up a tweezer and place it at C30 input of Q5 base. You will hear a loud audio buzz from the speaker confirming that the audio is passing through all the stages.

A video is also in the documents showing the process being done.

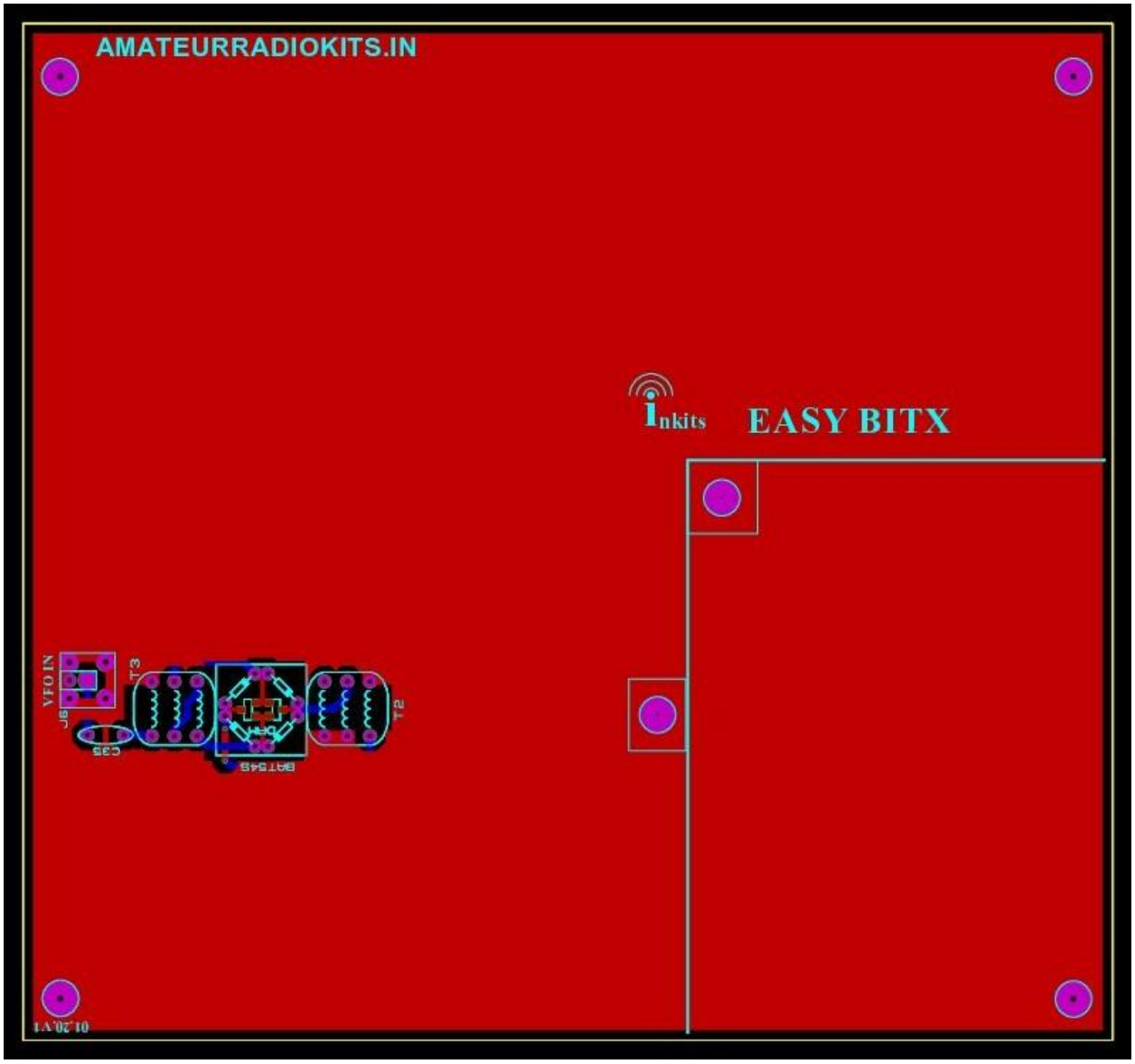
So this completes our Post Mix Amp stage.

We move on to the next step.

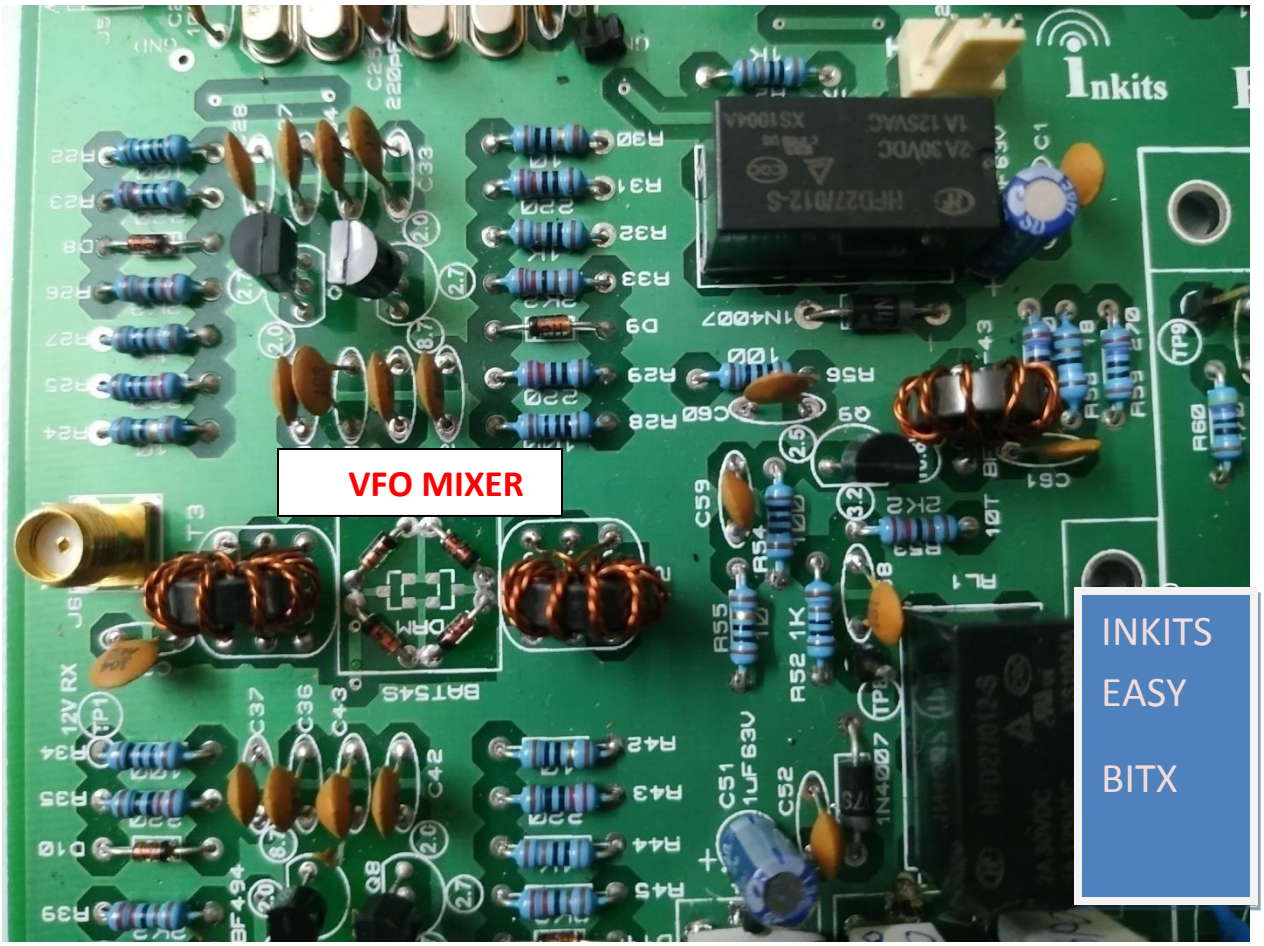
Step 7 VFO Mixer



Schematic of VFO Mixer



Components placement of VFO Mixer



T2 T3: 8 Turns Trifilar wound coils on T37-43 Toroid cores

Now we are working on the seventh stage which is the VFO Mixer, which is an important part of the transceiver.

Here we have the VFO which is mixed with signal coming from the Post Pre Mixer amp and going to the Post Mixer amp.

Open the packet Step 7 check all the components with BOM, study the schematic

This has T2 T3 8 turns trifilar wound on T37-43 toroid cores.

Choice has to be made to use the IN4148 diodes or the BAT54S, for beginners the IN4148 is recommended, match the diodes as extra have been provided. Select

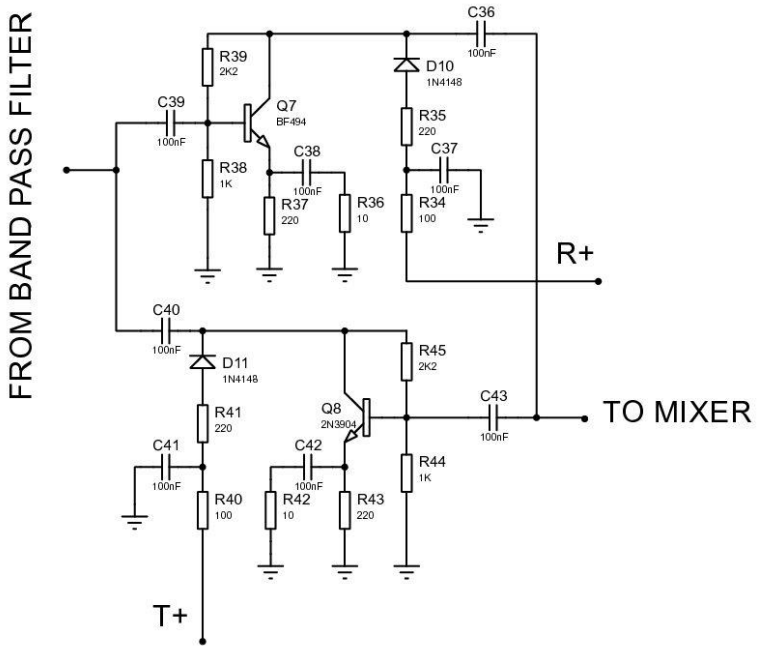
the best matched 4 no diodes and mount them as per the direction of the anode and cathode, recheck if mounted correctly.

After making the T2 T3 check them with a multi meter and place them on the board. Mount the SMA connector and also the input 0.1 capacitor to VFO input and soldering them.

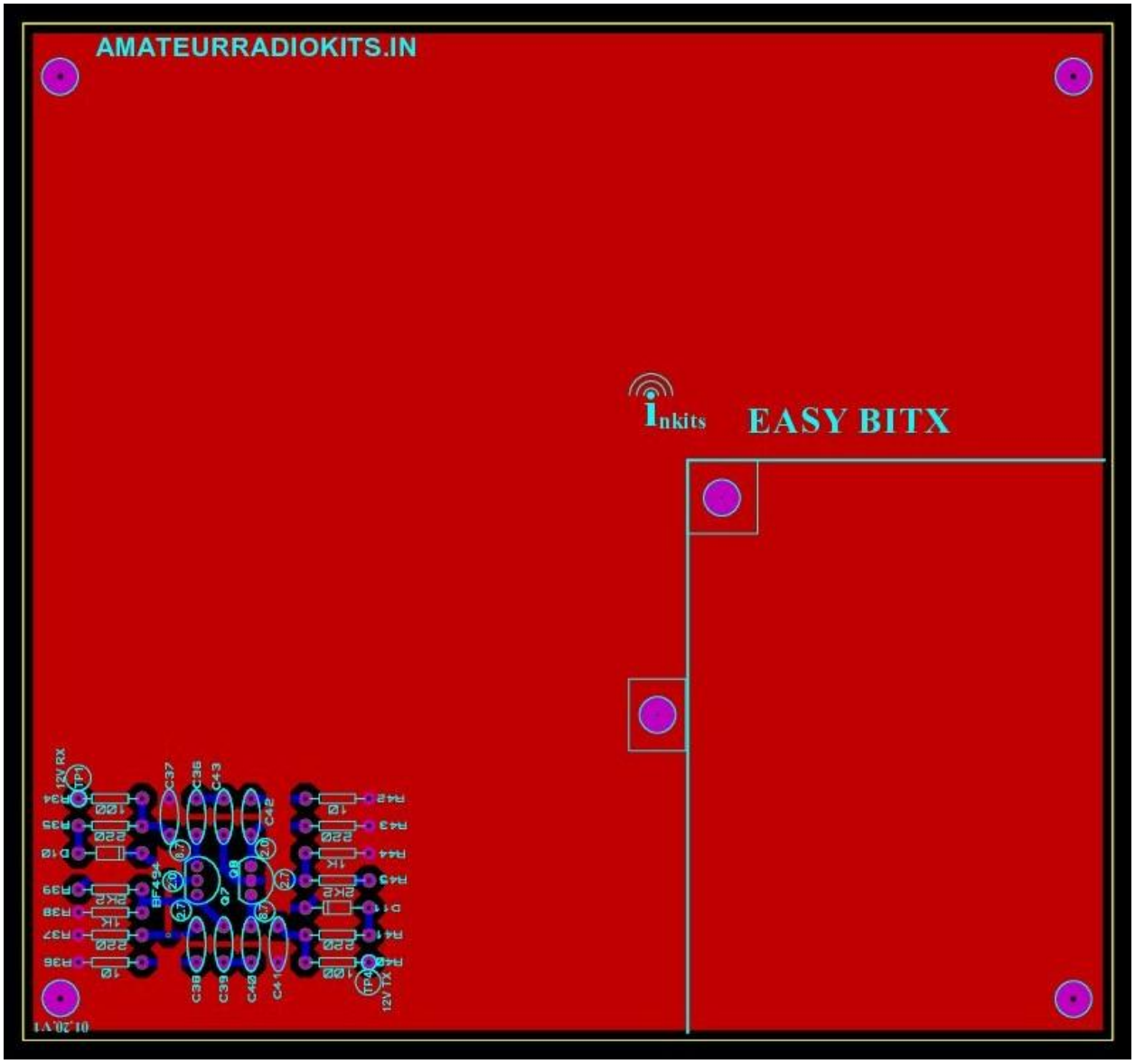
We have placed a link above as how to wind toroid coils

The VFO Mixer stage is complete, now we move on to the next step.

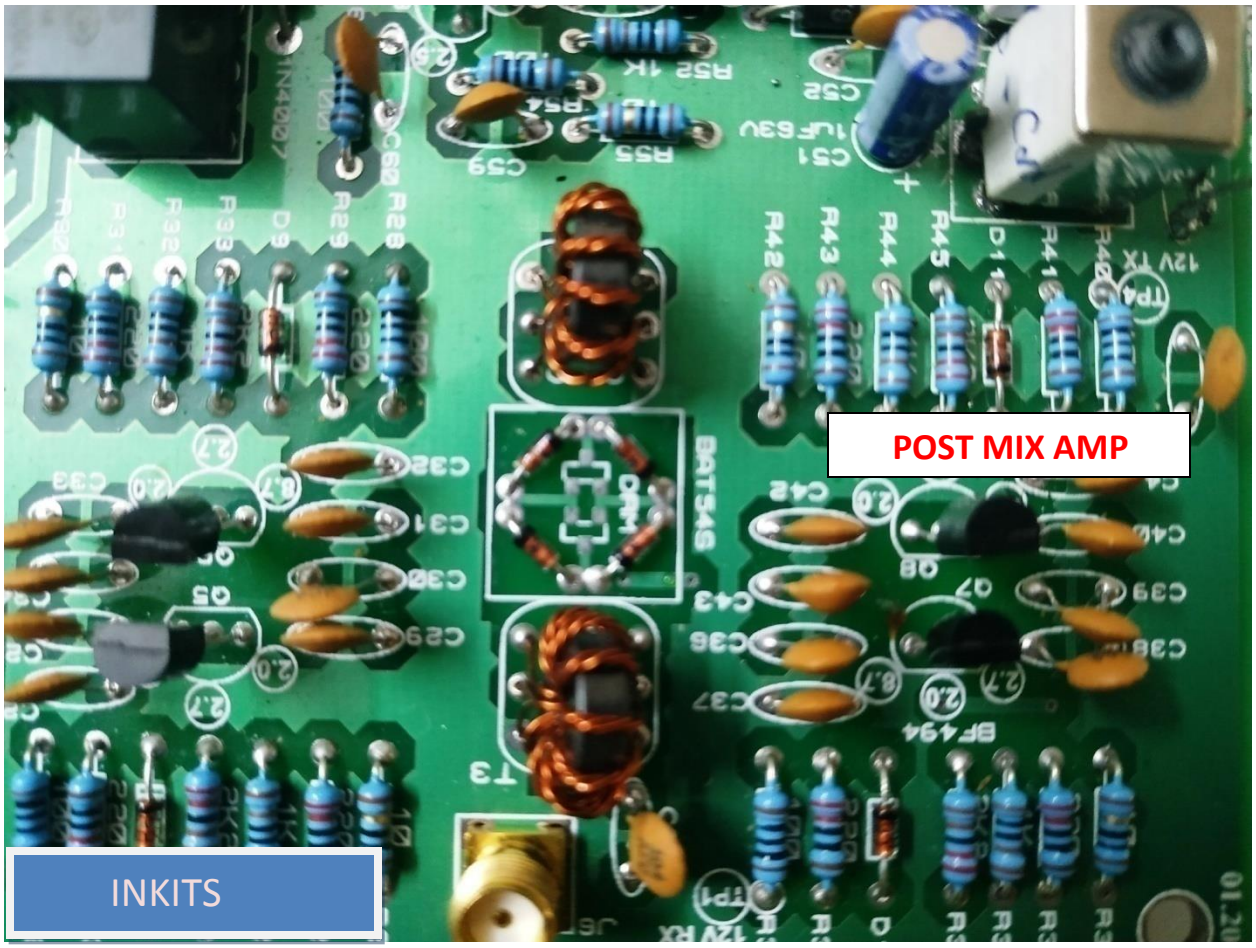
Step 8 Pre Mix Amp



Schematic of Pre Mix Amp



Components placement of Pre Mix Amp



Post Mix Amp Q7 Q8

The Post Mix Amp stage consist of two dual amplifiers sections for receive and transmit.

Q7 is BF494 transistor that amplifies the receive signal from the band.

Pass filter and passes on to the VFO mixer. Q8 is 2N3904 transistor that amplifies

The transmit signal from the VFO mixer and passes it to the band pass filter for further process.

So now for Step 8 we open the packet Step 8, check all the components as per BOM, study the schematic and components layout carefully to understand the process and components to be mounted on board. Use a multi meter to check the resistors.

Now mount the components starting with resistors, capacitors, diodes and finally transistors.

After mounting components carefully recheck them and then only start soldering them. Not all components to be mounted at one go. First start with resistors mount and solder then start with the next components like capacitors etc.

Once all the components are soldered. Recheck them.

When satisfied apply power and check DC voltages of Q7 in receive mode and voltages of Q8 in transmit mode with a multi meter, cross check the voltage chart.

If you view the board carefully you would find each and every transistor has its voltage of Emitter Base Collector printed on the board to make it easier.

Now in receive mode touch the base of Q7 with a tweezer, the BFO and VFO should be hove ever connected for this test.

For VFO BFO we have made some default setting in IF which can be changed later to fine tune the IF Freq. So you could connect the VFO and BFO for this test.

Set up the VFO BFO, attach the power leads and RF cables connecting them to the VFO and BFO on the Easy Bitx Board, and Power it on. If the unit is working OK it will display the Freq which has been set to 14 MHZ and default IF freq been set.

So when your set is now on in receive mode and the BFO VFO connected on touching the base of BF 494 with a tweezer you would hear the band noise, you could also use a short piece of wire as an antenna and touch the base of BF494,you would clearly hear the sound of band noise .

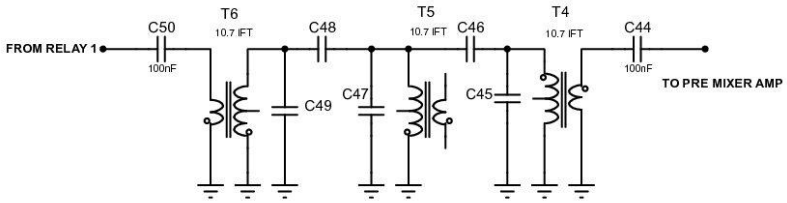
This way you have tested the receiver working up to the Post Mix Amp.

The testing of working of TX side can be done later.

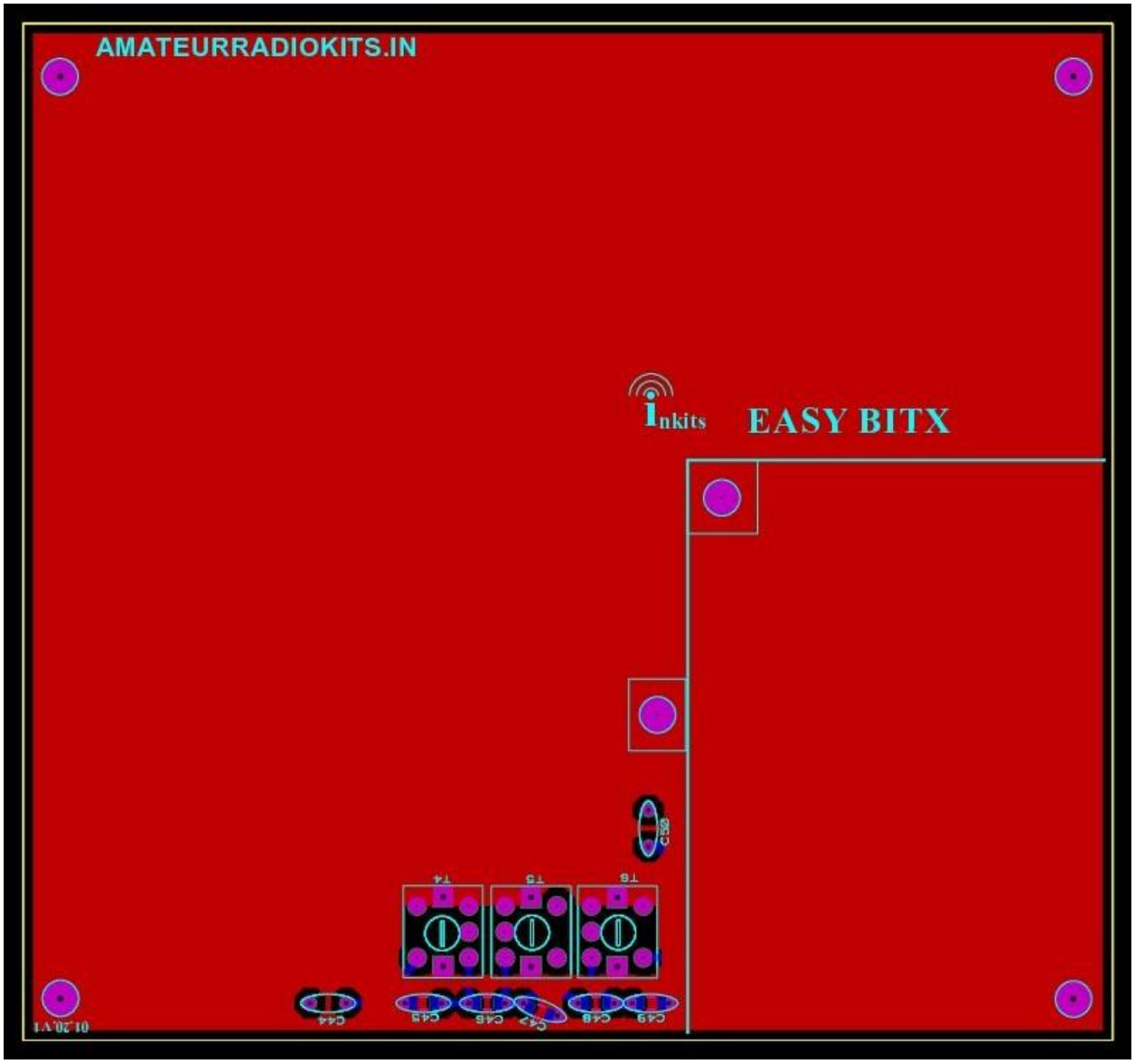
Post Mix Amp is complete now.

Time to move to the next step!

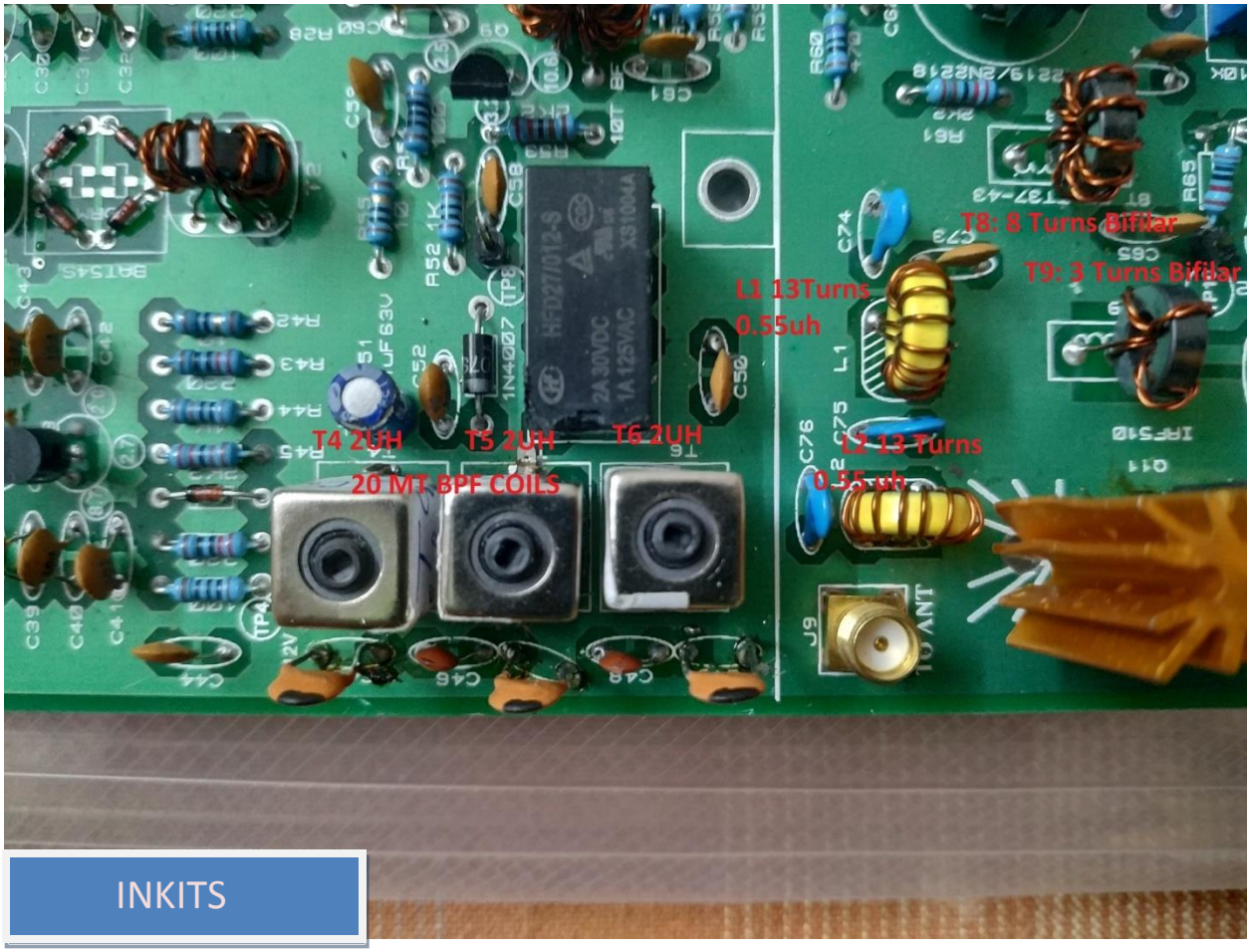
Step 9 Band Pass Filter



Schematic of Band Pass Filter



Components placement of Band Pass Filter



Band Pass Filter

The band pass filter will work for the band you have decided to make the transceiver for as you would need to wind the coils on a TOKO type transformer provided with the kit.

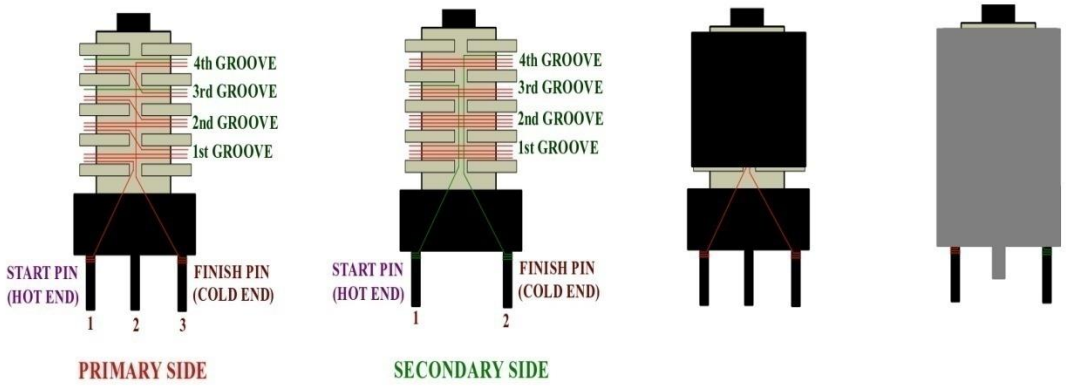
For each band we have given the complete details for the number of turns and inductance required for the coil. We have also made a chart giving details on the number of primary and secondary turns in case you do not have an inductance meter. Important points in winding coils are the hot and cold ends of the coil. The start point of winding is the hot end the finishing one is the cold end.

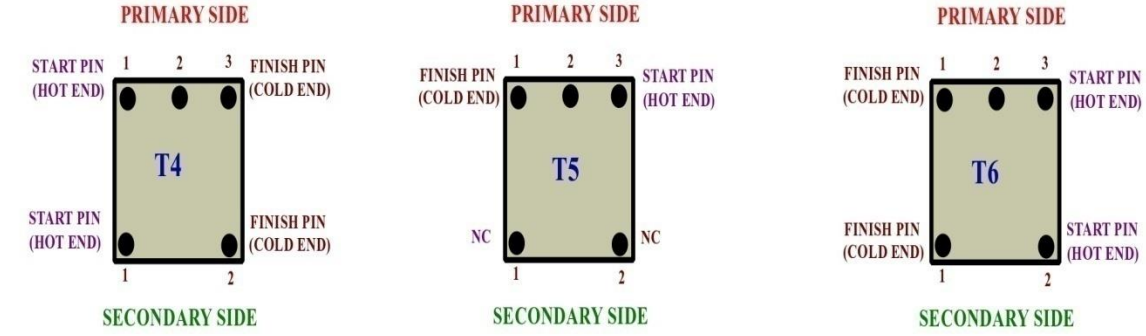
We have shown the hot and cold end for all three coils used T4 T5 T6.

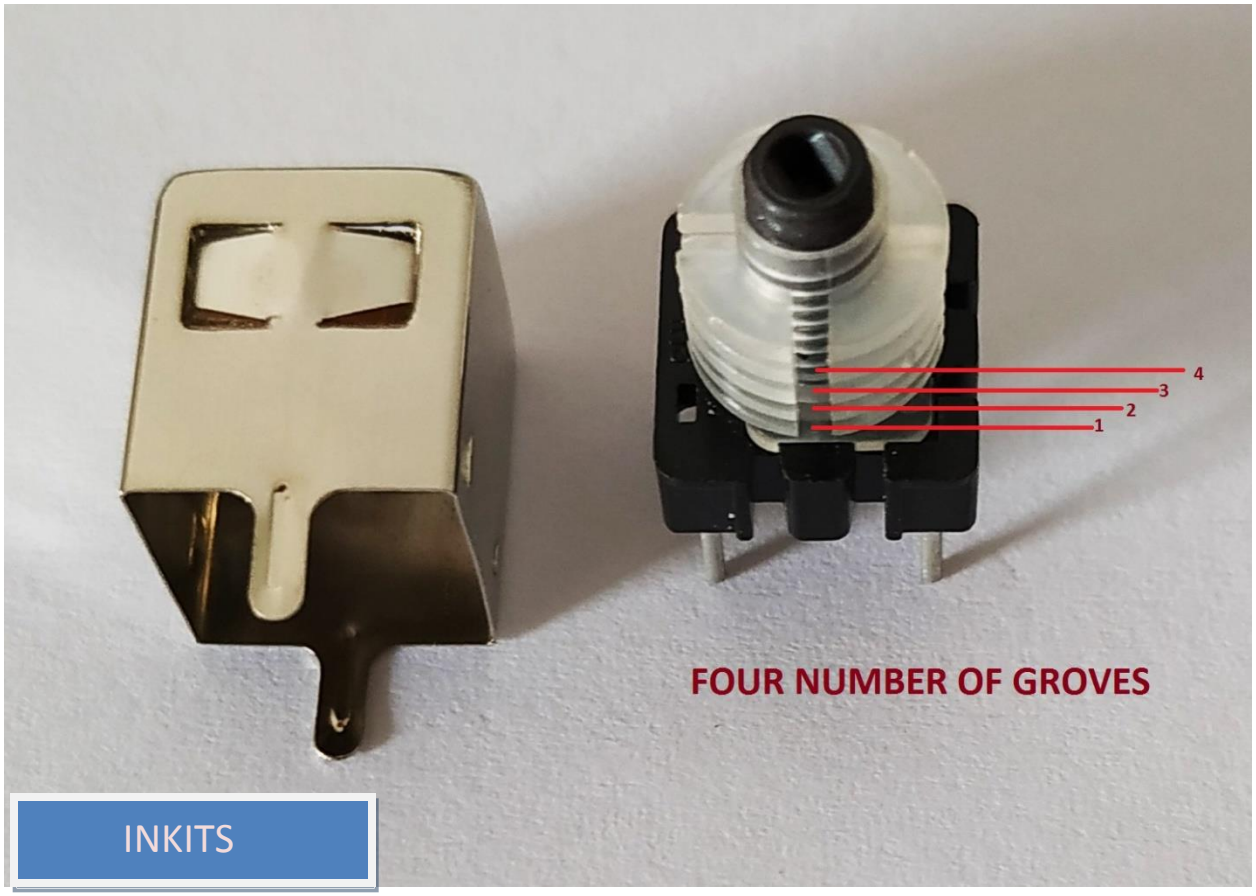
The coil former has 4 number of grooves, it is been mentioned how many turns are to be wound in each groove.

Please look at chart carefully below.

DRAWING BAND PASS FILTER COILS WINDING







FOR 20/40 COILS USE #36 SWG

FOR 80 MT COILS USE #38 SWG

Band	Inductance	Primary	Secondary	Groove 1: Turns	Groove 2: Turns	Groove 3:Turns	Groove 4: Turns
20 MT	2uh	14	2	5 Pr	5Pr	4Pr	2 Sec
40 MT	5uh	22	3	6Pr	6Pr	6Pr	4 Pr + 3 Sec
80 MT	7uh	32	4	10	10	6 Pr +2 Sec	6 Pr Z+ 2 Sec

BAND PASS FILTERS FOR 20/40/80 MT

INKITS

BAND PASS FILTER 20 MT BAND

No	Coil	Primary T	Secondary T	SWG	Inductance
T4	Toko Type	14 Turns	2 Turns	36	2 uh
T5	Toko Type	14 Turns	0 Turns	36	2 uh
T6	Toko Type	14 Turns	2 Turns	36	2 uh

C45	43 PF	DISC NPO	50V
C46	3 PF Or 2.2 PF	DISC NPO	50V
C47	43 PF	DISC NPO	50V
C48	3 PF Or 2.2 PF	DISC NPO	50V
C49	43 PF	DISC NPO	50V

So prepare now for making your coils for band pass filter for your preferred band as per the details provided above. As per the default parts in kit we shall make the band pass coils for 20mt band. Open the packet for step 9. There will be 3 no of Toko coils, 3 no 43PF and 2 no 3PF.

There are three transformers to be made first.

T4, T5, T6 all are 2uh for 20mt band.

The TOKO type transformer has 4 parts as follows.

1. Tin Cover
2. Ferrite coil former
3. Ferrite tuning slug
4. Ferrite Cap

Band	**Inductance**	**Primary**	**Secondary**	**Groove 1: Turns**	**Groove 2: Turns**	**Groove 3:Turns**	**Groove 4: Turns**
20 Mt	2uh	14	2	5 Pr	5Pr	4Pr	2 Sec

Use the SWG # 36 magnetic wire provided.

Take a length of 12 inches #36 copper wire scrap it from the one side clean it so that the copper is no more on the wire now wind 2 turns on the start pin which is number 1 hot end, wind 5 turns on the 1st groove, then again 5 turns on the 2nd groove and 4 turns on the 3rd groove. Now bring the wire down to the cold pin which is the end pin, scarp and clean it and apply some flux to the pin 1 and 3rd pin which is the cold side. The winding continuity needs to be checked with a multi meter, if LCR meter is available the inductance should be checked which should be 2uh, if you do not have an inductance meter then it is ok as the turns have been calculated by us.

Now again take about 8 inches of #36 magnetic wire scrap and clean wind 2 turns on Pin 1 hot end, next wind 2 turns on the 4th groove, clockwise, next bring the wire toward pin 2 hot end, scrap and clean wire add flux and solder on the pin.

After making the transformers check them with a multi meter for continuity.

Mount the TOKO transformers T4 T5 T6 on the board, after that the capacitors.

Look up at the components lay out picture to install the capacitors at the right place, or the band pass filter will not work.

After soldering recheck all the components installed.

This completes the band pass filter section.

Note:

For builders who may have difficulty in winding band pass filter coils on toko coil, they could buy ready available bpf from qrp labs and mount them on the bitx easy board relevant section.

Link

https://www.qrp-labs.com/bpfkit.html

An inductance meter would be very useful in calculating the inductance. If you do not have then just follow the number of turns as we have calculated for you.

One important point about inductance meters is that there are several ones available but very few will give correct reading.

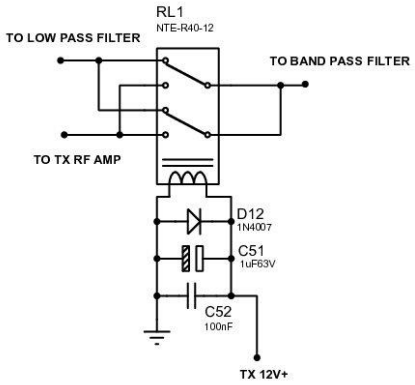
If possible try to build an inductance meter from open source design of Vk3BHR.

Link https://sites.google.com/site/vk3bhr/home/index2-html

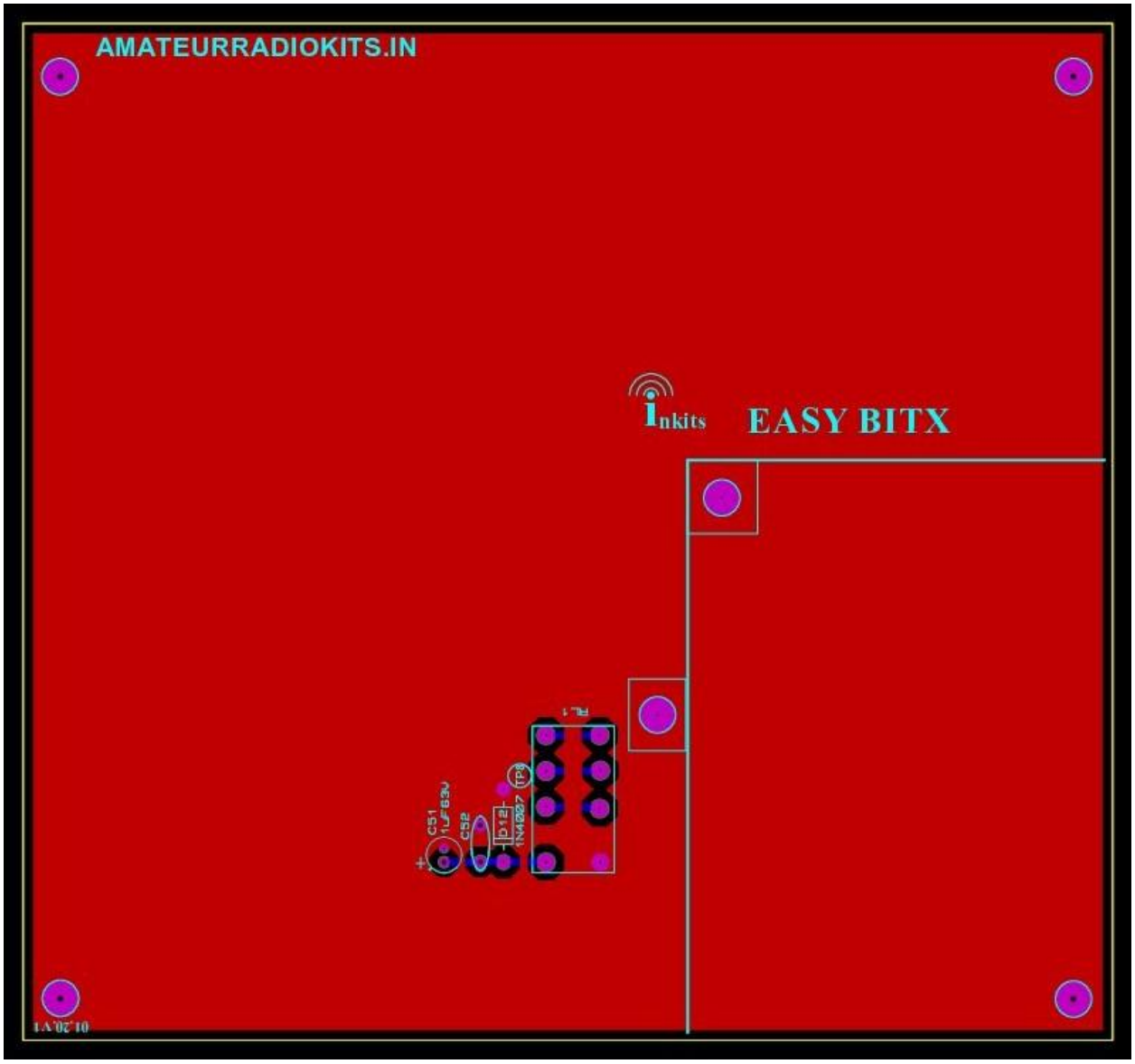
We are using the same design for our test the measurement is just about perfect.

We shall now move to the next step for the receiver section and test the receiver with the band pass filter in the next final stage of the receiver.

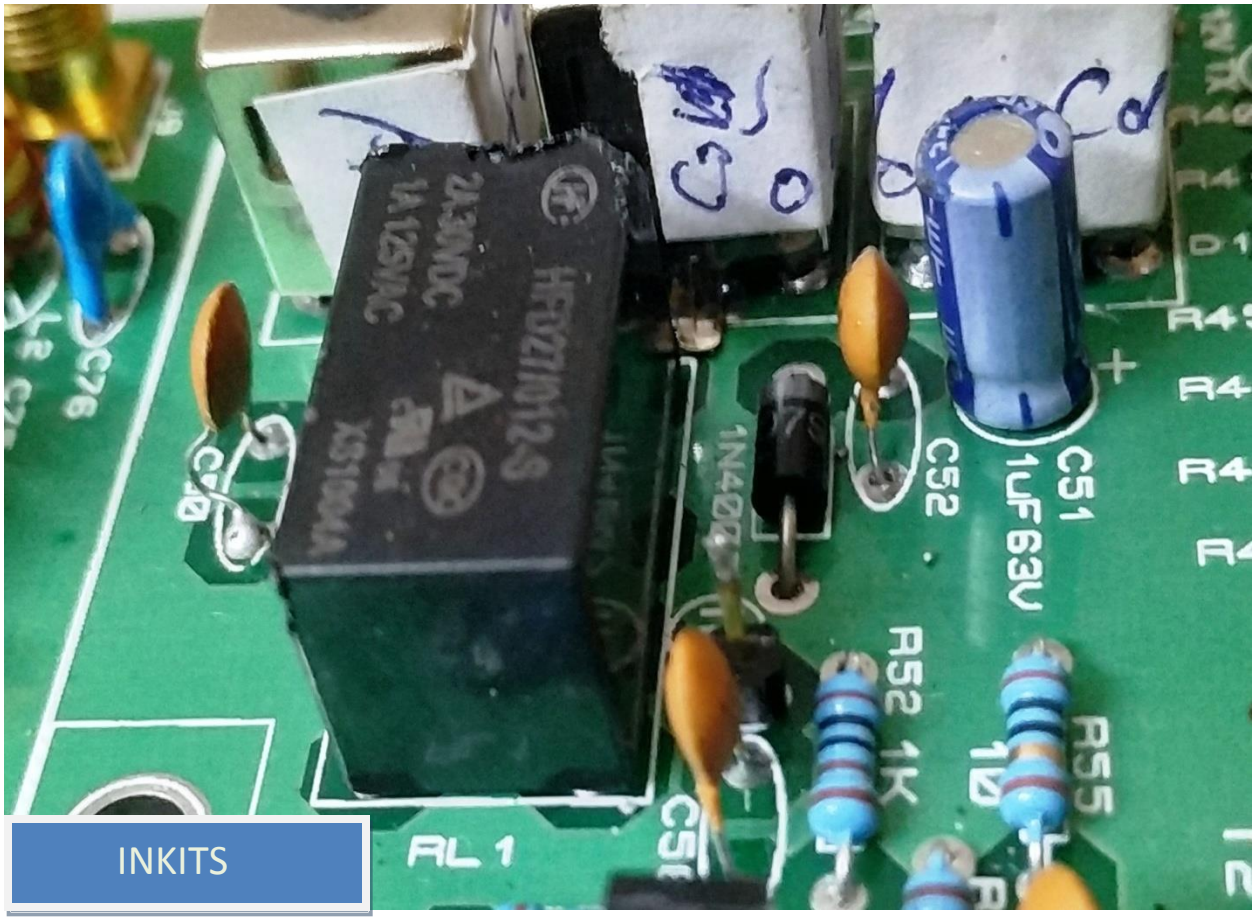
Step 10 Tx Rx Antenna Switch



Schematic of Tx Rx Antenna Switch



Components placement of Tx Rx Antenna Switch



Tx Rx Antenna Switch RL 1

The last stage of the receiver section is the Tx RX Antenna switch step 10.

RL 1 is a double pole 12V relay which switches the antenna for receiving and transmitting. The relay gets activated on press of PTT switch for transmit.

Open the packet Step 10 check the parts with the BOM. Mount the 12V relay

RL1 and solder it, mount other remaining components and solder them.

Do a double check for all components soldered.

This is the final section for the receiver, so we can now check the working of the receiver.

Follow the steps to check the operation of the receiver.

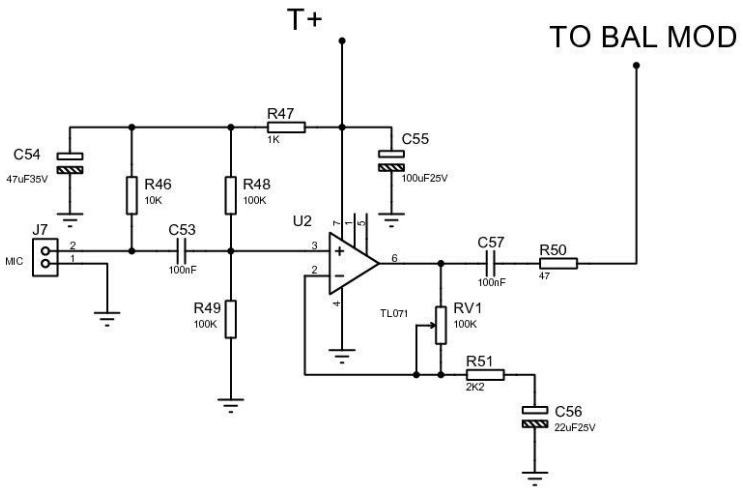
1. Connect 10K Volume Control.
2. Connect a speaker to LS connector on board.
3. Connect the BFO VFO to the Easy Bitx with RF cables.
4. Connect the 2 Pin +12V power input to the TCVR.
5. Connect the 2 Pin 12 V power inputs to the Si5351 BFO VFO.
6. Solder a short piece of wire as antenna at input of C50.
7. Now switch on the radio, you should be getting some band noise.
8. Check the frequency in LCD of DDS it should be on 14 MHZ.
9. Set the IF Freq to 9.997.469 for 20mt Band and 9.998.216 for 40mt band. Now connect the antenna to the short antenna wire that was made, If the band is open you should hear some signals.
10. Scan the band to find a strong signal then tune the slug in all three transformers, to peak them, this want be the final settings as yet, the final setting will be done in the TX mode.
11. Look out for good band conditions and adjust the receiver BPF coils and the BFO IF settings for optimum setting of the receiver.
    You're tcvr IF freq can be a bit different from ours as our crystals for ladder filter may be slightly different to supplied crystals, so tune it where the signal sounds natural.

The LPF is connected to TX and RX section both, so it is a good step to complete the LPF section.
You can jump to the last step Linear Amp / Low Pass Filter.
Build the Low Pass Filter as per details.

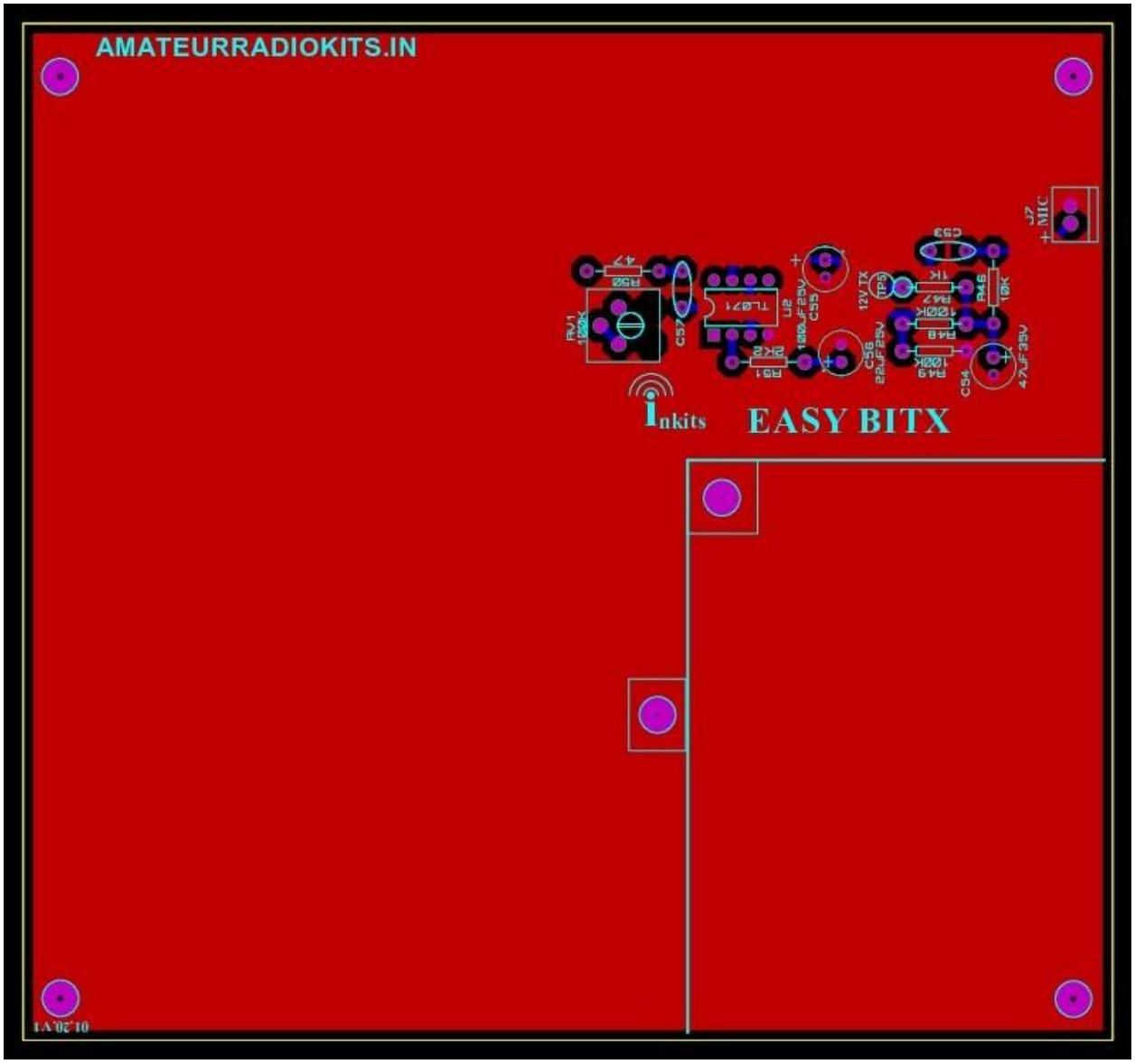
Now you can connect the antenna to the LPF, remove the short wire at C50 and connect antenna through the RF cable with SMA connector, and S0239.
Now tune the receiver again as we have the antenna connected in a proper way. The receiver is done now, we move to complete the remaining sections of the transmitter; most other bidirectional sections have been done.
You could also build the agc as per directions given in the AGC document and test its working or you could do it later when the transmitter section has been done.

We move to the next stage now.

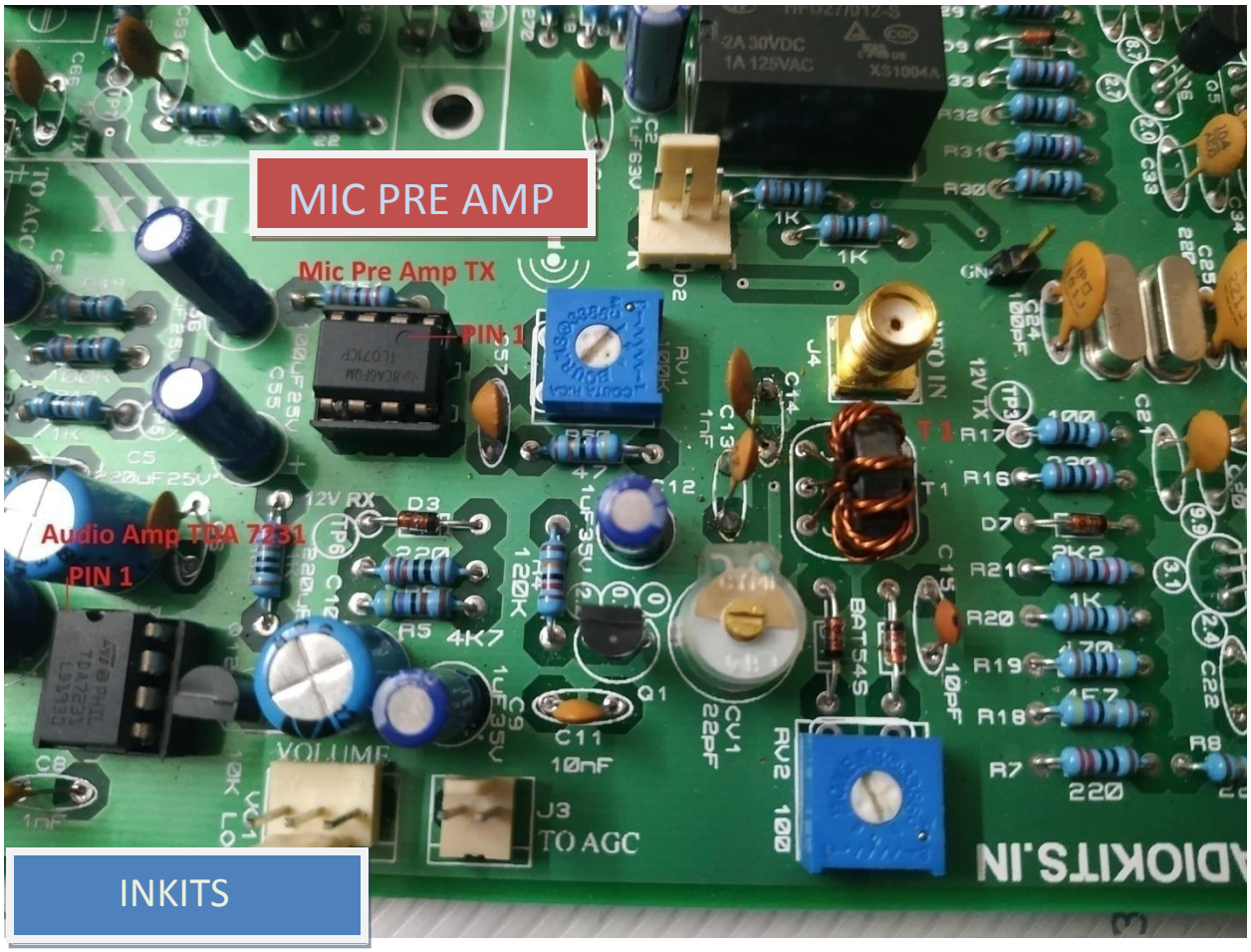
Step 11 Mic Pre Amp



Schematic of Mic Pre Amp



Components placement of Mic Pre Amp



Mic Pre Amp

The microphone pre amp used is TL 071 which is a Low-Noise JFET-Input General-Purpose Operational Amplifier, which makes it a highly suitable for our use.

The amp has sufficient gain to work in our Mic pre amp section.

Open the packet with step 11 check all components. Start by mounting the TL071 8 pin base in the correct orientation.

Nest start with the resistors, carefully check the value of each resistor with a multi meter and install on the board, after a double check solder them. Now mount the capacitors and condensers and the 100K preset.

Double checks that all the components are installed correct, and then solder them.

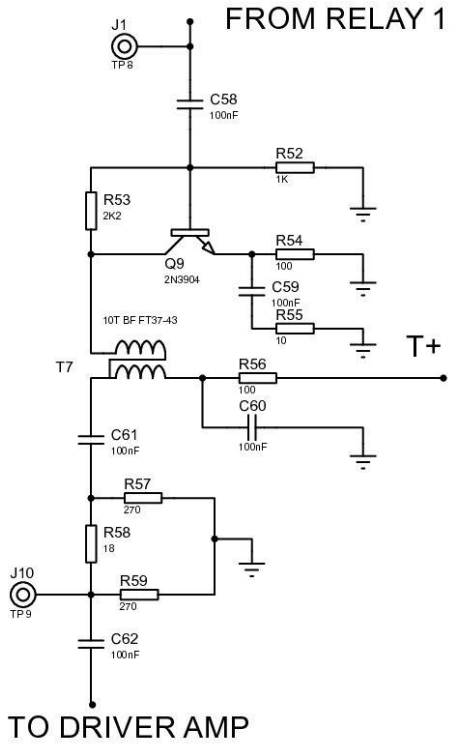
The preset RV1 100K needs to be turned clockwise to increase the gain. Keep setting at 90 % max gain by turning the preset clockwise.

Later use at suitable setting on transmits.

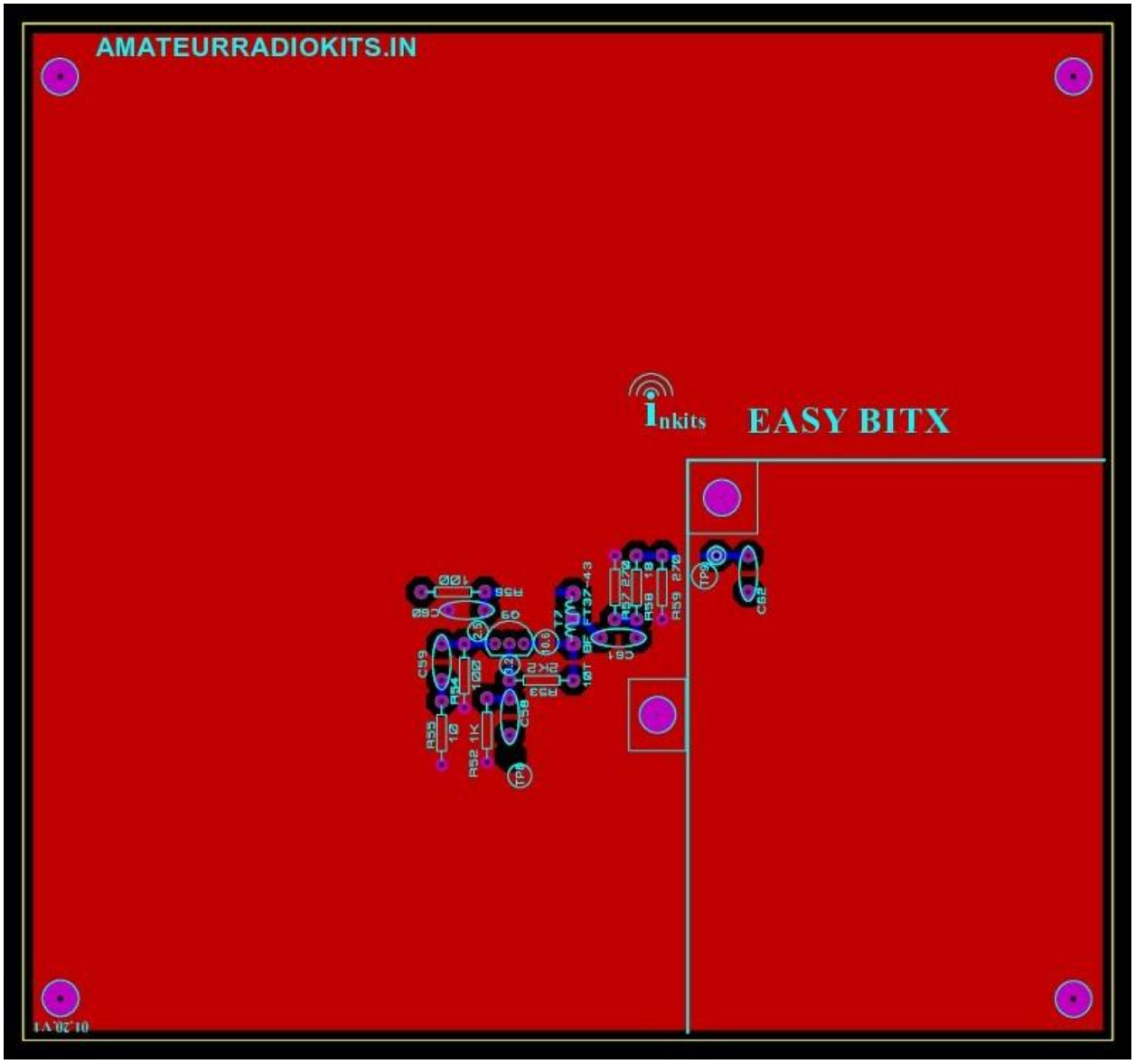
Now insert the TL071 in the right position as shown in the picture above. This completes the mic pre amplifier section.

We move to the next step now.

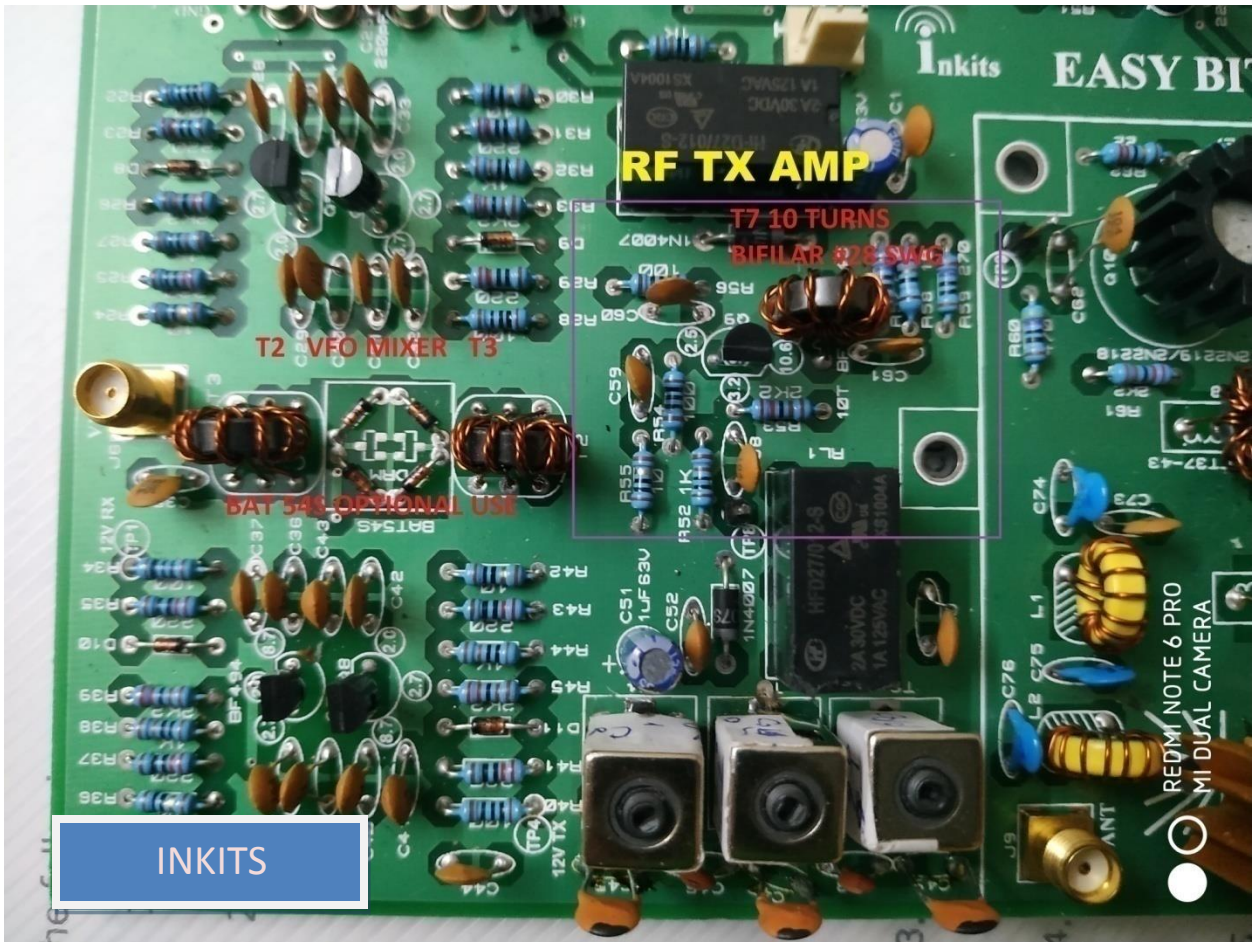
Step 12 RF TX Amp



Schematic of RF Tx Amp



Components placement of RF TX Amp



RF Tx Amp

The RF Tx amp is the 12th step in building the easy bitx kit.

The TX signal coming out from the band pass filter and RL 1 is amplified in this section with Q9, further on to the Driver.

T7 is a bifilar coil to be wound 10 turns with #28 magnetic wire.

Open the step 12 packet check all the components with BOM list.

A bifilar coil T7 has to be wound, after winding the coil check the coil with continuity between the final 3 connections.

Mount all the components and solder, be careful with the resistors by measuring the value with a multi meter.

Check the voltages of Q9 in transmit mode with the voltage reading provided.

TP 8, TP 9, and TP T10 are test points for checking the RF output of TX with an RF probe.

[Company]Testing the TX: The transmitter can now be tested.

You would need to do the following.

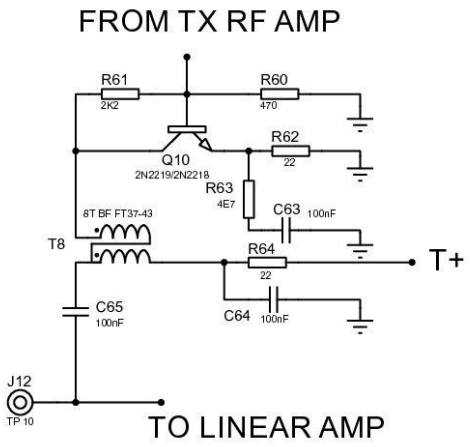
1. Connect the relimate +12 Volt wire connectors to the Exciter J1
2. Connect the relimate +12 Volt wire connector to BFO VFO
3. Connect the VFO BFO RF cables with SMA to the VFO In and BFO In on the Easy Bitx board. J6 VFO and J4 BFO
4. Connect the relimate wire PTT switch J2
5. Connect the relimate wire to the microphone as provided in the kit to J7
6. You would need an RF probe for this test. Connect the RF probe to TP 9 and ground. The tip of the probe could be soldered on the TP 9 and the clip attached to ground.
   Switch the radio on now press the PTT switch, you should see the meter show forward movement, now you can modulate your voice into the microphone, you could also do the test with a smart phone, download an app that generates 700 hertz tone, I found it good, but your voice is ok for the moment, or whistle into the microphone. Now using a screw driver tune the slugs in the transformers one by one, start with T4, the coil is tuned when the meter reads the maximum level and you would get a sharp dip in the meter, so naturally an analogue meter 50ua to 250ua would be good to use with the RF probe or use the multi meter in DC voltage position. The dip indicated the coil is tuned.
   Do same for T5 and T6.

While doing this test you would see that the meter needle if analogue meter is used and some voltage show's up to a certain level, this is the carrier from the balance modulator which has to be made zero or null. To null the carrier press PTT with RF probe connected adjust RV2 100 ohms in balance modulator till the meter needle comes down to zero, adjust the 22pf trimmer too. So when you modulate now you want see any movement in meter apart from a ticking of

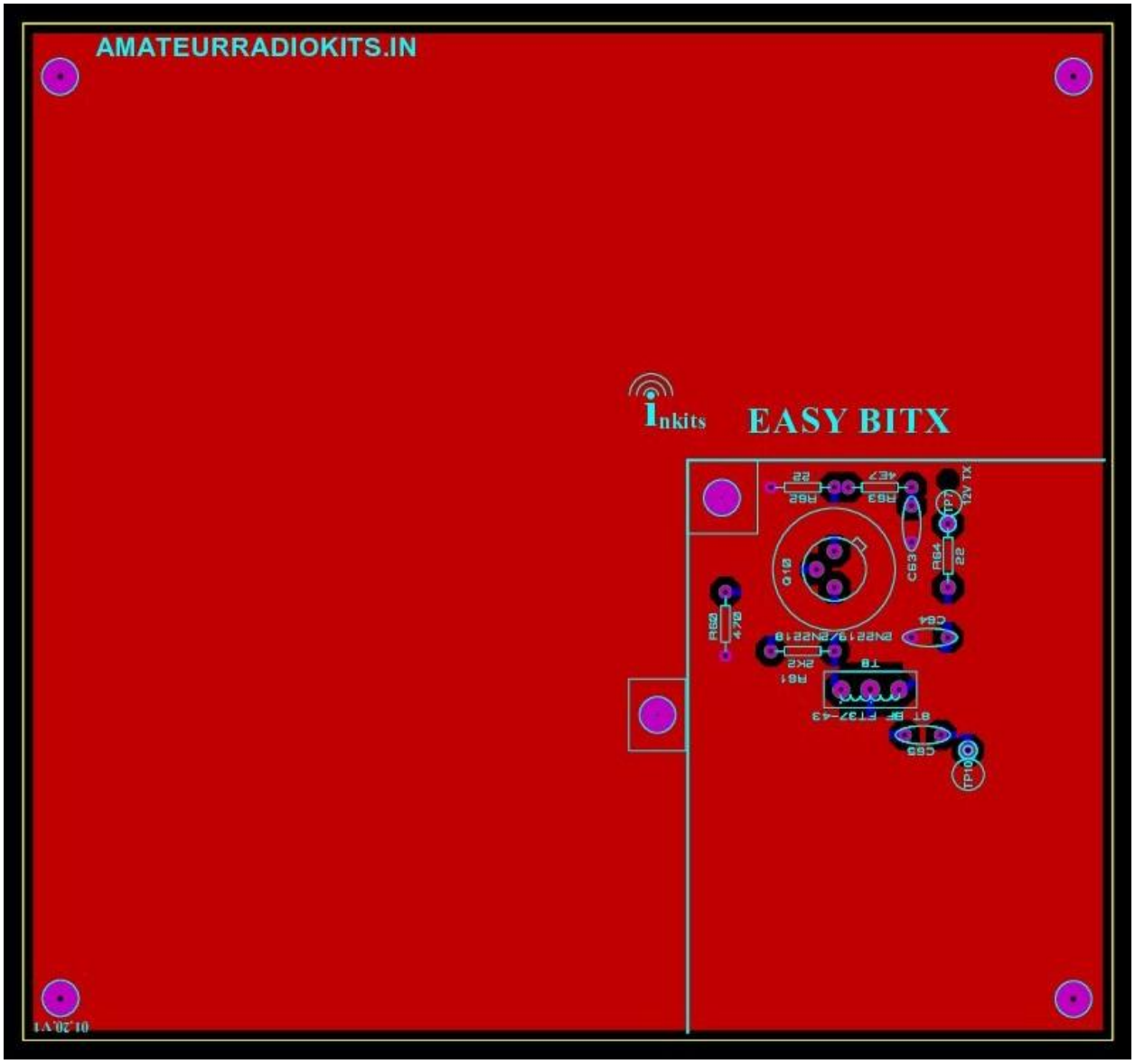
meter, so when you modulate now the meter will move and come back to zero when no modulation is done.

This completes the test and section. We move to the next step.

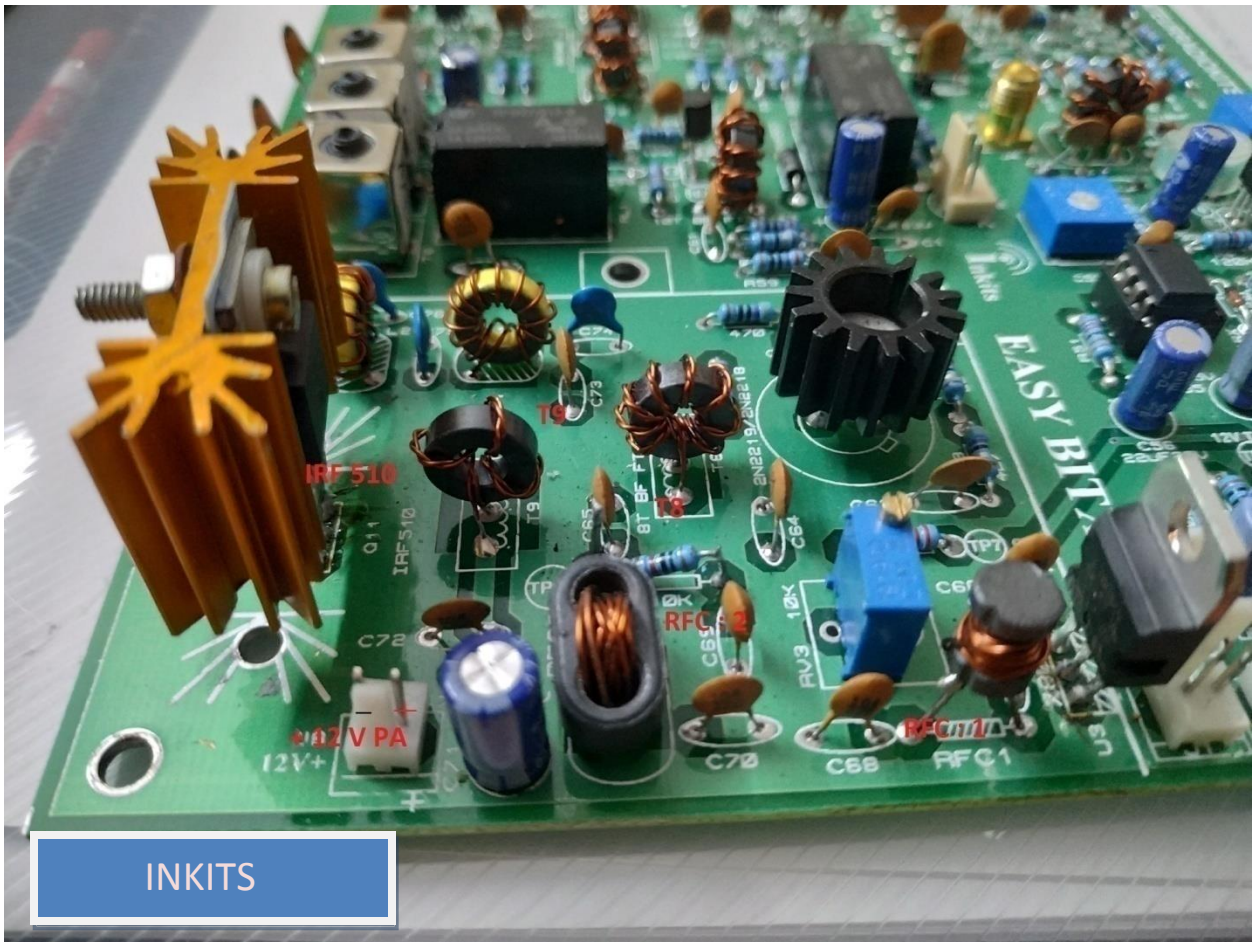
Step 13 Driver



Schematic of Driver



Components placement of Driver



2N2218 Driver T8 Bifilar coil 8 Turns on FT37-43

The driver section with transistor 2N2218 amplifies the signal coming from the RF TX amp.

Now we shall start with opening the step 13 packet.

Check all components with BOM.

A Bifilar coils T8 is to be wound with #28 SWG magnetic wire 8 turns on

FT37-43.

After winding the coil check the continuity with a multi meter.

Now start mounting the resistors first by checking the values with a multi meter.

Solder and move to the capacitors, mount and solder, and also the 2N2218, don't insert the transistors legs much inside the board as you would need some clearance to measure the voltage with a multi meter.

Also mount the T8 coil and solder.

After all components have been soldered do a check with the printed values on the board and installed components also with the components layout.

Switch on radio press PTT and measure the voltages on Q10 2N2218 as per the voltage chart provided.

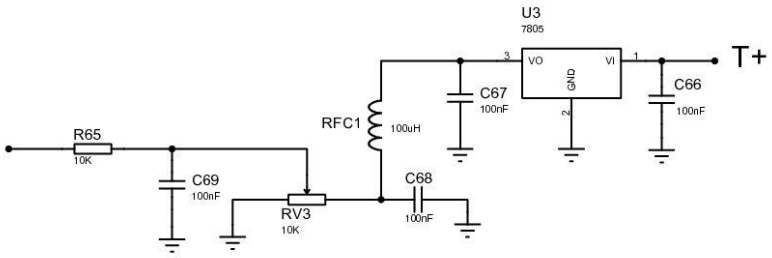
The voltage chart can be printed and kept for reference while doing test, which makes it much more convenient.

Now we again need to repeat the same process of measuring the transmitter output and adjusting the transformers T4 T5 T6 with an RF probe, and null if any carrier is seen on the meter by adjusting RV2 100 Ohms in balance modulator.

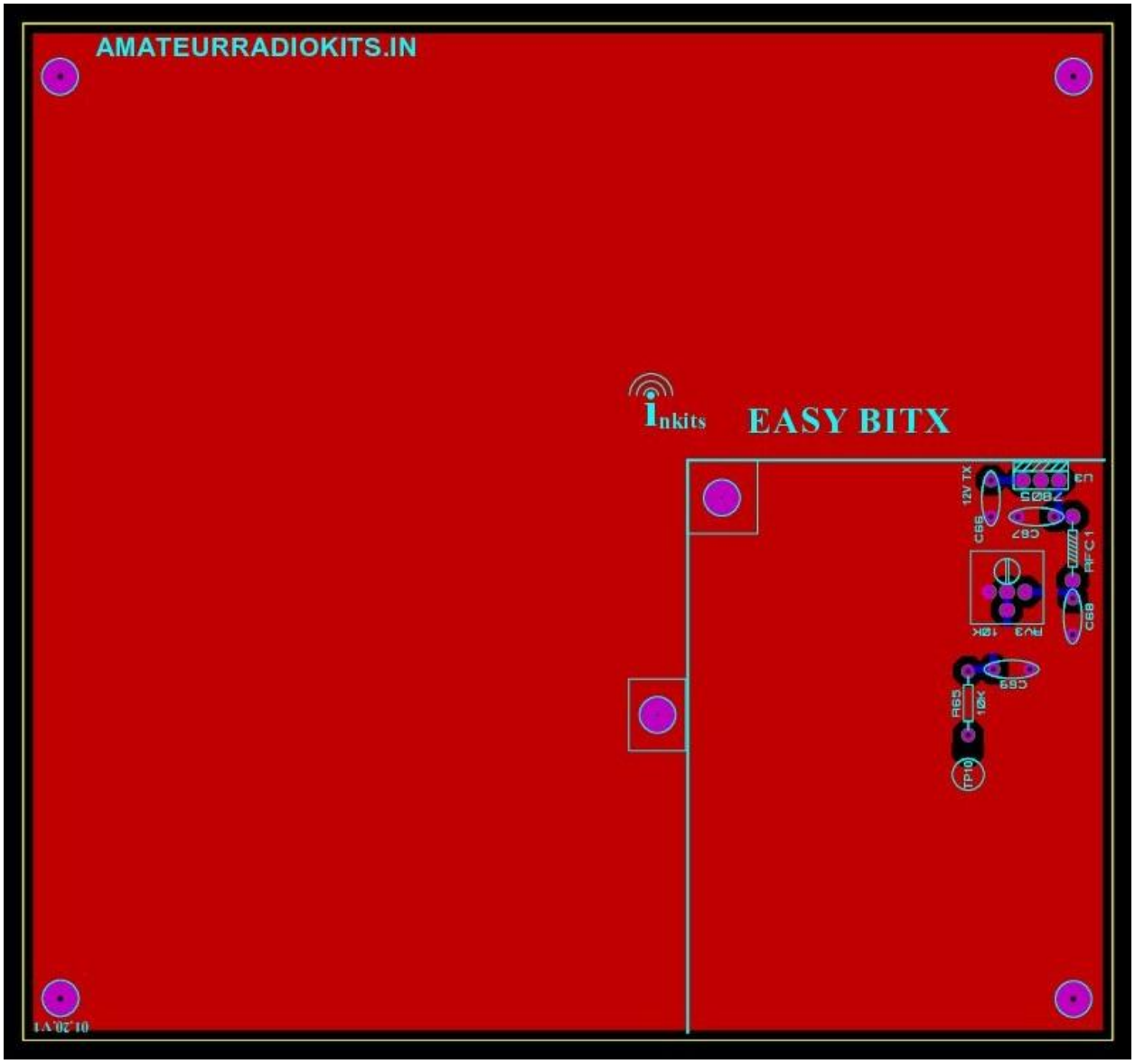
After doing this test the driver section is complete.

The important point is that you should not get any oscillations.

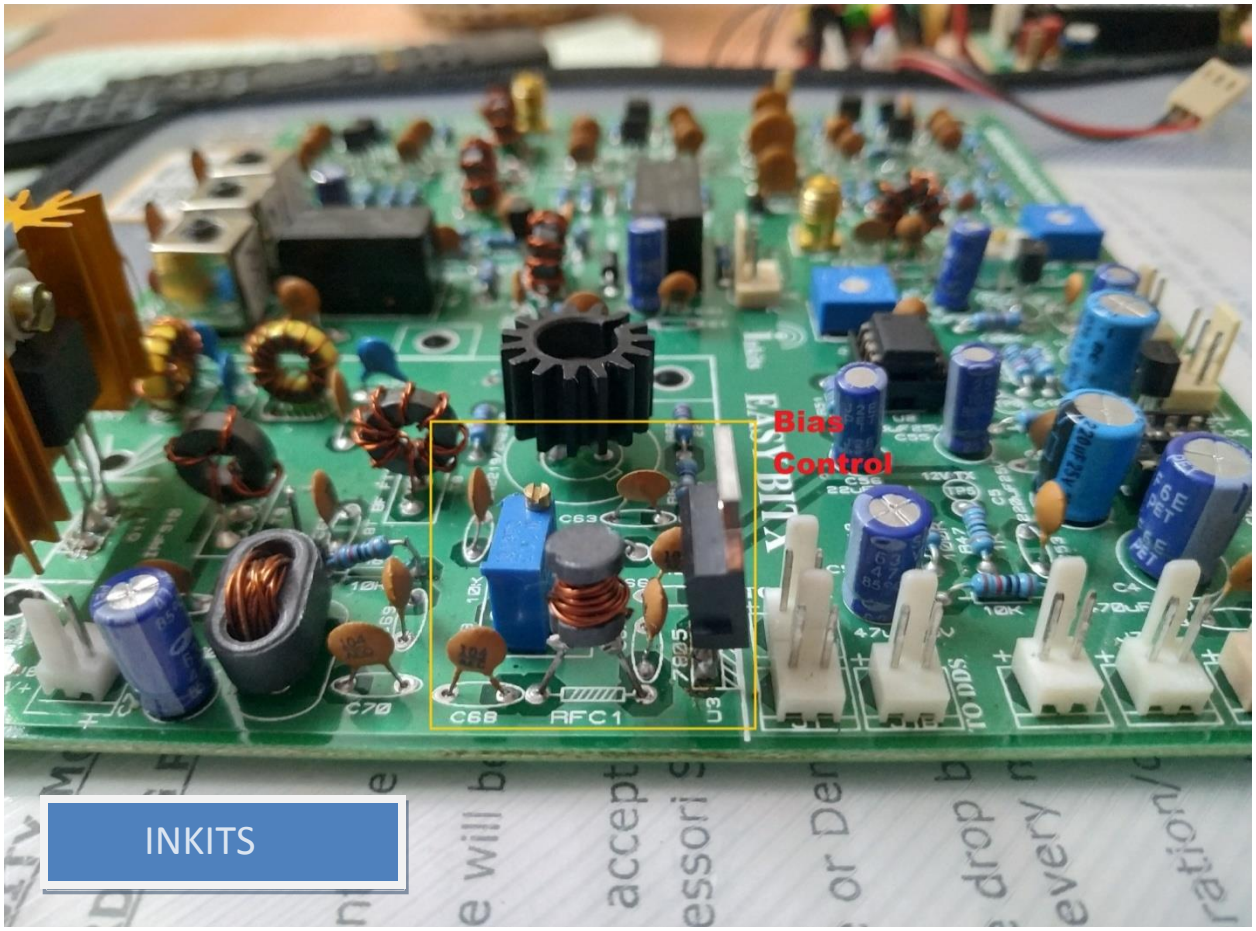
Step 14 Bias Control



Schematic of Bias Control



Components placement of Bias Control



Bias Control

We have reached step 14 which is bias control for the Final PA transistor IRF 510.

This setting of bias needs to be done with some care as the set up has to be done well to set the bias current for the IRF 510.

Open your packet step 14 and check the components with BOM.

There is one RFC to be wound on ferrite bead provided as in picture.

Wind about 25 turns with #28 SWG wire provided clean both ends of wire and solder on both the legs, the inductance is not very critical here.

Solder the RFC 1 on the board as well as 7805 in the correct direction and the capacitors and trimmer 10K multi turn preset RV3.

BIAS SETTING IRF 510 MOSFET

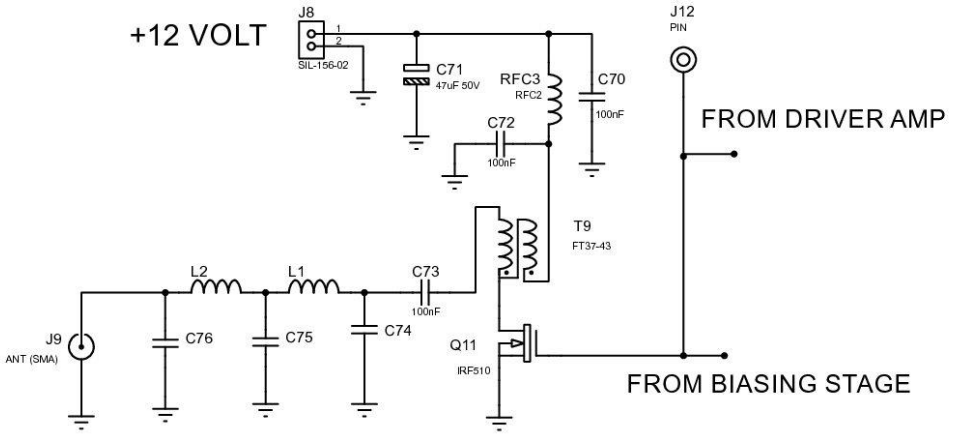
The biasing has been explained here but it has to be done only after building the next step Linear Amp / Low Pass filter

1. Set up a Dummy load 50 ohms.
2. You need a multi meter in 10 Amps current range to be set up in series with positive side of power supply +12 Volts.
   10 amp range is preferred; it could also be done in the lower range.
3. Unplug the 2 Pin microphone jack and not the PTT one, we do not want any modulation or an input RF signal as yet on setting bias.
4. Now apply + 12V to TCVR and +12 Volts to the PA.
5. Now click PTT switch.
6. Now tune RV3 10K till you get 50ma current reading in your multi-meter.
   You may have to tune several times as RV3 is a multi turn preset.
   Once the currents is set to 50 ma plug in the microphone jack and modulate to get RF OUPUT which should be 3 watts on 20mt and 5 watts on 40mt bands.
   The Power Meter should also be in line with dummy load to observe the output.
   This completes the bias setting and checking the power output for final amplifier.

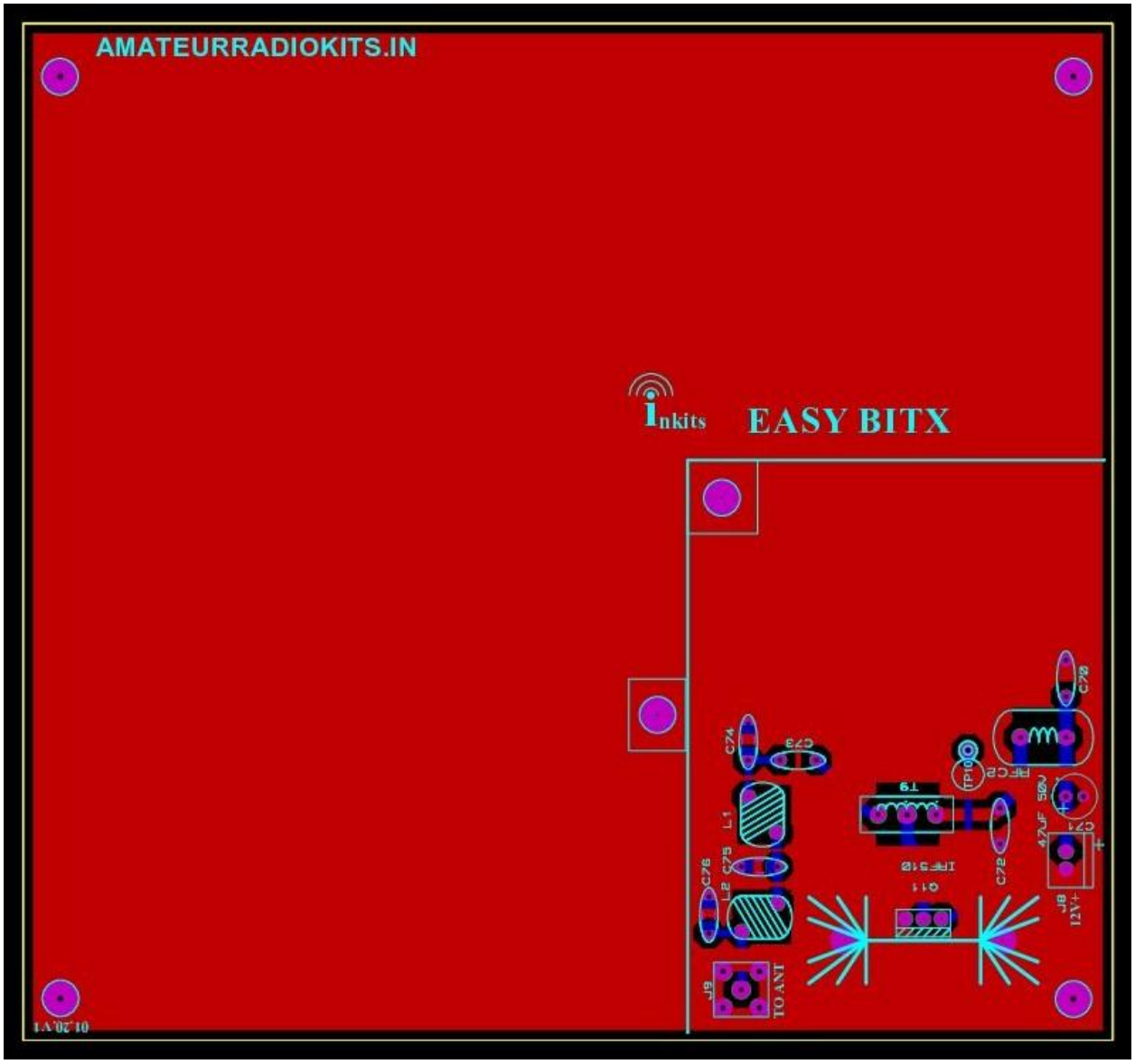
The bias setting has to be done in the following way.

Once your tcvr is working and checked with peak of band pass filter coils on test point TP 9 with an RF probe you are set to adjust the bias current on the IRF 510. It is assumed you have connected the VFO BFO MIC etc to do this test.

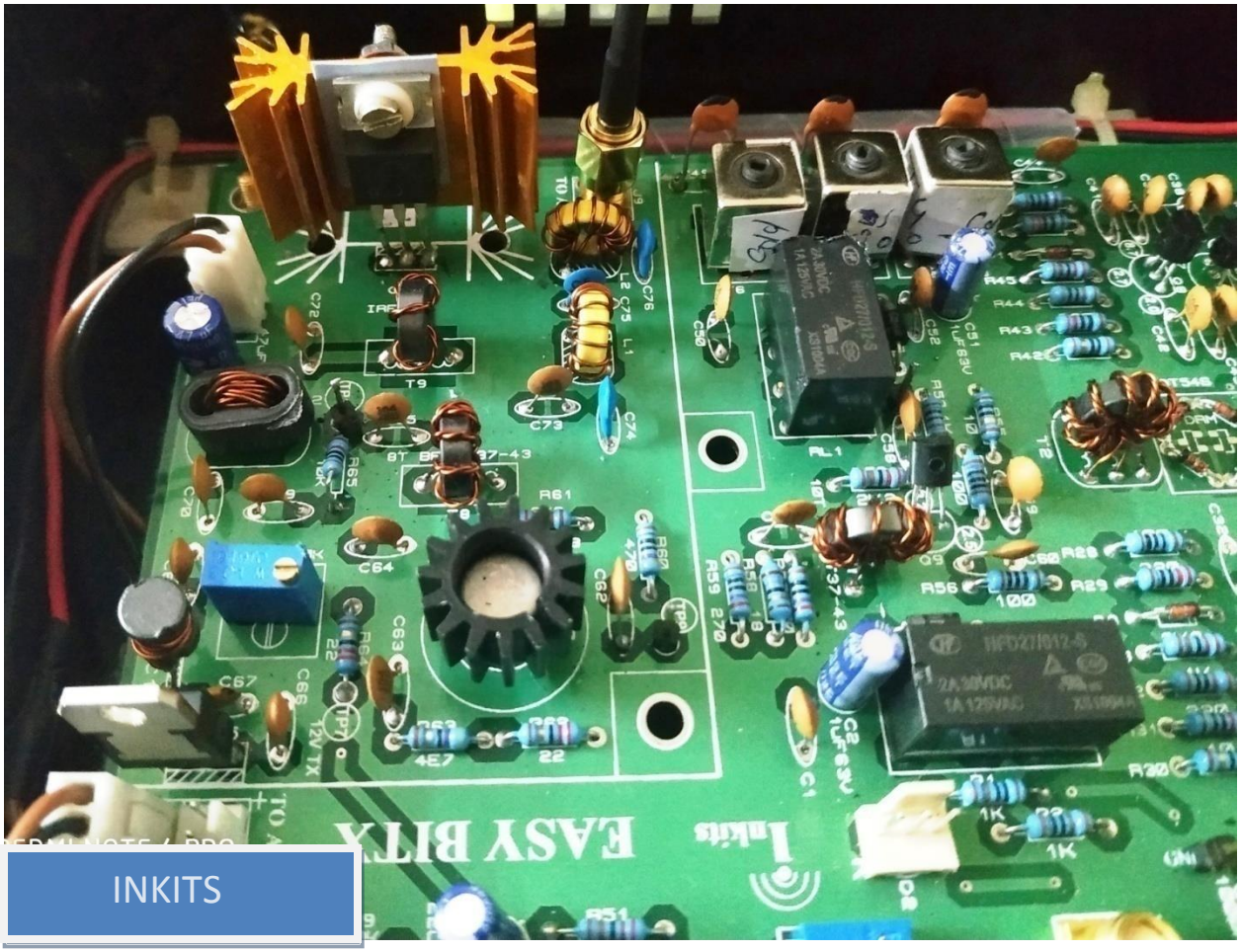
Step 15 Linear Amp Low Pass Filter



Schematic of Low Pass Filter / PA



Components placement Low Pass Filter / PA



The Power Switching section of the PA board will support DC power supply. The final of the PA, based on the IRF510, requires about 2 amp power supply if operated at 12V and up to 3 Amps if operated at 18 Volts for a higher output amount of voltage to operate properly.
You power supply should be capable of delivering required current. You should use a well regulated power supply.

We will build the PA section comprising IR 510 and the second part of Low Pass filter which has been clubbed into a single section.

So now we start building this section. PA and Low Pass Filter, the last stage of the transceiver.

Open the packet Step 15. There are following coils and RFC to be wound first.

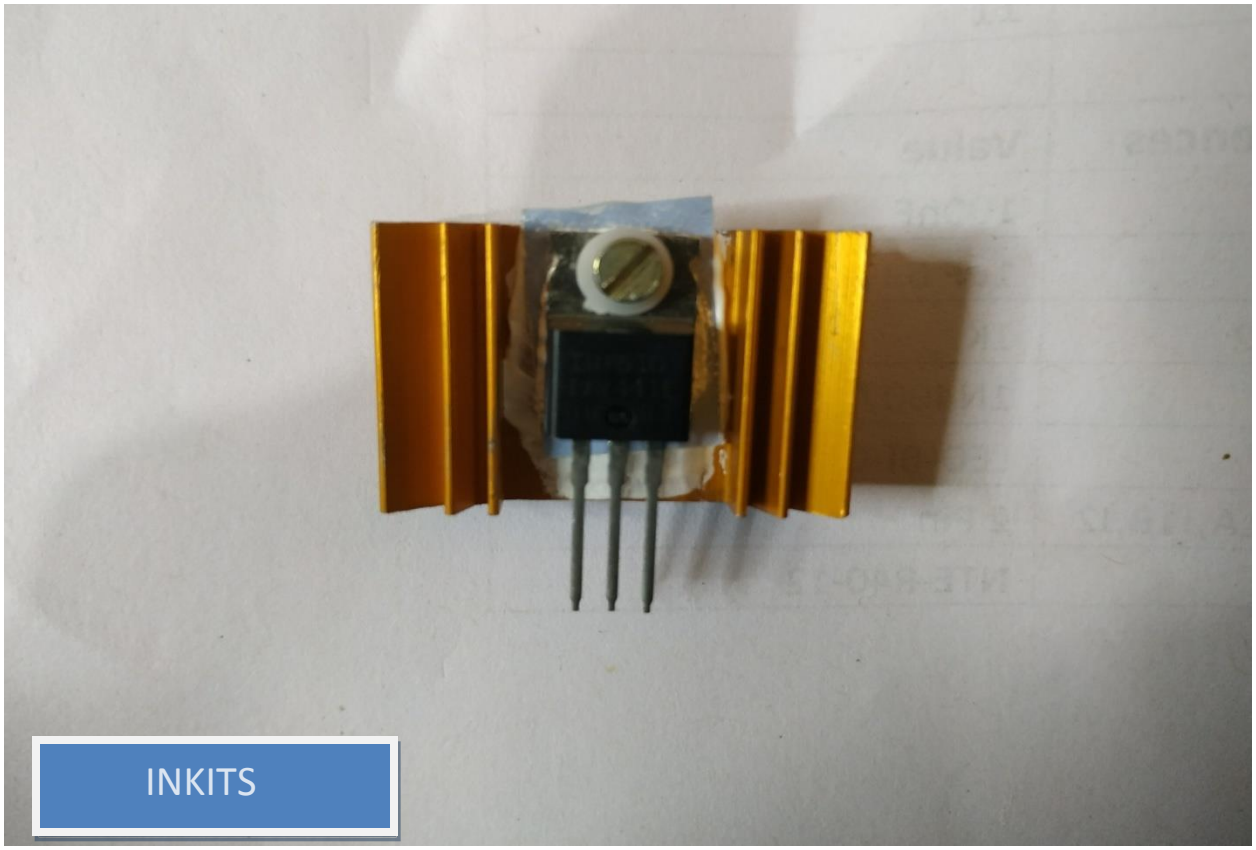
1. RFC 2: Fill the balun or T37-43 with #28 SWG wire, number of turns not important.

2. T9 : 3 Turns Bifilar wound on FT37-43 using #28 Magnetic wire.
3. L1 : 13 Turns wound on T37-6 using #28 Magnetic wire 0.55uh.
4. L2 : 13 Turns wound on T37-6 using #28 Magnetic wire 0.55uh.

Keep the coils we shall mount them after mounting the discreet components. Mount all the capacitors in PA and LPF section, also the SMA antenna connector and +12V 2 pin connector J8 for the PA voltage.

The IRF 510 does not require a large heat sink so we have provided a heat sink that will be sufficient for 3 watts, for higher output use a larger heat sink.

The heat sink is placed a bit above the board on purpose, so that by accident there is no short circuit if the mica is not properly fitted with the heat sink and IRF 510.
This saves the board if there is a short circuit.



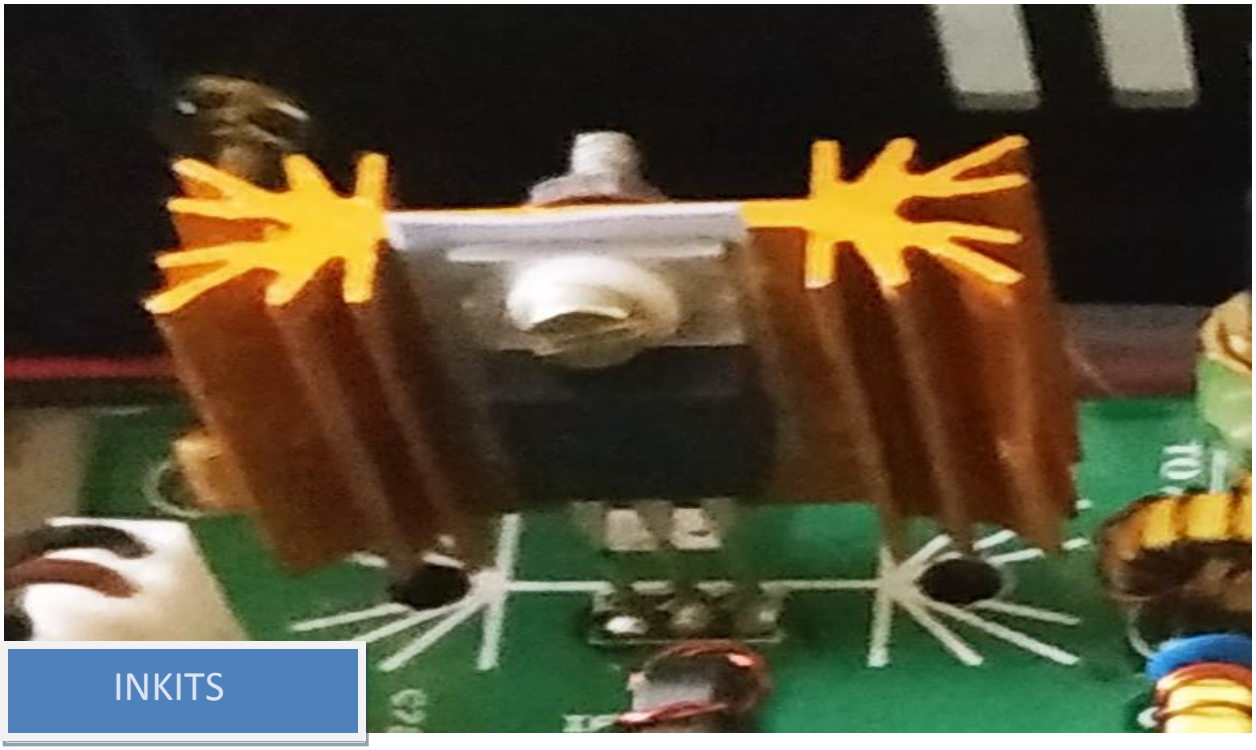
Heats sink Mica fittings.

Heat sink and mica fitting have been provided for 2N2218 and IRF 510.

Apply heat sink compound on the Mica and paste it on the heat sink and then
Use the mica kit to insulate the IRF 510 from the heat sink.
Use a multi meter, there should be no continuity between the IRF510 Drain and heat sink.

Now mount the IRF 510 as in picture, and solder it.

It should look like in the picture.



IRF 510 mounted with heat sink

Now mount L1 L2 T9 RFC 2 and solder on the board, double check the coils continuity by checking from the solder side of the board.

Now the final amp and low pass filter is complete.

Now a dummy load can be connected to the antenna with a power meter,
Put out a test signal by modulating, increase mic gain if required by turning the preset RV1 100K clockwise. You should get an output of 3W to 3.5 Watts; the current consumption should be between 1 Amps to 1.25 Amps

This completes the construction of Easy Bitx Version 1 for 20mt band.

If you wish to build the kit for 40mt or 80mt you could do so, the same band pass filter transformer Toko type supplied for 20mt will work for 40mt and 80mt, just by changing the turns as per the chart it can be used for these bands too.
But the low pass filters need to be changed according to the chart.

After Boxing Easy Bitx

4/15/2020