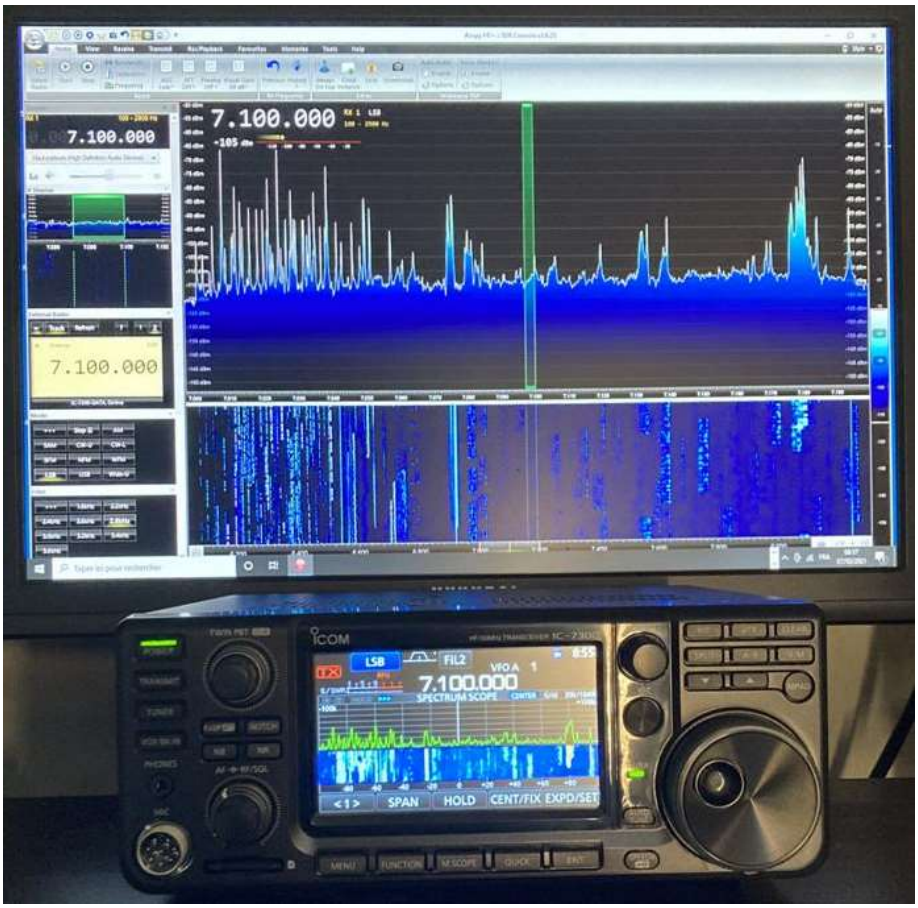
IC 7300 SMART PANADAPTER INTERFACE by F5LOL



ABSTRACT

Many people complain about the lack of the possibility to connect a large display or a SDR receiver to the ICOM IC-7300.

The IC-7300 has no RX2 output, but fortunately it is possible to have access to the main board RF input after the preselector filters and LNA/Attenuator.

Some “on the shelf interfaces” are available at relatively high price. They need to modify the tuner output connector.

The purpose of this smart interface is quite the same, without external modifications or drilling in the cabinet.

SPECIFICATIONS OF THE SMART PANADAPTER INTERFACE

No degradation of the IC 7300 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 spurious in 1MHz bandwidth when the antenna is disconnected.

Output frequency between 1 and 60 MHz

Installation must be easily reversible.

Needs few components only, easy to find.

SCHEMATIC

Figure 1 shows the solution used to avoid any drilling in the die cast cabinet: we use the “SEND” output connector normally used to make the PTT of a linear amplifier. This out put is connected to the NO contacts of the PTT relay via a choke coil and to the GND of the IC 7300.

During reception the contacts are open and the output RF signals are sent to the external receiver.

During transmission the contacts are closed and the output is connected to the ground via the ferrite bead EP102_MPZ2012S601A (600Ω at 100MHz), so the signal can be monitored even during the PTT command.

To avoid any loading of the RF at J1431 connection, we use a JFET BF245B in common drain impedance adapter.

The RF signals are “sniffed” directly on J1431; the corresponding pad is directly connected to the gate of the BF245B with an input impedance close to 50KΩ.

The output is picked directly on the source of the BF245B via 100nF and routed to the SEND connector thanks to a thin coax cable. To prevent against possible high voltage coming from the linear relay in case of PTT, two 1N1711 schottky diodes are connected between source and ground.

Keying a linear amplifier remains possible using a bias tee.

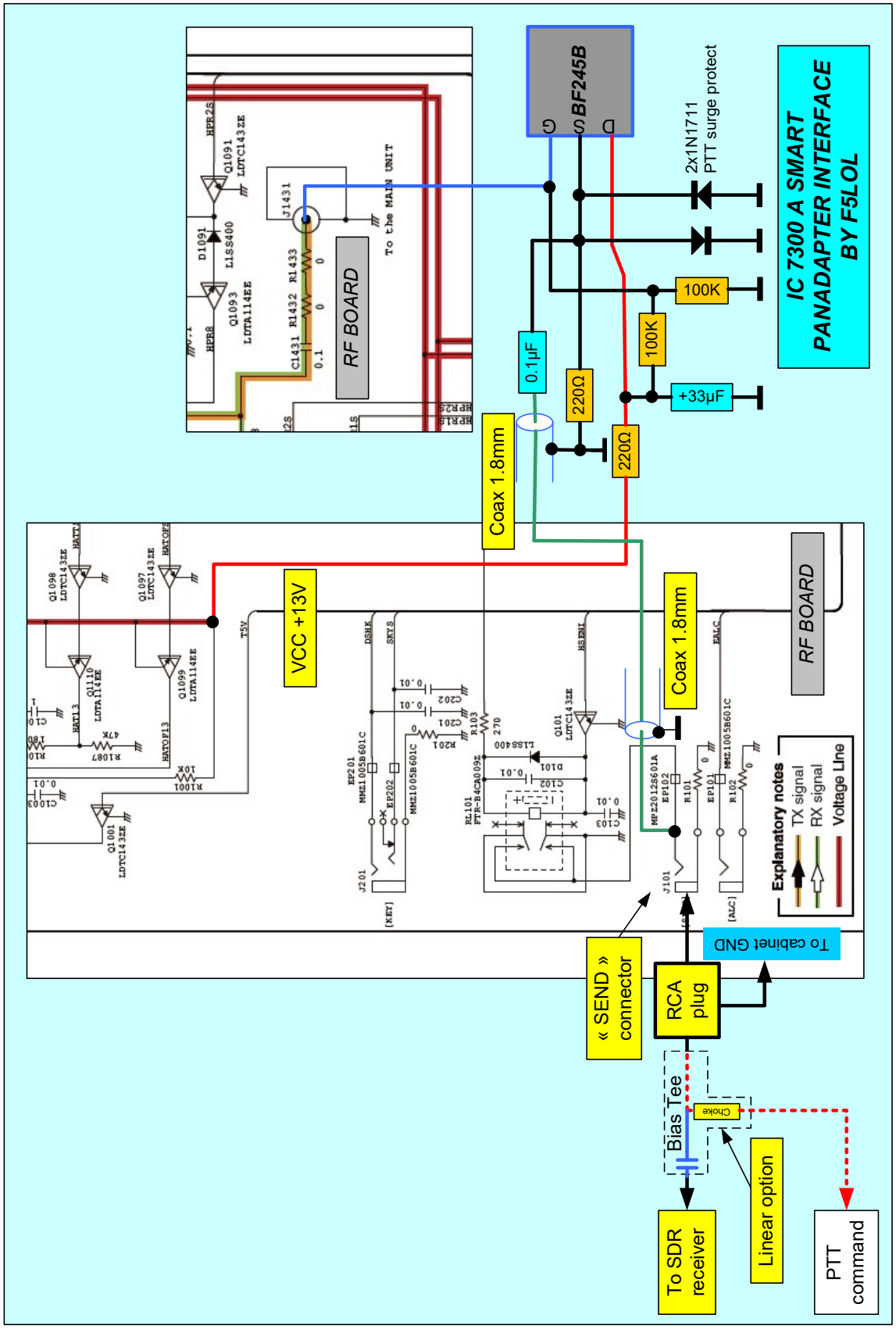

IC 7300 A SMART
PANADAPTER INTERFACE
BY F5LOL
BF245B
G
D
2x1N1711
PTT surge protect
100K
100K
+33µF
0.1µF
220Ω
220Ω
Coax 1.8mm
RF BOARD
To the MAIN UNIT
VCC +13V
Coax 1.8mm
RF BOARD
Explanatory notes
TX signal
RX signal
Voltage Line
To cabinet GND
« SEND »
connector
RCA
plug
Bias Tee
Choke
To SDR
receiver
Linear option
PTT
command

Fig. 1

REALISATION

A brass spacer is installed on the RF board (Figure 2)

The components are soldered on a small PC board (Figure 3); the board is fixed on the spacer making the GND connection. The whole installation is shown on the Figure 4.

Fig. 2

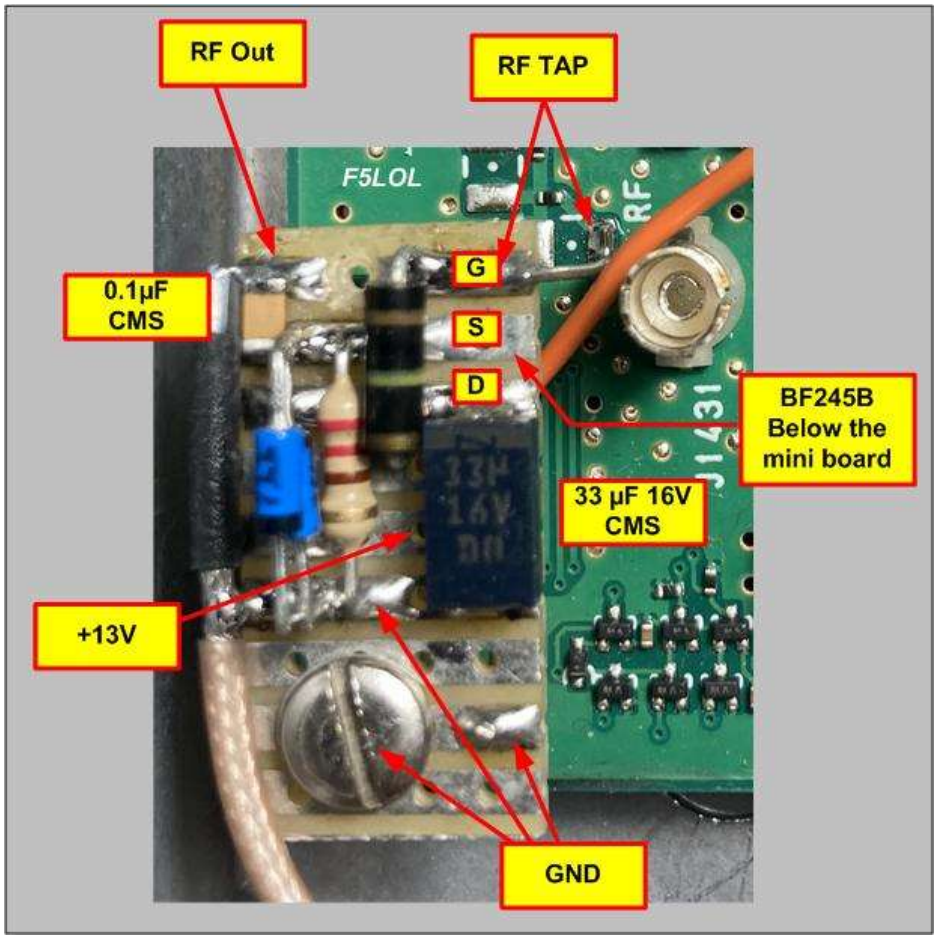


Fig. 3

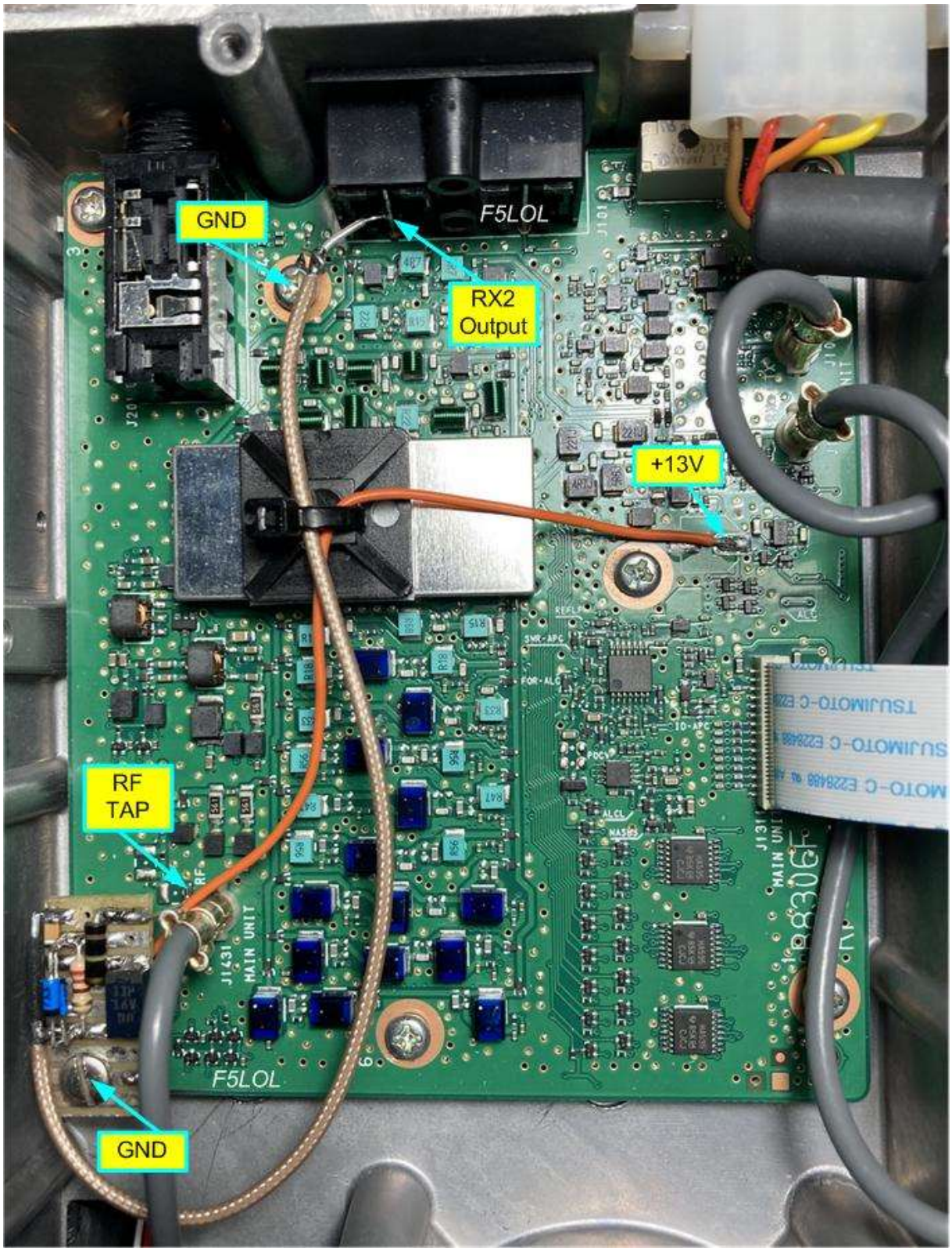


Fig. 4

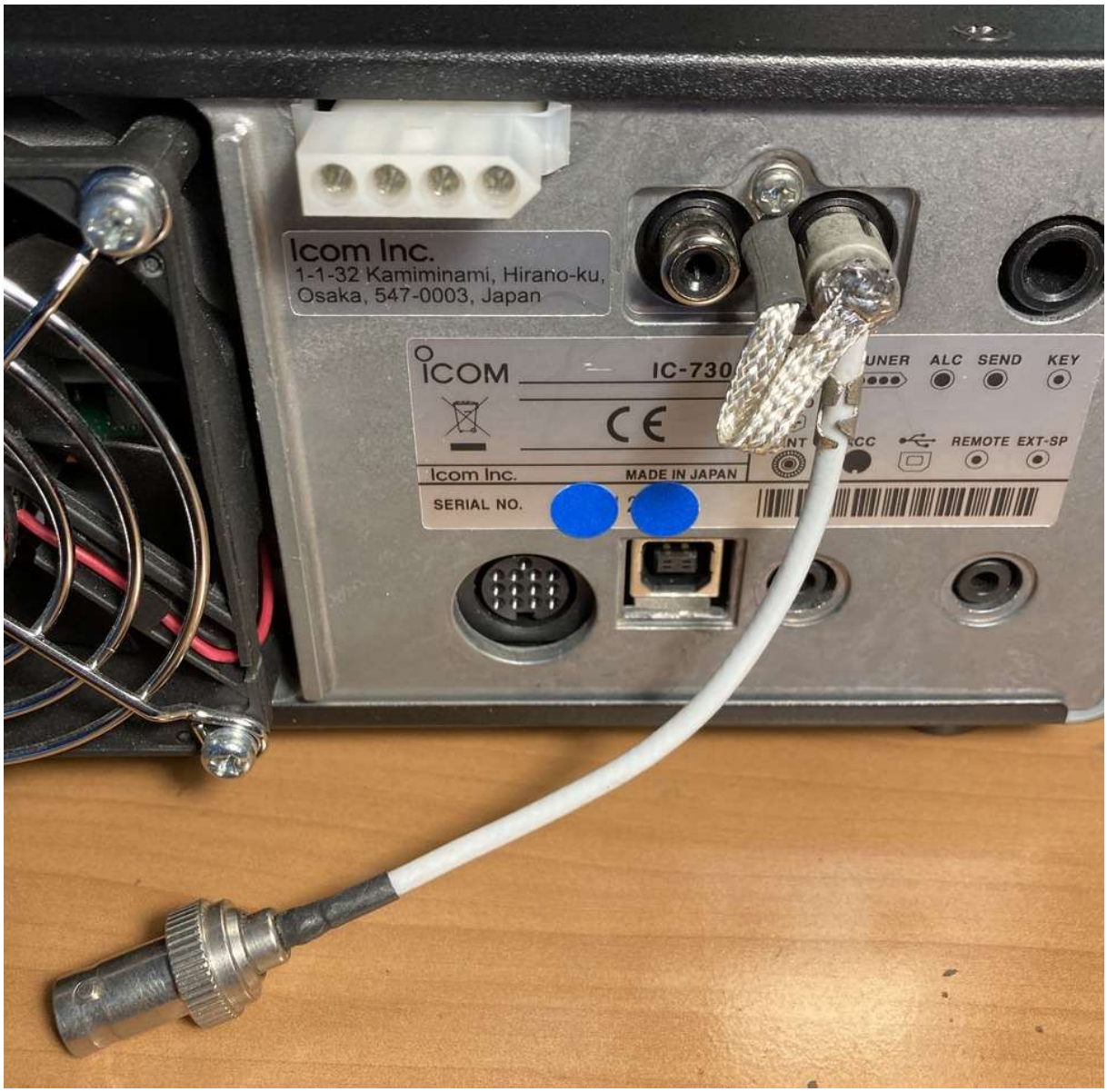


Fig. 5

Figure 5 shows the coaxial cable jumper connected to the SEND connector. The shield of the cable is grounded to the cabinet giving a better ground contact to avoid possible spurious received by the external receiver or entering the IC 7300.

If a PTT command is needed, it is possible to connect a bias tee or similar, to the BNC connector.

TRANSMISSION TEST FROM ANTENNA TO PANADAPTER

The paths from the antenna input of the IC-7300 to the RF board output (J1431) or to the SEND connector are swiped with the spectrum analyzer and its trigger generator. The traces are recorded in max hold mode while the IC-7300 is tuned between 10KHz and 70MHz. The LNA is off.

The Figure 6 gives the result. The two traces are similar. We see that the output of the interface follows the antenna input with 3 to 4 dB difference; this is not an issue because the external receiver will keep the same C/N ratio.

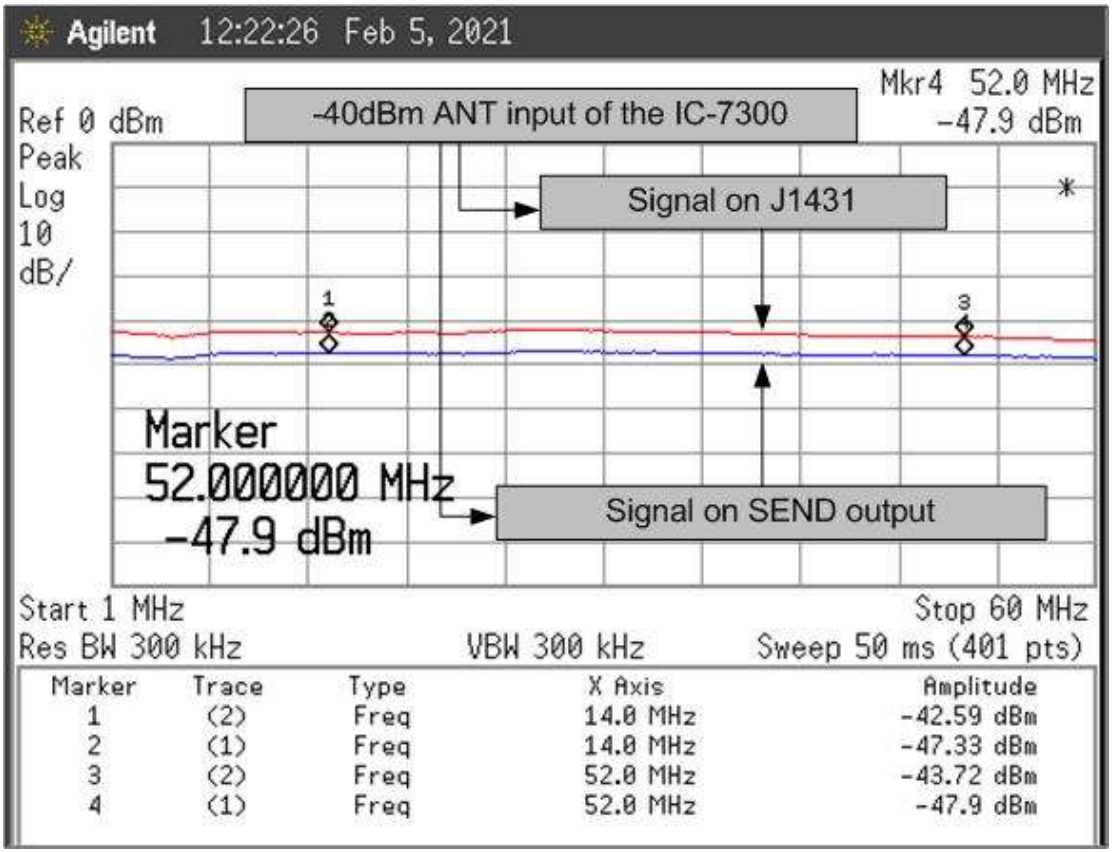


Fig. 6

Conclusion:

The IC 7300 and the interface use the same input circuits:

antenna connector → attenuator → preselector filters → LNA → J1431

Figure 6 shows that the interface does not modify the transmission but adds only few dB attenuation when the LNA is OFF. This attenuation doesn't matter with the SDR receivers because (except for the PERSEUS) they give relative level values of the signal. The attenuation doesn't modify the C/N ratio and the antenna noise level is always higher than the RX noise floor. For higher bands the LNA1 or LNA2 could be activated if necessary.

INTERMODULATION TEST USING THE PERSEUS SDR

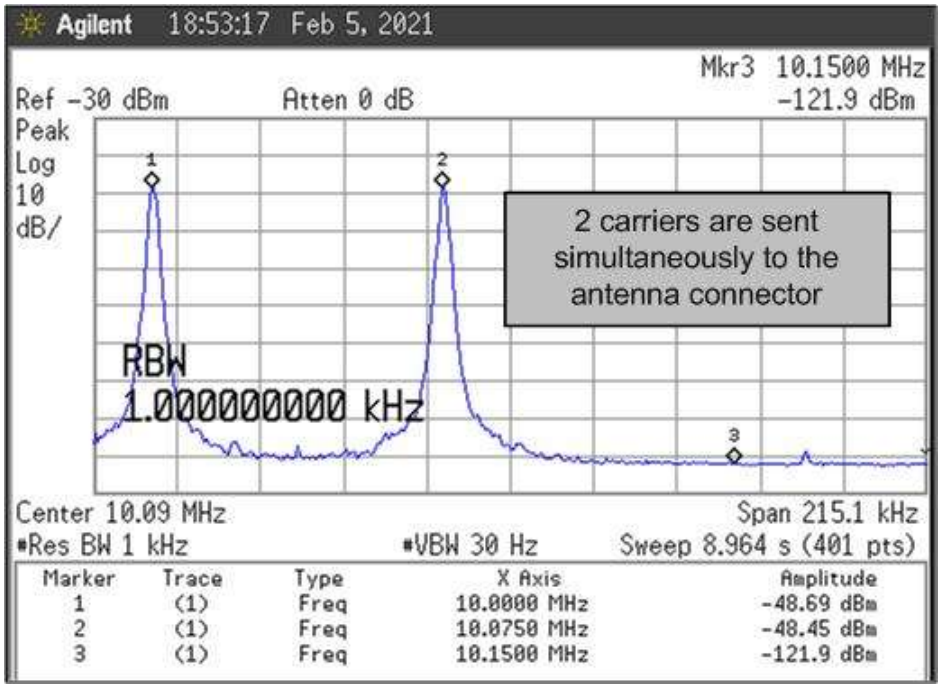


Fig. 7

Two RF generators (10.000 MHz and 10.075 MHz) are mixed with a 3dB coupler and sent to the antenna input of the IC 7300. The carriers have a level of -48dBm (S9 + 25dB) as shown on figure 7.

During the test the LNA and the attenuator of the IC 7300 are OFF.

Figure 8: The PERSEUS SDR receiver is connected to the interface through the SEND connector and only the 10.000 MHz generator is ON:

- The noise floor level is -135dBm and perfectly flat and no spurious are generated by the IC 7300 and/or the interface.

Figure 9: The PERSEUS SDR receiver is connected to the interface via the SEND connector and the two generators are ON:

- We see the two carriers at 10.000 MHz and 10.075 MHz with a level of -56dBm. One 3rd order inter modulation is present at 9.925 MHz with a level of -132dBm i.e.-76 dBc.

Figure 10: in parallel of the PERSEUS tests, the IC 7300 receives the same two carriers and the inter modulations are below the noise floor (LNA is OFF); the IC 7300 is not disturbed by the interface and the sensitivity remains the same w/o the interface. The displays of the IC 7300 and the PERSEUS are similar.

Conclusion: this interface does not modify the RX specs of the IC 7300 and it is very strong against intermodulation with a IM3 level of -76dBc when two S9+25dB signals are present in the band.

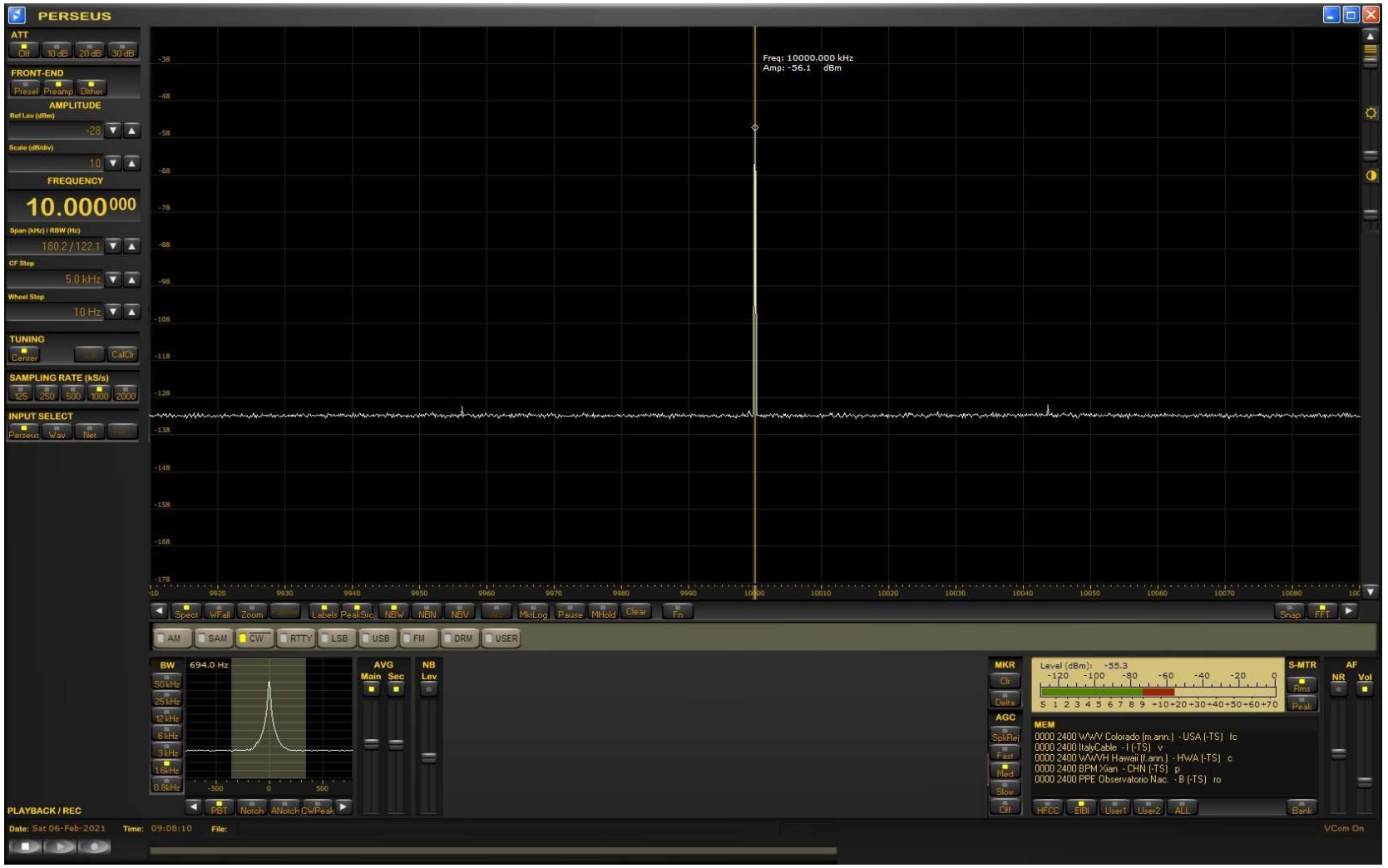

PERSEUS
ATT
Off
10 dB
20 dB
30 dB
FRONT-END
Presel
Preamp
Dither
AMPLITUDE
Ref Lev (dBm)
-28
Scale (dB/div)
10
FREQUENCY
10.000000
Span (kHz) / RBW (Hz)
180.2 / 122.1
CF Step
5.0 kHz
Wheel Step
10 Hz
TUNING
Center
CalClr
SAMPLING RATE (kS/s)
125
250
500
1000
2000
INPUT SELECT
Perseus
Wav
Net
Freq: 10000.000 kHz
Amp: -56.1 dBm
Spect
wFall
Zoom
Labels
PeakSrc
NBW
NBN
NBV
MkrLog
Pause
MHold
Clear
Fn
Snap
FFT
AM
SAM
CW
RTTY
LSB
USB
FM
DRM
USER
BW
694.0 Hz
50 kHz
25 kHz
12 kHz
6 kHz
3 kHz
1.8 kHz
0.8 kHz
PBT
Notch
ANotch
CWPeak
AVG
Main
Sec
NB
Lev
MKR
Clr
Delta
AGC
Spl/Rej
Fast
Med
Slow
Off
Level (dBm): -55.3
S-MTR
Rms
Peak
AF
NR
Vol
MEM
0000 2400 WWV Colorado (m.ann.) - USA (-TS) fc
0000 2400 ItalyCable - I (-TS) v
0000 2400 WWVH Hawaii (f.ann.) - HWA (-TS) c
0000 2400 BPM Xian - CHN (-TS) p
0000 2400 PPE Observatorio Nac. - B (-TS) ro
HFCC
ElBl
User1
User2
ALL
Bank
PLAYBACK / REC
Date: Sat 06-Feb-2021
Time: 09:08:10
File:
VCom On

Fig. 8

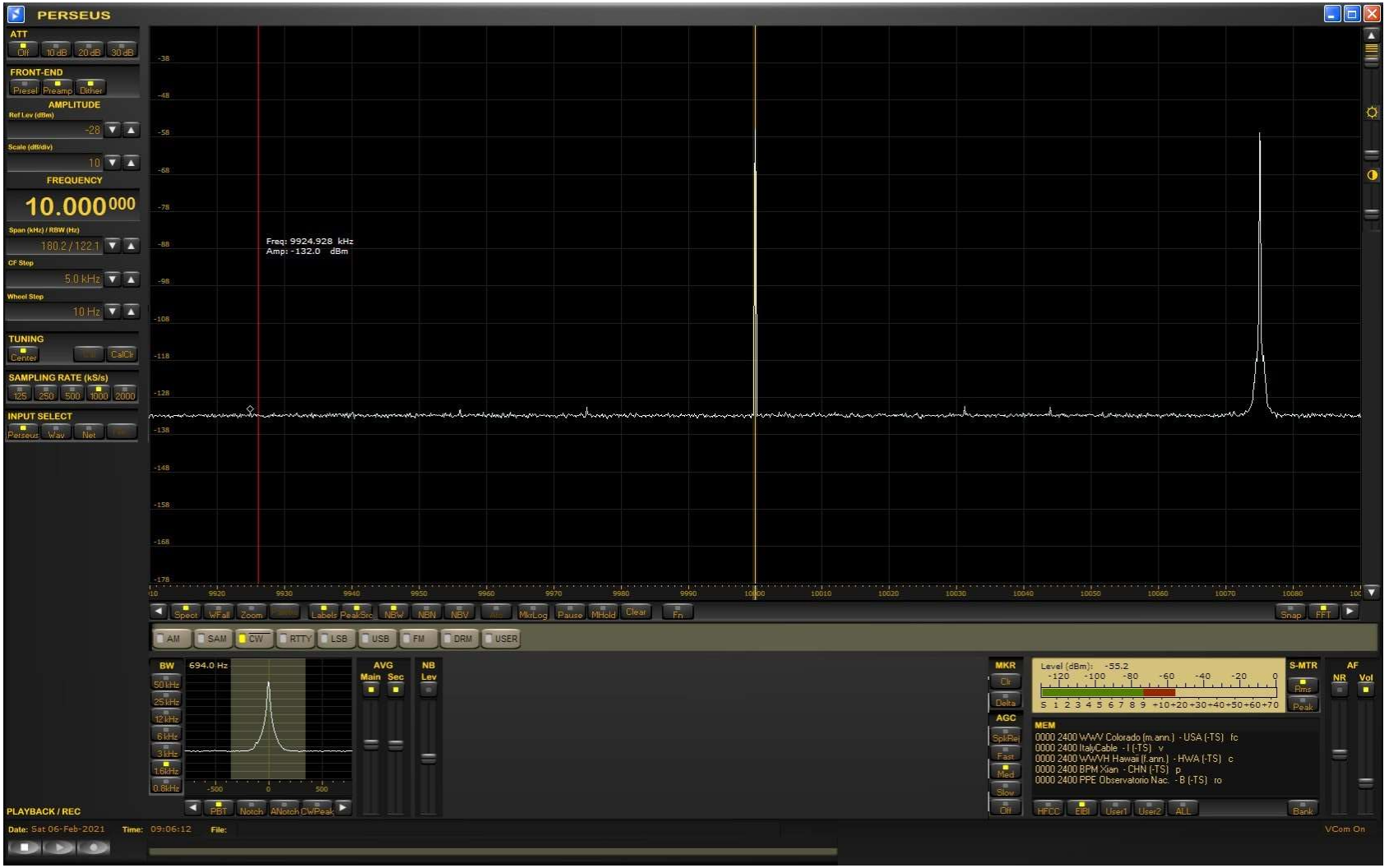

PERSEUS
ATT
Off
10 dB
20 dB
30 dB
FRONT-END
Presel
Preamp
Dither
AMPLITUDE
Ref Lev (dBm)
-28
Scale (dB/div)
10
FREQUENCY
10.000000
Span (kHz) / RBW (Hz)
180.2 / 122.1
CF Step
5.0 kHz
Wheel Step
10 Hz
TUNING
Center
CalClr
SAMPLING RATE (kS/s)
125
250
500
1000
2000
INPUT SELECT
Perseus
Wav
Net
Freq: 9924.928 kHz
Amp: -132.0 dBm
Spect
wFall
Zoom
Labels
PeakSrc
NBW
NBN
NBV
MkrLog
Pause
MHold
Clear
Fn
Snap
FFT
AM
SAM
CW
RTTY
LSB
USB
FM
DRM
USER
BW
694.0 Hz
50 kHz
25 kHz
12 kHz
6 kHz
3 kHz
1.6kHz
0.8kHz
AVG
Main
Sec
NB
Lev
PBT
Notch
ANotch
CWPeak
MKR
Clr
Delta
AGC
Spl/Rej
Fast
Med
Slow
Off
Level (dBm): -55.2
S-MTR
Rms
Peak
AF
NR
Vol
MEM
0000 2400 WWV Colorado (m.ann.) - USA (-TS) fc
0000 2400 ItalyCable - I (-TS) v
0000 2400 WWVH Hawaii (t.ann.) - HWA (-TS) c
0000 2400 BPM Xian - CHN (-TS) p
0000 2400 PPE Observatorio Nac. - B (-TS) ro
HFCC
ETBI
User1
User2
ALL
Bank
PLAYBACK / REC
Date: Sat 06-Feb-2021
Time: 09:06:12
File:
VCom On

Fig. 9

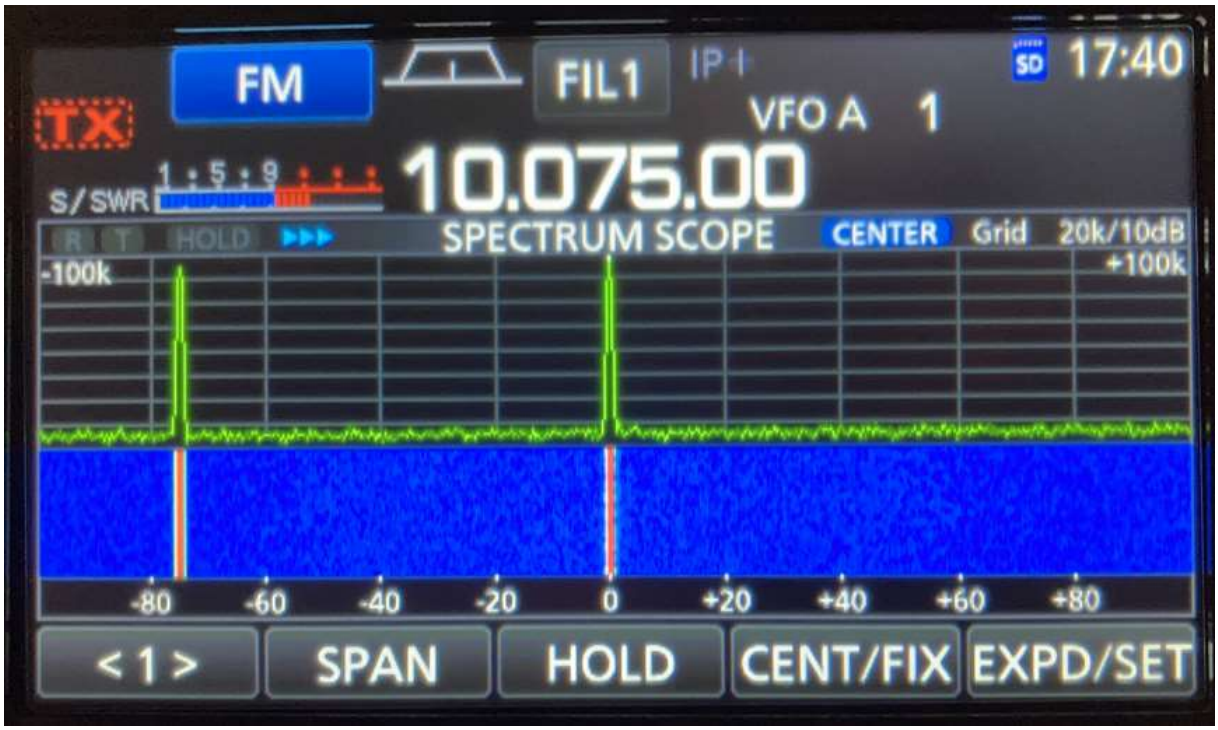


Fig. 10

-130dBm SENSITIVITY TEST

For the sensitivity test, the RF generator sends a -130dBm carrier to the IC 7300.

The test is performed with the PERSEUS and the AIR SPY HF + Discovery.

Figures 11 and 12 show the results. In both cases the signal is 25 to 30dB above the noise floor of the receiver.

This test means that the MDS (Minimum Discernible Signal) with the panadapter is lower than -130dBm.

-130dBm SENSITIVITY TEST USING THE PERSEUS

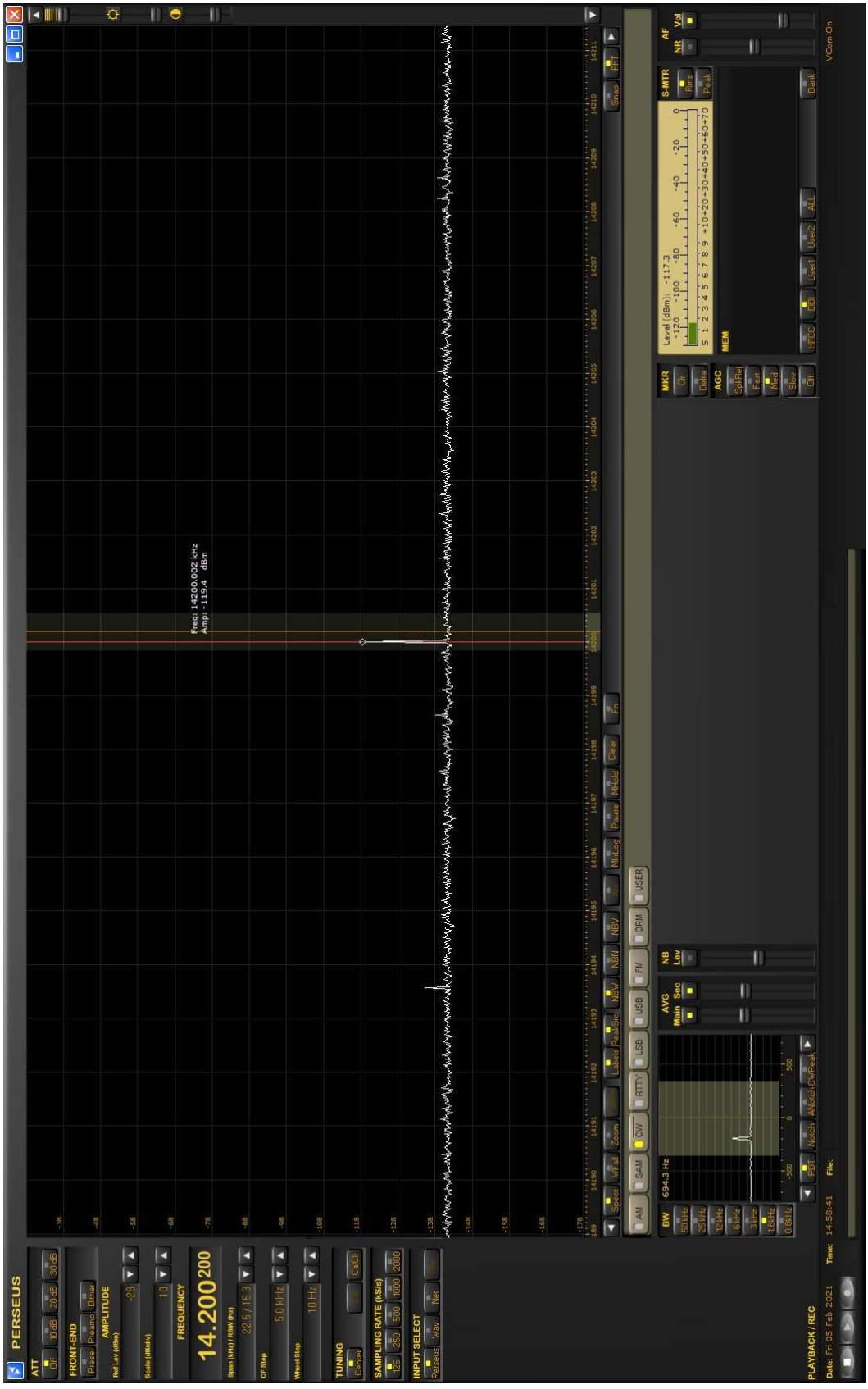


Fig. 11

-130dBm SENSITIVITY TEST USING THE "AIR SPY HF+ DISCOVERY" SDR

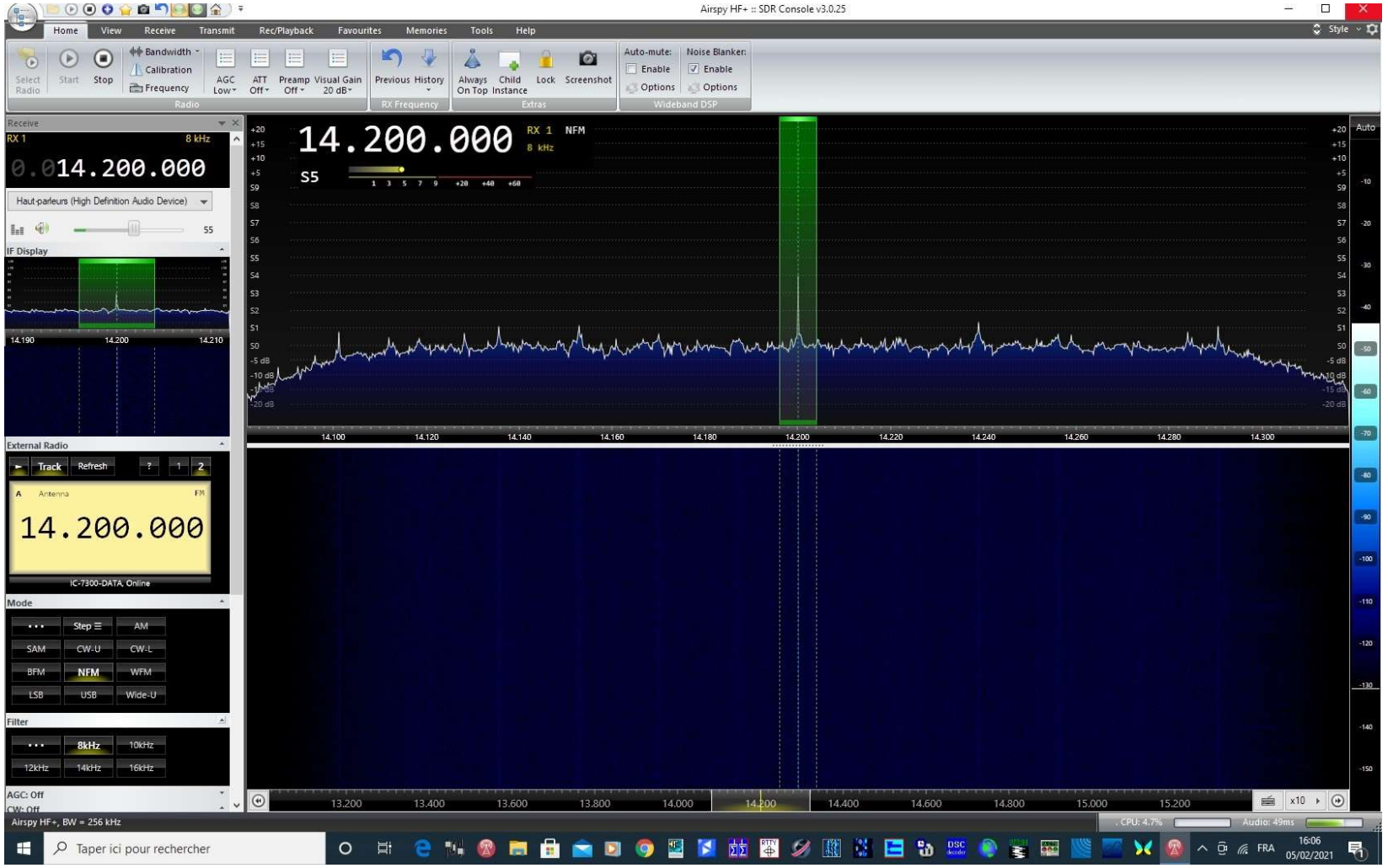

Airspy HF+ :: SDR Console v3.0.25
Home
View
Receive
Transmit
Rec/Playback
Favourites
Memories
Tools
Help
Style
Select Radio
Start
Stop
Bandwidth
Calibration
Frequency
AGC Low
ATT Off
Preamp Off
Visual Gain 20 dB
Radio
Previous
History
RX Frequency
Always On Top
Child Instance
Lock
Screenshot
Extras
Auto-mute:
Enable
Options
Noise Blanker:
Enable
Options
Wideband DSP
Receive
RX 1
8 kHz
0.014.200.000
Haut-parleurs (High Definition Audio Device)
55
IF Display
14.190
14.200
14.210
External Radio
Track
Refresh
A
Antenna
FM
14.200.000
IC-7300-DATA, Online
Mode
Step
AM
SAM
CW-U
CW-L
BFM
NFM
WFM
LSB
USB
Wide-U
Filter
8kHz
10kHz
12kHz
14kHz
16kHz
AGC: Off
CW: Off
14.200.000
RX 1
NFM
8 kHz
S5
Auto
14.100
14.120
14.140
14.160
14.180
14.200
14.220
14.240
14.260
14.280
14.300
13.200
13.400
13.600
13.800
14.000
14.200
14.400
14.600
14.800
15.000
15.200
x10
Airspy HF+, BW = 256 kHz
CPU: 4.7%
Audio: 49ms
Taper ici pour rechercher
FRA
16:06
05/02/2021

Fig. 12

TEST ON ANTENNA USING THE “AIR SPY HF+ DISCOVERY”

Figure 13 is an example of the panadapter used with the antenna connected to the IC 7300. The whole 7MHz band can be monitored.

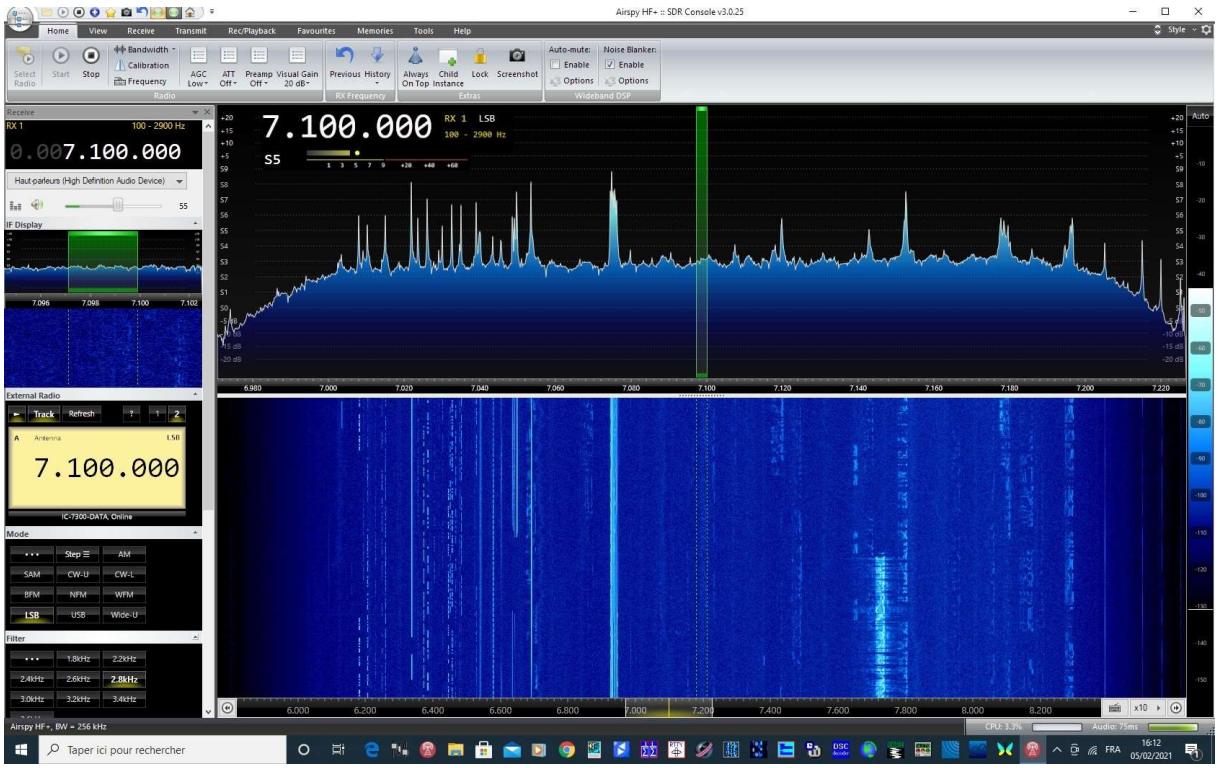


Fig. 13

CONCLUSIONS

This description aims to give a low-cost alternative to the “on the shelf” IC 7300 panadapter interfaces. In needs only 3 soldering points on the RF board and no drilling in the die cast cabinet. It is completely reversible. It doesn’t degrade the performances of the IC 7300.

Used with a SDR receiver, it is possible to monitor a larger span than the IC 7300 and more accurate.

Used with Omni Rig, the panadapter RX can track the IC 7300 and some settings of the IC 7300 can be sent by the panadapter directly.

The modification will be made at his own risk and without incurring the responsibility of the author.