

# Icom IC 746 Pro SDR RX Modification.

RX mod for dual IC746 and Funcube SDR.



My aim when setting out on this mod was to be able to use a “Brick” radio for TX and a SDR for RX. Like many I would have loved to purchase an ANAN SDR for TX/RX but alas I could not justify the cost for just one band, 6m. I would still have had to purchase a transverter for 2m. I have little to no interest in HF. My IC 746 is used for 6/2/222 only. When weighing up my options I realized that for most of what I do, DiGi signals on FSK441 MS or JT65 that my TX is more than adequate. What was lacking was a good RX. I had purchased a RTL Dongle and was more than impressed with it being an RX equal, if not slightly better in my opinion, to my IC 746 on pure RX of the signal. I live in a quiet area so I did not compare it in a inner city environment. I also was using the RTL on 6m and above so not crowds on HF to deal with. Based on my results I decided to order a Funcube Pro +.



Next came how to install the SDR so as to make it integrated with my IC 746.

Initially I considered an external coaxial relay with the NC going to the SDR whilst the NO would go to the IC 746 when switched on TX. This is by far the most simple method and will work for many people particularly if they do not want to work inside the radio. I decided that it would be easier to use the internal TX/RX relay and switching system of the IC 746 so I searched the internet and found a few articles to use as a starting point. As with many things I have found on SDR the information was out there but in a few different places. My aim here is to put some of it together so as to save search time. Hopefully the pictures will ease the descriptive process.

Jimm, WA3LBI, was kind enough to actually do the mod whilst I played on his Flex 5000. Initially we intended to use standard length SMA chassis mount females, hence the mill work started on the rear of the IC 746. Because the IC 746 chassis is so thick we put the radio on the CNC machine but quickly decided against it due

to the lack of purchase that the IC 746 offered. Instead we decided to install Barrel connectors. I will put a full list of cables and connectors at the end of these notes.

As you can see 4 connectors have been installed on the rear panel of the IC 746. Two for HF/6m and 2 for 2m. One connector is RX out the other is RX in. Basically a return feed to allow either the IC 746 to work alone (factory) on RX. The SDR to act alone on RX (SDR only) or for both the IC 746 and the SDR to be used in RX (Dual RX).

Most of the pictures are self explanatory and will require few notes. All pictures were taken post modification after I had had chance to make sure the mod worked as designed.



IC 746 Pro with top cover removed.



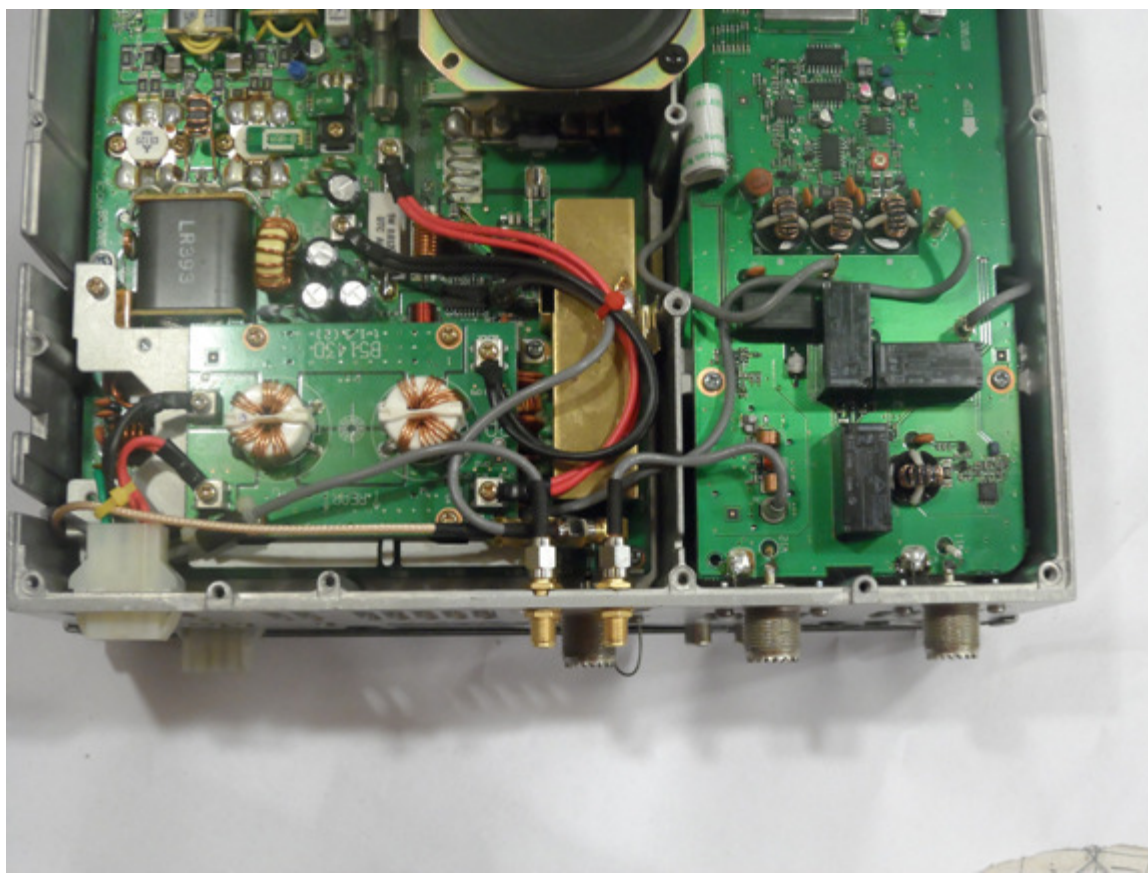
Internal cover removed revealing the HF/6m SO259 connectors and the 2M connections. For 2m follow the red and black DC power lines on which I have installed a red cable tie.

We determined the best place to install the SMA barrel connectors and drilled out the chassis before inserting and fastening the barrel connectors in place.

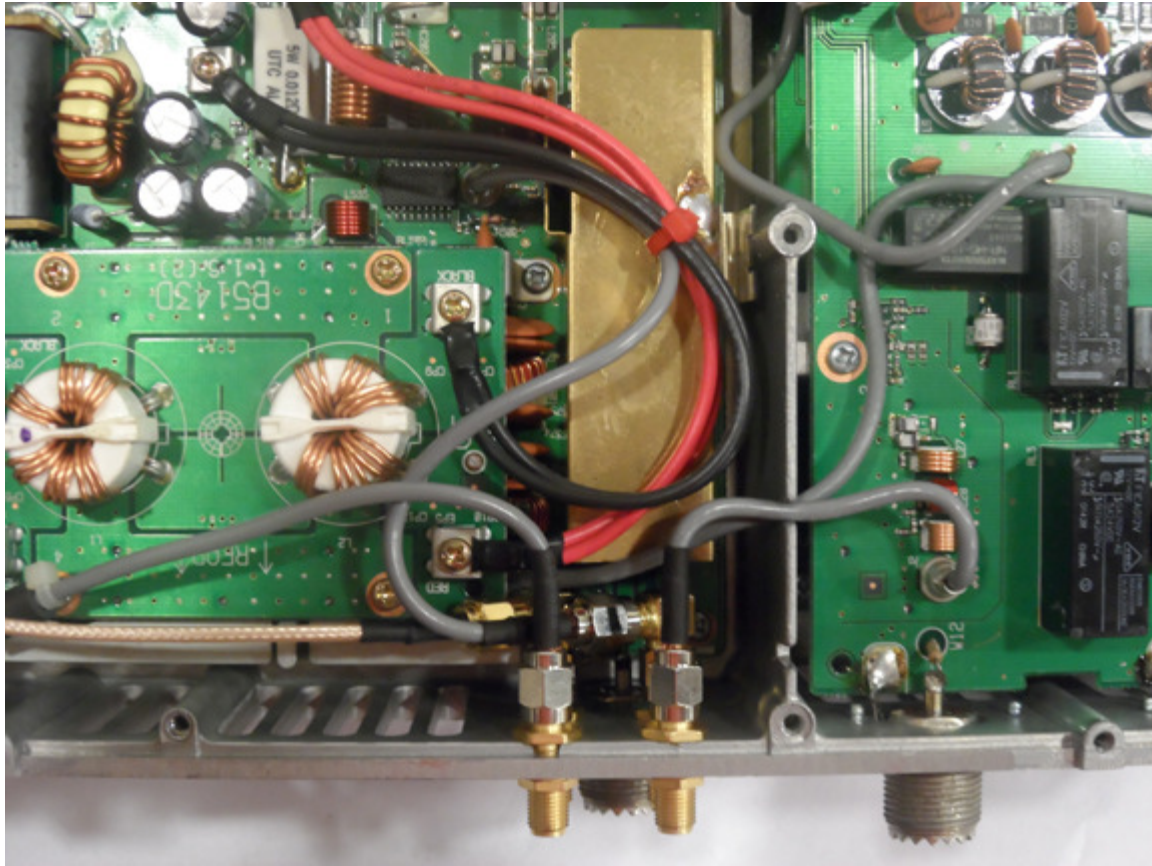
The upper pair of SMA connections are for HF/6m whilst the lower are for 2m. This was purely decided by how the cables wanted to lay. The HF line was very easy to work on and at minimum just requires snipping and the SMA males installing before they are screwed back on the barrel connectors.

2M was a little more tricky as the factory cable was not long enough to go to the rear panel before returning to the VRX socket. WA3LBI made up a little jumper cable from what he had laying around. At the end of these notes I will list what I think would be my number 1 choice of cables to use. Alas connectors for what would be my number 1 choice do not exist so they will have to be modified.



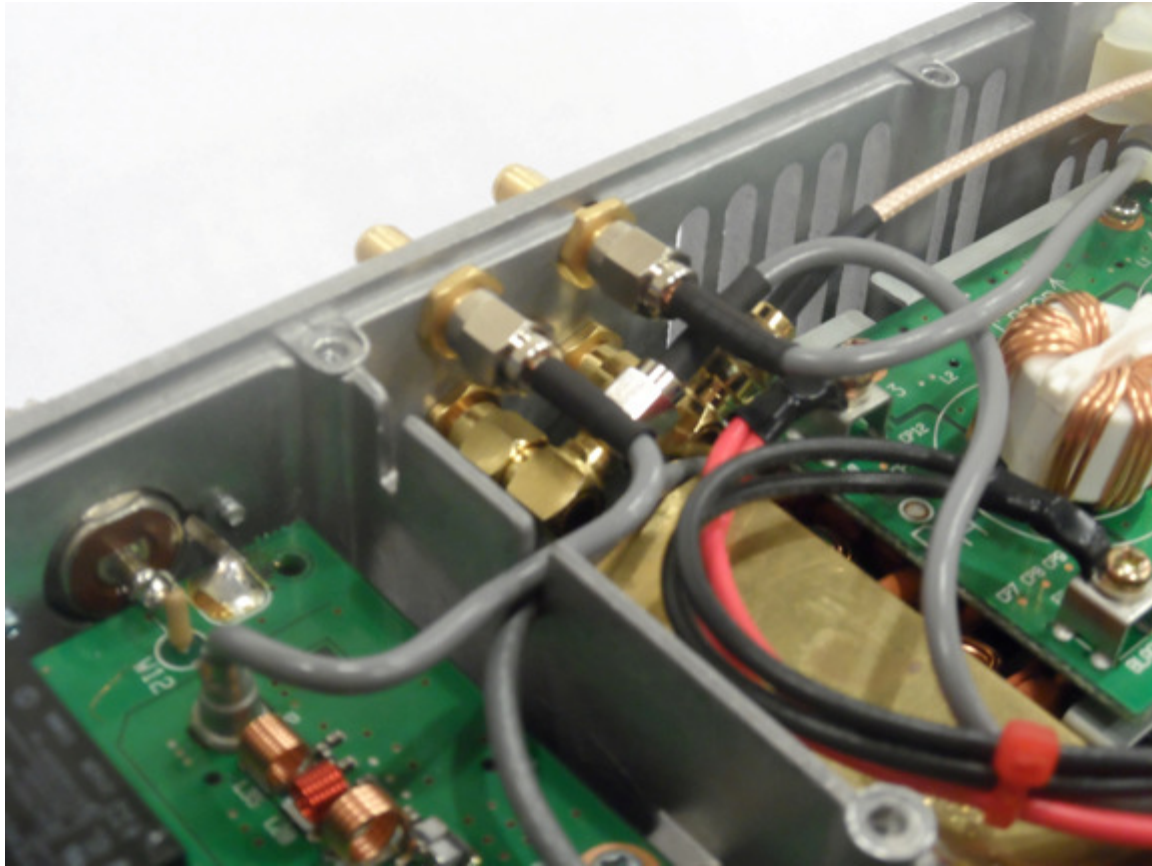


Inside the top of the IC 746 showing the final cable connections and runs for the mod. The gold coaxial cable is the only new cable we used. The rest were modified cables already in the radio. I will list what I consider would have been an easier way to do this mod at the end. Still the same results but I would not have got it done that evening. For my mod WA3LBI just installed SMA males on the existing cables with the exception of the gold cable which has an SMA on one end and a TMP male on the other. For ease I will also suggest buying cables with SMA's already installed. Again please see the notes at the end.



The HF/6m cable runs from left to right. We broke the cable enroute from the TX/RX board to the HRX connection on the bottom of the radio and installed SMA males.

The 2m cable is the grey cable running from the upper part of the picture, adjacent to the red cable tie and goes to the VRX on the bottom of the radio via the gold cable. Right angle SMA adapters were used on the 2M cable run in order to make the installation fit easier.



A close up of the internal rear connections. HF/6m on top 2M on the bottom.

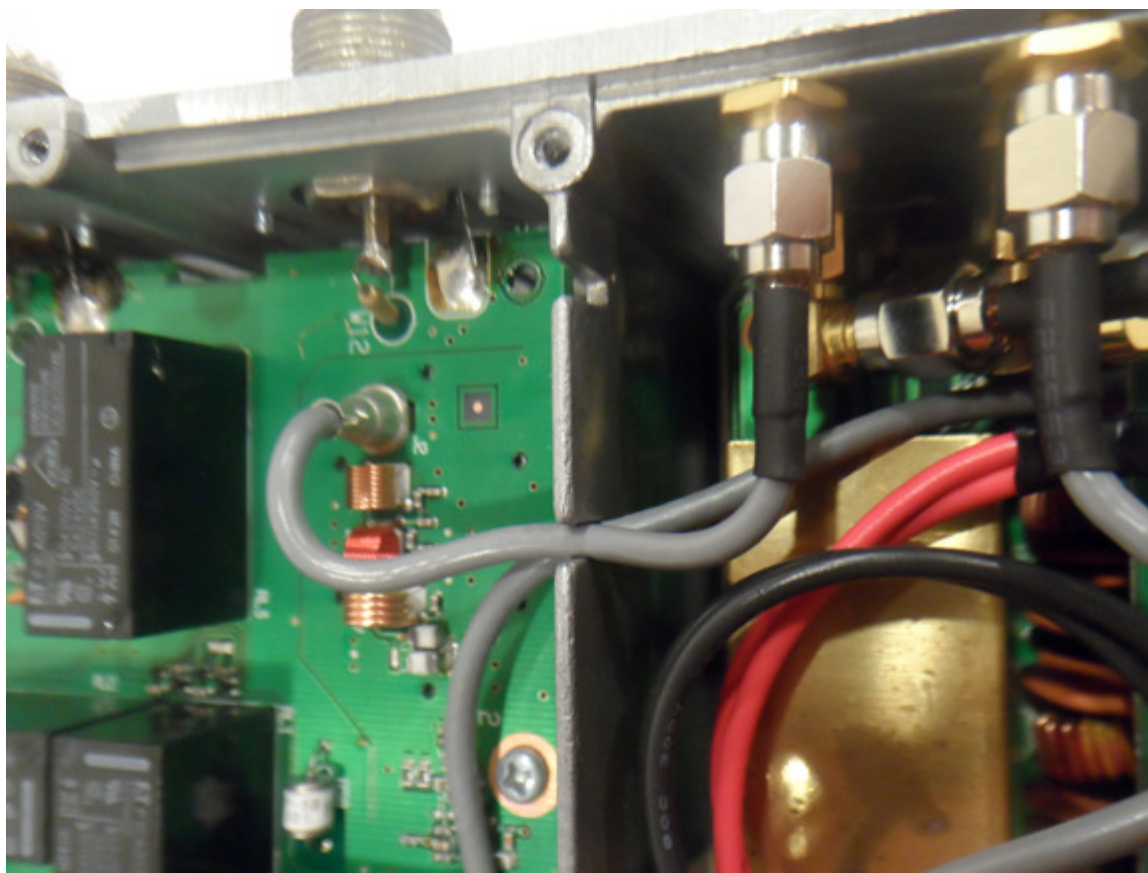
The left hand pair of connectors on this picture are the output to the SDR whilst the right hand pair return the signal to the IC 746 RX.



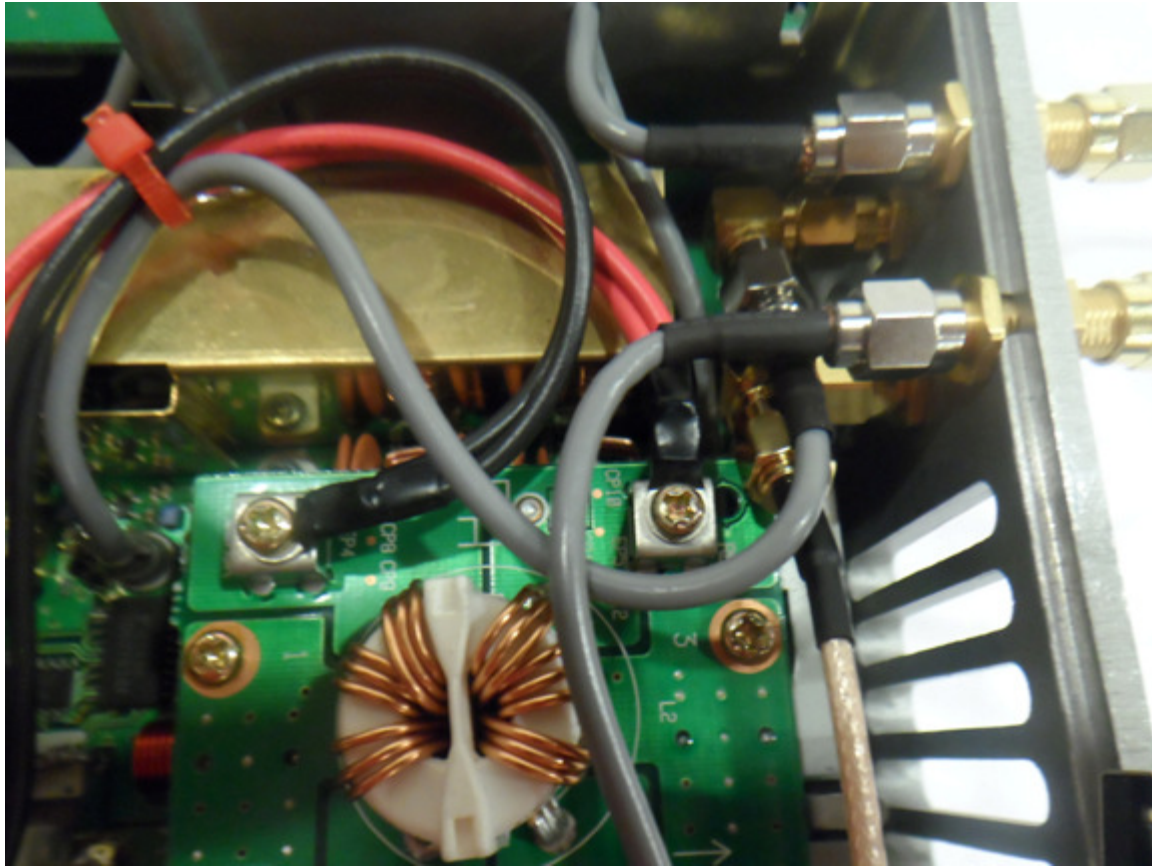


You can see from this picture that right angle adapters were used on the 2m coaxial lines in order to place the cables at a better angle. The gold cover plate you see in the picture made a straight connection very difficult.





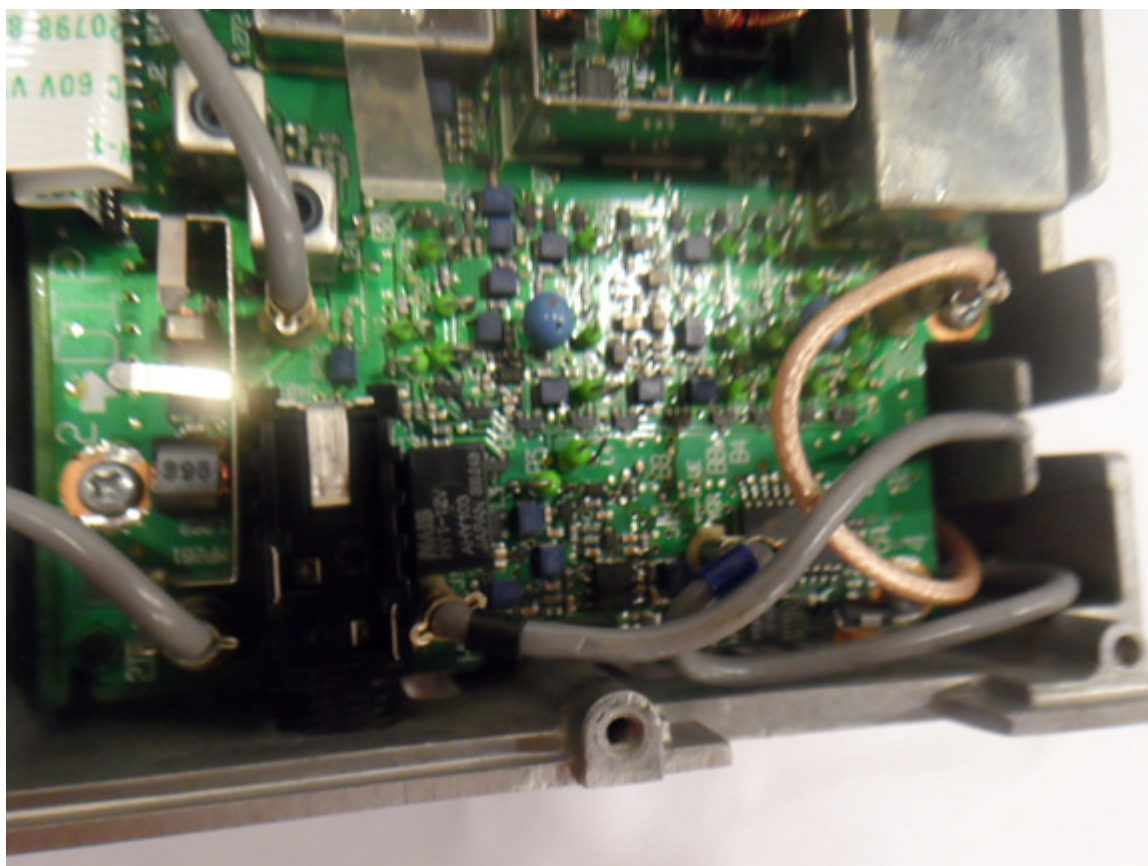
A close up of where to take the HF/6m RX signal from the inside of the radio just after the TX/RX relay.



A close up of where to take the 2m RX signal from the inside of the radio just after the TX/RX relay.



The IC 746 pro with the underside cover removed. You are going to be working beneath the cover on the right hand side of the amp where the yellow and red wires can be seen going to the ATU output connector.



Inside the bottom of the radio where the cover adjacent to the ATU connector was removed. The black coaxial cable is the HF/6m RX and goes to a TMP female connector labeled HRX. The Gold coaxial cable is the one that we added/.. It is the 2m RX coax and goes to the TMP connector female labeled VRX.



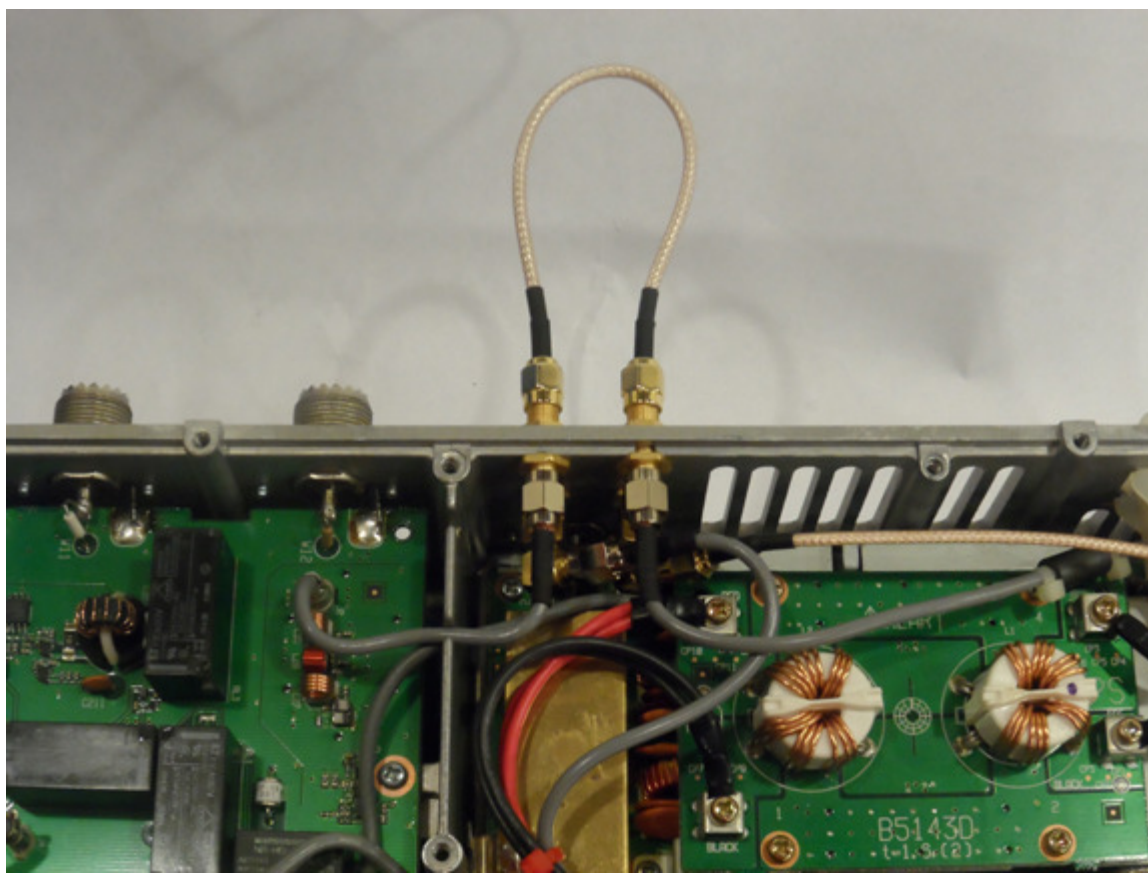


A close up of the replaced 2m coaxial cable clearly showing the VRX TMP's.

For this connection we made up a cable with a Male SMA on one end and a Male TMP on the other. This would be my first choice of how to make up all cables using Male SMA's and Male and Female TMP's. This would make it more plug and play.

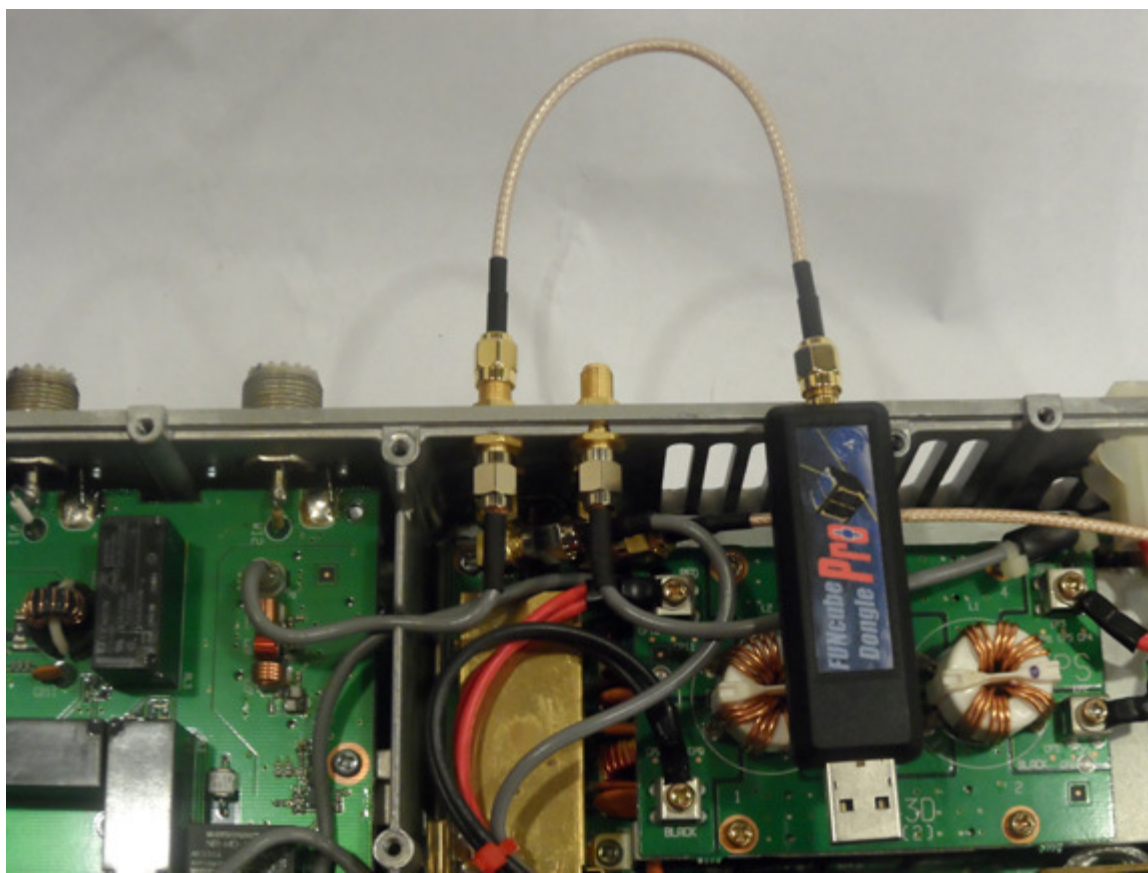


A close up of the HF/6M HRX TMP connection. The HF coaxial cable is the one with the black band around it.



Modification complete. Showing set up for HF/6m only for clarification during photography.

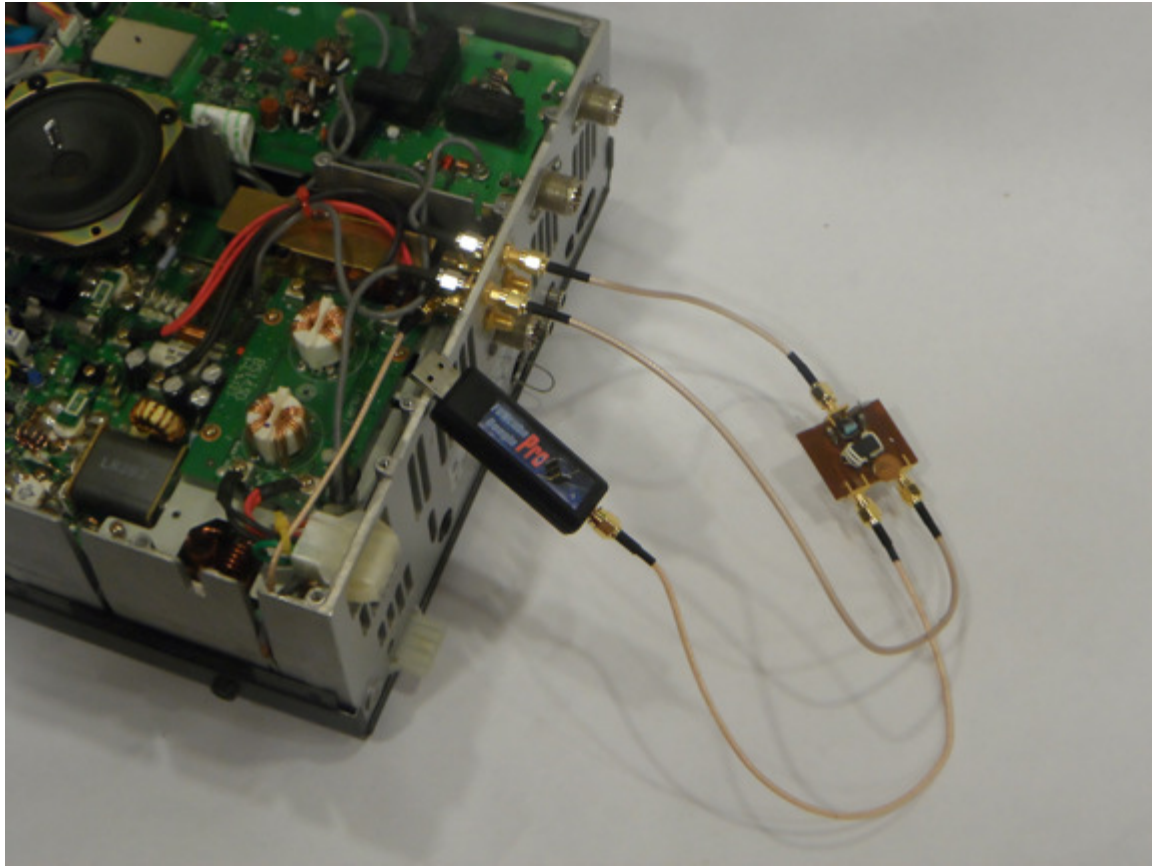
In this configuration, using a SMA Male to SMA Male jumper cable the IC 746 will operate as factory utilizing only the IC 746 RX.



Modification complete. Showing set up for HF/6m only for clarification during photography.

In this configuration, using a SMA Male to SMA Male jumper cable the goes to the input of the SDR. In this configuration only the SDR will be used for RX.





Modification complete. Showing set up for HF/6m only for clarification during photography.

In this configuration, using a SMA Male to SMA Male jumper cable goes to a splitter box which we took out of its enclosure to better illustrate. In this configuration both the IC 746 RX and the SDR RX will be operational at the same time. Dual RX.

Cables and connectors.

This would be my choice of cables and connectors I would use if starting from scratch. Starting at the TX/RX relay. These cables would mean no cutting of the factory cables as they would just plug into the new jumper cables. The only problem with this is that there is no TMP series in line female connector available. My suggestion is to choose a suitable surface mount TMP female connector and install heat shrink over the connector once you have soldered it to the cable. As we did not have any TMP females connectors on hand we cut the factory cables and crimped on SMA Males instead. Both methods work I just feel the TMP female route would be easier for most. My suggestion is to purchase SMA Male to SMA male jumper cables already made up and to cut one of the SMA Male connectors off to install the TMP series connectors. This will be, in my opinion, both the cheapest and easiest method of making up the cables requires. As with all the connectors and jumpers, particularly the TMP series, I would suggest ordering a few spares in case you damage any during installation. This is particularly important with the TMP connectors as you are less likely to have any in your spares box.

Interior.

HF/6m

TMP Female to SMA Male Jumper.

SMA Barrel connector, Long. Qty 2

SAM Male to TMP Male Jumper.

2m

TMP Female to SMA Male Jumper.

SMA Barrel connector, Long. Qty 2

SAM Male to TMP Male Jumper.

Exterior.

SMA male to SMA Male jumpers. Qty 2

These will be used to connect the SMA barrel connectors together when not using the SDR in RX.

All other connections will be based on the particular SDR RX that you are using. In my case it was the Funcube Pro + as well as my RTL with a HF UpConvertor. If I may suggest just ordering a further 6 SMA male to SMA male jumper cables (10 in total) then you should find that you have more than you need to complete the mod.

TMP Series connectors.

The difficult part of this project is in finding the TMP series connectors. These are Taiko Denki TMP series connectors for which I found data for at the following link.

<http://www.scsiglobal.com/TaikoDenki/Documents/SCSI-204-TMP%20Series.pdf>

As you can see there really is not a 100% suitable Female available hence my comments about using the one you feel suits your needs the best and applying heat shrink.

Elecraft did have some Male and Female TMP series connectors listed for sale on their site if you have trouble finding them.

[http://www.elecraft.com/elecraft\\_prod\\_list.htm](http://www.elecraft.com/elecraft_prod_list.htm)

SMA connectors.

I usually just order my jumpers and connectors from my favorite supplier in China via Ebay. It is by far the most cost effective way of obtaining the cables but does require a little forethought. Below are pictures of what I would consider ordering.



SMA male to SMA RF Pigtail Coaxial Cable RG316 30cm QTY 10





SMA male plug to female jack Right Angle RF connector Adapter QTY 2



SMA female to SMA female bulkhead with nut rf connector adapter Qty 4

I would like to thank Jimm, WA3LBI, for performing the mod on my IC 746 Pro for me. Or should I say more correctly telling me to go play with his Fles 5000 and leave him alone to do what he does best. I am sure you will find mistakes in my notes so please feel free to email me at [g6yzc@msn.com](mailto:g6yzc@msn.com) so that I may correct them.

Since installing this mod I have had chance to operate my IC746 first as a Dual RX and now as SDR RX only. I find that not only is it advantageous to have the SDR display but I actually hear beacons on the Funcube Pro + SDR that I cannot hear on my IC 746. I use Simon Brown's SDR Console for my RX computer interface software.

Indecently my first Hybrid (746 TX/SDR RX) QSO was a 6m QSO with K5N who was operating from a rare grid, EL84. The reason I worked them was that whilst listening on 50.125 Mhz I saw a signal appear on my SDR waterfall on 50.165 Mhz. The DX-perdition frequency. Without the benefit of SDR I would have had my "brick" listening on 125 and never have heard K5N.

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