

FT1000-MP / FT1000-MK5 : AN EFFECTIVE PANADAPTER by F5LOL

ABSTRACT

The YAESU FT1000-MP or MK5 have nice receivers but without possibility to monitor a whole band directly on the screen as the new SDR transceivers.

Before writing this paper, I tried a lot of SDR receivers used as panadapters : Airspy HF+, FDM-S2, G305-i, PERSEUS. With all these SDR receivers it is possible to « view » a wide spectrum, but the best of the best SDR is the PERSEUS for the following reasons :

Pros :

- The interface is very easy to use and don't needs a lot of hidden tuning parameters
- The noise floor only can be averaged while the signals aren't.
- Absence of faulse signals or interferences in the spectrum displayed.
- In CW, there is no delay between the signal trace and the corresponding audio; the signal traces move according the dots and the dashes even when the noise floor is averaged.

Cons :

- Limited to HF 10KHz to 30MHz
- High price

For all these reasons, I decided to built a panadapter interface for the FT1000-MP based on a PERSEUS with possibility to use it with a VHF RTL dongle.

SPECIFICATIONS OF THE PANADAPTER

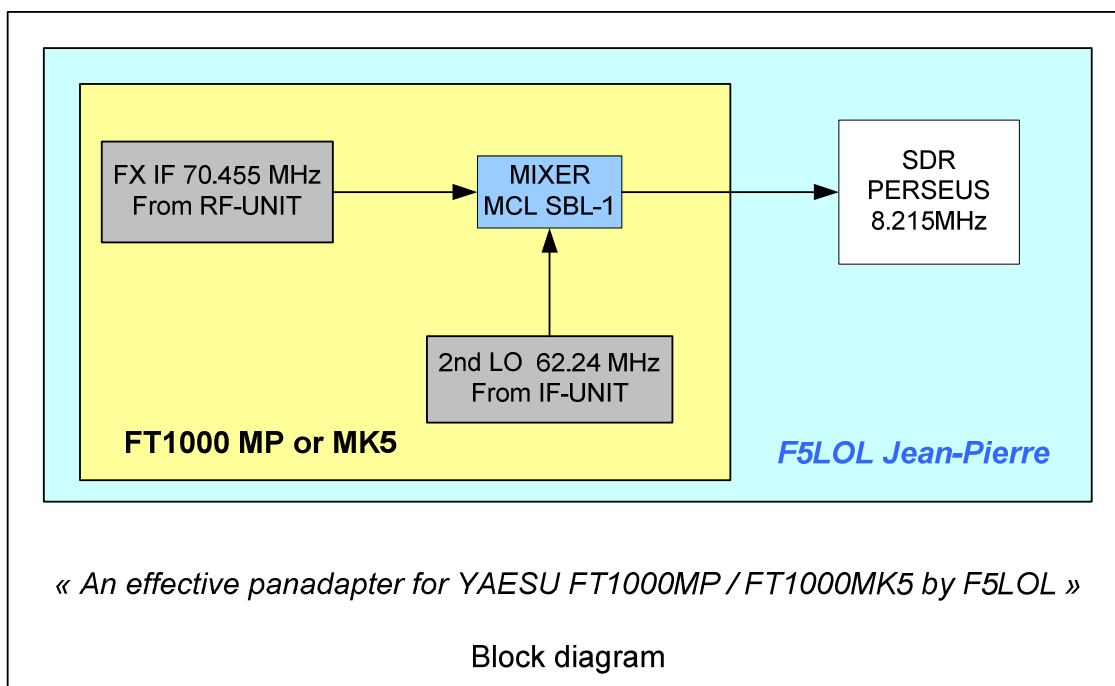
No degradation of the FT1000-MP specifications (sensitivity, spurious, etc) after installation of the interface.

Audible weak signals shall be seen above the noise floor i.e. about -135dBm antenna RF input

Absence of faulse signals in 1MHz bandwidth when the antenna is disconnected

Output frequency between 2 and 28MHz

BLOCK DIAGRAM



The IF frequency of the FT1000-MP or MK5 is 70.455MHz but the bandwidth is limited to 12KHz by the roofing filter ; it is too narrow for a good panadapter.

One idea is to transpose the IF band in the HF band thanks to an extra mixer with an extra OL. We can use the second OL at 62.24MHz to transpose the IF band in the 8.215MHz ($70.455\text{MHz} - 62.24\text{MHz} = 8.215\text{MHz}$) as in the main receiver ; if we peak the IF band before the roofing filter the bandwidth will be not limited by the roofing filter.

The panadapter display bandwidth will be limited by the SDR receiver itself and the front end filters of the FT1000-MP or MK5.

The image frequency of the transposition will be $70.455\text{MHz} + 62.24\text{MHz} = 132.695\text{MHz}$; it should be used to feed a VHF SDR receiver like the AIRSPY HF+ instead of the PERSEUS to make a low cost panadapter.

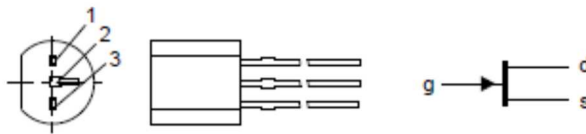
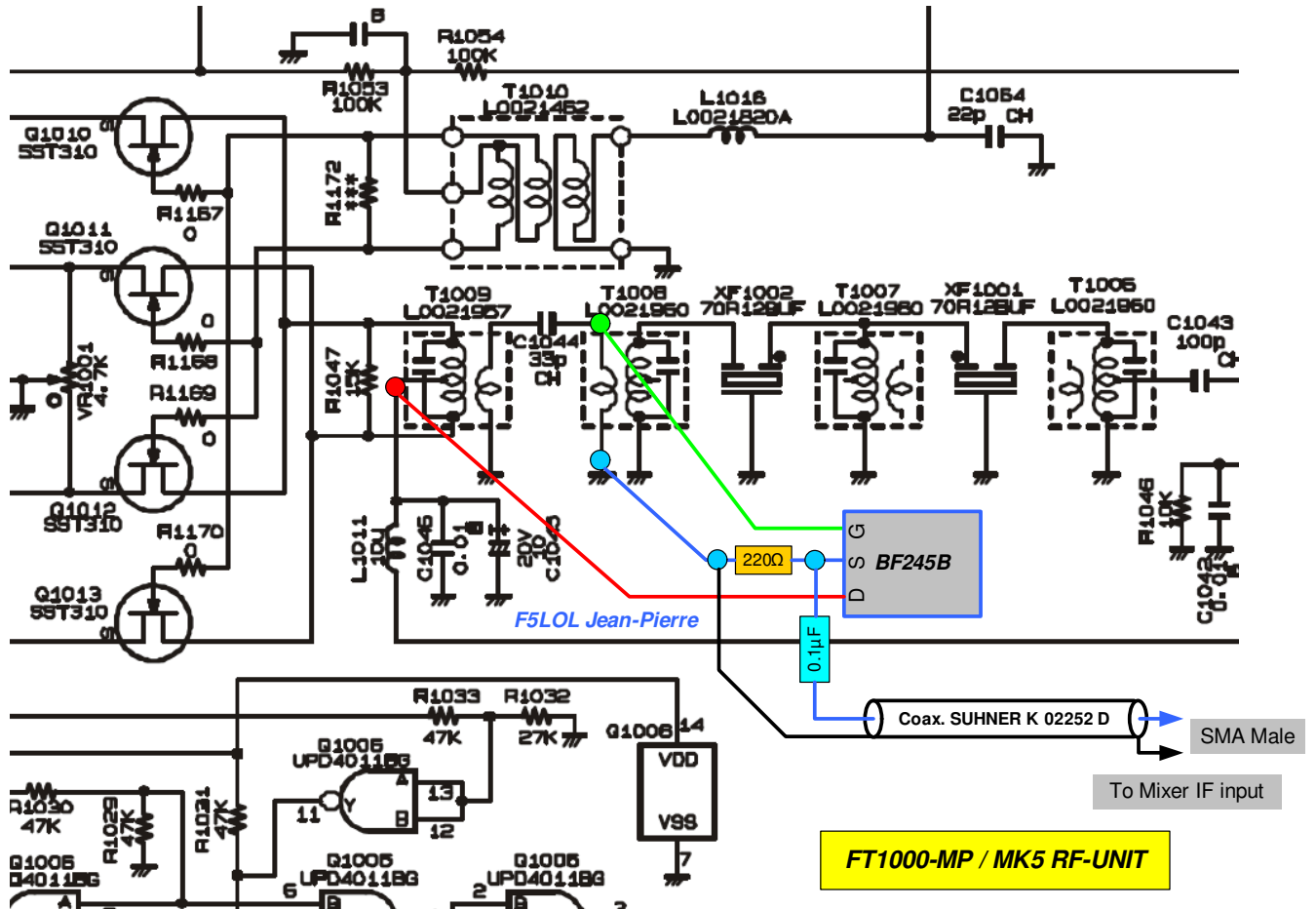
The block diagram above explains the solution.

The only constraint to don't disturb the actual receiver will be to use high impedance interfaces between the tap points and the coaxial cables connected to the mixer.

RF TAP

The whole IF band is picked directly at the output of the first mixer. A JFET BF245B is used in source follower mode to feed the double shielded coaxial cable connected to the mixer.

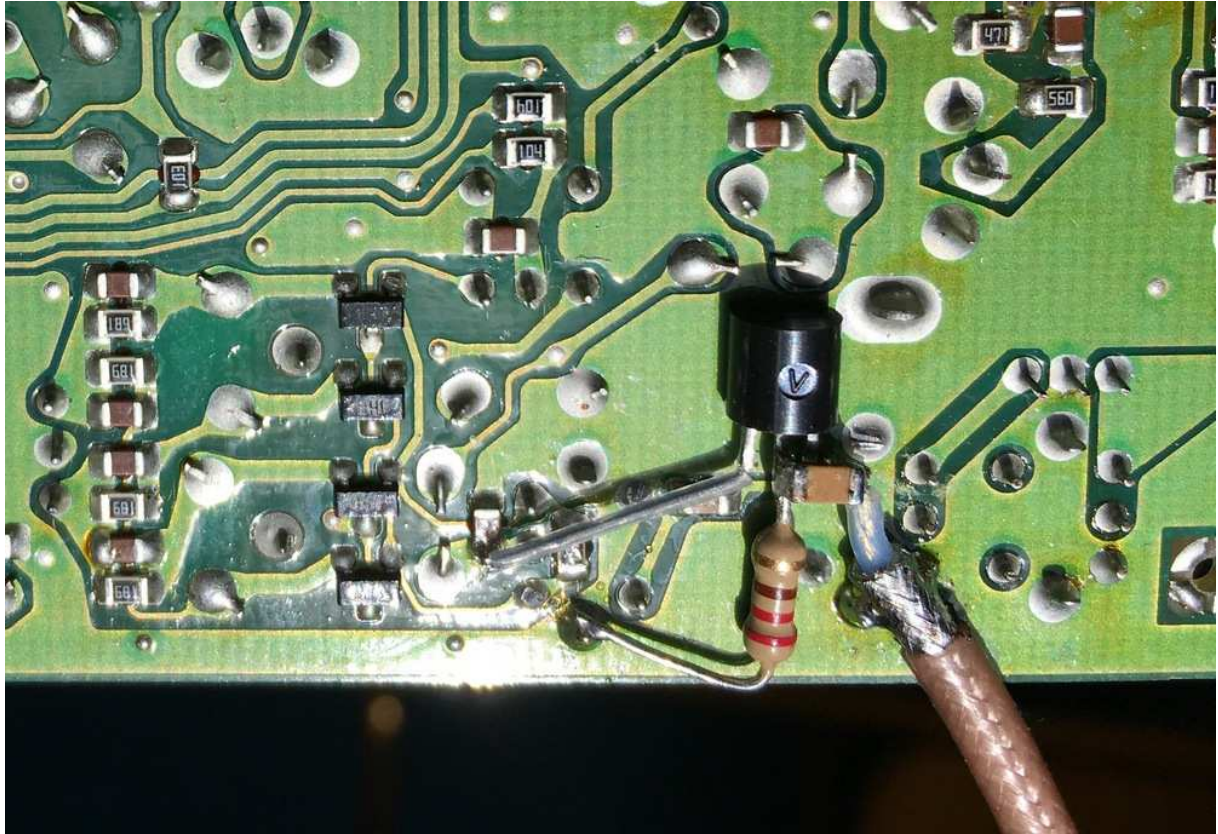
After modification, T1016 and T1017 (FT1000-MP) or T1008 and T1009 (FT-1000 MK5) will be returned if necessary.



PINNING

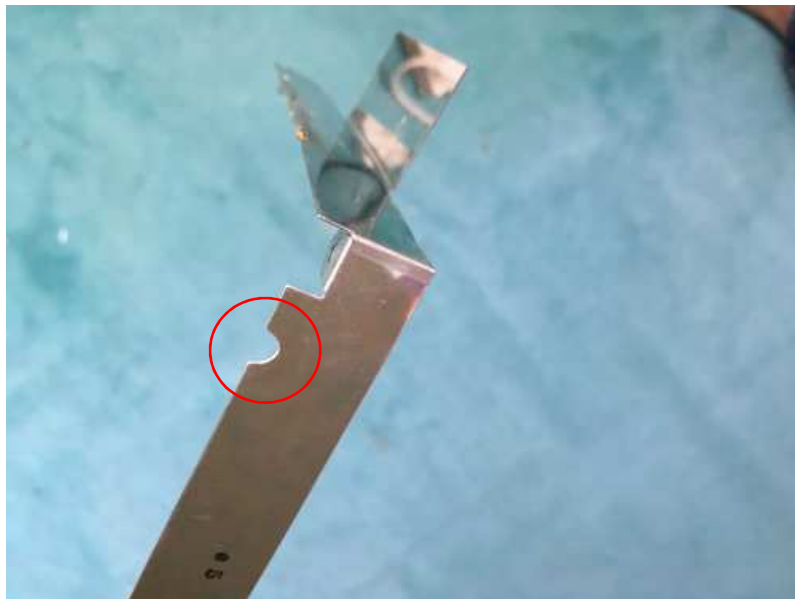
PIN	SYMBOL	DESCRIPTION
1	d	drain
2	s	source
3	g	gate

BF245B



FT1000-MP RF-UNIT

The JFET BF245B is soldered as short as possible on the PBC. The height below the PCB is limited, the BF245B shall be installed close to the PCB like on the picture. We use chip 100nF capacitor for the same reasons. The drain wire is insulated.

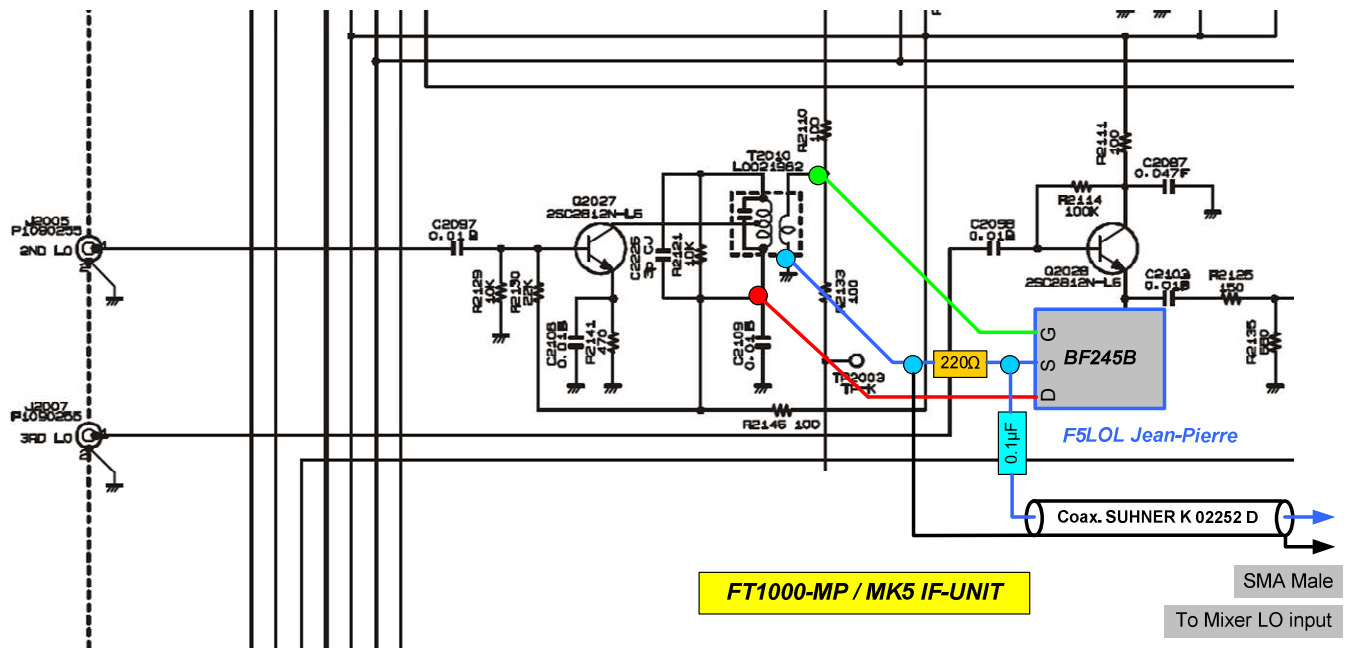


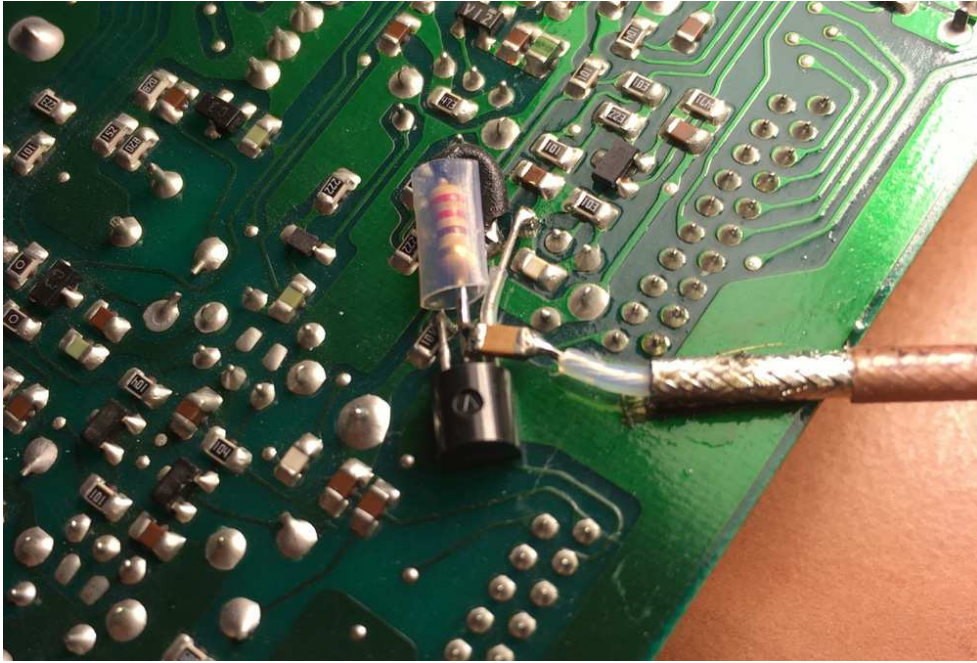
The RF-UNIT shield must be modified for routing the coaxial cable to the mixer.

2nd LO TAP

The 2nd LO signal is picked after amplification directly at the output of T2010 on the IF-UNIT. A JFET BF245B is used in source follower mode to feed the double shielded coaxial cable connected to the mixer.

After modification, T2010 (FT1000-MP or FT-1000 MK5) will be retuned if necessary.

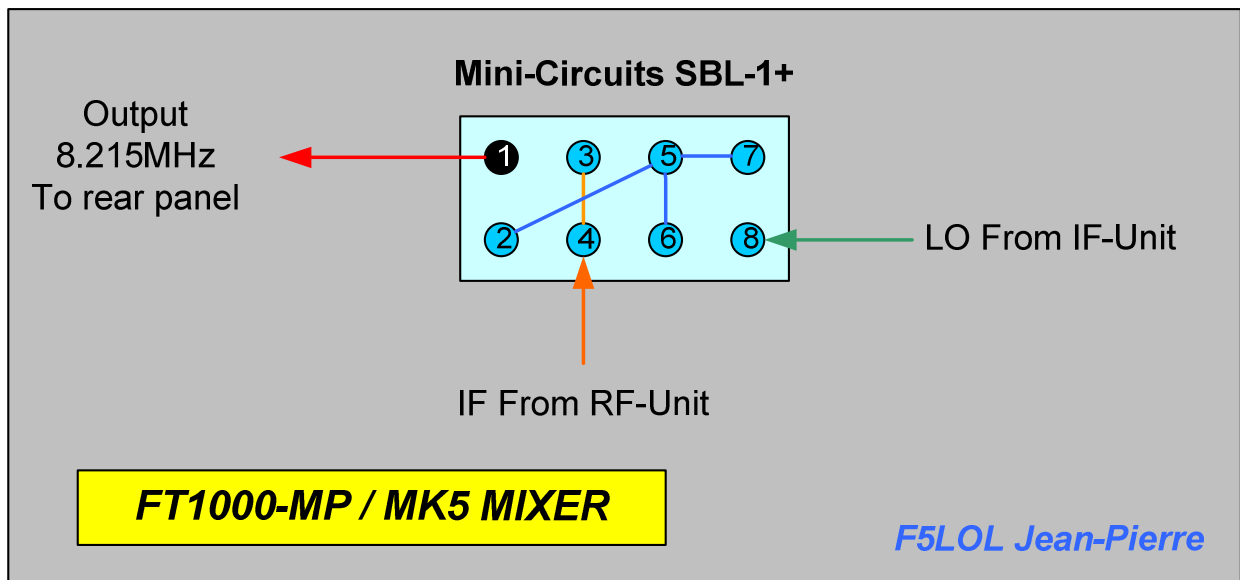




FT1000-MP / MK5 IF-UNIT

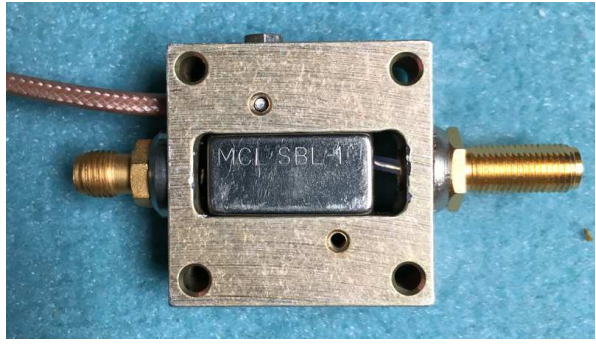
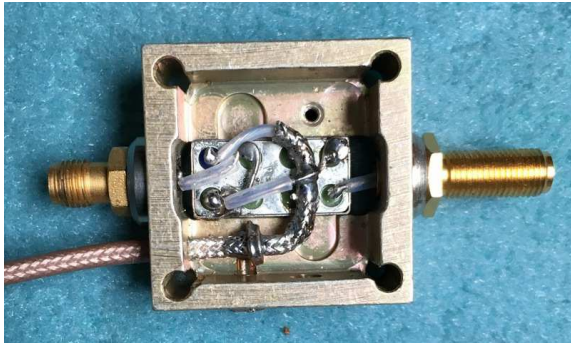
The JFET is mounted like for the RF-UNIT.

MIXER



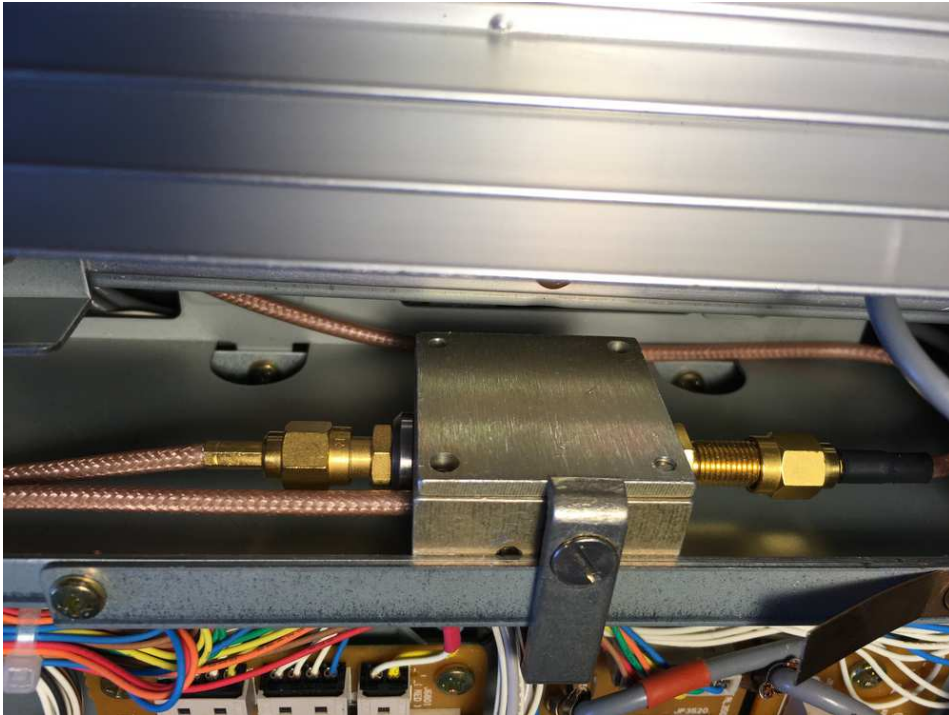
The SBL-1 mixer works fine even with the LO level lower than the +7dBm specification.

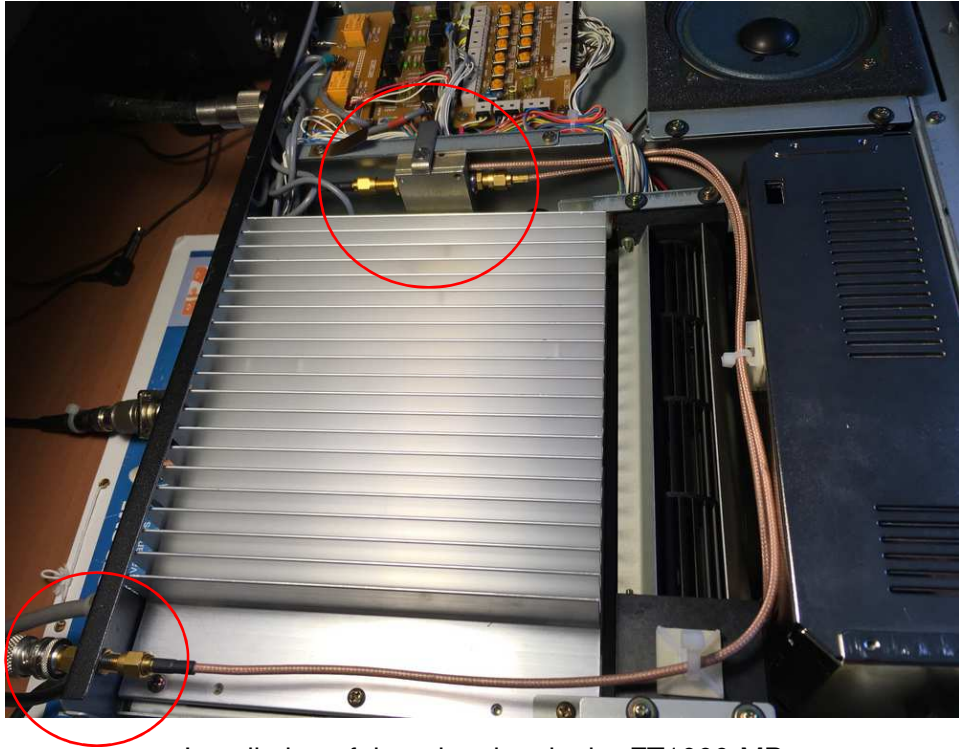
The mixer is installed in an old Mini-Circuits ZFL-1000 enclosure. An extra hole is drilled to give access to the double shielded Output coaxial cable. All the connectors are SMA type. After cabling, the 2 covers are fixed, and the mixer is completely shielded.



INSTALLATION IN THE FT1000-MP

An SMA transition is installed in the up right corner of the FT1000-MP, connected to the output of the mixer. The mixer box is attached like the pictures below.



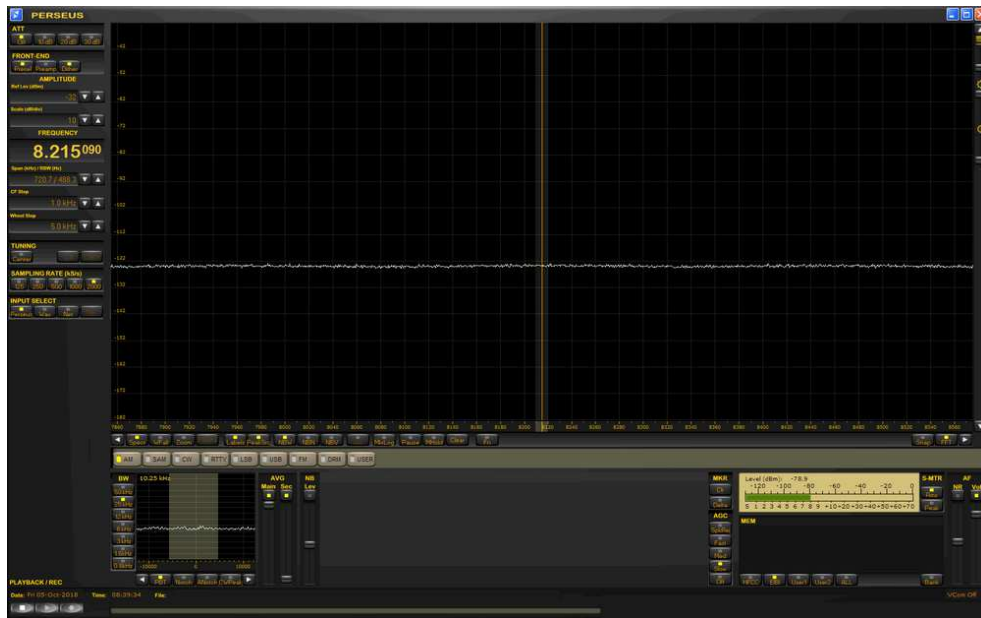


Installation of the mixer box in the FT1000-MP

TESTS

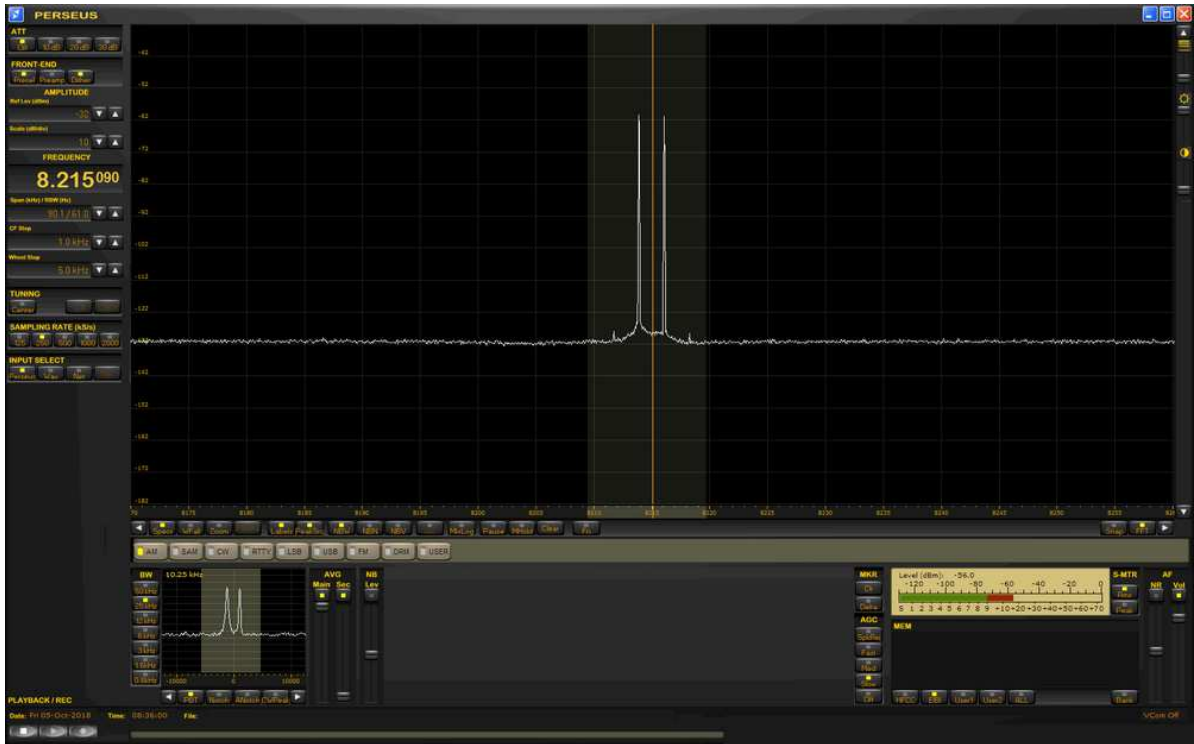
1_FT1000-MP antenna disconnected

No spurious present in 1MHz bandwidth, the noise floor is perfectly flat.



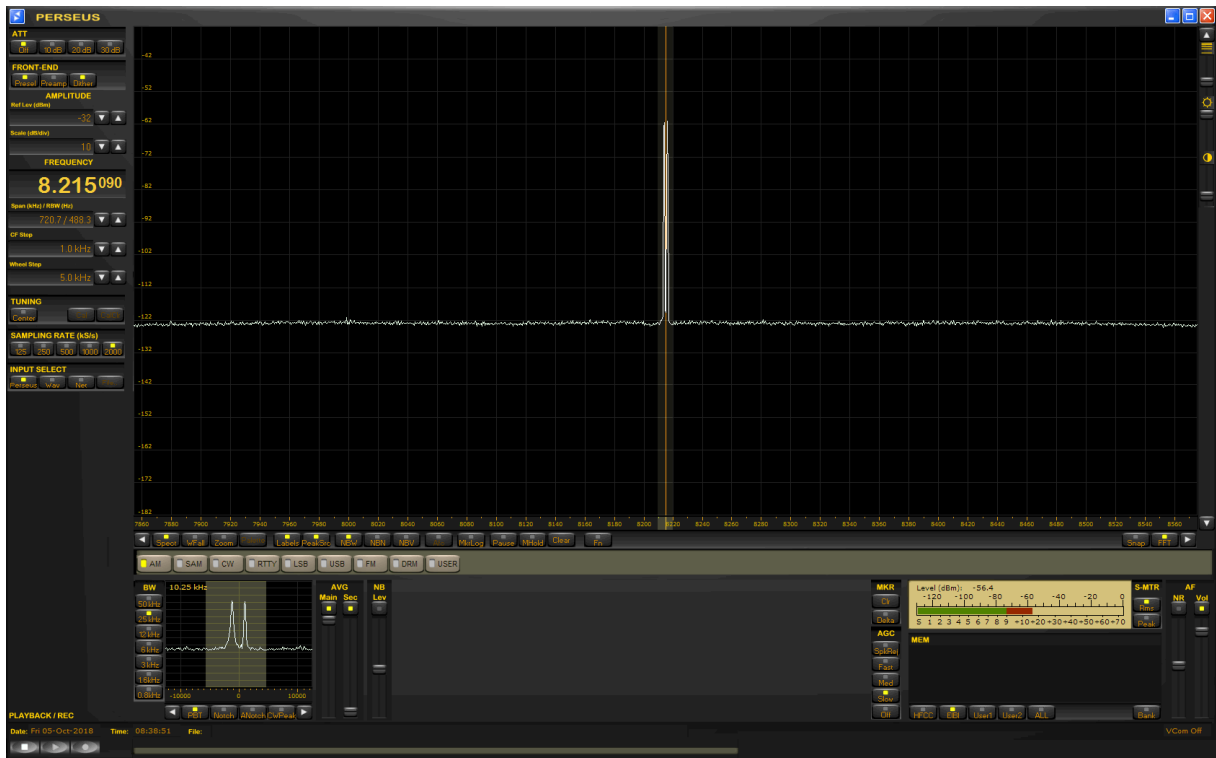
2_TWO CARRIERS S9+20dB, 5KHz spacing / IPO ON (FLAT or TUNED)

The level S9+20 corresponds to the starting of IM3 on the panadapter output. We can see the intermodulations level at -70dBc.



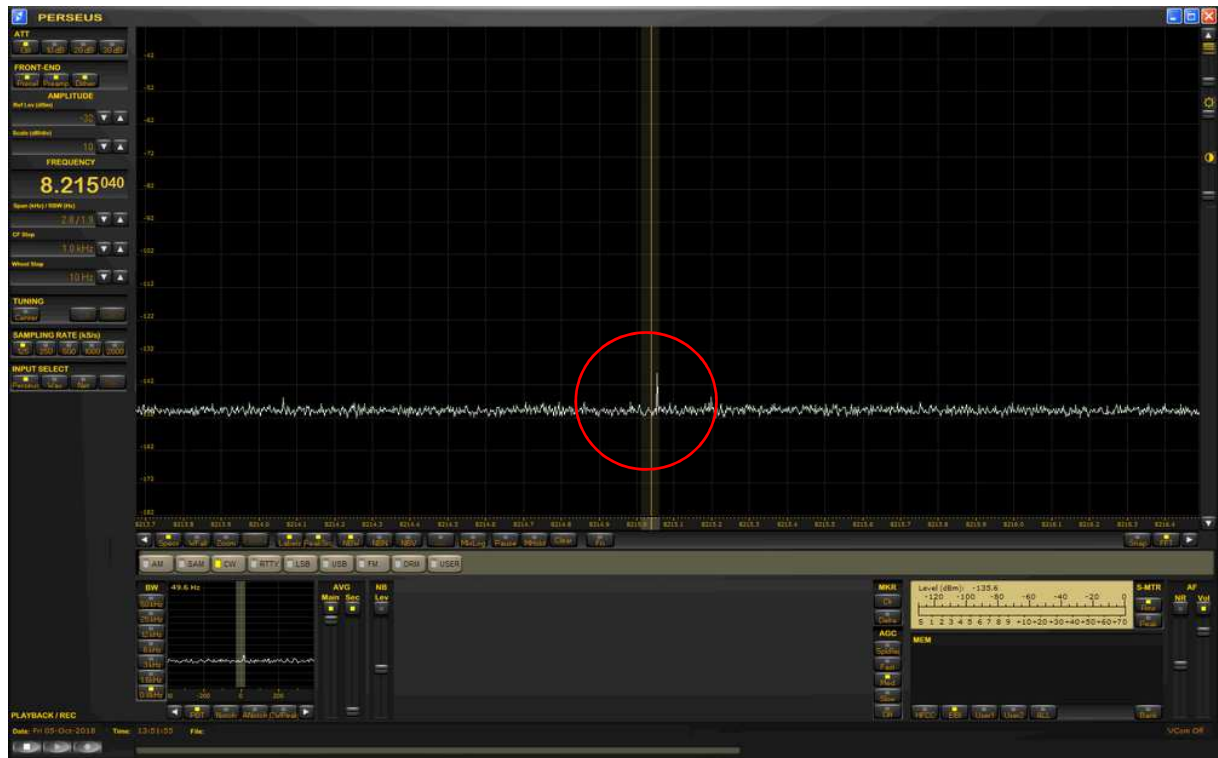
3_TWO CARRIERS S9+20dB / 5KHz spacing / IPO ON / 1MHz bandwidth

There are no spurious in the band.



4_ONE CARRIER 28MHz / -135dBm / IPO OFF/ TUNED

Even a so weak signal (-135dBm) can be seen with the panadapter above the noise floor.



CONCLUSIONS

The PERSEUS as panadapter is the right choice. The installation in the FT1000-MP or MK5 as described by F5LOL in this paper gives very good results and it is very pleasant to use.

It is possible to use an RTLdongle as the AIRSPSY HF+ tuned at 132.695MHz instead of the PERSEUS at 8.215MHz but the result is not so pleasant to use particularly in CW because the image and the audio are not in synchronism. The spectrum of the AIRSPSY HF+ isn't free of interferences when the antenna is disconnected.