RX antennas at IV3PRK: the PENNANTS revisited

Last improvements trying to reduce the common mode problem.

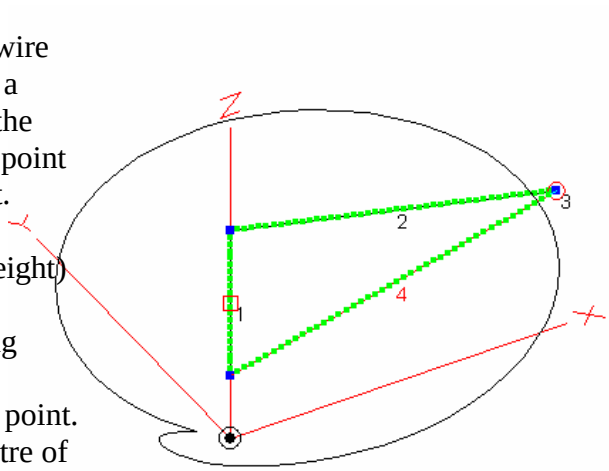
By Pierluigi "Luis" Mansutti IV3PRK

The existing Pennants setup

In summer 2008, while preparing the switcher and combiner boxes for the new four square Rx array, I realized that I had learnt something more on switching techniques and common mode decoupling. So why not revisit and update with new ideas all my Pennants system?

I built them in autumn 2002 following the standard design of K6SE in the QST July 2000 article, as widely detailed in my document RXant.PRK_160m.INTERACTIONS.pdf.

There are two groups of three Pennants each, whose vertical wire is tied on a fiberglass tube, on top of a wooden pole; the other two sides of the triangle are connected at the feeding point on a common box at 4 meters height.

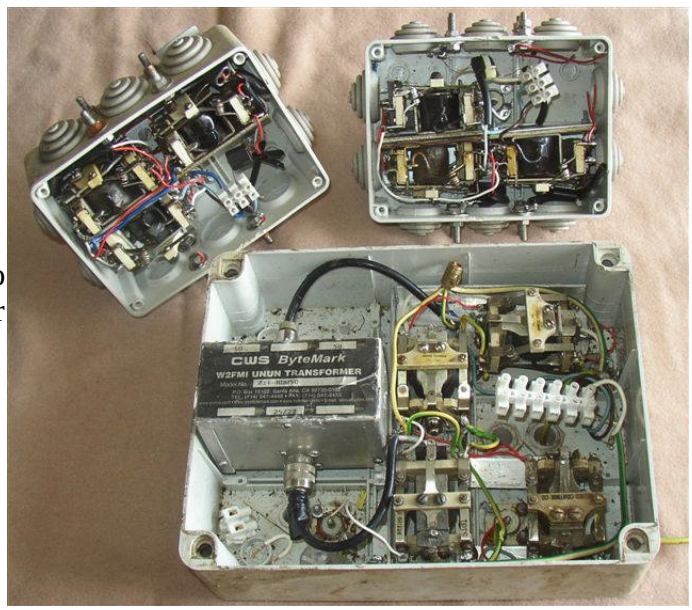


Pennant building data:
wire 1: m. 4.26 (bottom at 1.80 m. height)
wires 2 and 4: m. 9.12
wire 3: virtual short one at the feeding point in a relay box.
Beaming lobe is towards the feeding point.
Loading resistor: 880 ohm in the centre of the vertical wire (actually four 220 ohm 1 watt carbon resistors in series).

18:1 transformer: I tried at first with a FT114-77 toroid; then I discovered better results with a FT140-43 in series with a 900 pF capacitor (to tune out the reactance, but it was a single frequency affair). At that time there was only one xfmr per box with switching on the high impedance side by means of rugged surplus RF open frame relays.

Later, following the advice by W8JI, I changed to the much easier transformers wound on the binocular core BN 73-202 (3 turns on primary and 12 turns on the secondary), put one of them for each single antenna, and thus with better switching on the 50 ohm impedance side.

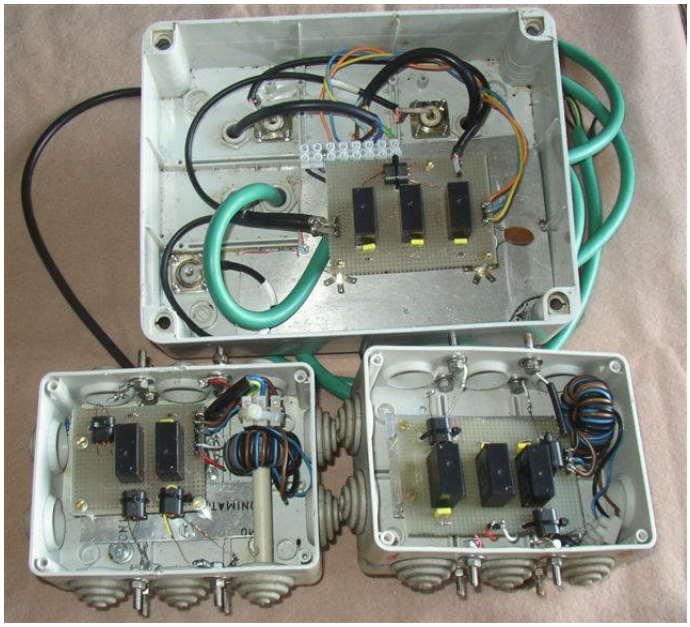
The picture to the right shows the two Pennant boxes and the central buried box for broadside switching with a W2FMI un-un 2:1 transformer as used by Jeff, K1ZM. But I have been convinced that this stuff, good for transmitting and handling power, could be not the best for receiving only purpose, so I decided to modify switching with small sealed relays and to take all the attentions in reducing the common noise.



The Pennants switching boxes with the old open frame surplus relays

Rebuildings and improvements

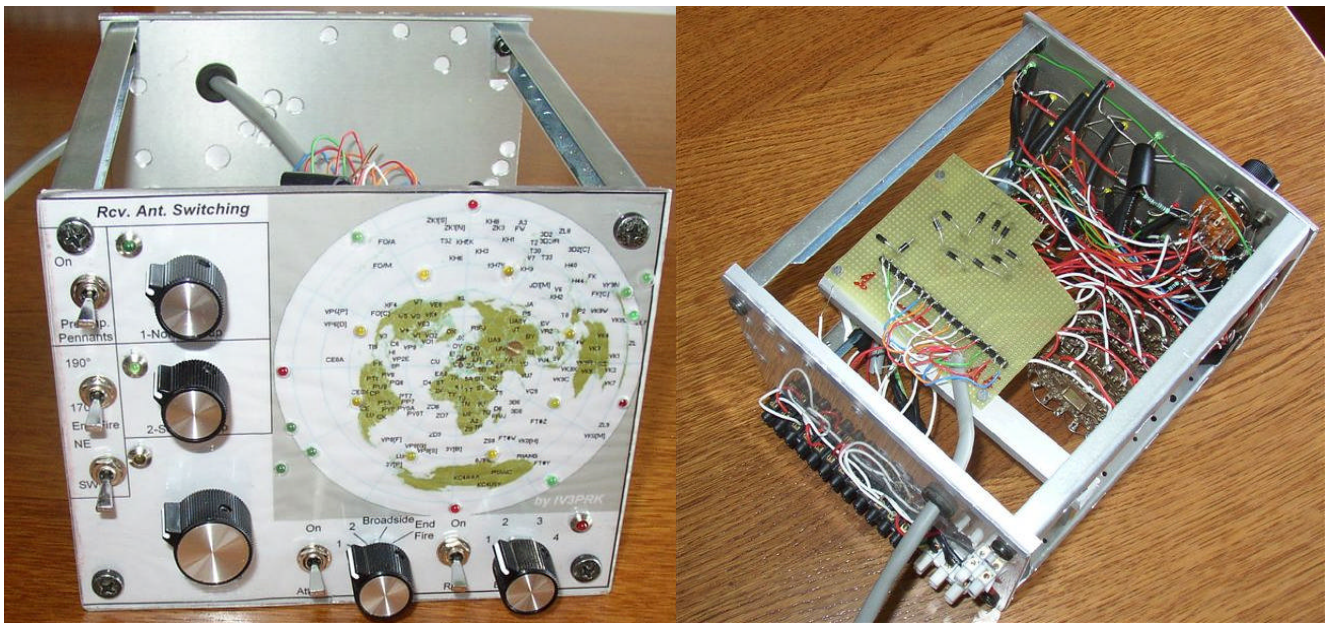
1. All the old RF open frame relays have been substituted with the cheap Tyco/OEG OMI-SH 212D PC board sealed relays
2. I put a 10 KpF capacitor in parallel with a reversed diode across every relay
3. I put an high impedance choke on the control line (15 turns through an FT140-J toroid) in the two Pennant boxes
4. On the same boxes I put also a very high impedance choke on the coax feedline (12 turns of RG58 trough two FT140-J)
5. I provided a low impedance path to ground (to remove any signal left on the coax shield) by means of a new ground rod in the buried central box
6. In the same grounded box I connected also a 10 KpF capacitor between the negative side of the relays coils to provide an RF short path to ground.



The boxes rebuilt with the new sealed relays

7. The big W2FMI un-un, with cables and PL259 connectors, has been substituted with a small and simple binocular (BN73-202) 1:2 transformer (7 turns with tap on the 5th turn); it is activated in the broadside operation to rise the 25 ohm impedance, resulting at the T connection, back to 50 ohms.

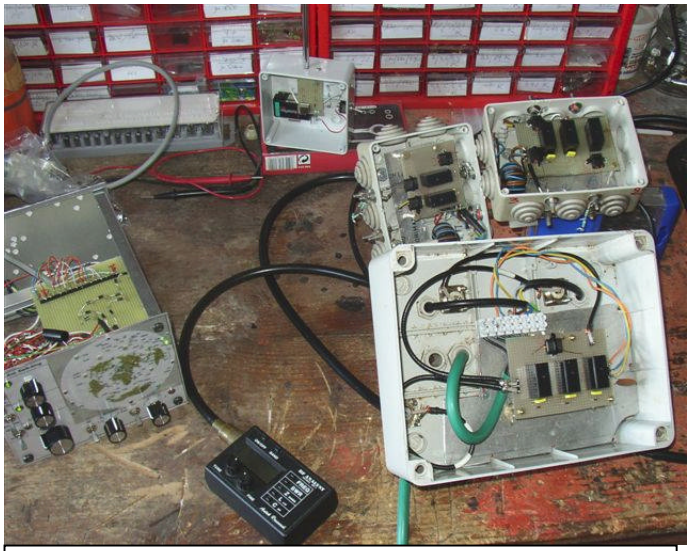
In the mean time I completely rebuilt also the Receiving Antennas Switching Box, as shown in the pictures below, and I was ready to test the correct switching and impedance matching with loading resistors on the bench.



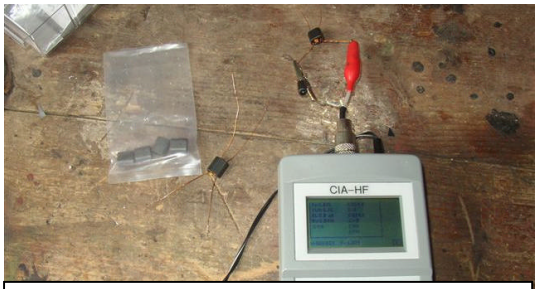
The new receiving antennas control box. The big rotary switch in the right picture is used for the 4-square array

The crazy binocular transformer

With both my antenna analyzers I checked several times all the switching combinations: with the 900 ohm resistor connected, the output impedance is always about 50 ohms, while without any load, the output reading is around 400 ohms.
But I have been puzzled by a strange reading only on one position: the SW in the southern group of Pennants. With 900 ohm load the output impedance from this transformer is correct like all the others, but without a load the output reading is just above 100 ohms!



On bench test with the RF1 analyzer

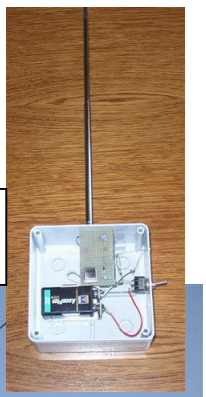


Testing a binocular transformer.

I took it away, and wound again with new wire: absolutely the same results. So I wound on a new binocular (of the same type) and it gave the expected results.

Moral of the story: that South West Pennant has always been very noisy and useless. I had been trying for years to fix the problem and to look for the source of noise from power lines and neighbours…. Could have been all that atmospheric noise originated by something wrong in a defective ferrite 73 material?

I completed the set-up and installed as before. I bought from Mouser a cheap clock oscillator on 1.843 MHz and put it in a simple circuit to get a reference signal for Rx antenna tests and everything seems to work as it should, but now it's summer and it's better to wait for the real life of the winter season.



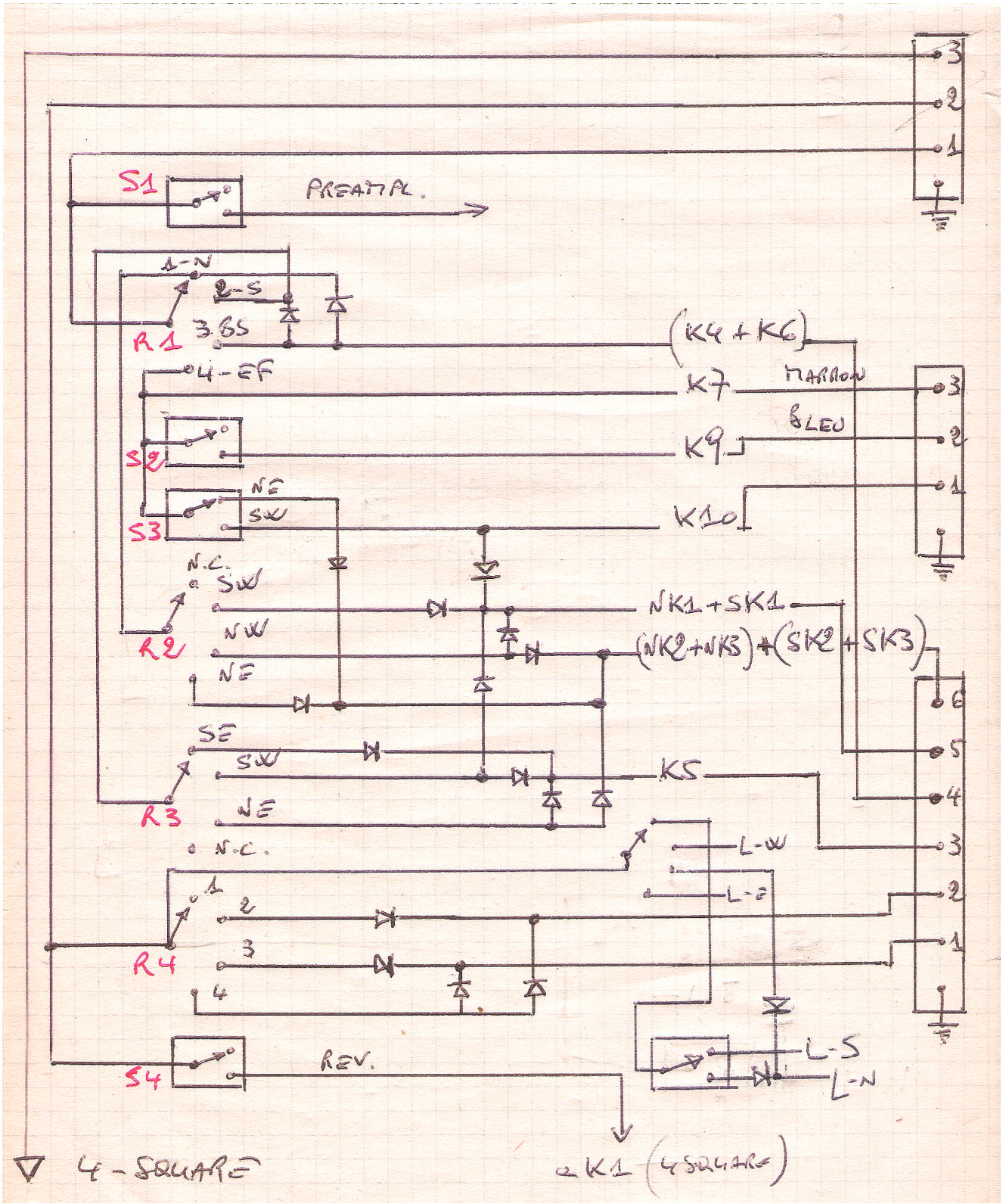
The 1.843 MHz oscillator mounted in 10x10 cm. box

The Pennants central box ready to be buried with a K9AY preamplifier

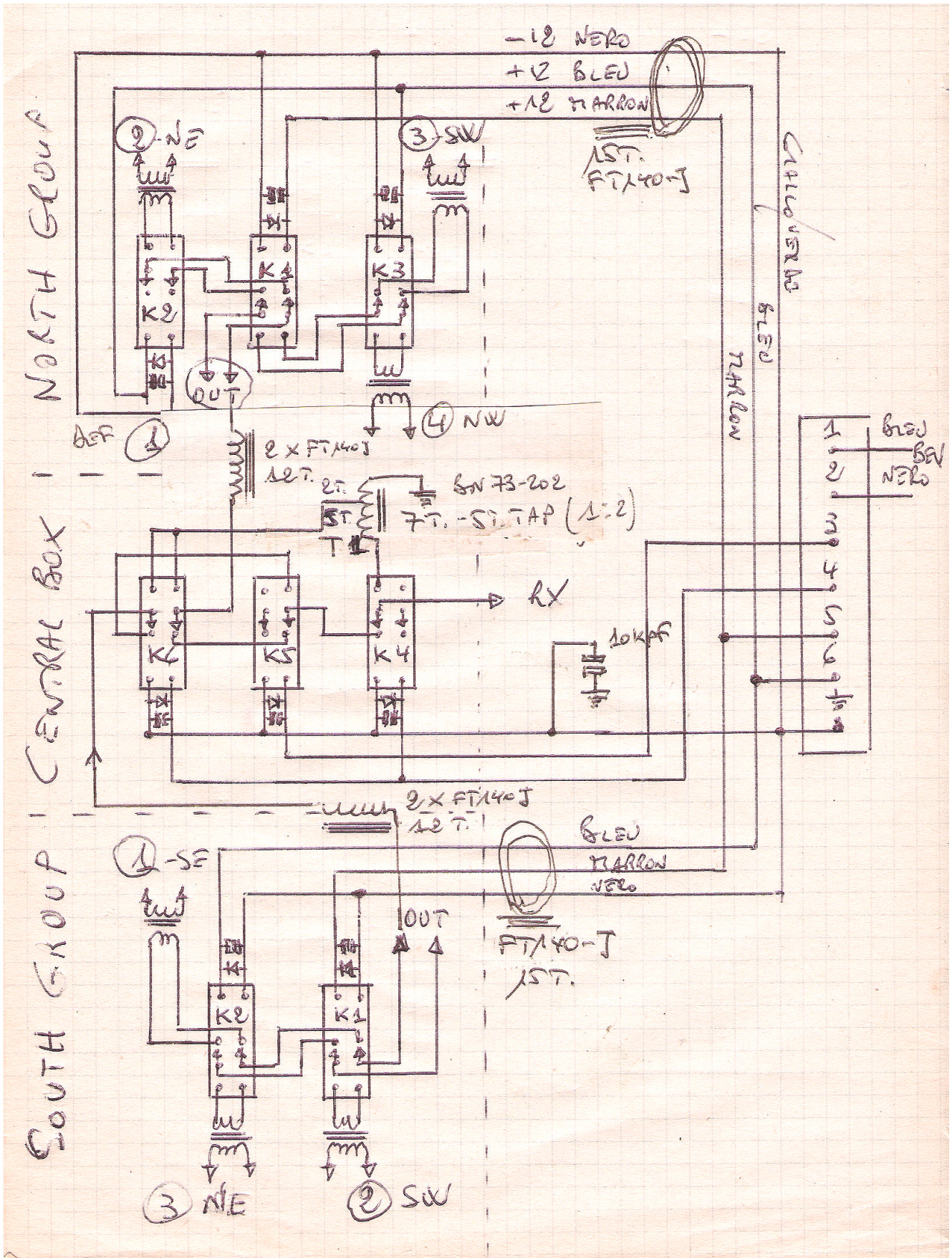
The Pennants switching box of the southern group with the added common mode choke.

Luis IV3PRK, July 2008

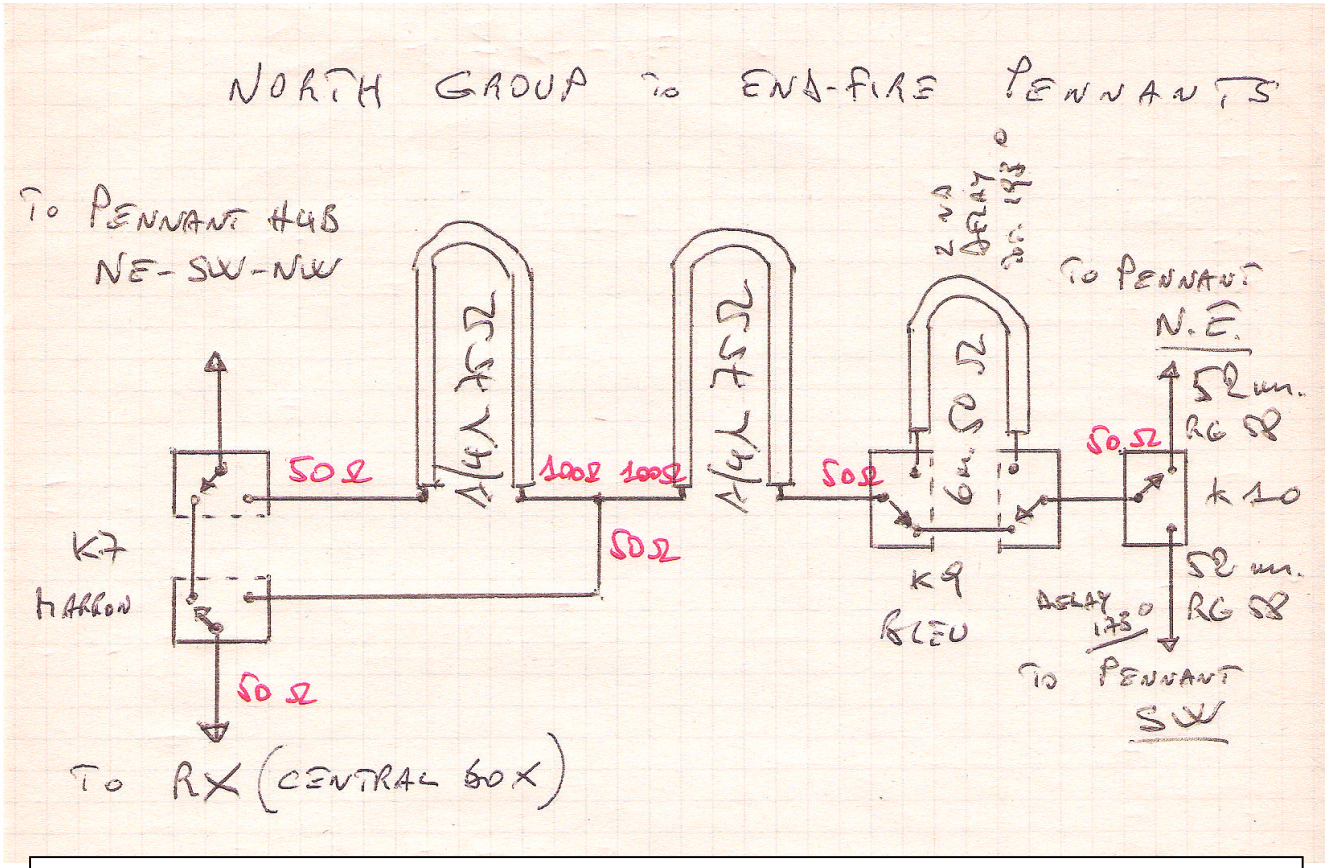
WIRING DIAGRAMS



A) Wiring diagram of the Rx antennas control box for the Pennants and Beverages part.



B)Overall switching, connections and common mode chokes of 3 + 3 Pennants system.



C) Switching and phasing lines for the End-fire Pennants added to the northern group.
(See specific PDF document on End-Fire Pennants)