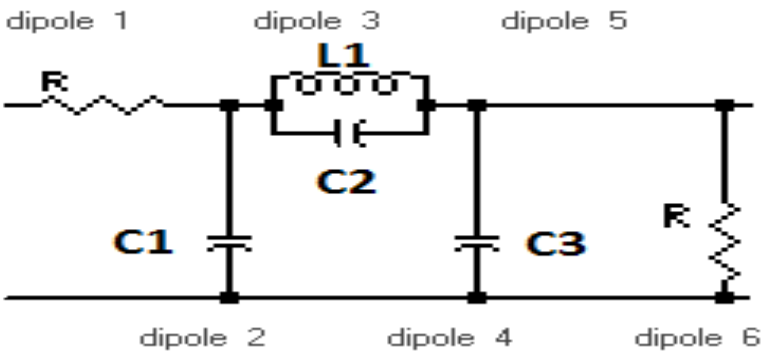
Avala-01 Mixer Low Pass Filter

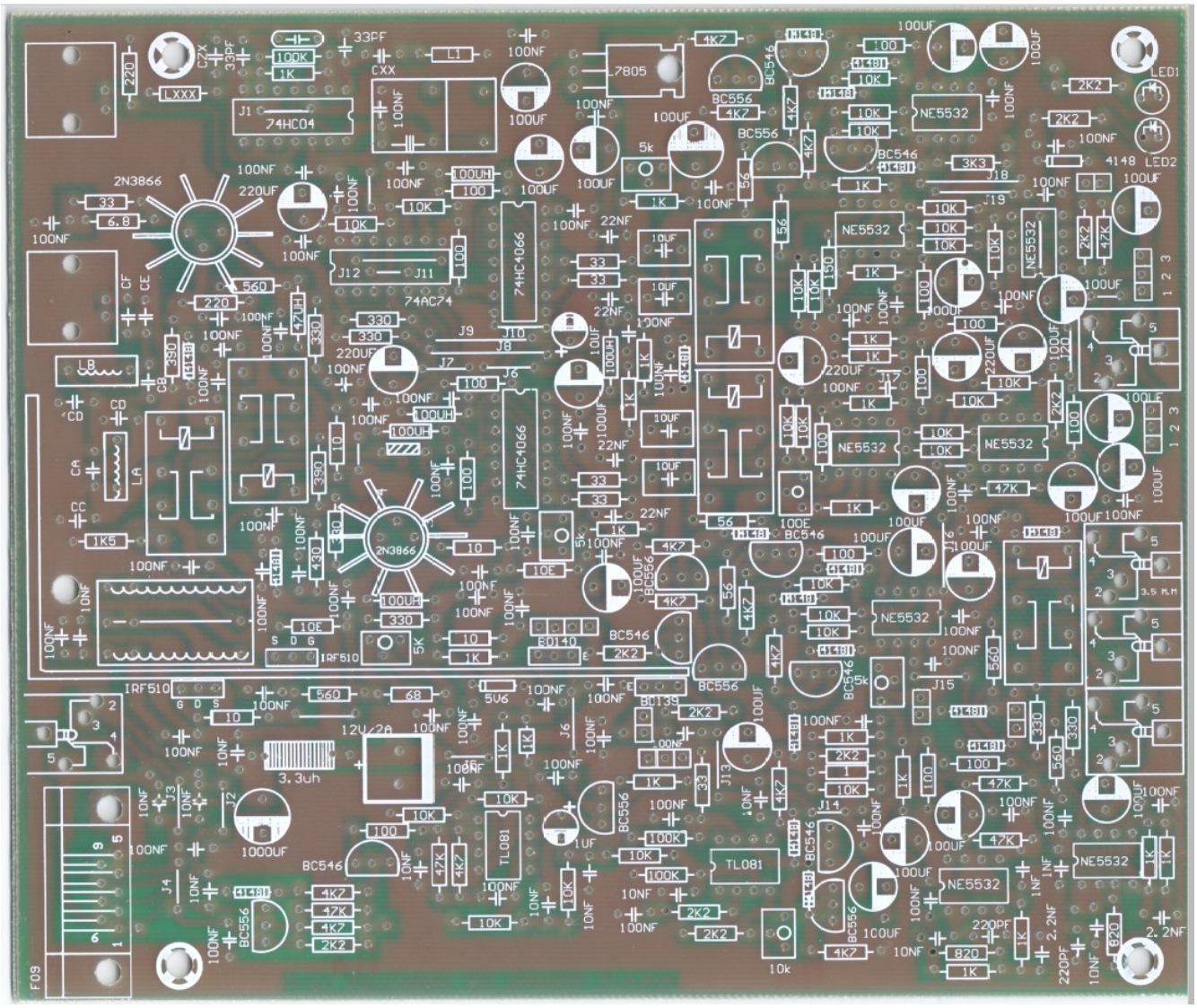


Band	C1, C3	C2	L1	Measured Inductance Using AADE Meter	L1 Turns on T25 Toroid
160M	2800pF	160pF	3.3uH	3.5uH	32 Turns #32 wire
80M	820pF	150pF	1.4uH	1.8uH	22 Turns #32 wire
60M	820pF	100pF	1.2uH	1.28uH	19 Turns #28 wire
40M	820pF	68pF	.83uH	.82uH	15 Turns #28 wire
30M	560pF	68pF	.57uH	.57uH	14 Turns #28 wire
20M	330pF	56pF	.4uH	.44uH	12 Turns #28 wire
17M	300pF	22pF	.34uH	.37uH	11 Turns #28 wire
15M	180pF	22pF	.32uH	.36uH	11 Turns #28 wire
12M	180pF	22pF	.27uH	.26uH	9 Turns #28 wire
10M	180pF	22pF	.2uH	.21uH	8 Turns #28 wire

T25-2
T25-6
Tested

Avala-01 Operating Instructions

Receiver Set Up



Revisions

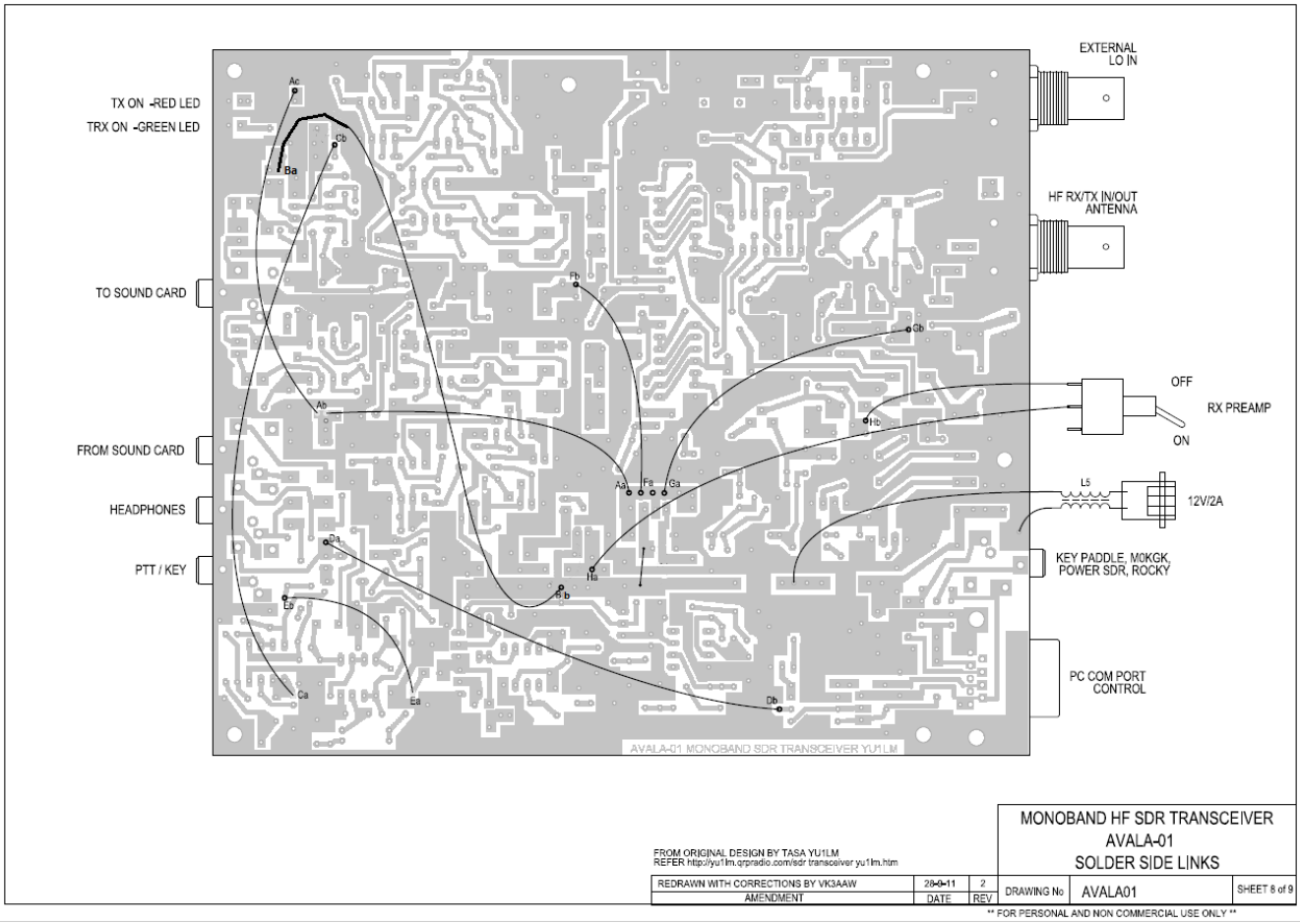
Contents

Chapter 1

1. Multimeter
2. Signal generator or another radio capable of transmit on desired frequency

Chapter 2

First lets make sure the Avala-01 interconnect wires are connected correctly. Look at the picture below.

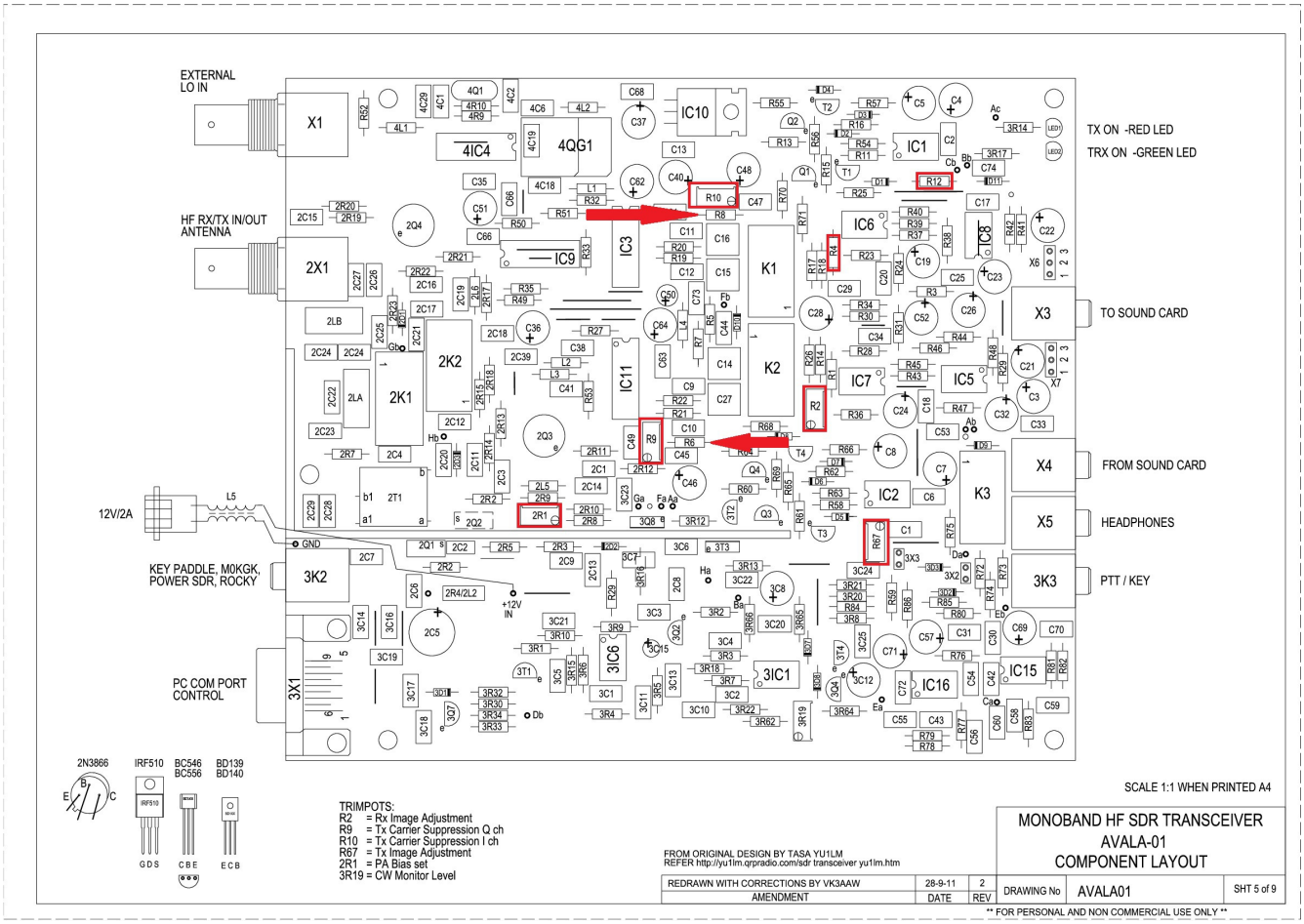


Connect sound card input to X3(to sound card). Place jumpers on X6(pins 1,2) and X7(pins2,3). This is the lower of the two settings for a +23db gain.

Connect serial cable to 3X1 port(DB9 connector)

Chapter 3

The next steps I take are to preset some of the trimmers. Look at picture below.



Measure across R4 with ohm meter and record reading. Then measure between pins 2 and 7 of IC7. Adjust R2 trimmer to match reading from R4.

Measure resistance across R12 and record reading. Then measure from pin1 on IC16 to pin 2 of IC2. Adjust trimmer R67 to match reading on R12.

Connect 12-13.8V power to Avala-01.

Now we need to adjust R9 and R10 to be close to equal voltage. Measure volts at each arrow in picture and adjust R9 and R10 to make them equal. You will need to go back and forth because one affects the other. Volts should be between 2.4-2.5V.

Lets jump to Software setup so we can test the receiver function.

Chapter 4

For RX testing we have several options of software that I have tested.

HPSDR
SDR Sharpe
GSDR
Power SDR V2.4.4

I will Start with GSDR because it is the only one that is capable of transmission when using a mono band Avala-01

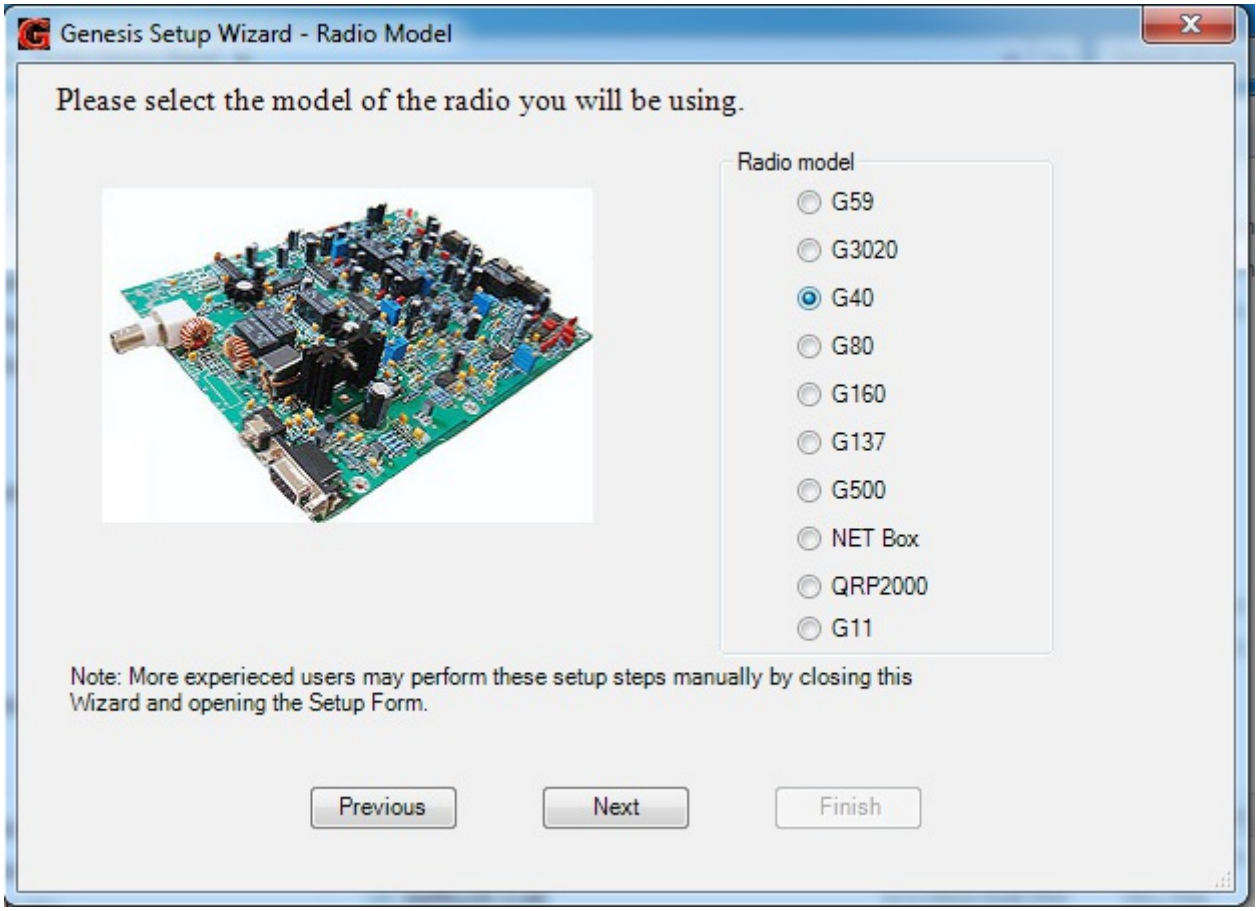
Go here GSDR Down load and download the file GSDR install.zip. Extract this to your computer. Then download the latest update. Currently it is GSDR update 21022014 and extract to computer. Now we have two folders. Open the update folder and copy all the files and then paste into the install folder. When prompted choose overwrite files. This will update the program. When new updates do come out, it is the same process.

After you have the Avala-01 all setup I would copy the database.xml file to another location just in case the program gets corrupted. This will have all of your configuration settings and Image rejection adjustments.

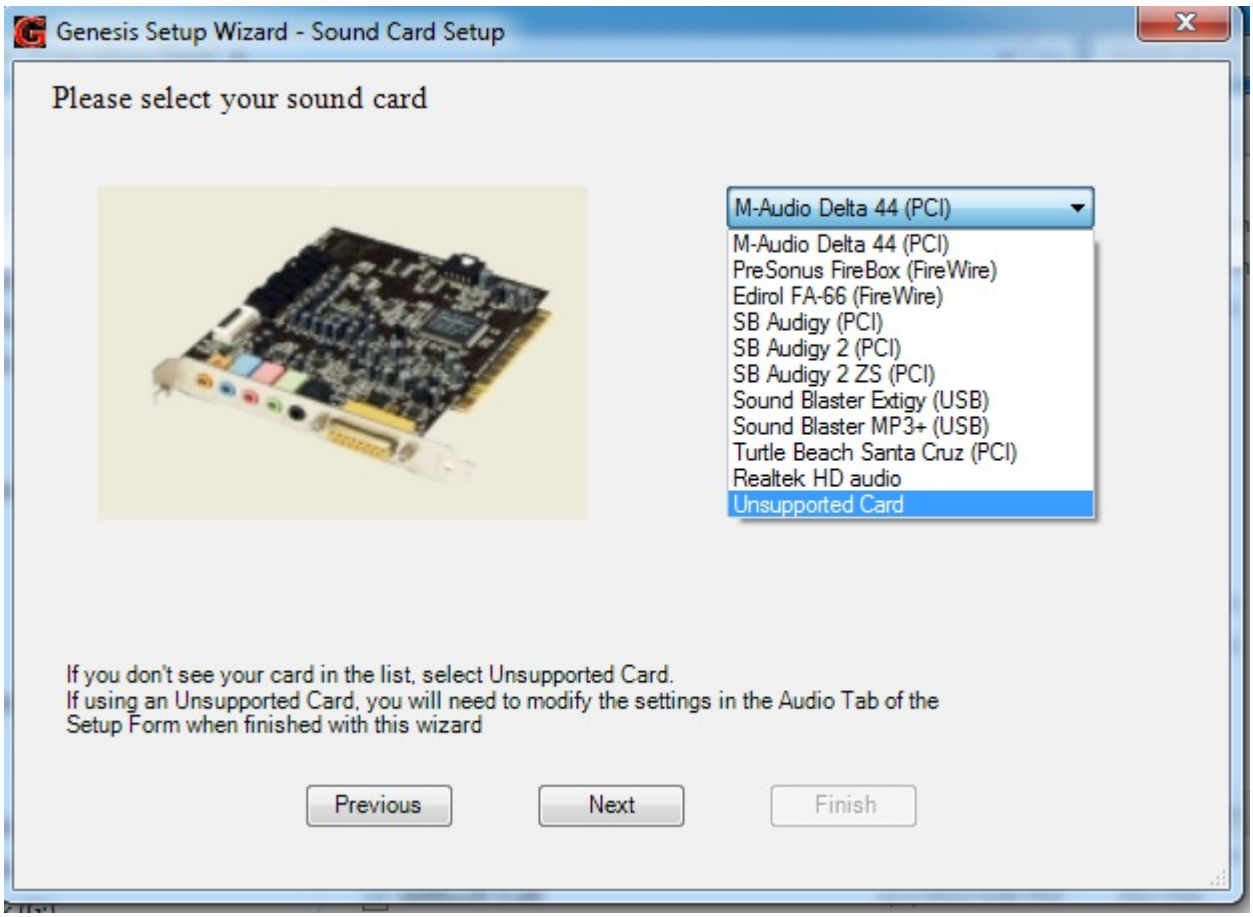
Now double click on Genesis.exe. Don't use GenesisDX.exe.

The first window will be a DOS windows to check FFT speeds. Just click OK and let it run.

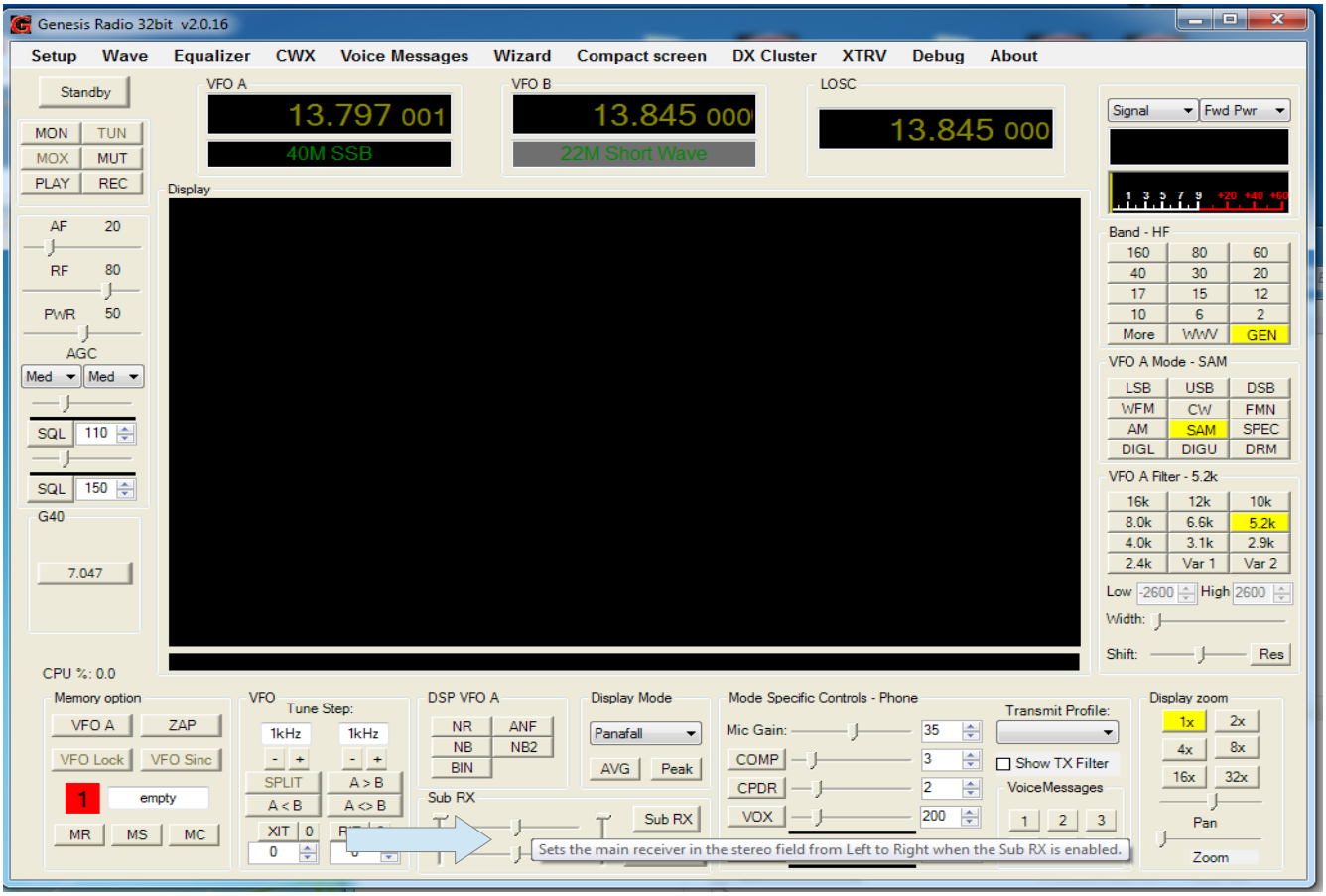
This will be the next window. Select G40



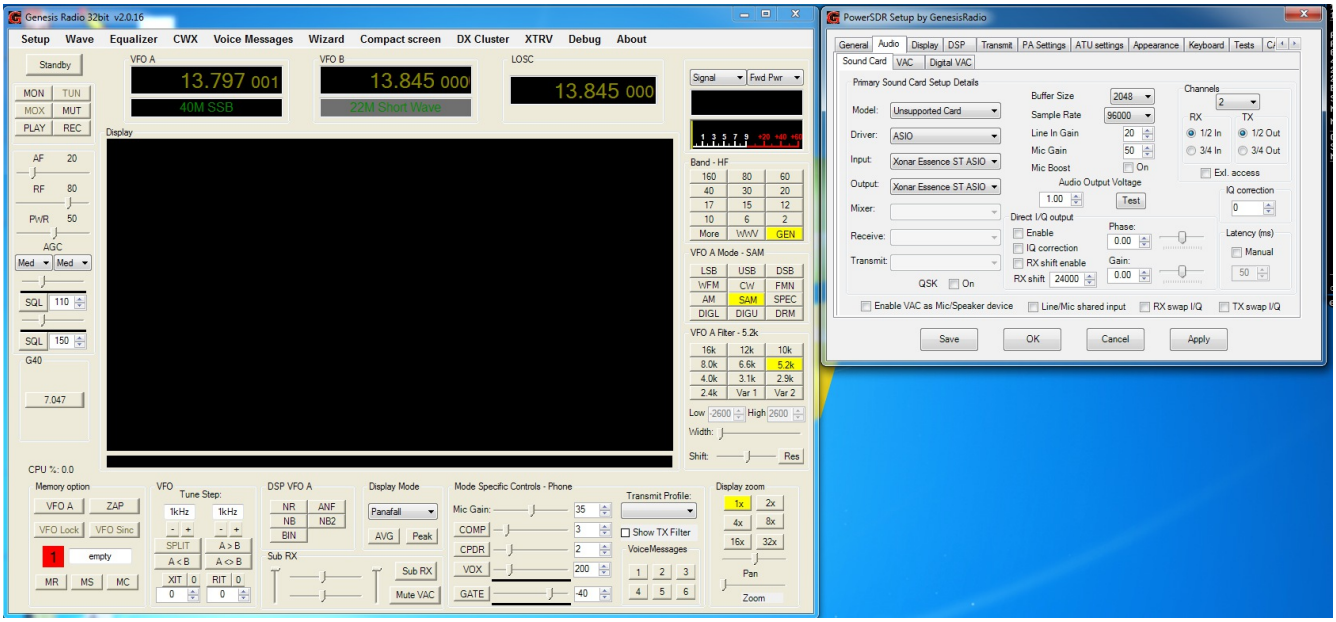
Click Next.



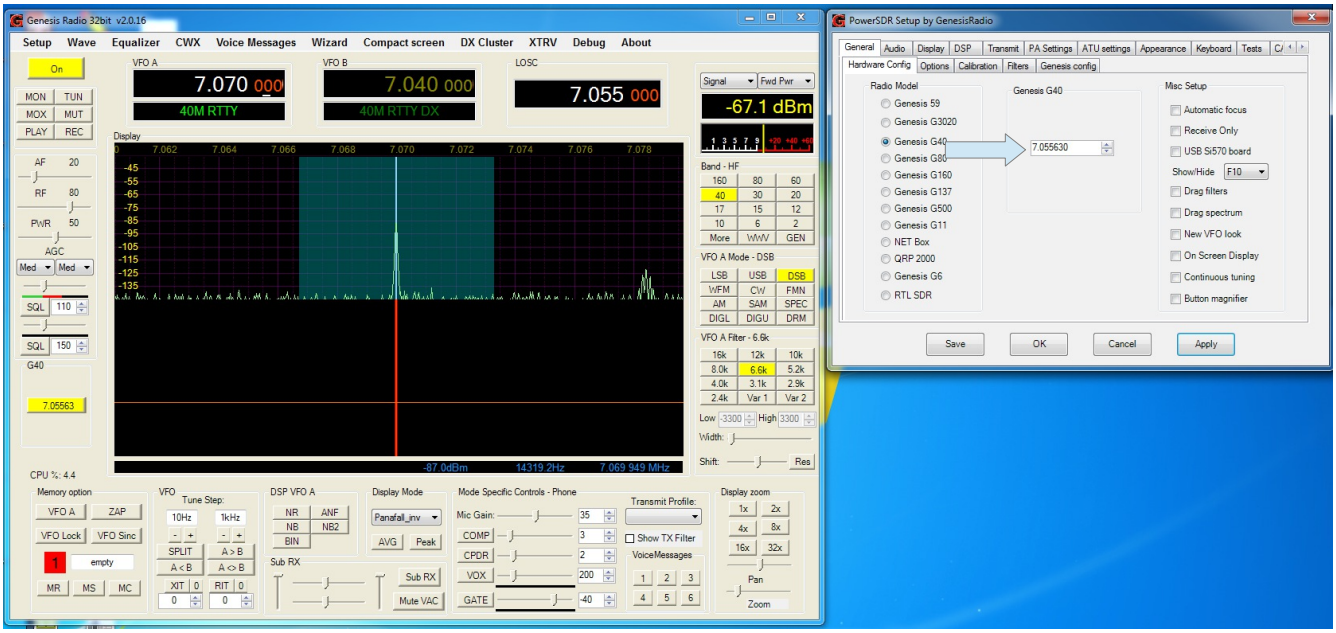
Unless you have one of these legacy sound cards, select “Unsupported Card”



Note the Arrow. Make sure both horizontal sliders are in the middle.



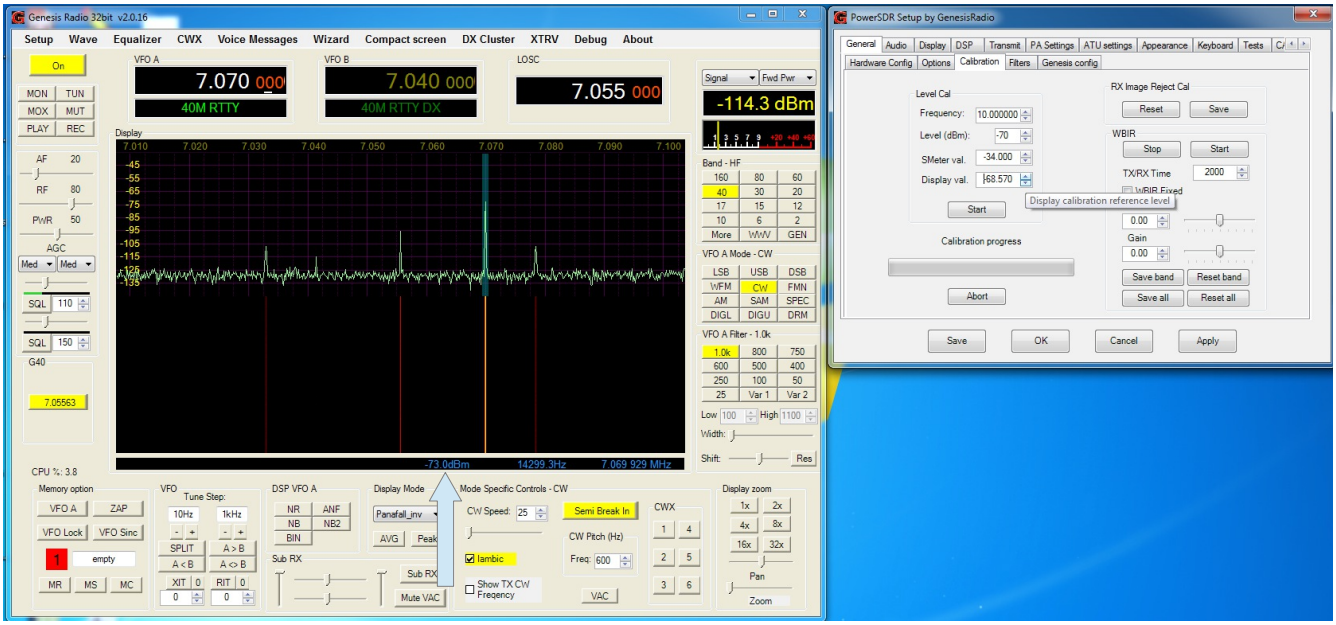
Sound card setup. Select Setting on upper left of main window and then select Audio-->sound card Tab. This will look different depending your sound card. Basically select the driver and your sound card for input and output. Set sample rate and buffer. Leave the rest at default for now.



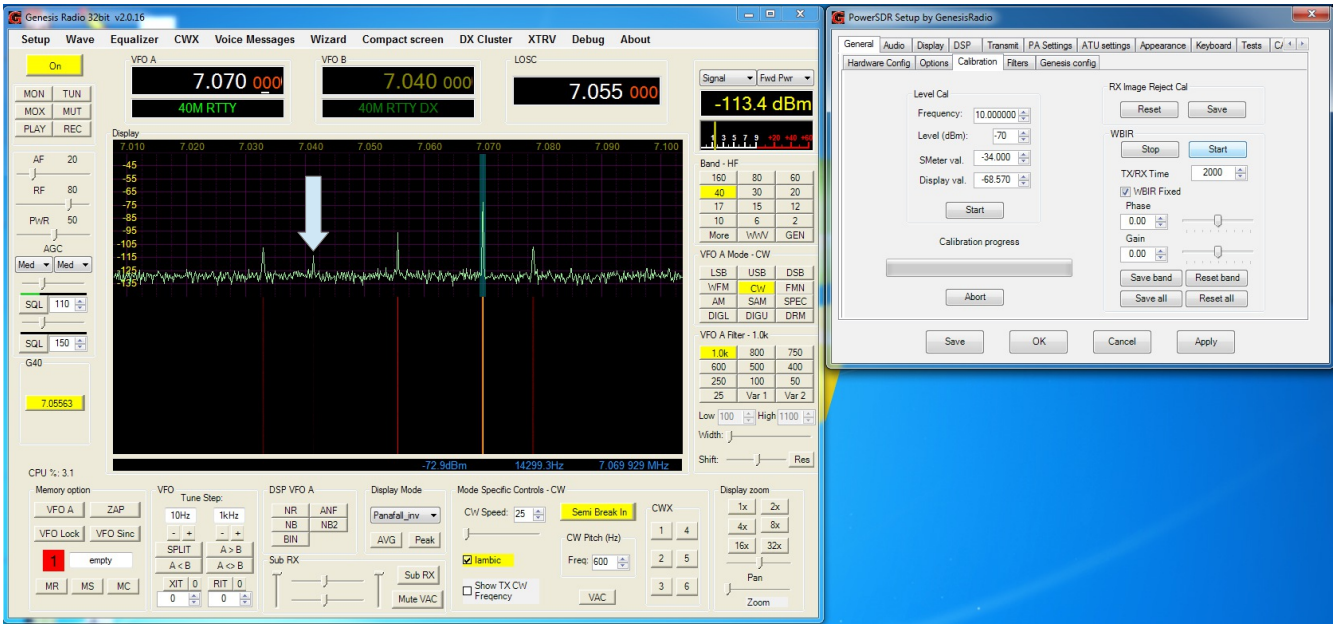
We should now be able to select the power button on upper left, It will change to on and we should see some noise in the display. The level is not calibrated yet so the noise floor may be higher or lower that what you see here.

We need to calibrate the frequency now. First note the arrow. Take your crystal frequency and divide by 4 and enter that into the block. This should be close enough for now.

Now we need a signal source. Using your known signal source, which should be viewable in panadapter. Adjust the crystal frequency up or down in the block to bring the signal to center. I Normally use VFO A mode DSB for this because it has a line in the center. I will also zoom in a little for better resolution. Your signal should look like mine when done. Click Apply.



Level calibration is next. The automatic function does not work with crystal radio. Note the Arrow. This will show the highest signal in the display which should be your signal. If you have a calibrated signal then you need to adjust Display val. Until the signal level is correct. To make it go quicker because the up and down arrows will take a very long time. You can manually enter numbers. I would go up or down by 10 until I get close, then adjust the arrows to get it spot on. Typically the noise floor into dummy load should be -115 to -125 db. If you do not have a calibrated signal level then adjust the noise floor to this level is fine. My sound card is one of the higher end models.

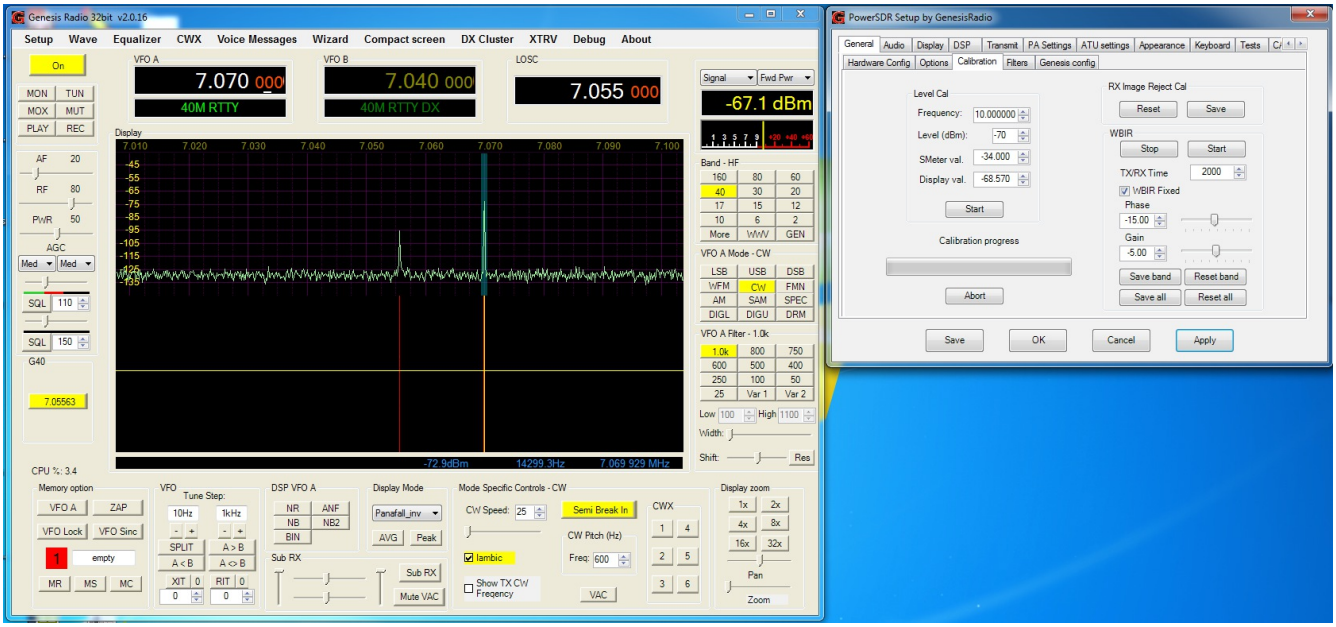


Next is Receive image rejection adjustment. Note the arrow. This is my image. The other 2 images are my florescent lights. On the Calibration TAB select STOP WIBR. First we will adjust R2 on the Avala-01 for the lowest image. You should be able to make image move up and down by turning the trimmer. If your image is the same level as your signal then there is a problem in the audio chain.

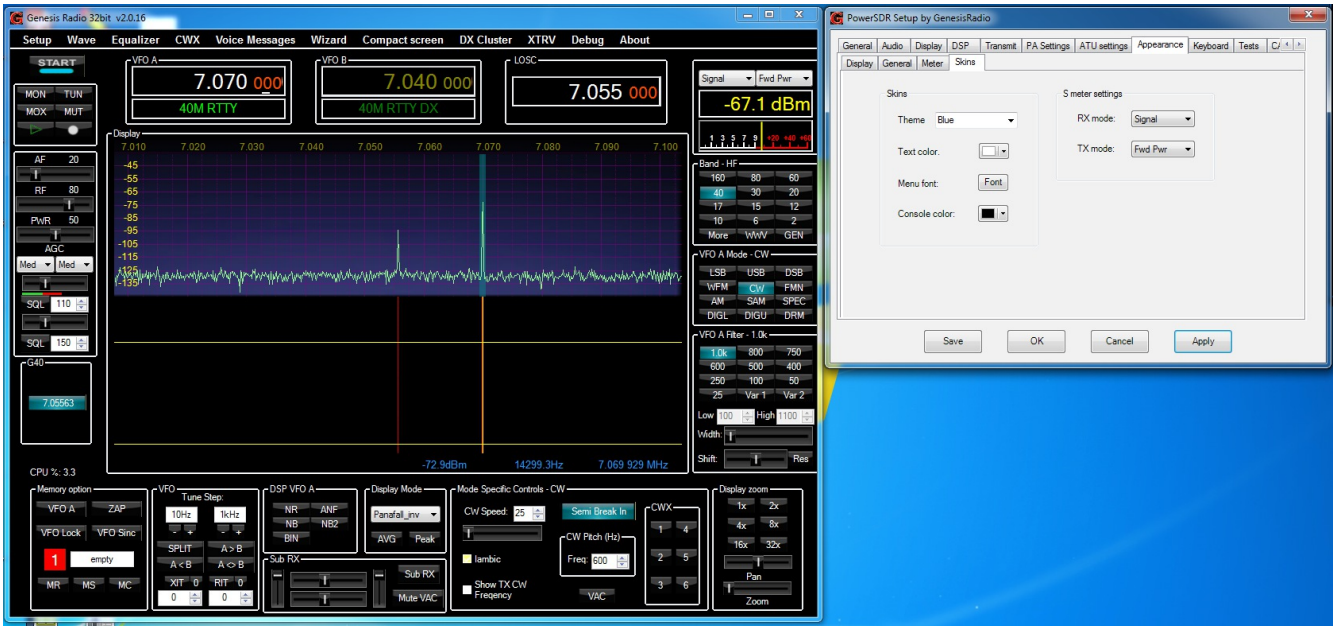
I have not had much luck using the automatic WIBR. I normally use Manual. You can try it if you like. Select Start and then reset, now watch the image. When it gets low enough for you, select save button next to reset button.

To manually adjust image select start as before but also check WBIR Fixed. Then adjust sliders to get lowest image. Select save band.

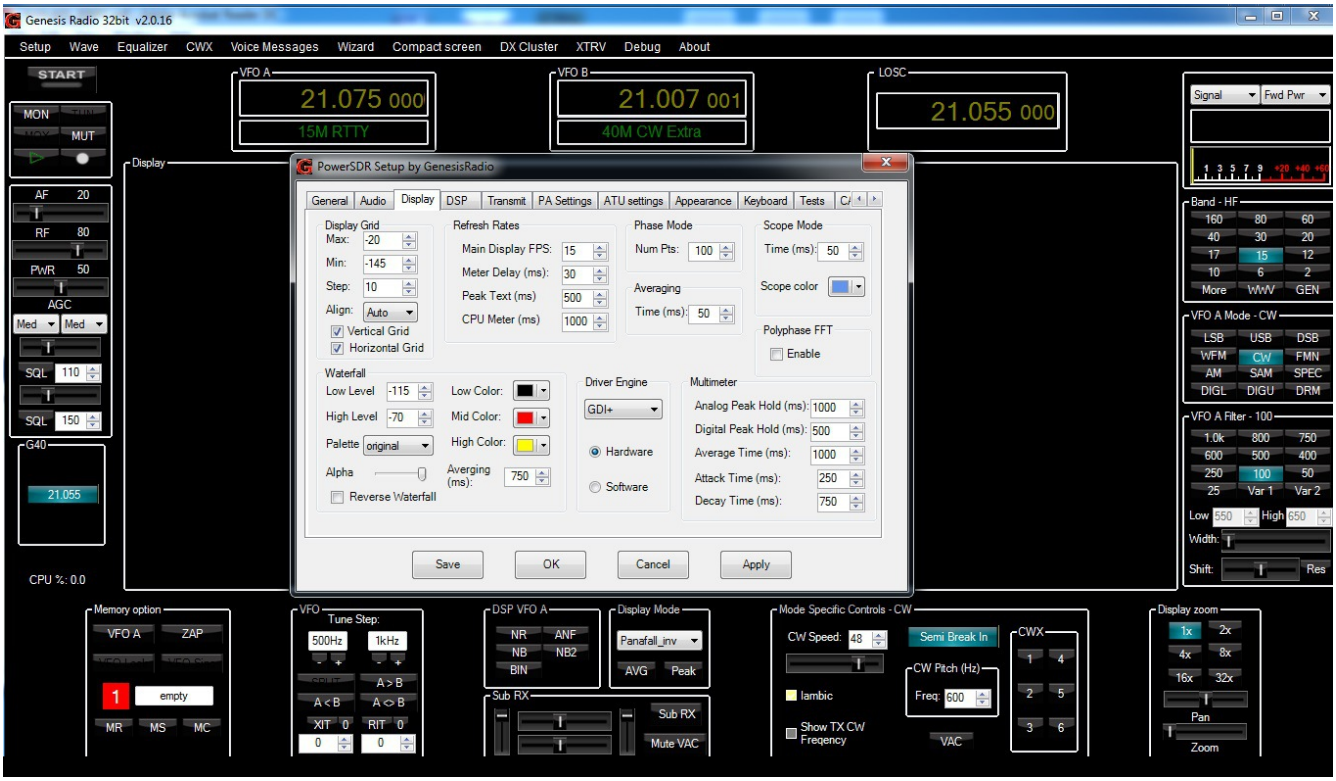
It should look like this(with my florescent lights off)



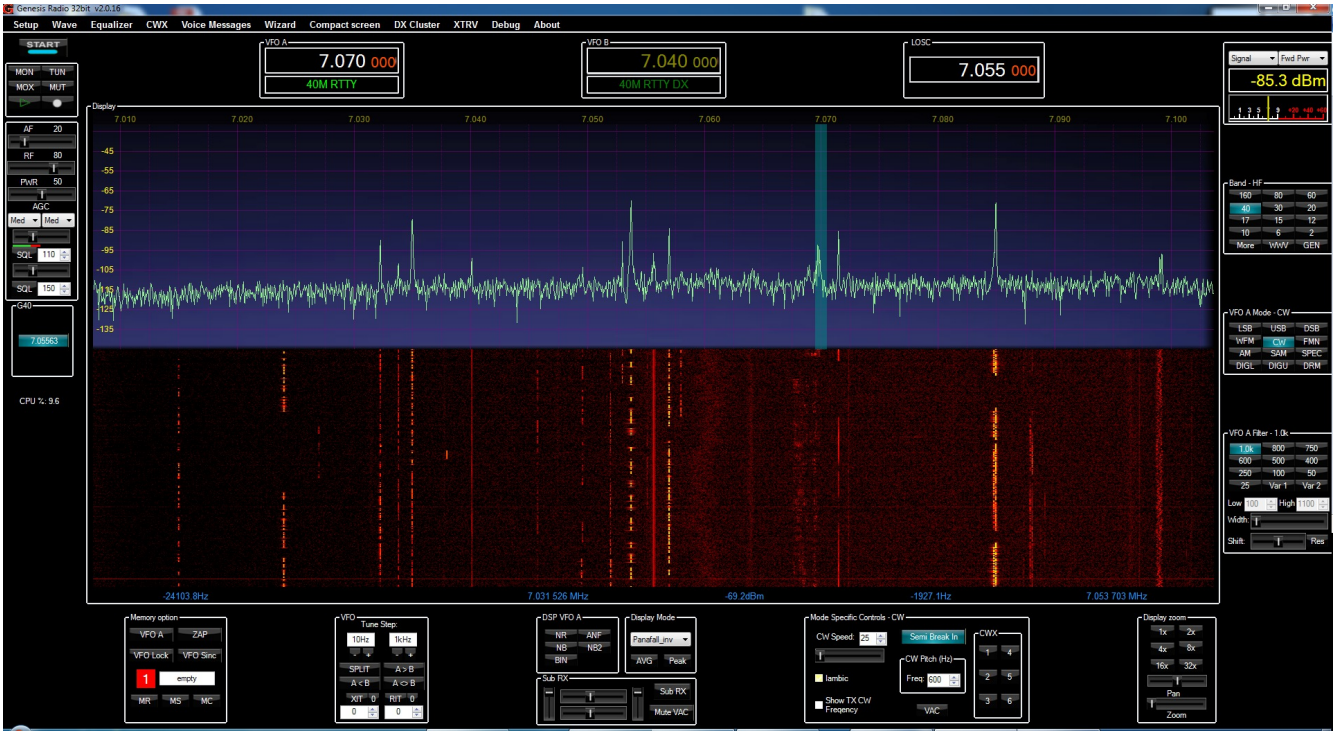
To change the look of GSDR, go to Appearance--->skins tab. Chose one of the skins. You also need to change console color to black and text to white. Looks like this now.



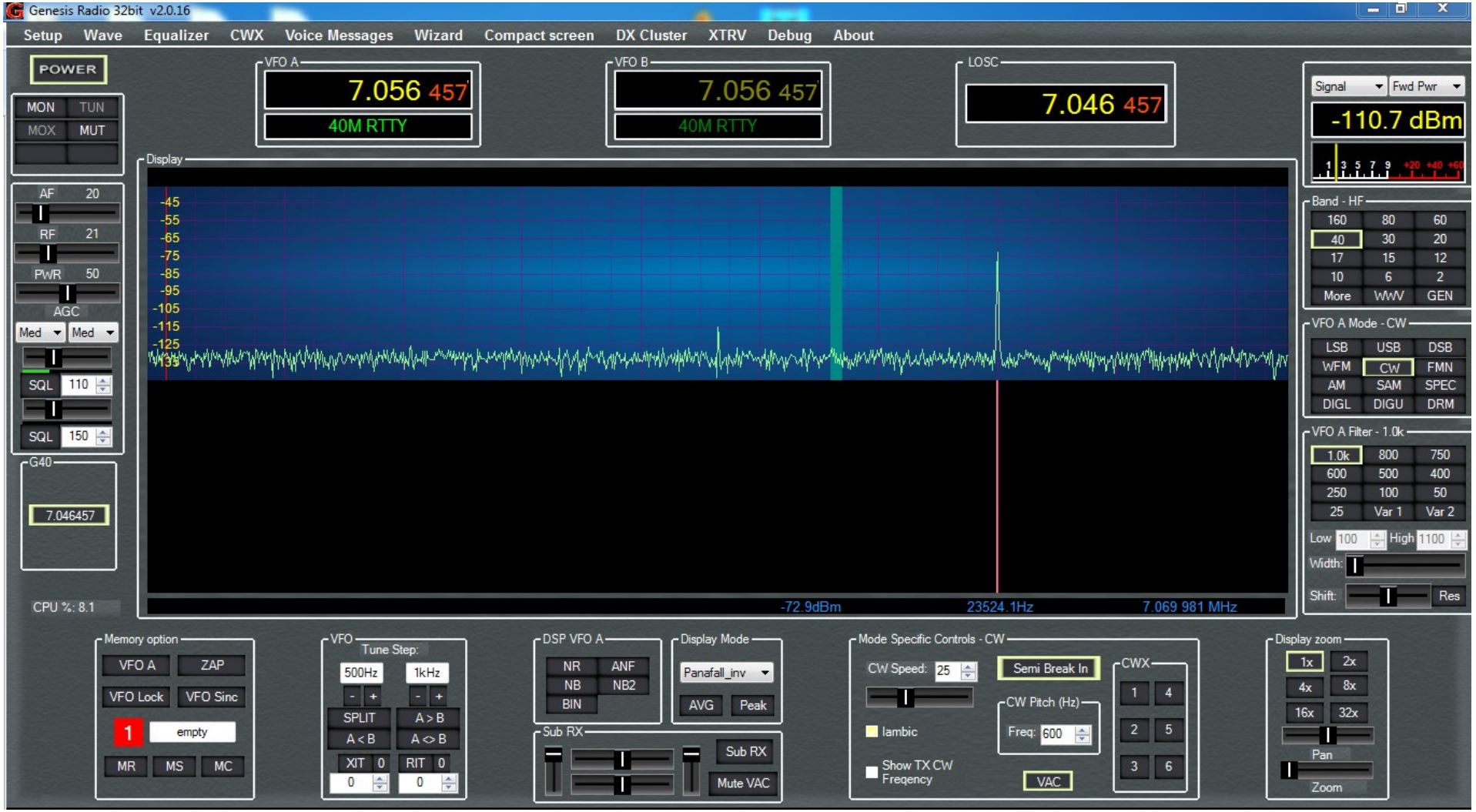
To change the way the signal looks on panadapter you can adjust display grid Max level and Low Level. Low level should be set close to your noise floor. That way the waterfall won't be all red with the noise.



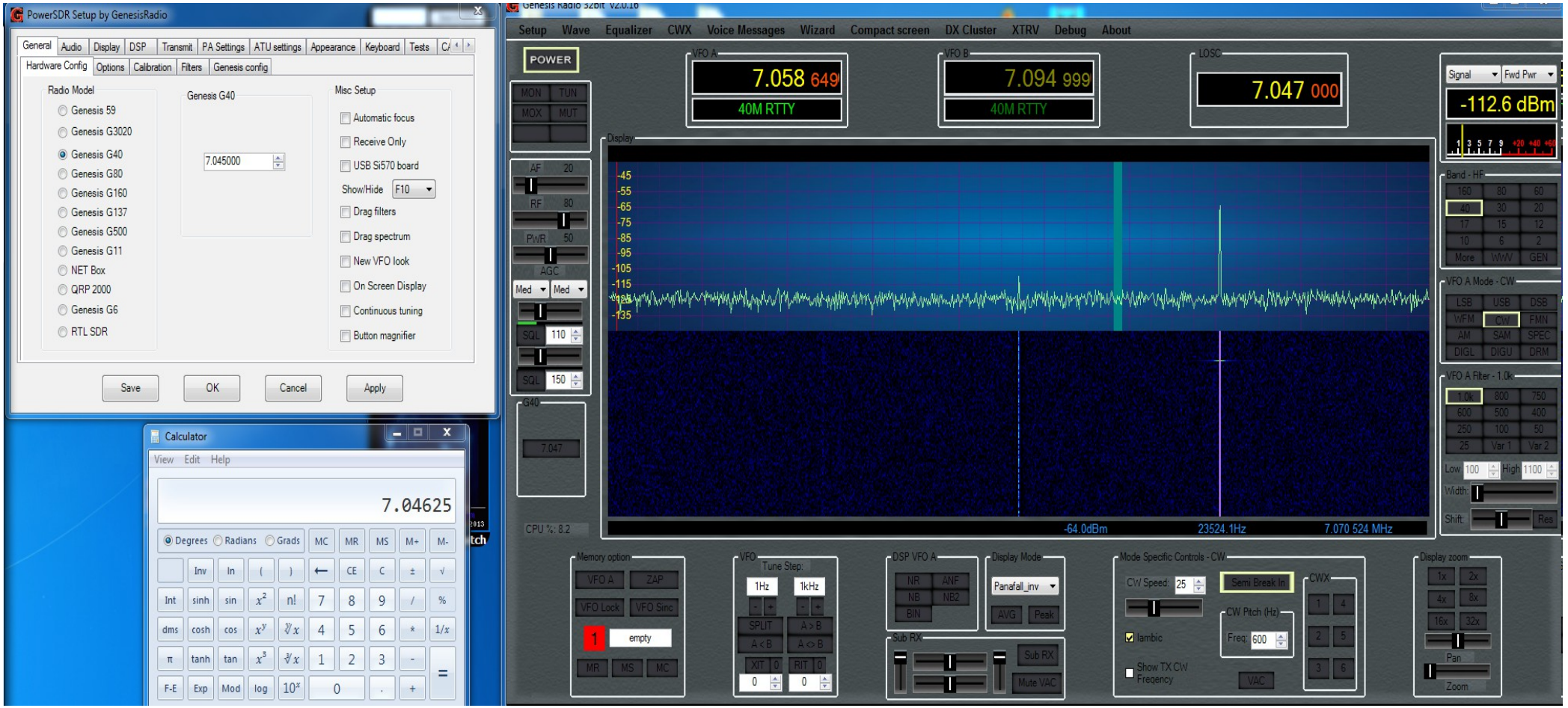
Now connect antenna and enjoy viewing some signals!



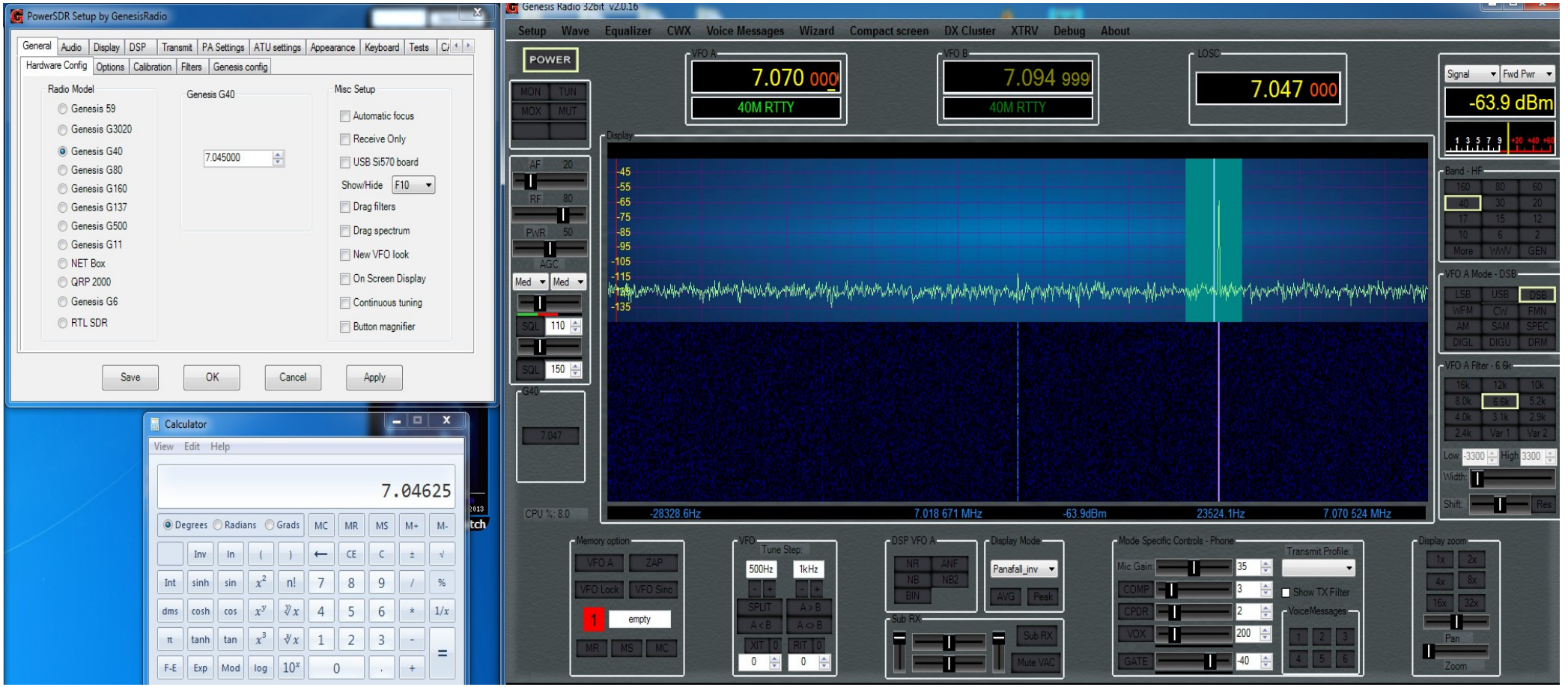
Transmit Setup and calibration instructions for crystal controlled Avala-01 and G40/3020 using Genesis Radios GSDR 32bit update 21022014



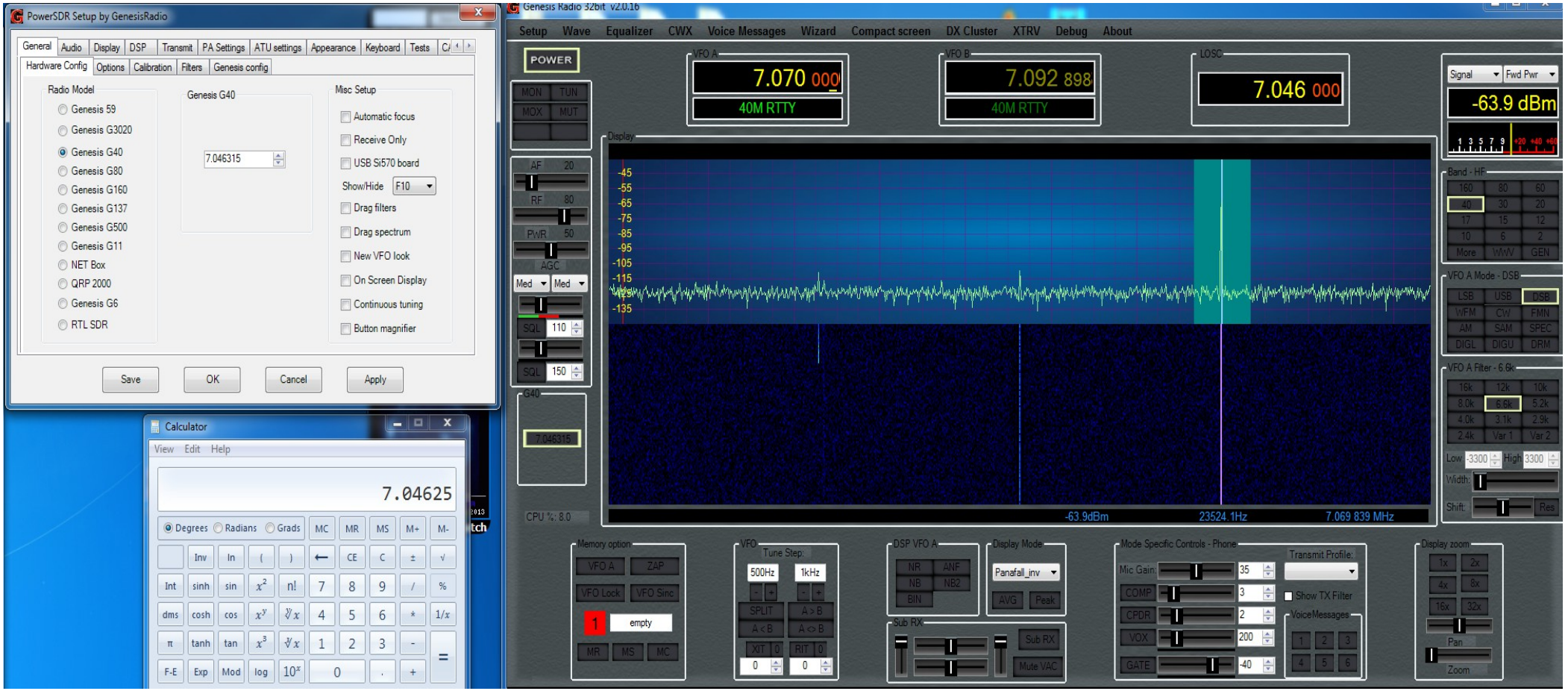
First, lets review RX setup
Frequency Calibration:
1. First take the crystal frequency and divide by 4
2. Enter that into the freq box. Doesn't have to be exact.
I left it at default setting.



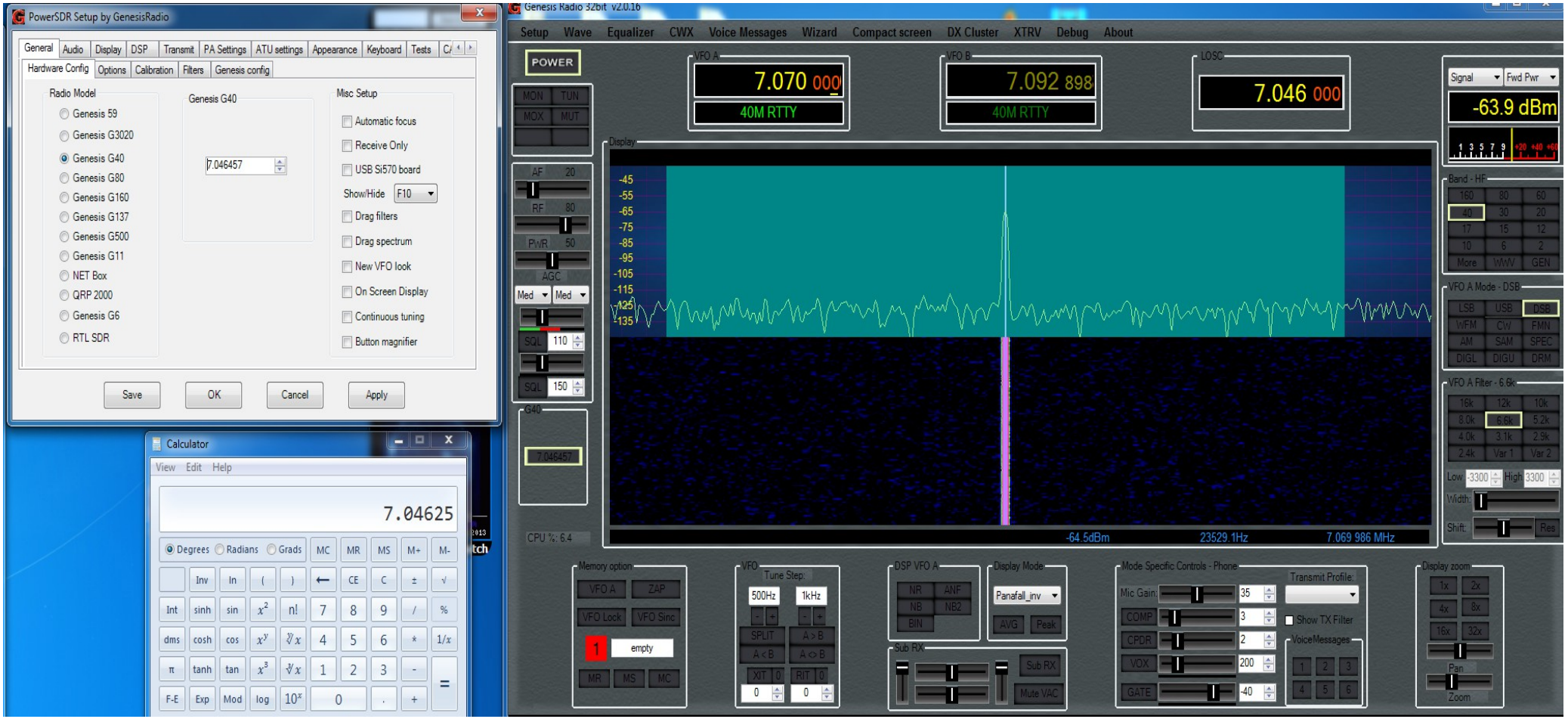
Using a signal source of a known frequency, select DSB and tune VFO A to that frequency



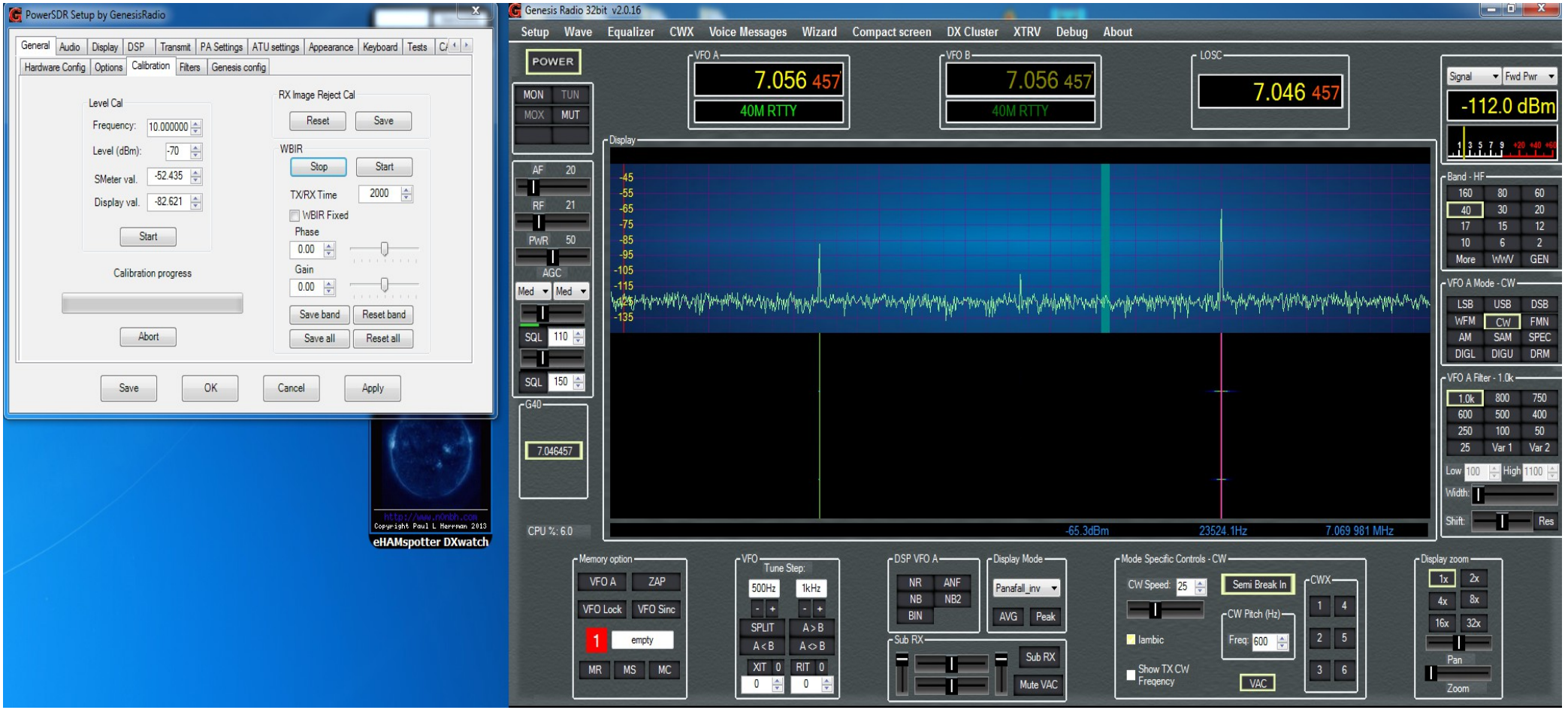
Select up or down arrows to the right of the frequency. Until it is close to on the center line.



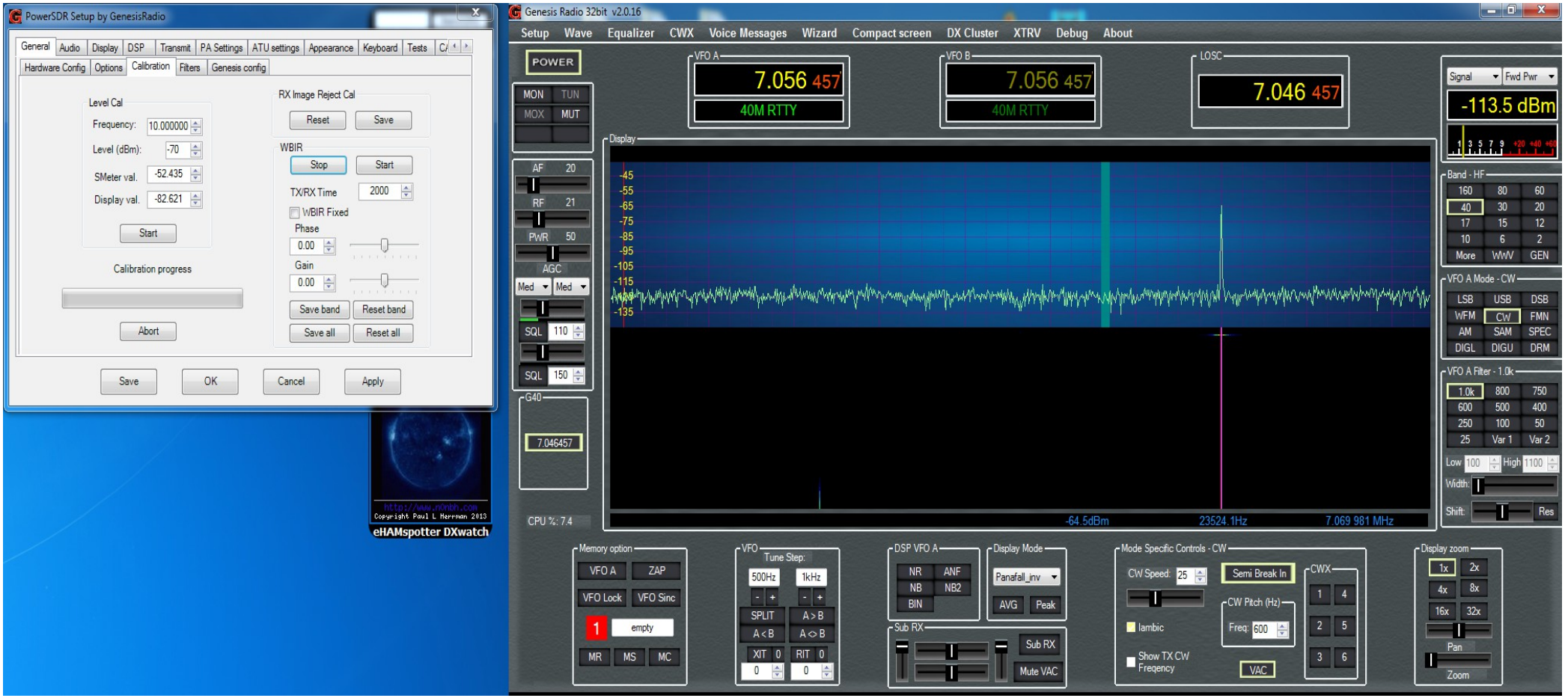
Select Display zoom, and adjust frequency until it is centered. Frequency Calibration is complete



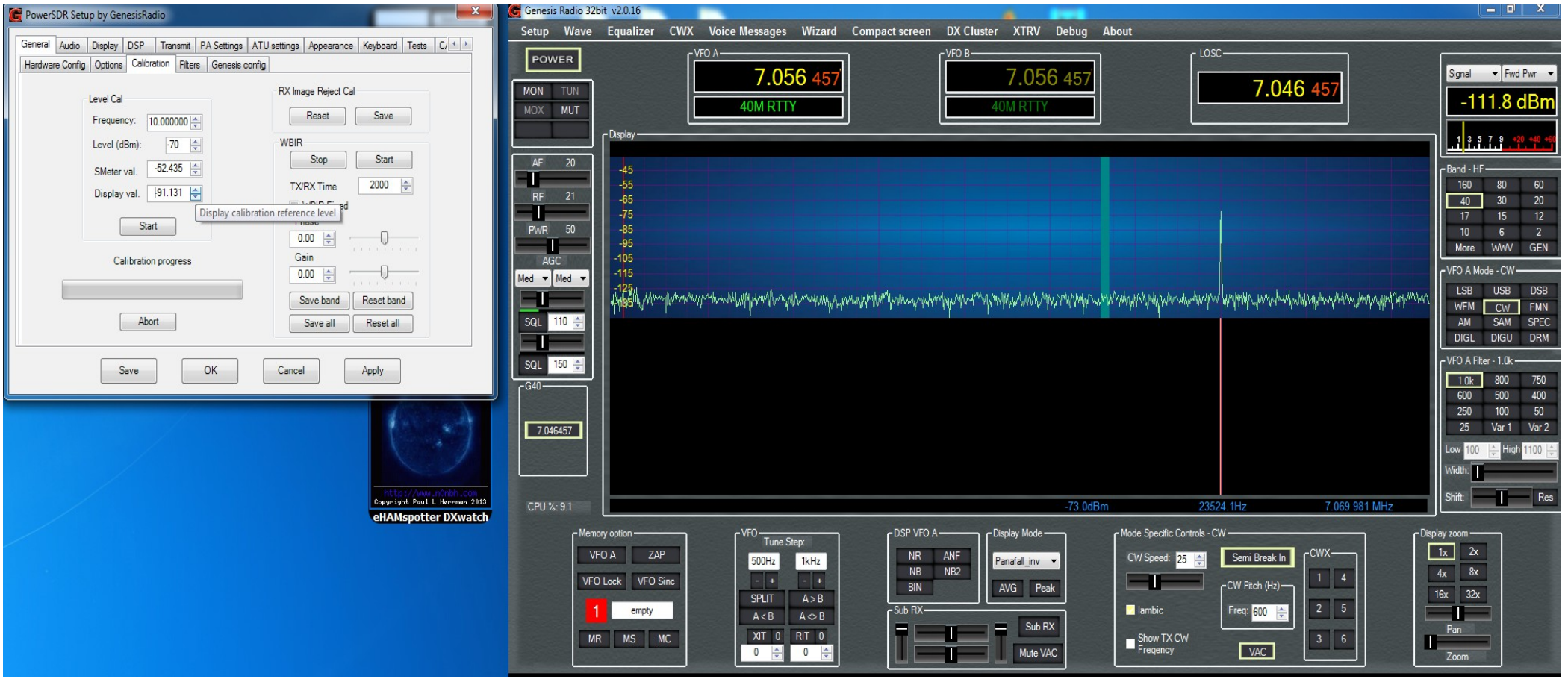
You may see an RX image on the other side of LOSC. If so, go to the calibration tab and select Stop WBIR



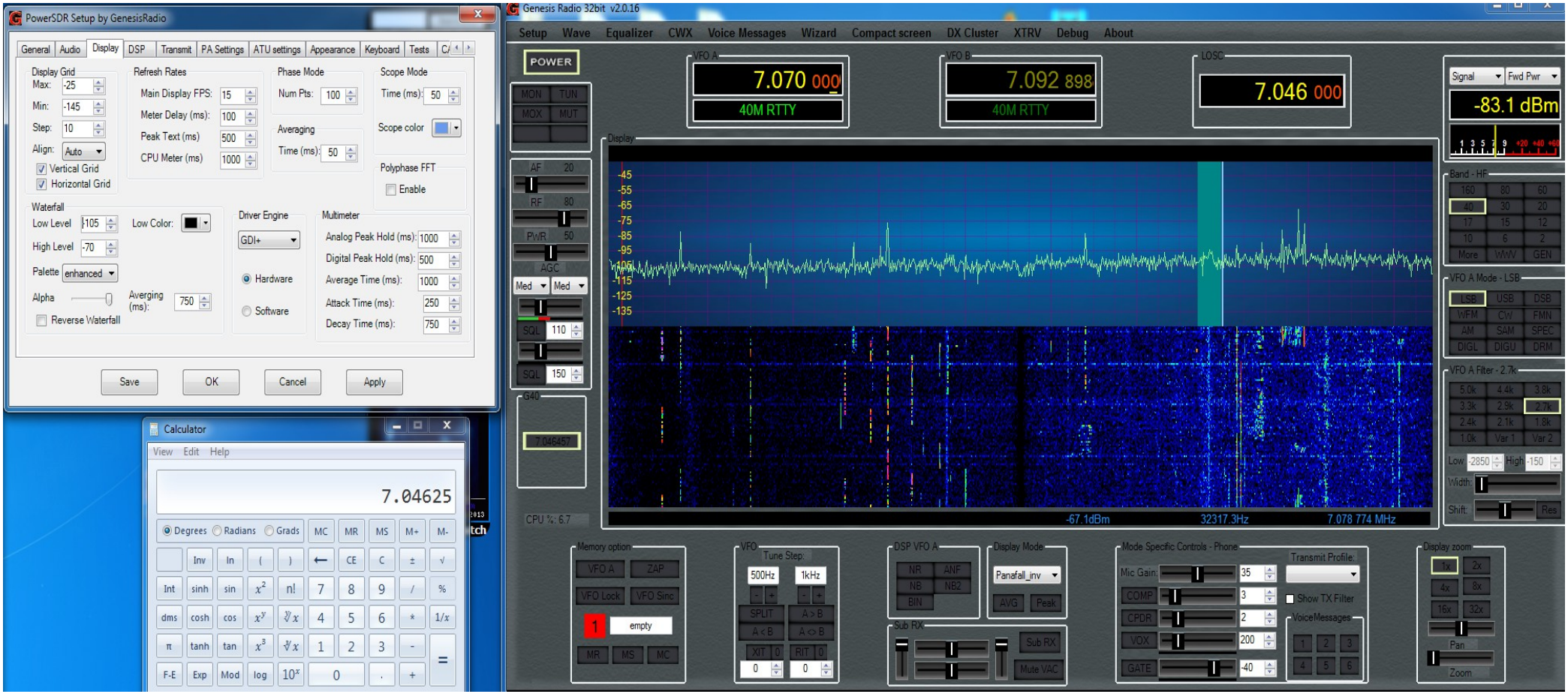
Adjust R2 until image is gone. Then select Start WBIR



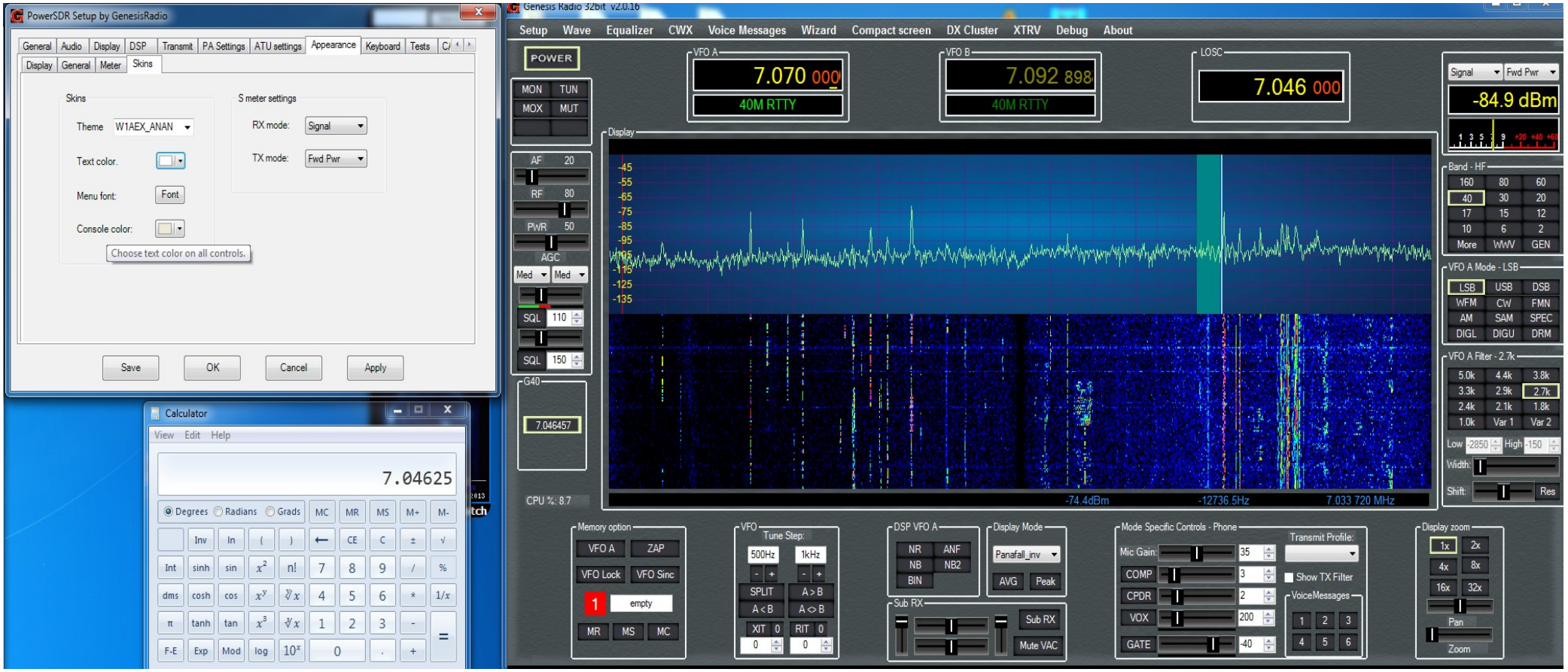
Next is to calibrate the signal level
With a signal of known level. adjust Display Val arrows up or down to set level. In the panadapter there is a reading at the bottom of highest signal level displayed. Mine is -73dbm



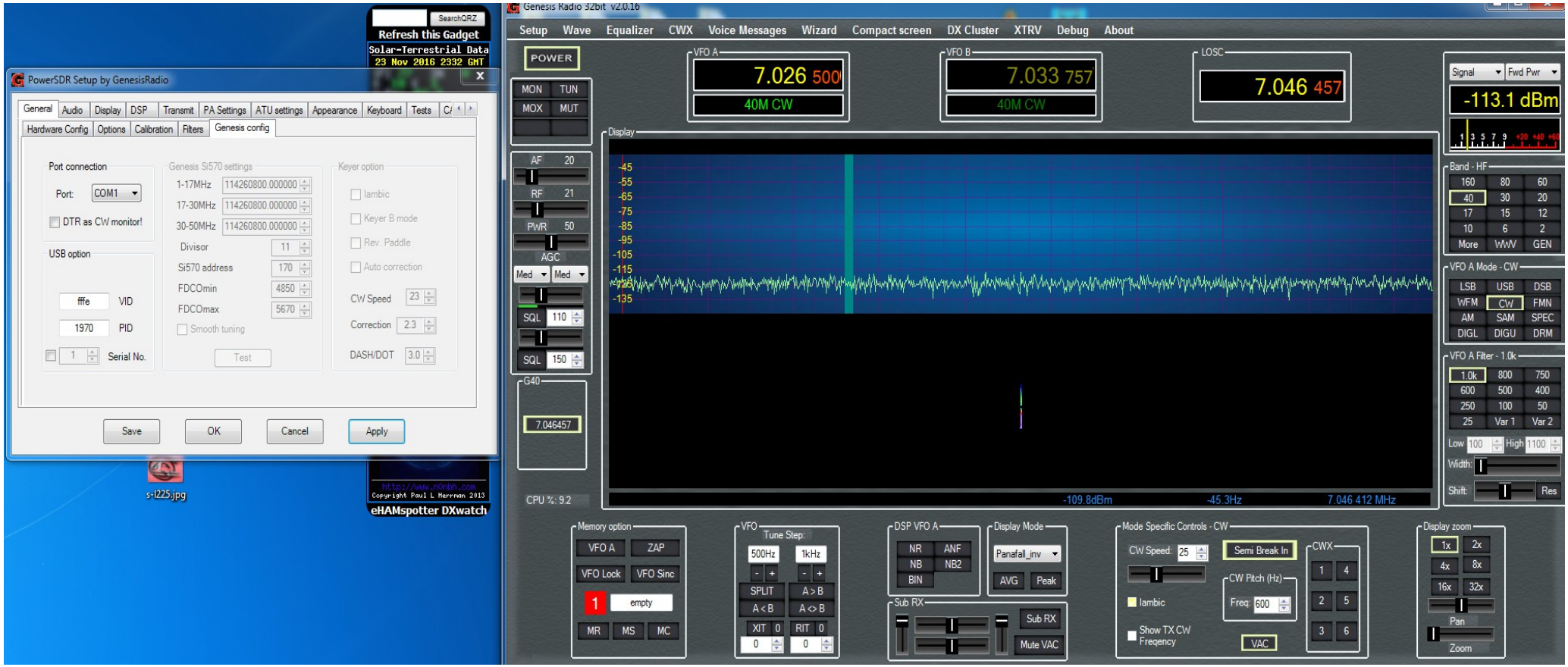
You may notice the text letters are black. Next page shows how to change that.



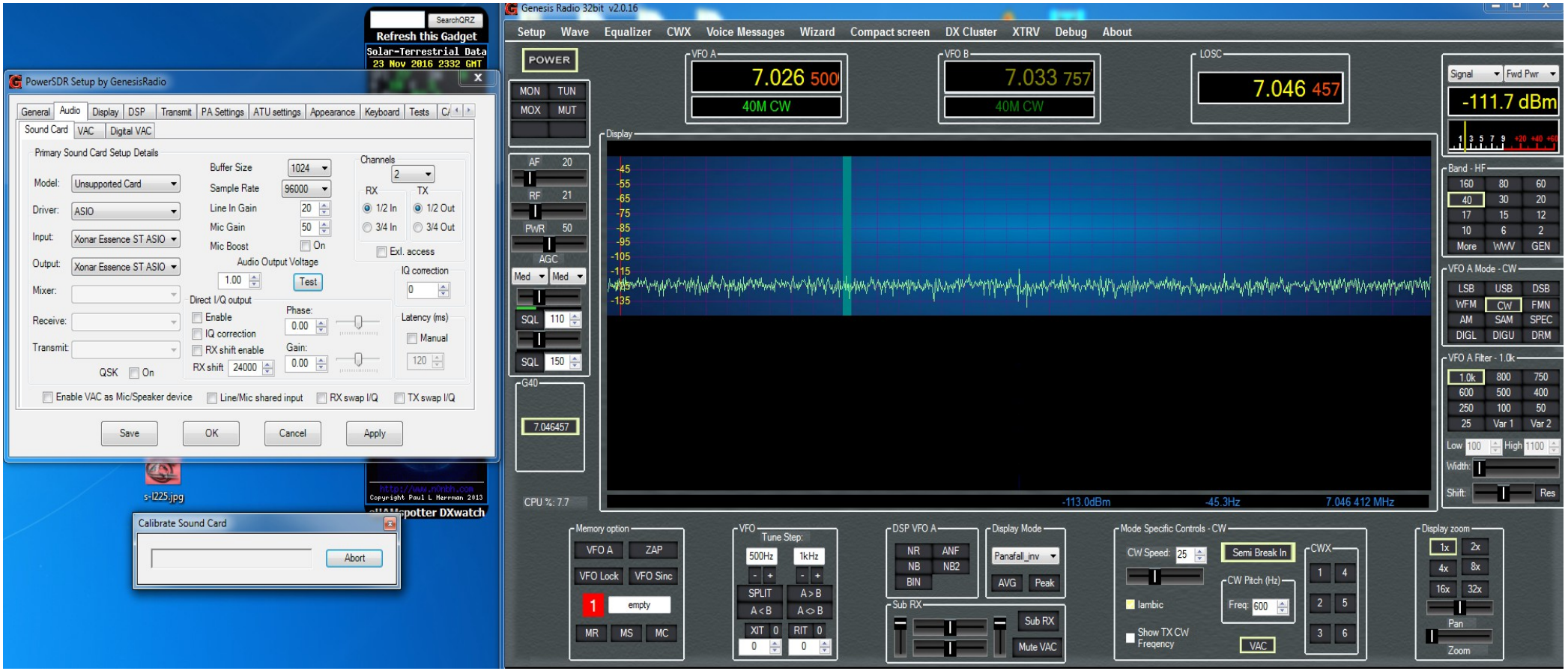
Go to appearance ---> Skins Tab, change text color to what ever shows up better



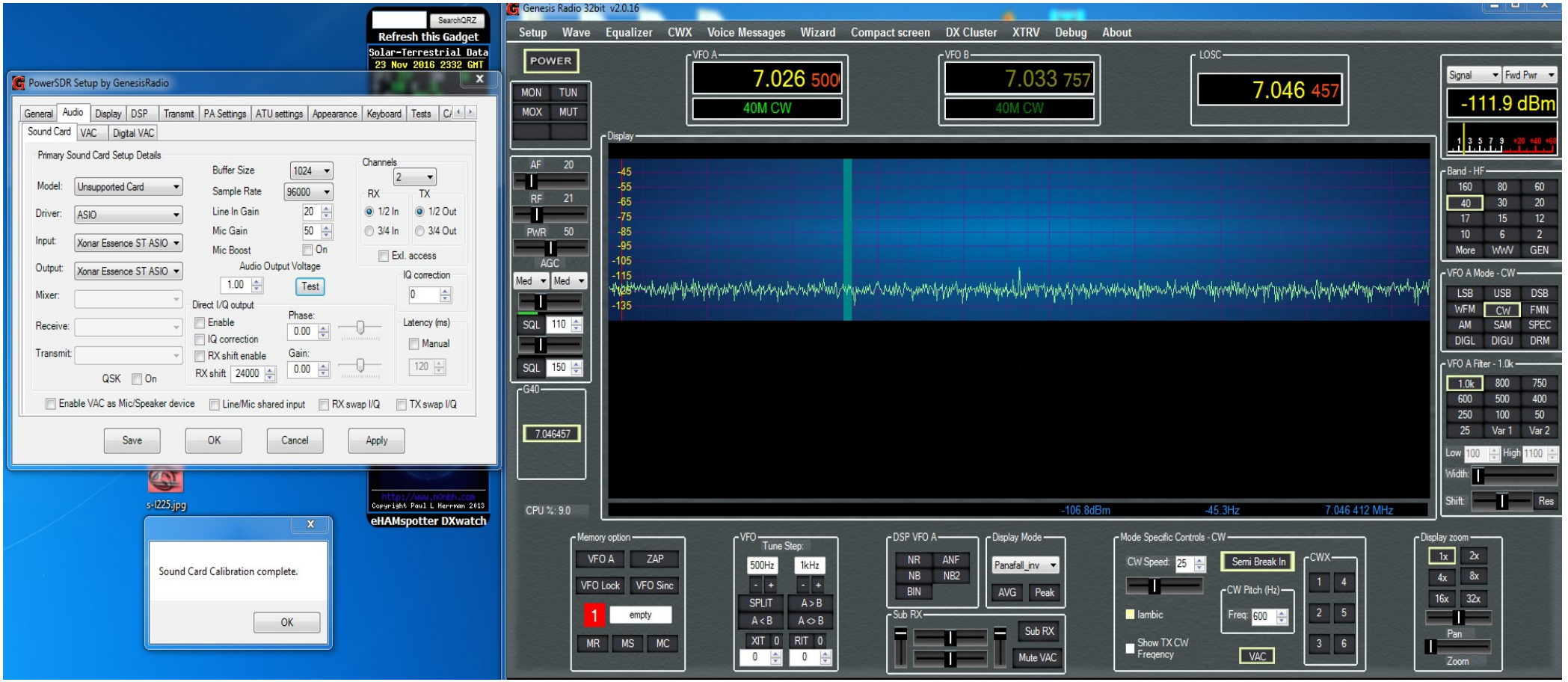
Now for the TX setup. Connect your serial cable and select the port it is using, mine is COM1. Connect dummy load and press TUN button. Radio should Transmit.



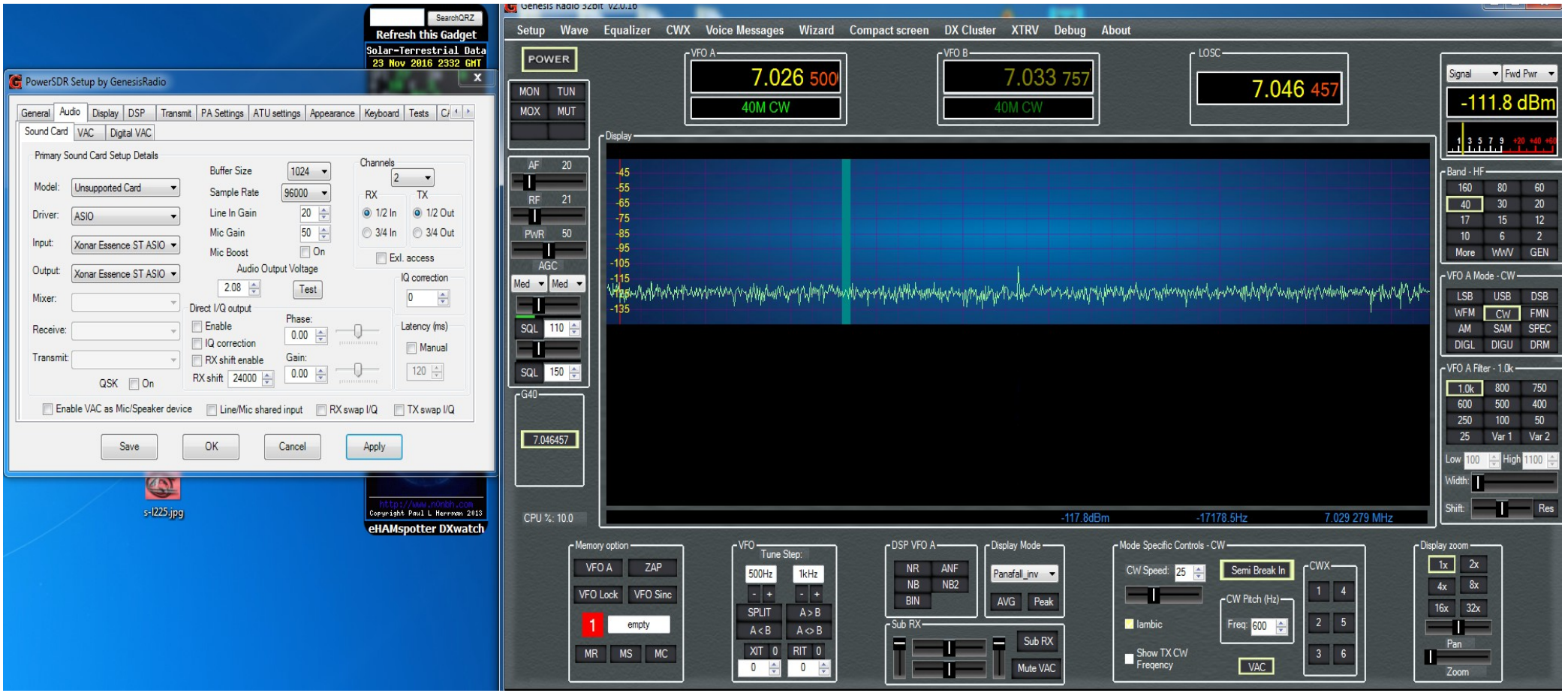
Now we need to set the Sound card Output voltage level. With a volt meter set to AC scale, connect to tip and sleeve of cable coming from sound card output. Press TEST button and you should see a voltage reading. Then click Abort on small window that popped up.



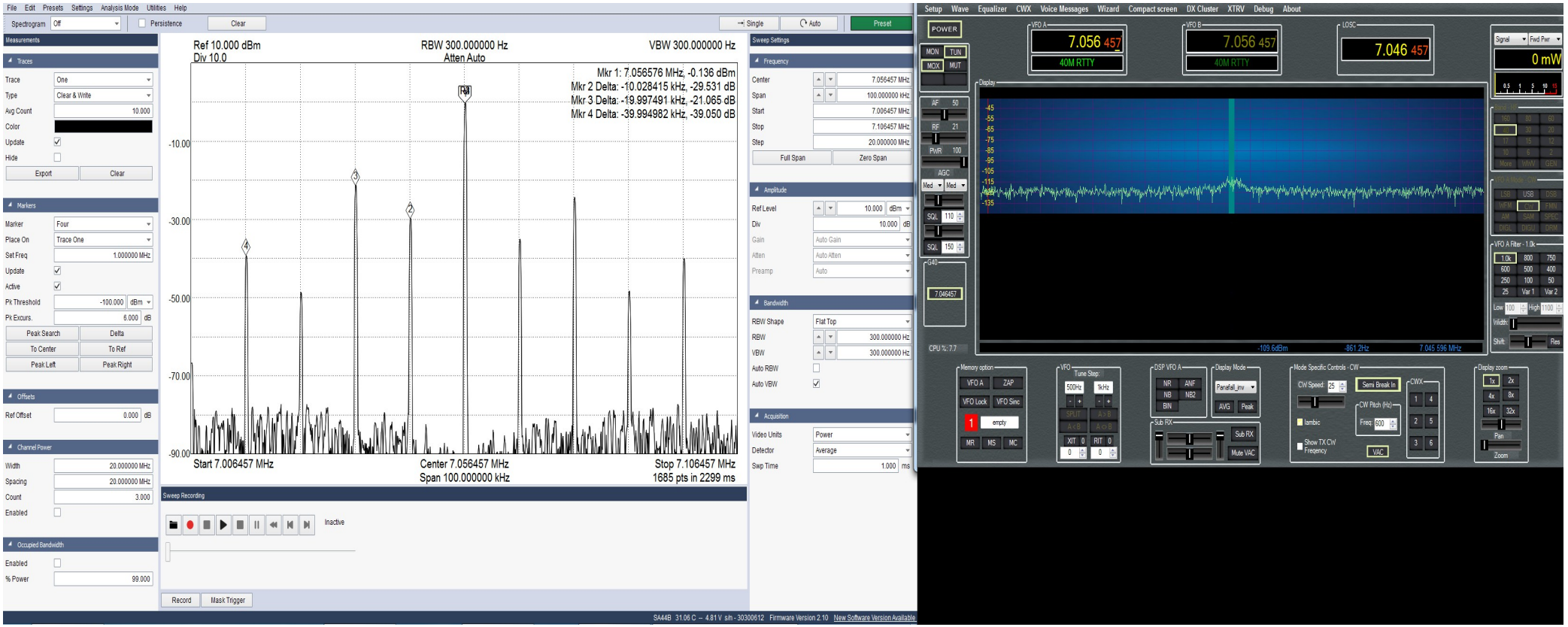
Another small window pops up, click OK. Then enter the voltage reading into Audio Output Voltage. Sound card is now calibrated



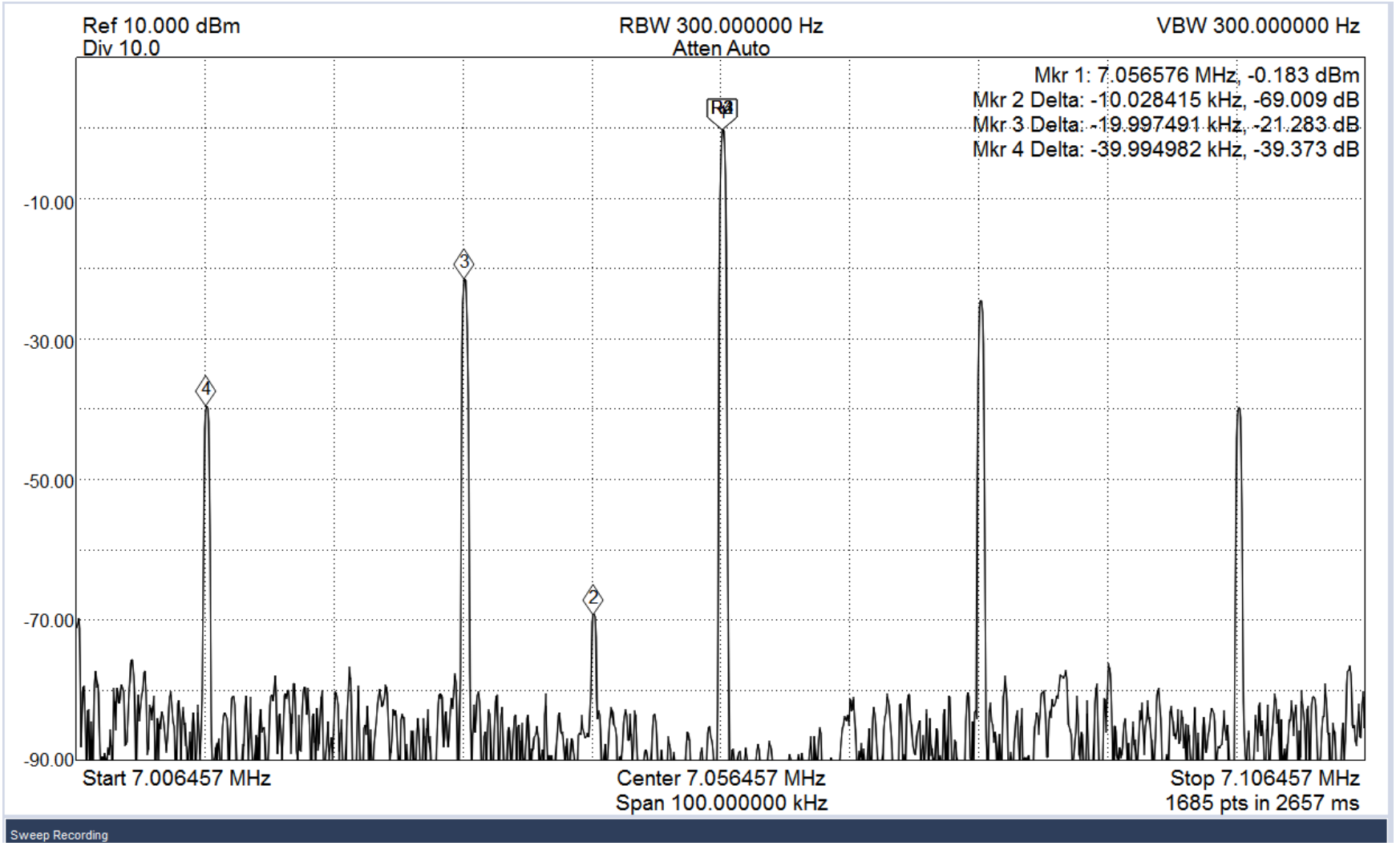
New Voltage entered



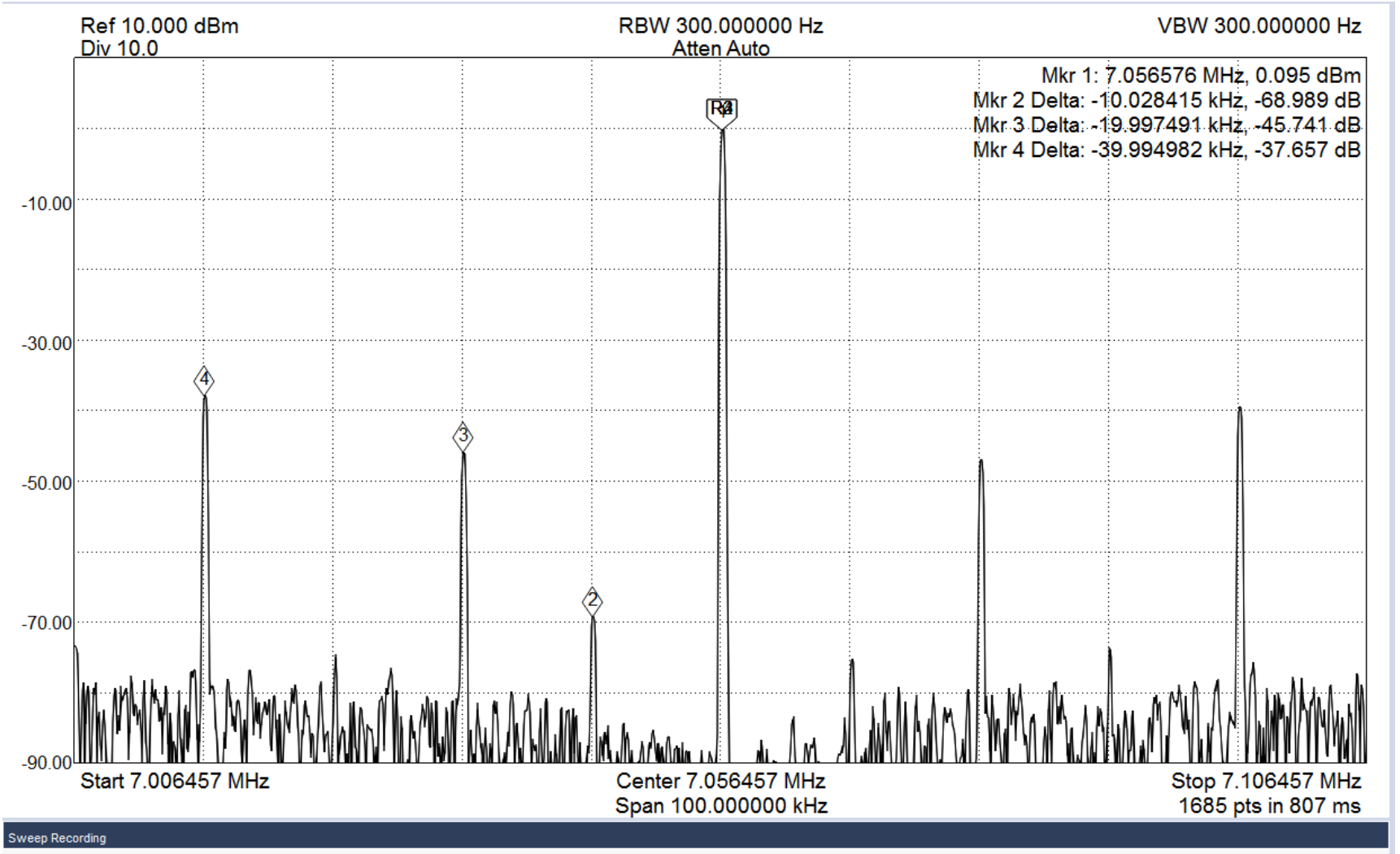
To make explaining this easier I'm using a Spectrum Analyzer. Another receiver can be used. To make this process easier lets pick an offset from the LOSC that we can easily figure out the 1st, 2nd, 3rd and 4th signals that we need to work with. I chose 10khz. Lets go over the markers. 1 is the transmitted signal, 2 is the LO signal, 3 is the TX Image, 4 is a signal that is adjusted by your sound card drive level. A strong signal here is caused by overdriving the radio.



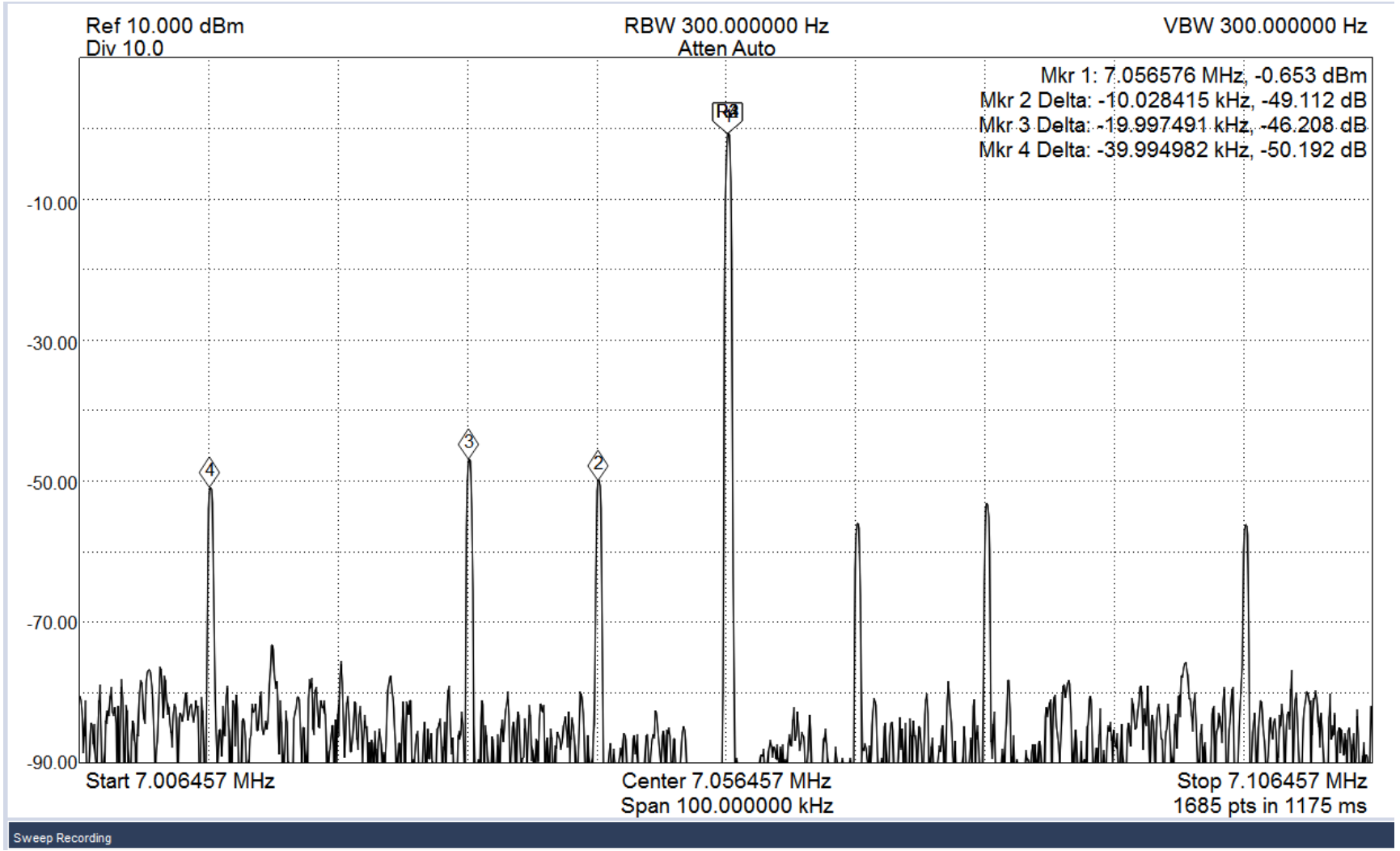
First thing we are going to do is adjust the trimmers,R9 and R10 back and forth until we get the LO(2) reduced as far as we can go while transmitting into a dummy load. Make sure you monitor the PA heat sink! Let cool between adjustments as necessary!



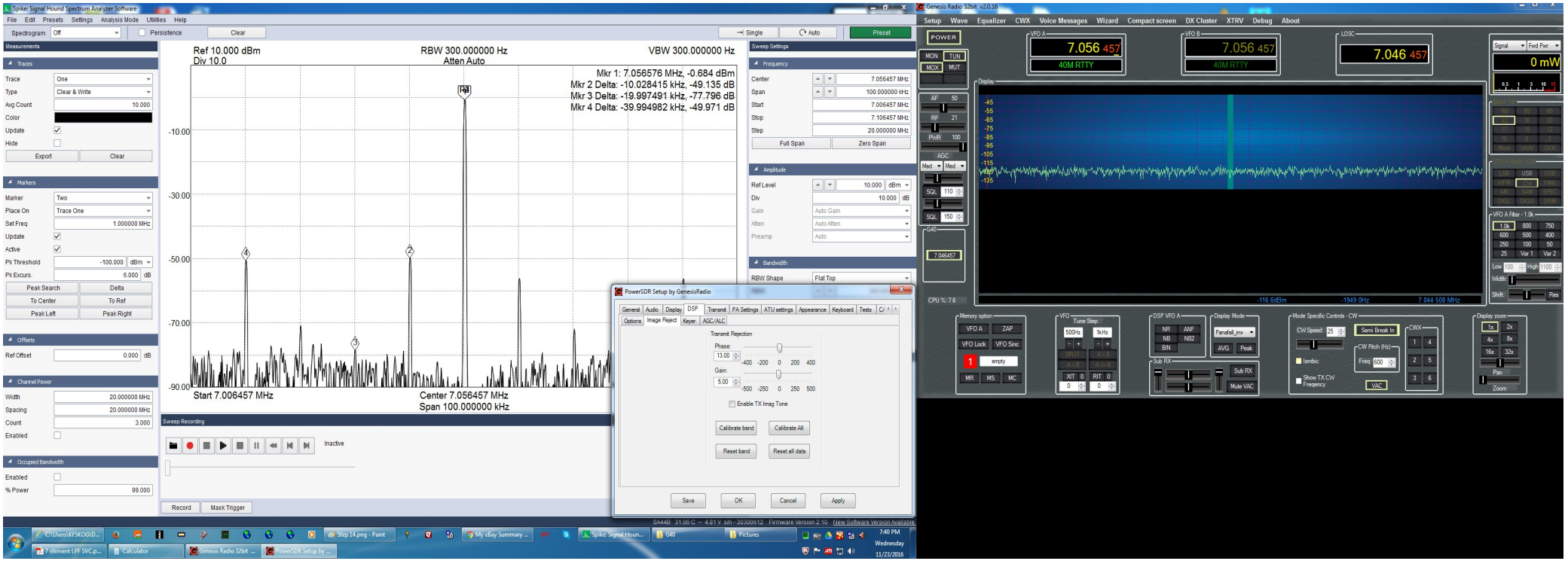
Now adjust the TX image(3) with Trimmer R67 for lowest level. This is only half the adjustment. Software is next.



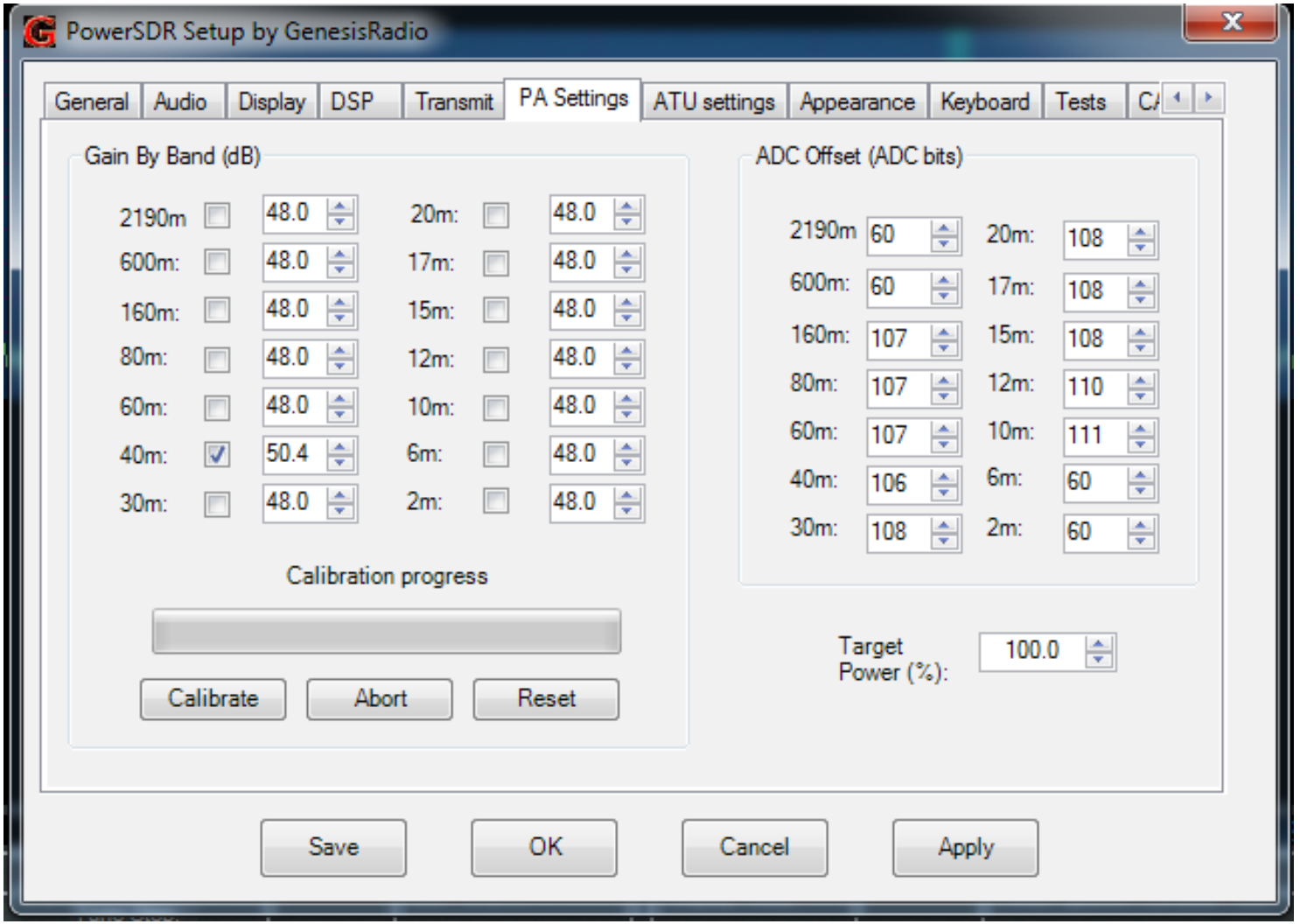
You may have to go back and adjust the LO signal again. Everything seems to interact with each other. LO, TX and RX image adjustments.



Now the software TX image adjustments. Adjust sliders Phase and Gain until you get image(3) as low as possible. Click Save.



Now adjust drive level until the 4th signal is within limits. Initially my power output was 7 watts now it is 6 watts. Do not try to over drive this radio! A tip I learned if using another RX radio. Set the transmitted signal to show S9 on the meter. If all 4 of the signals in question don't show a needle deflection you are good to go!



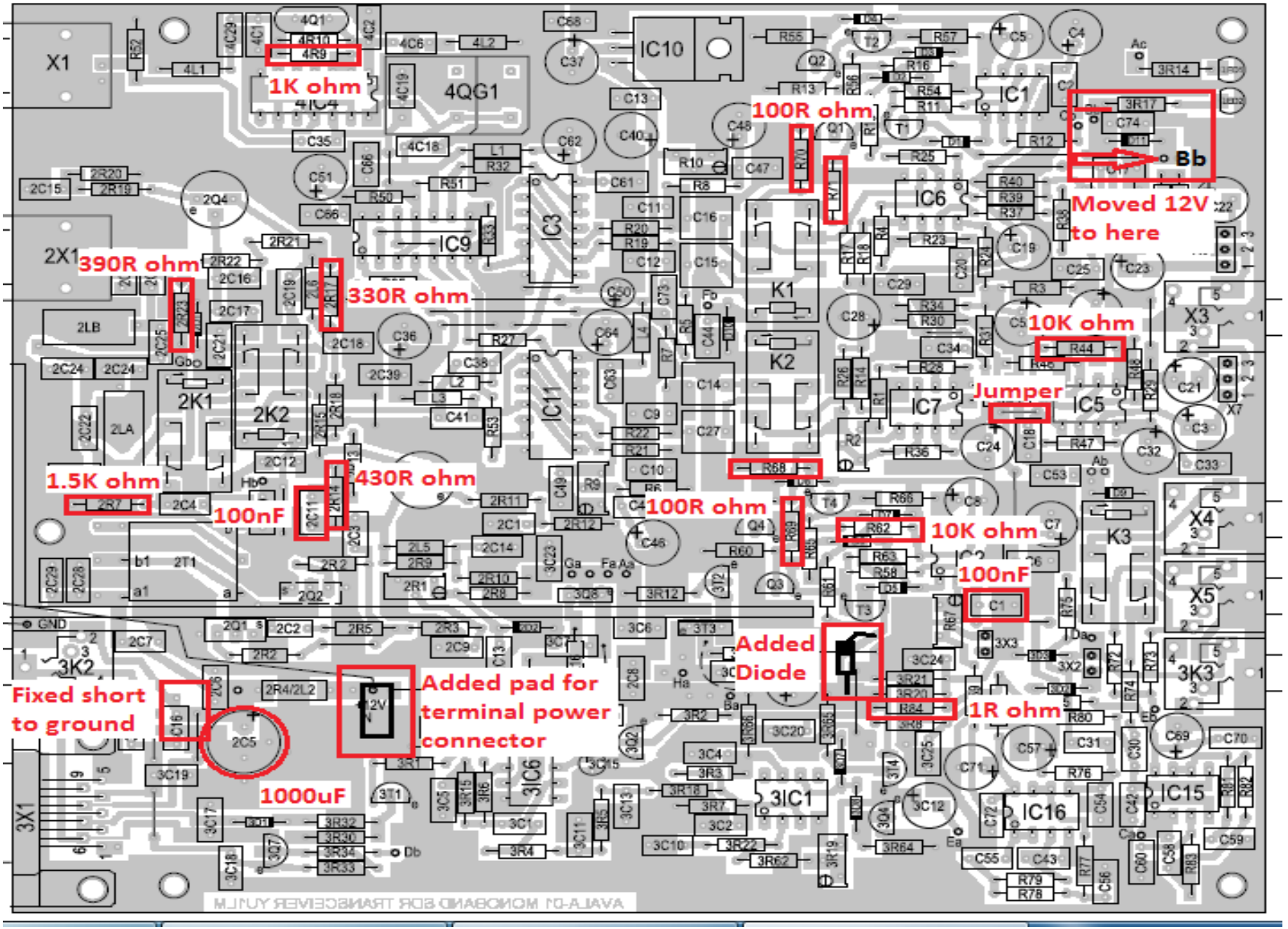
Changes to new production of Avala-01 PCB

The following pictures document the changes made to the Avala-01

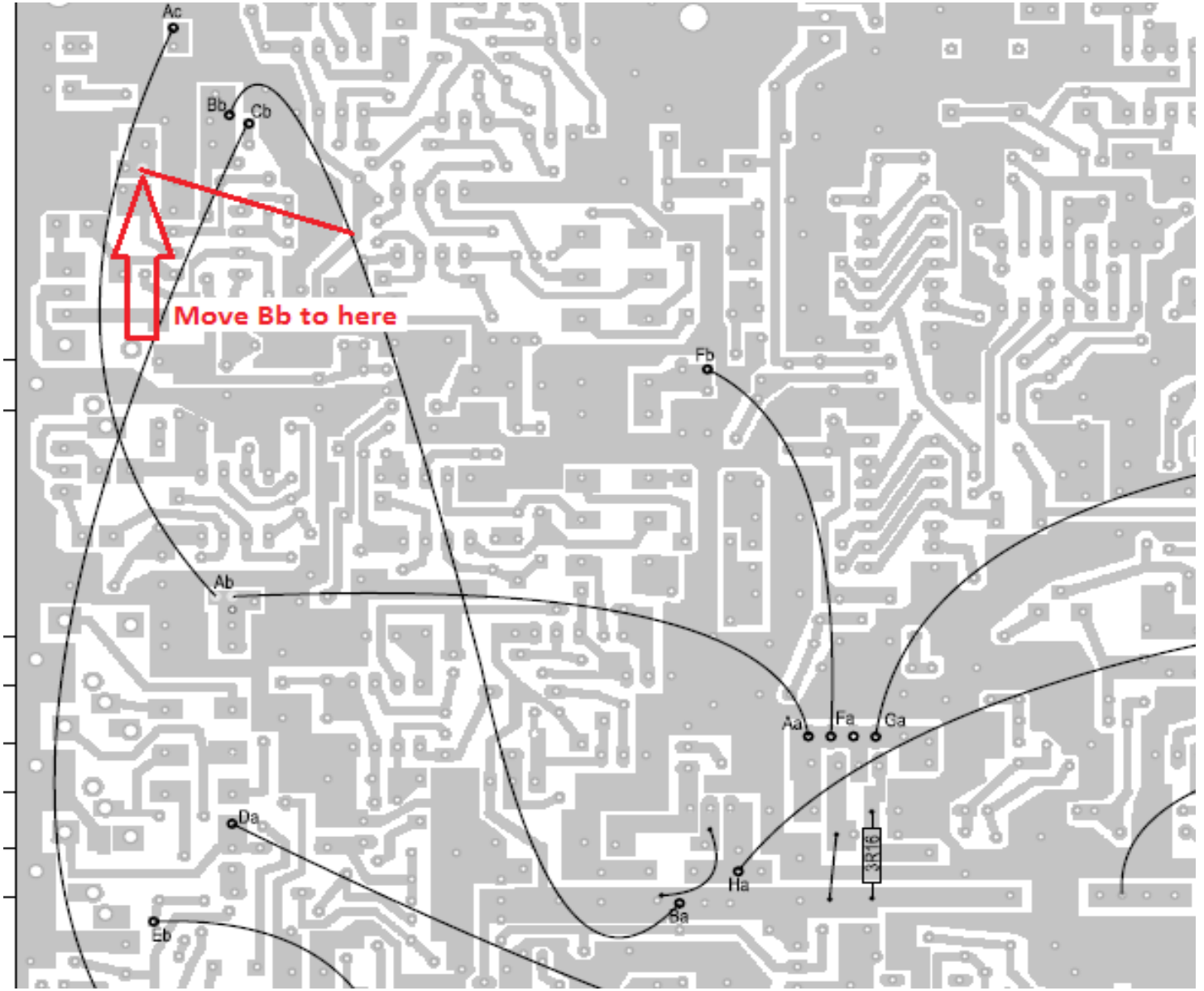
Changes to new production of Avala-01 PCB

The following pictures document the changes made to the Avala-01

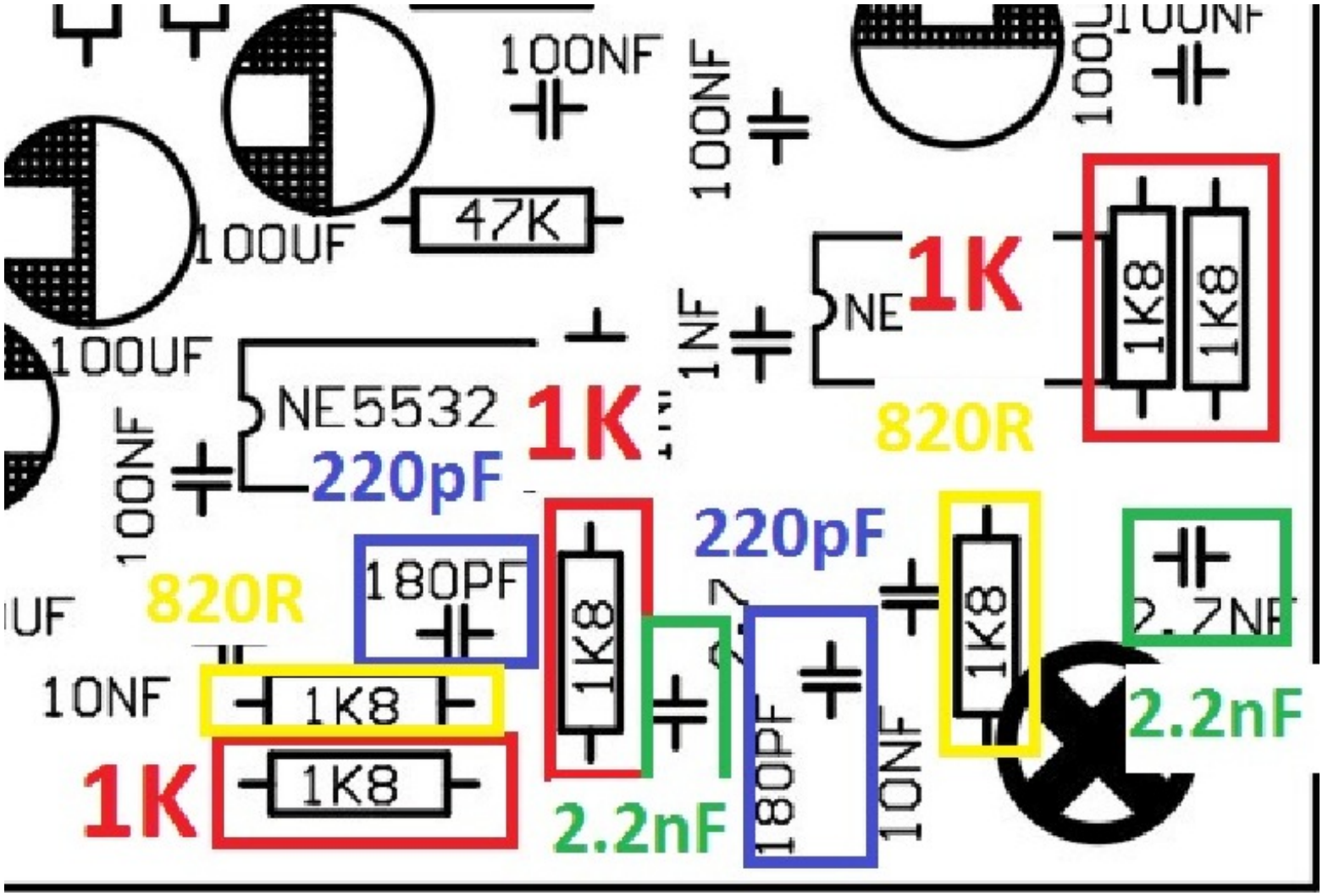
PCB top side


1K ohm
100R ohm
Bb
Moved 12V to here
390R ohm
330R ohm
10K ohm
Jumper
1.5K ohm
100nF
430R ohm
100R ohm
10K ohm
100nF
Added Diode
1R ohm
Fixed short to ground
Added pad for terminal power connector
1000uF

PCB Bottom side

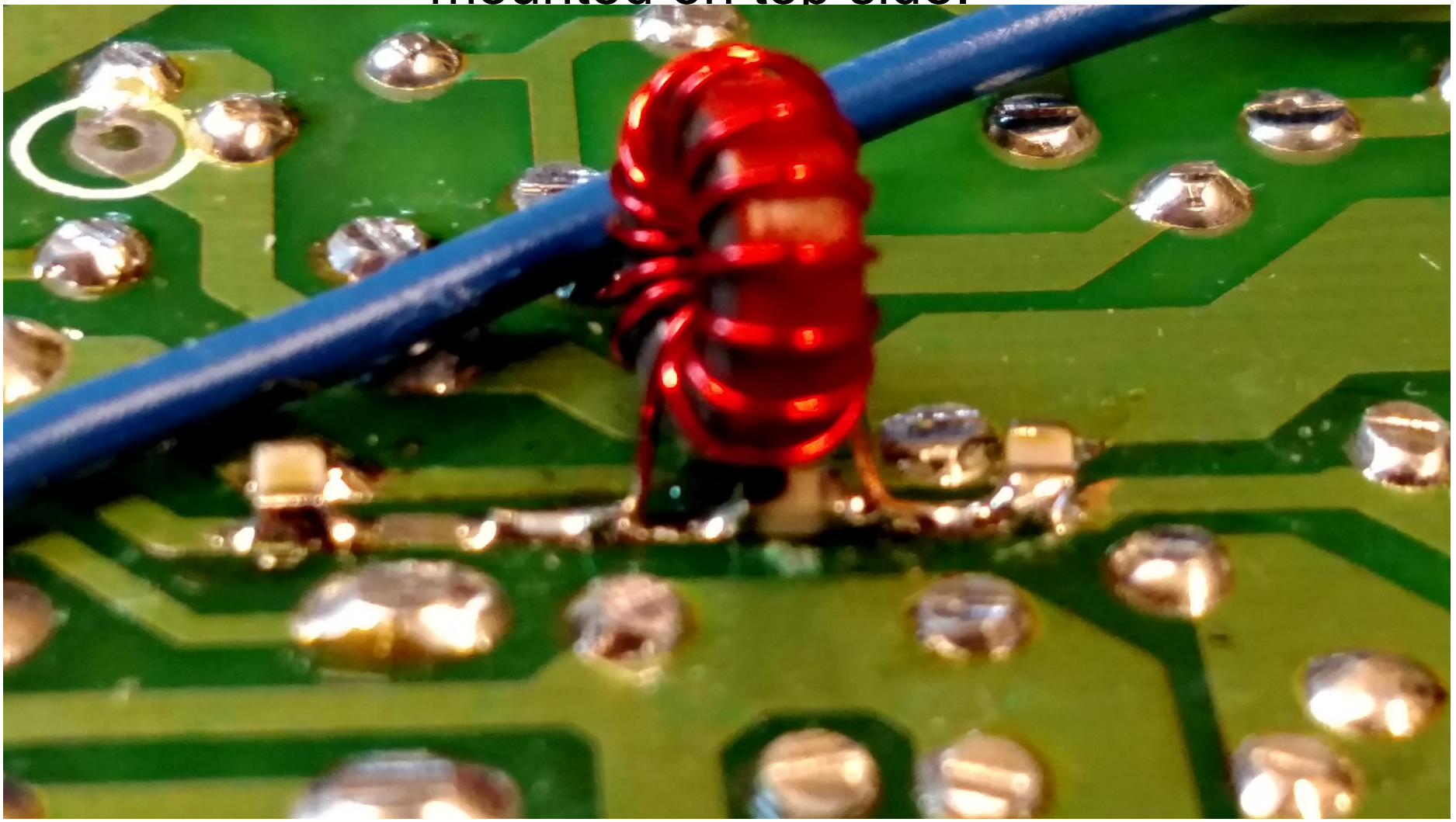


Changes to TX sample and hold LPF circuit, now 96khz sample rate

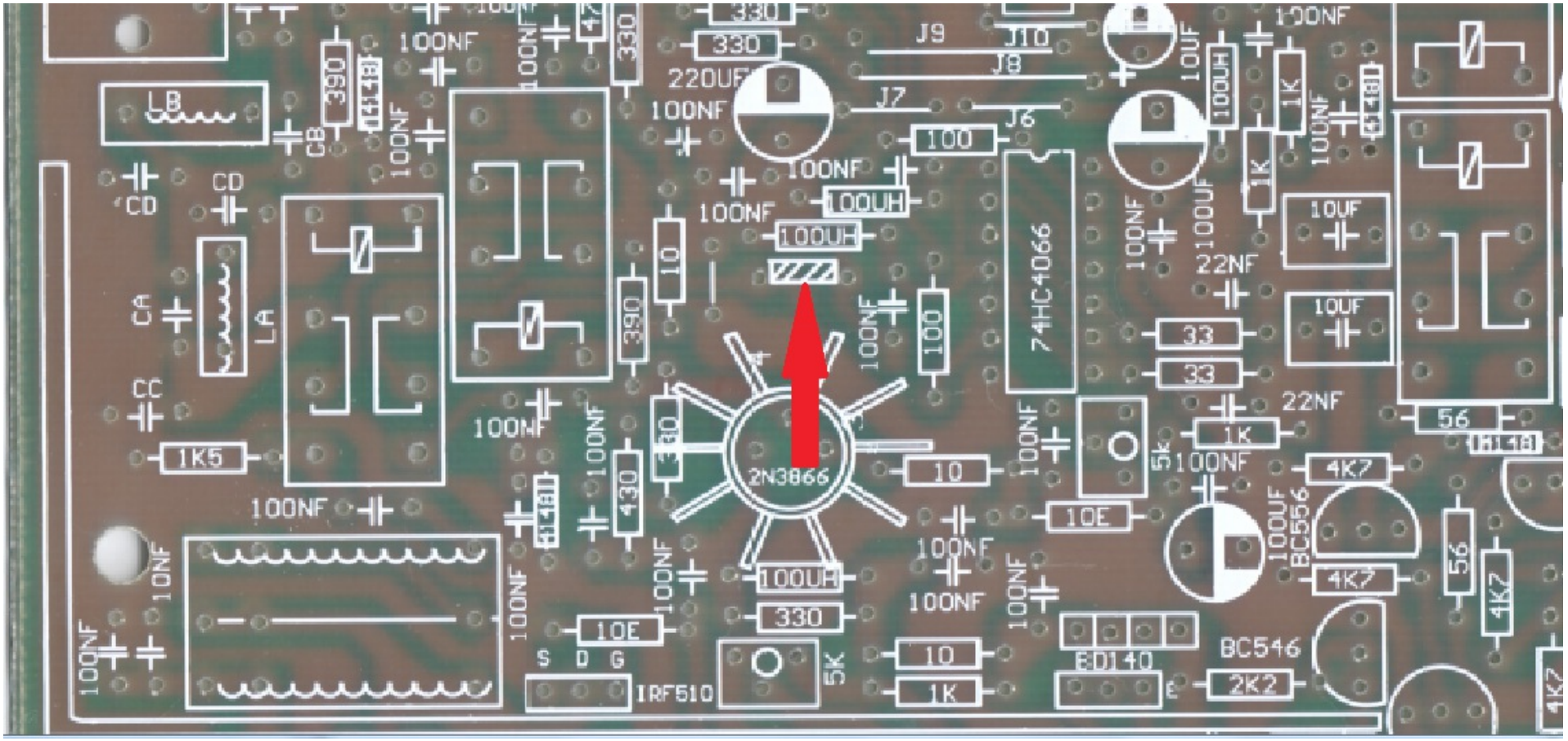


Adding simple LPF to mixer

Note: This picture was on older release PCB. New PCB has this filter included on PCB, see below. Toroid will be mounted on top side.

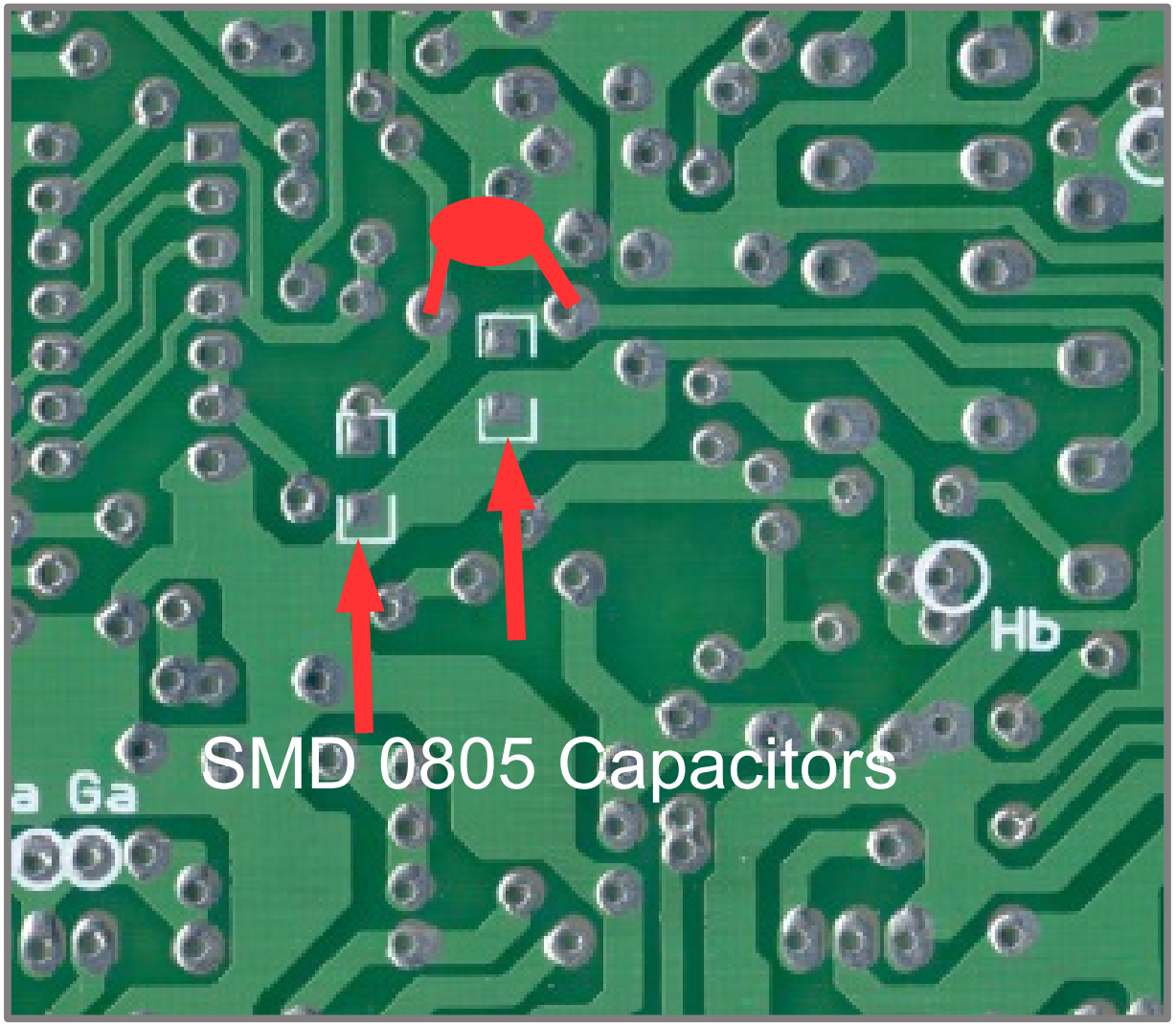


New release PCB Has Mixer LPF



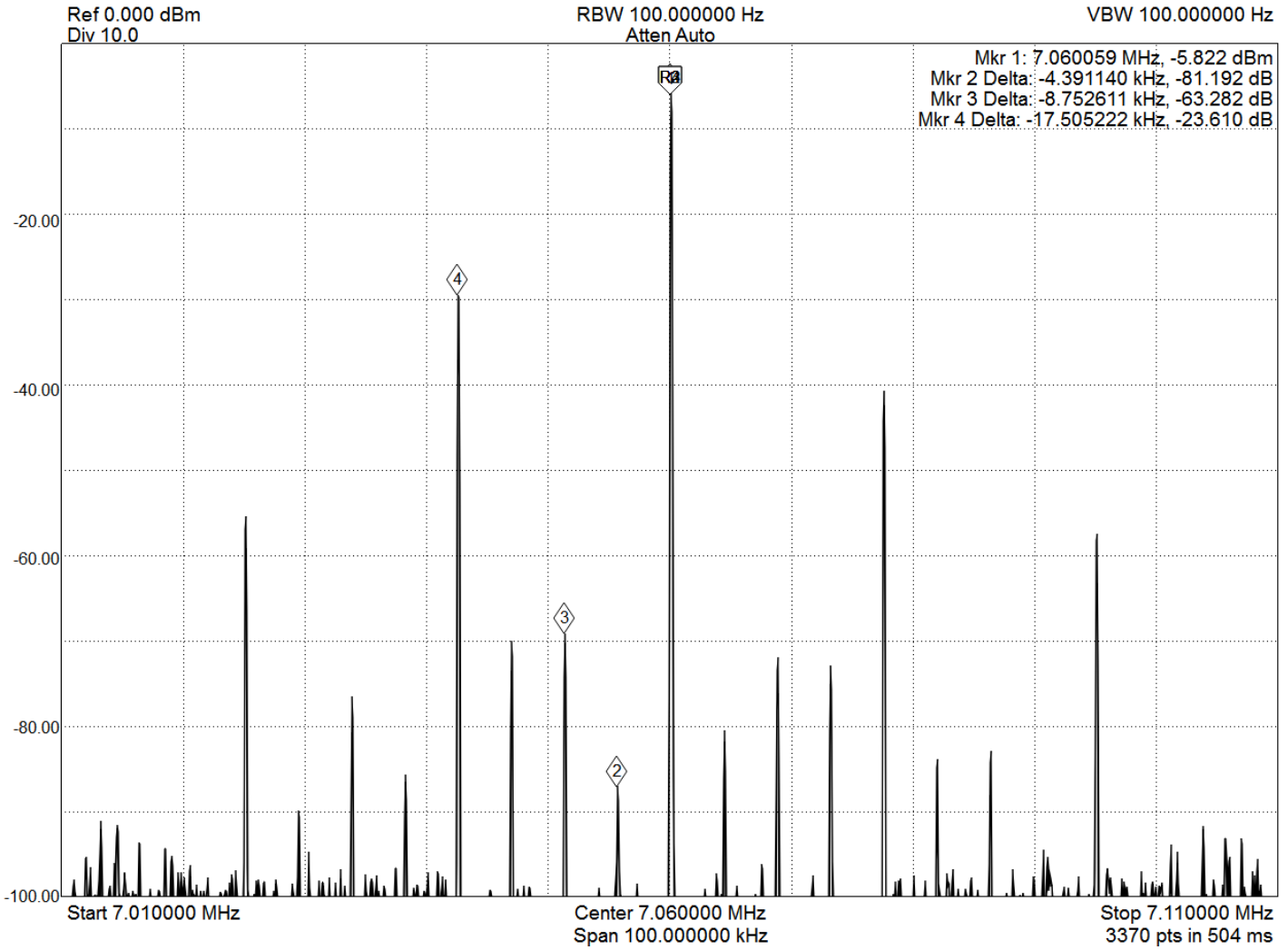
PCB Bottom

Radial Capacitor added to bottom

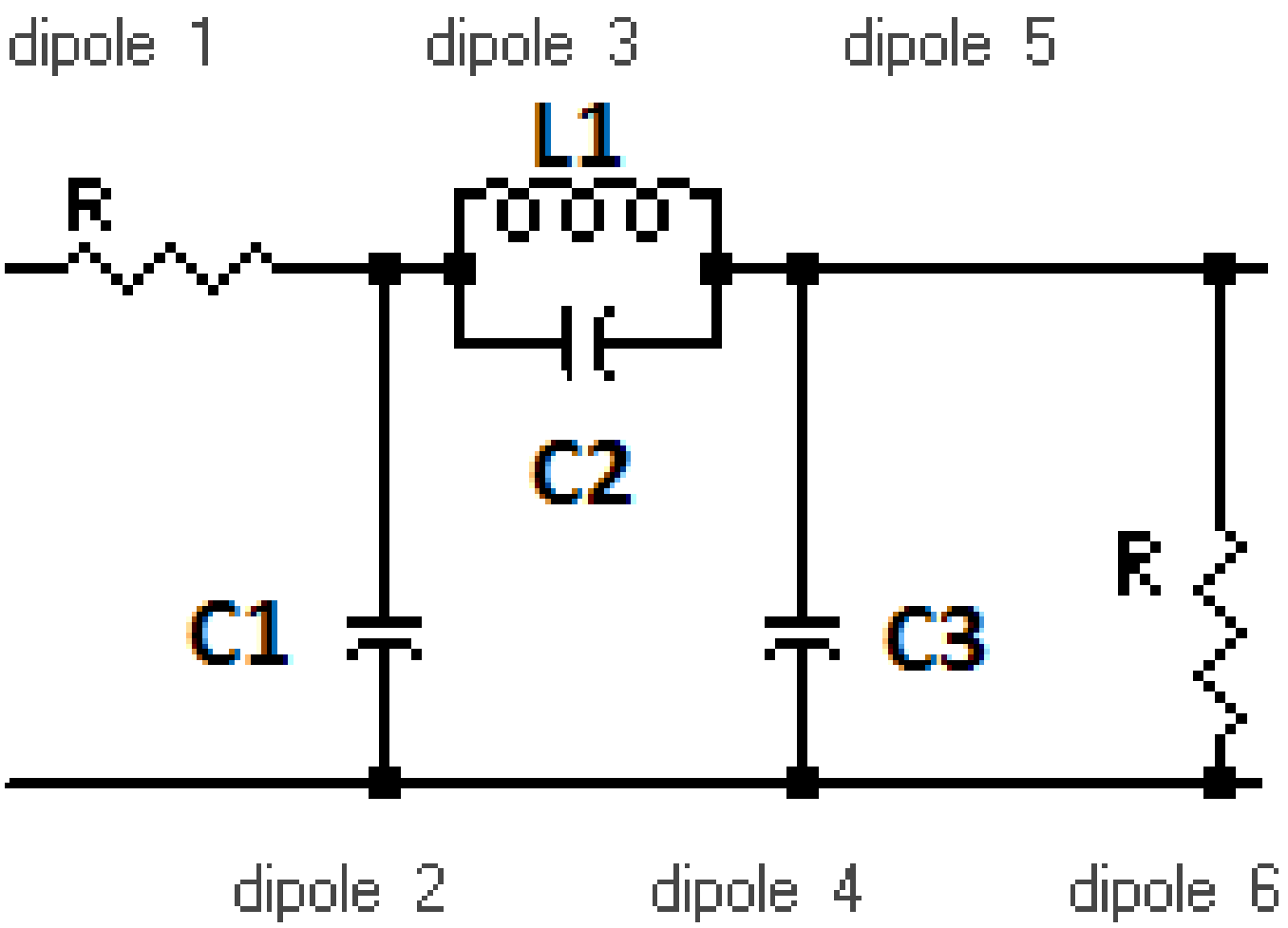


No LPF

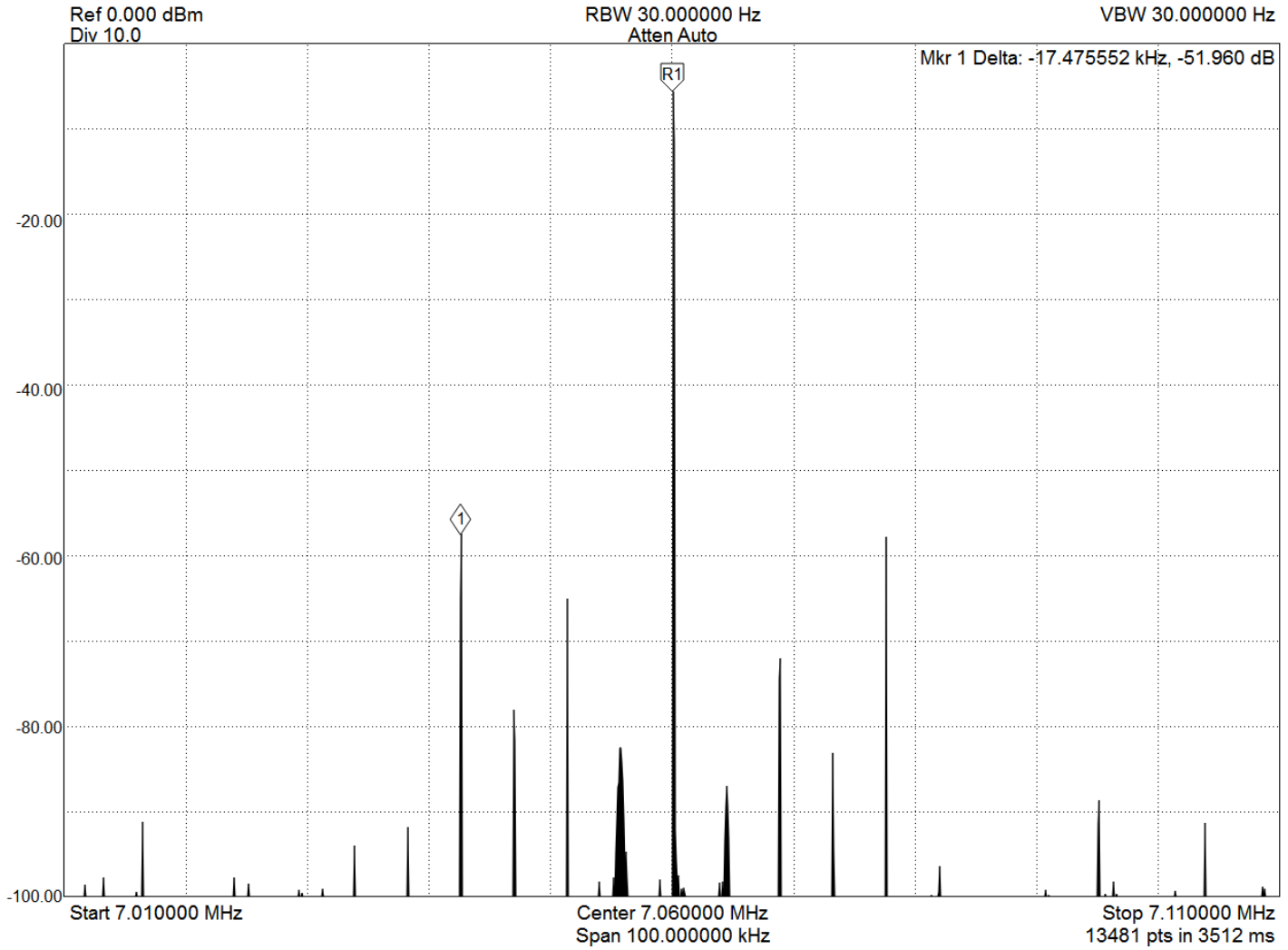
Marker 2 is LOSC; Marker 3 is TX Image; Marker 4 is the problem



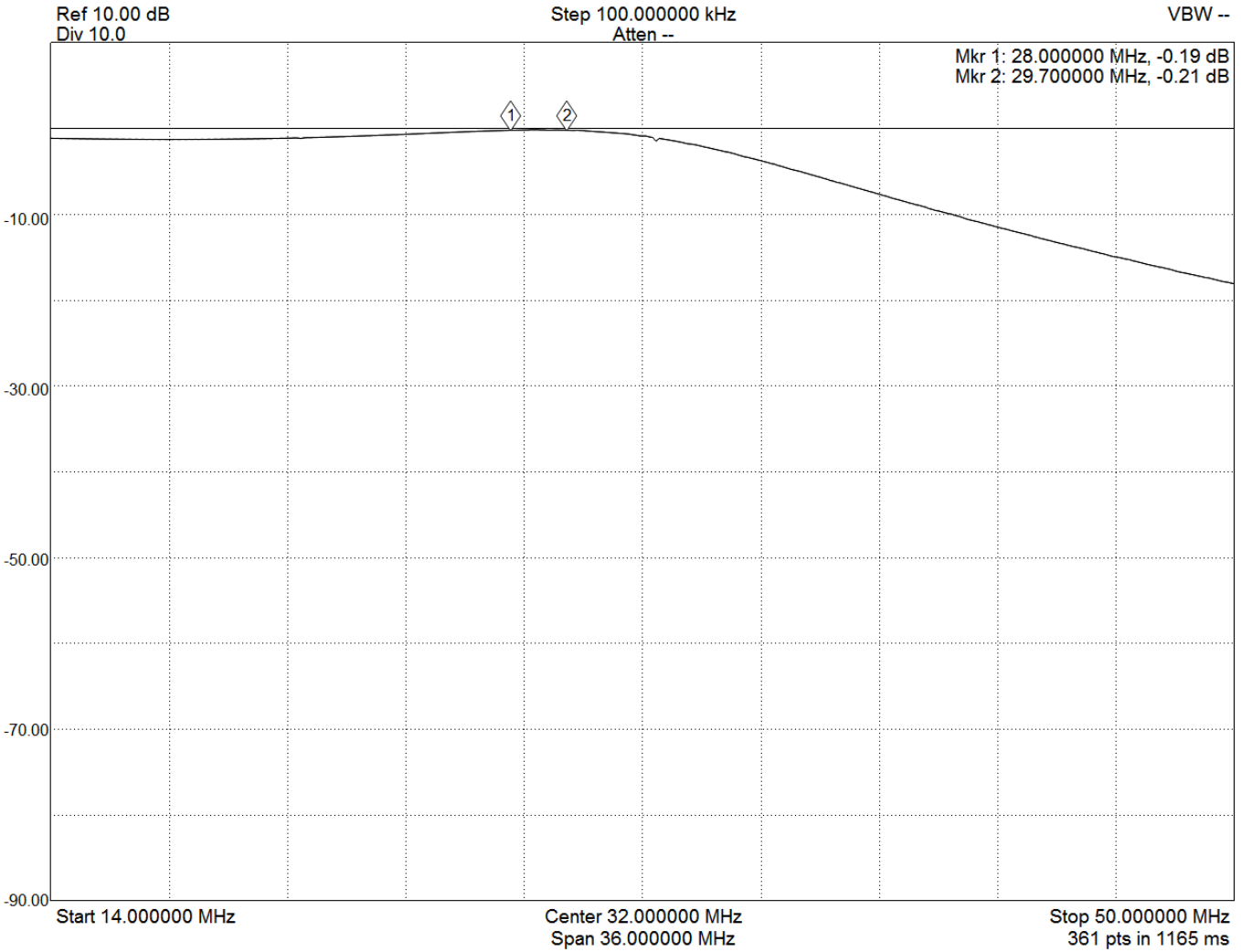
LPF


dipole 1
dipole 3
dipole 5
L1
R
C2
C1
C3
R
dipole 2
dipole 4
dipole 6

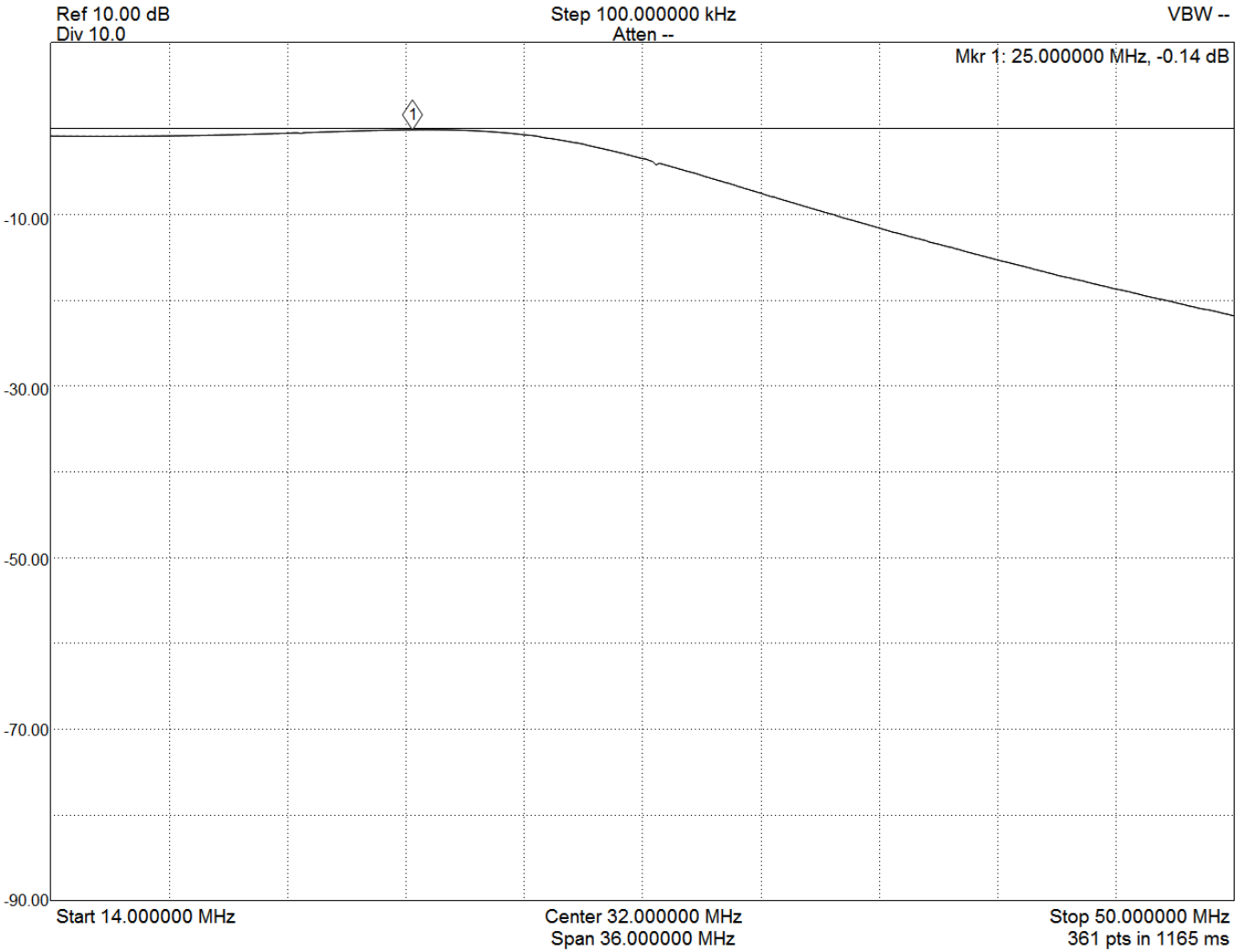
With LPF
Problem fixed :)



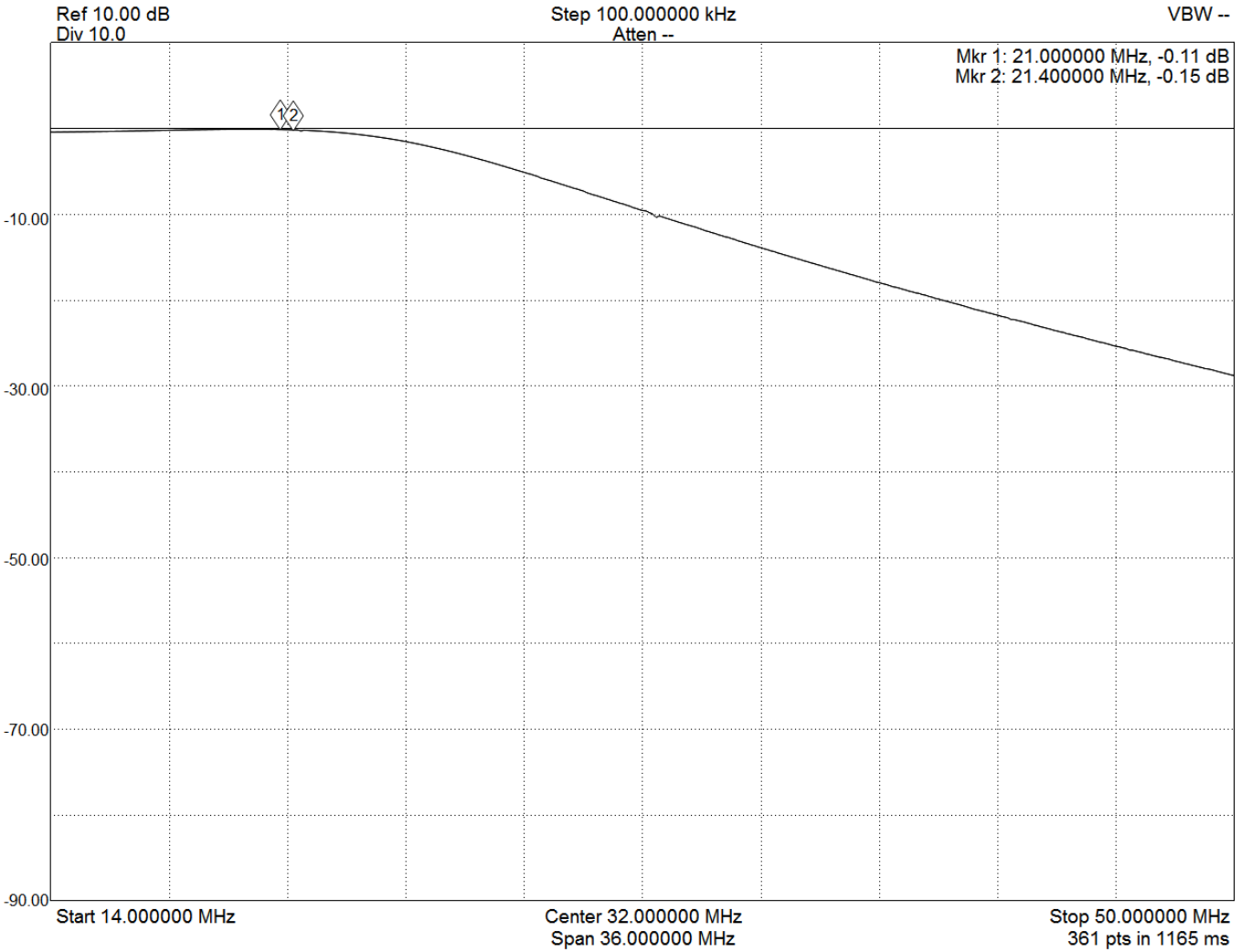
10M


Ref 10.00 dB
Div 10.0
Step 100.000000 kHz
Atten --
VBW --
Mkr 1: 28.000000 MHz, -0.19 dB
Mkr 2: 29.700000 MHz, -0.21 dB
-10.00
-30.00
-50.00
-70.00
-90.00
Start 14.000000 MHz
Center 32.000000 MHz
Span 36.000000 MHz
Stop 50.000000 MHz
361 pts in 1165 ms

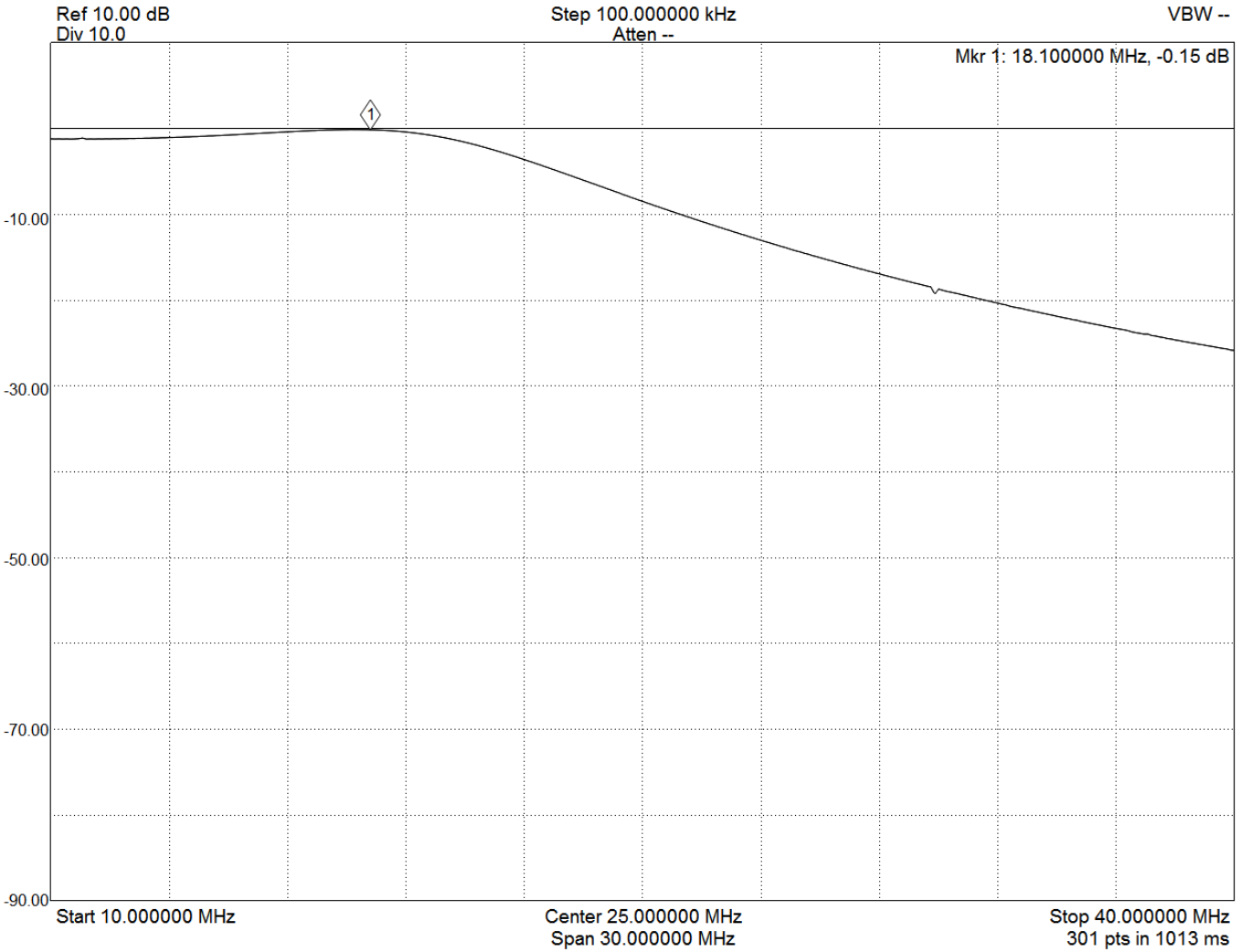
12M


Ref 10.00 dB
Div 10.0
Step 100.000000 kHz
Atten --
VBW --
Mkr 1: 25.000000 MHz, -0.14 dB
-10.00
-30.00
-50.00
-70.00
-90.00
Start 14.000000 MHz
Center 32.000000 MHz
Span 36.000000 MHz
Stop 50.000000 MHz
361 pts in 1165 ms

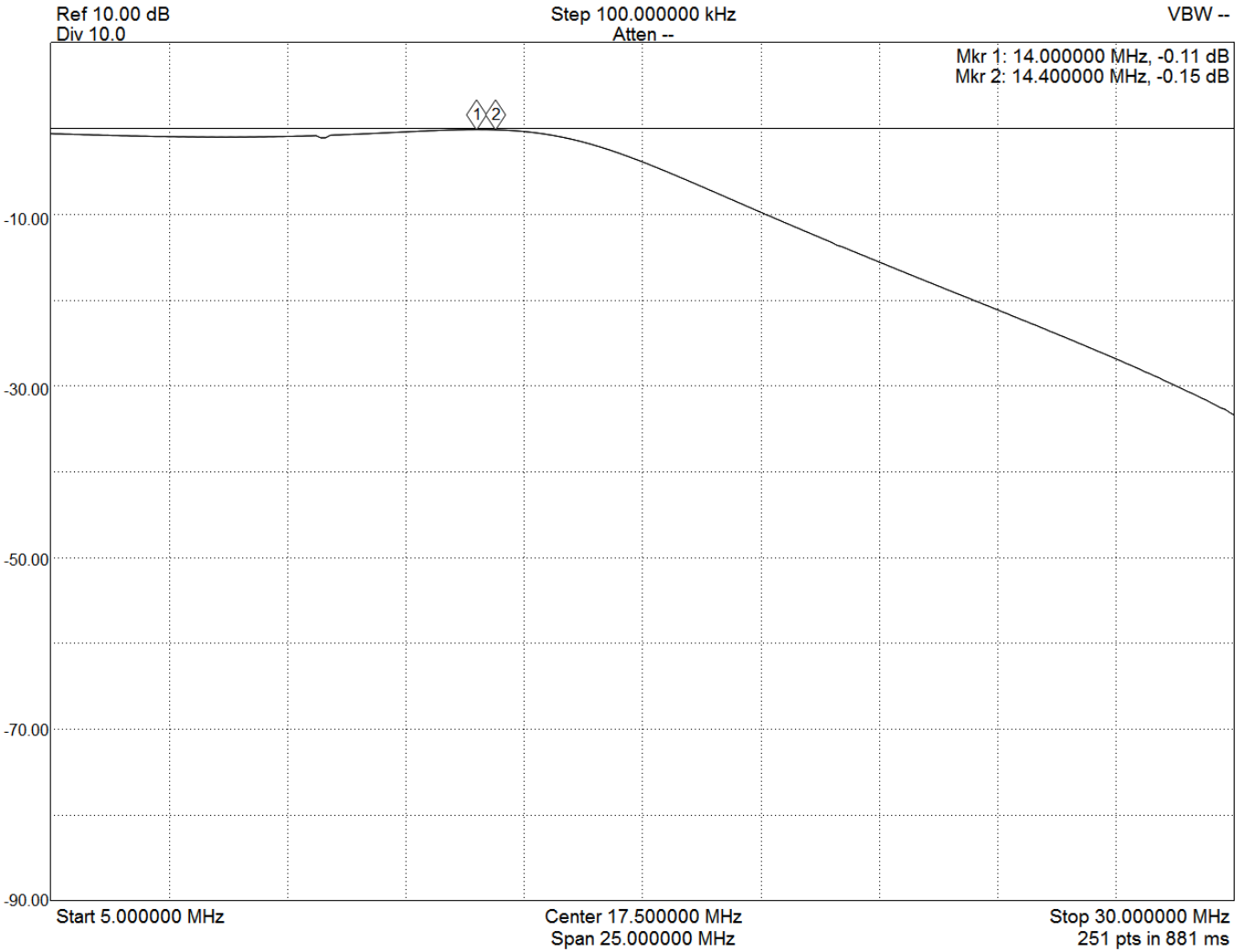
15M


Ref 10.00 dB
Div 10.0
Step 100.000000 kHz
Atten --
VBW --
Mkr 1: 21.000000 MHz, -0.11 dB
Mkr 2: 21.400000 MHz, -0.15 dB
-10.00
-30.00
-50.00
-70.00
-90.00
Start 14.000000 MHz
Center 32.000000 MHz
Span 36.000000 MHz
Stop 50.000000 MHz
361 pts in 1165 ms

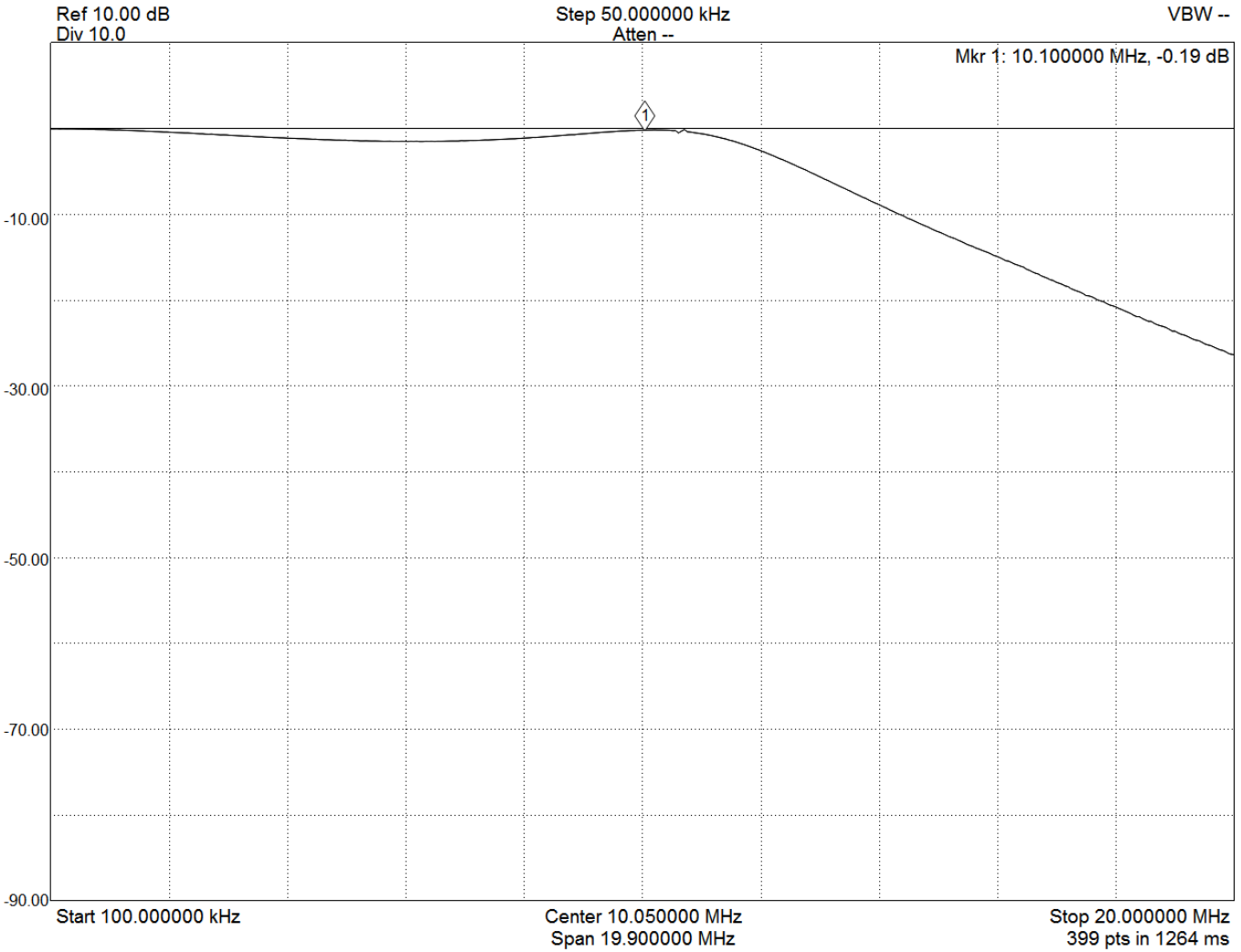
17M


Ref 10.00 dB
Div 10.0
Step 100.000000 kHz
Atten --
VBW --
Mkr 1: 18.100000 MHz, -0.15 dB
-10.00
-30.00
-50.00
-70.00
-90.00
Start 10.000000 MHz
Center 25.000000 MHz
Span 30.000000 MHz
Stop 40.000000 MHz
301 pts in 1013 ms

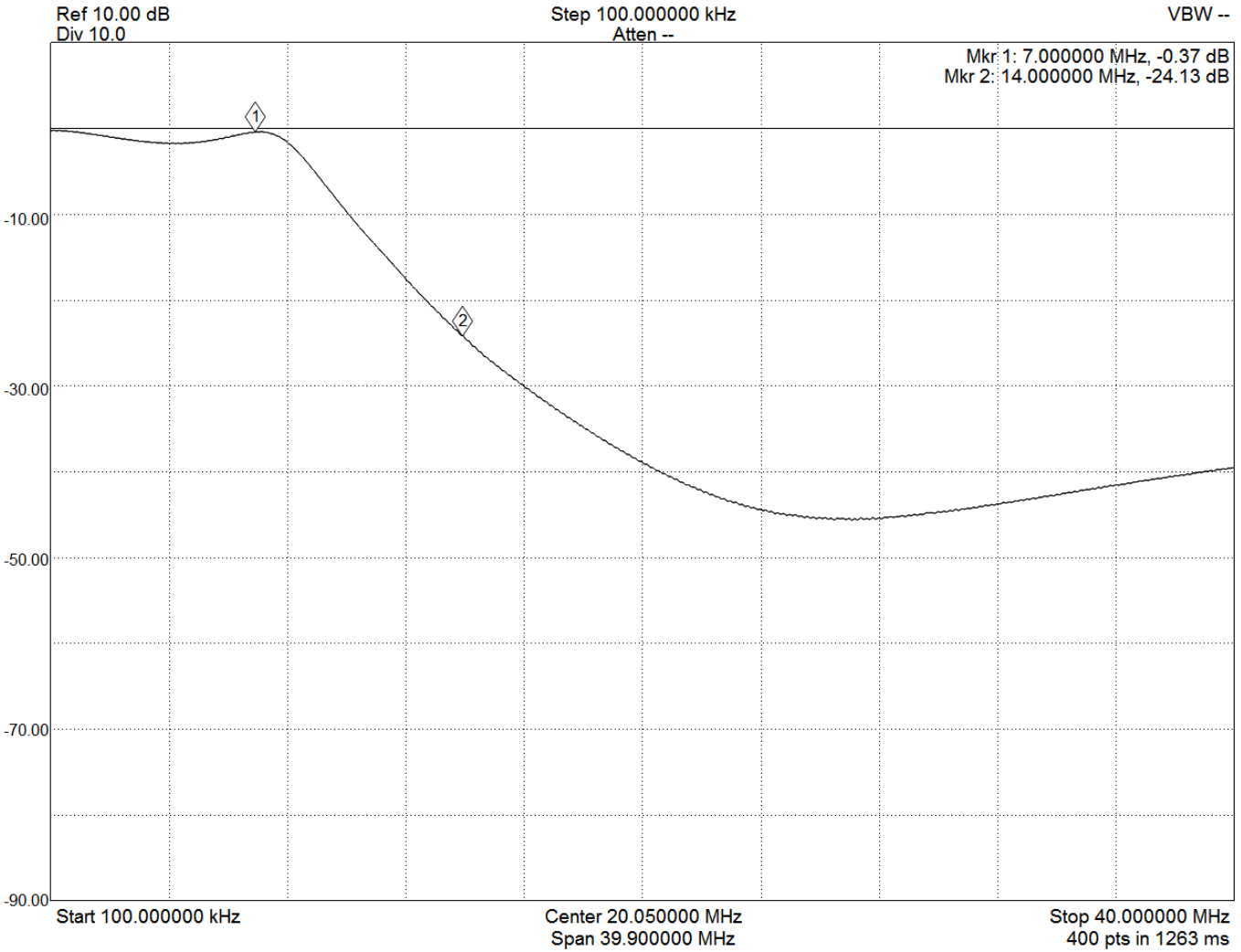
20M


Ref 10.00 dB
Div 10.0
Step 100.000000 kHz
Atten --
VBW --
Mkr 1: 14.000000 MHz, -0.11 dB
Mkr 2: 14.400000 MHz, -0.15 dB
1
2
-10.00
-30.00
-50.00
-70.00
-90.00
Start 5.000000 MHz
Center 17.500000 MHz
Span 25.000000 MHz
Stop 30.000000 MHz
251 pts in 881 ms

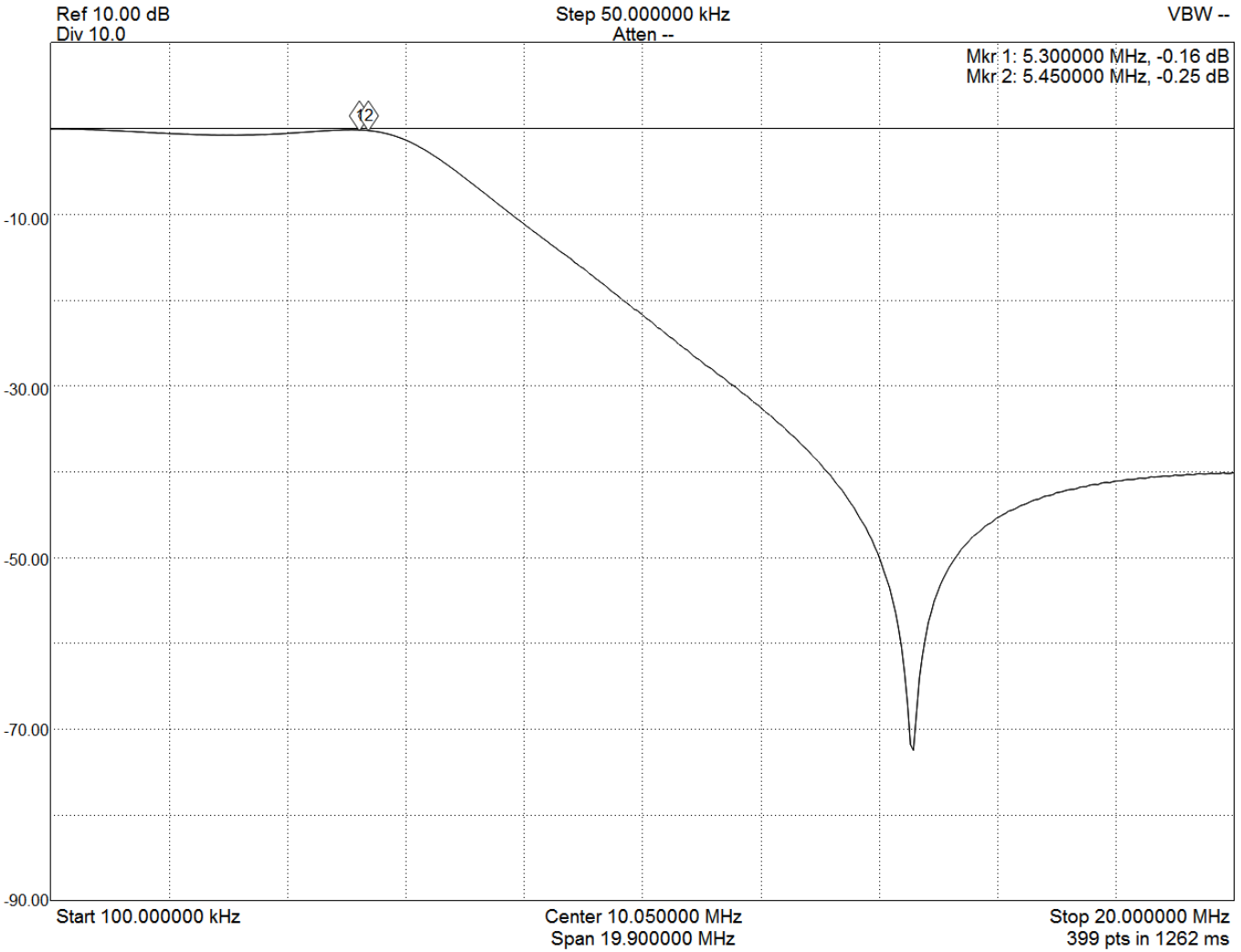
30M


Ref 10.00 dB
Div 10.0
Step 50.000000 kHz
Atten --
VBW --
Mkr 1: 10.100000 MHz, -0.19 dB
-10.00
-30.00
-50.00
-70.00
-90.00
Start 100.000000 kHz
Center 10.050000 MHz
Span 19.900000 MHz
Stop 20.000000 MHz
399 pts in 1264 ms

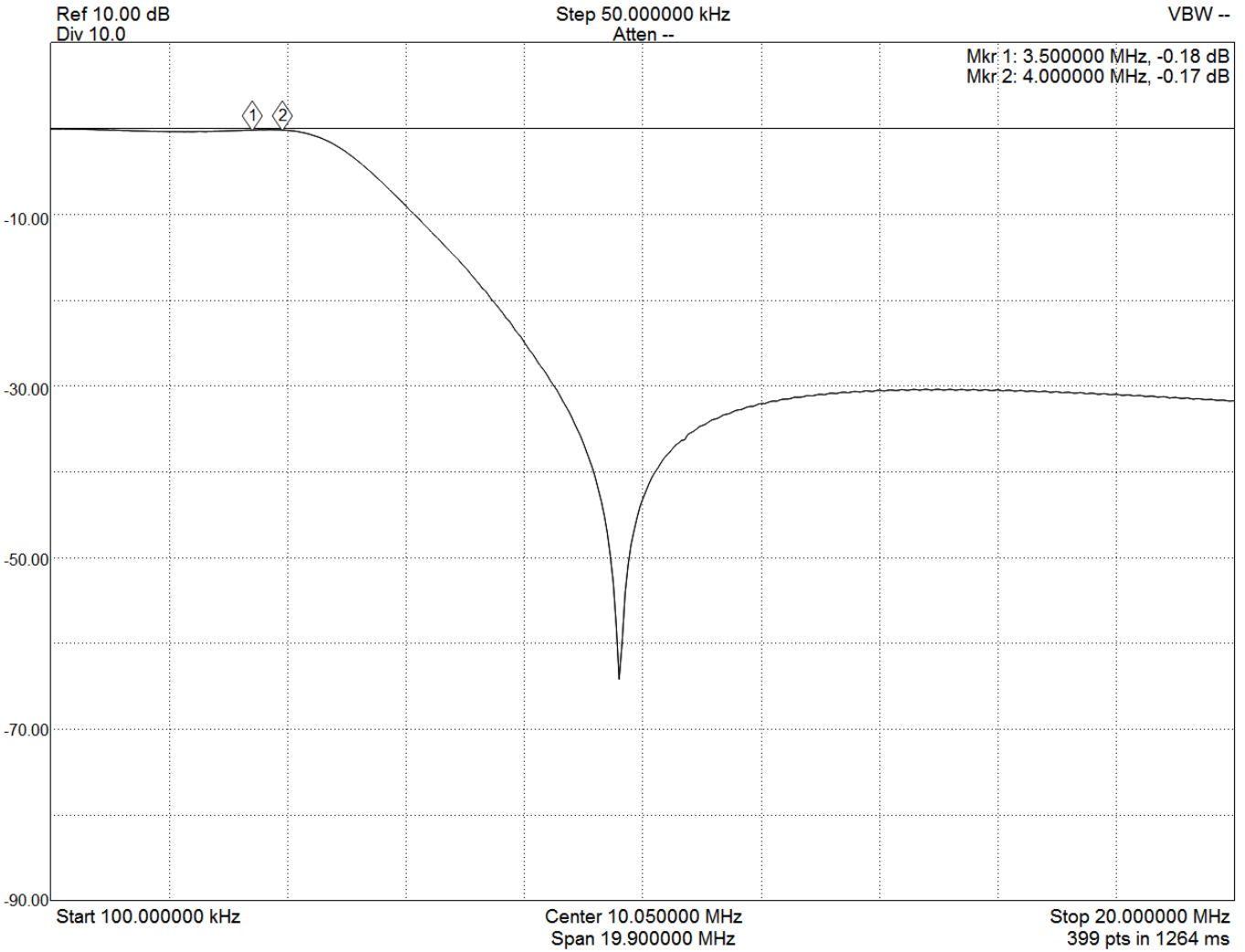
40M


Ref 10.00 dB
Div 10.0
Step 100.000000 kHz
Atten --
VBW --
Mkr 1: 7.000000 MHz, -0.37 dB
Mkr 2: 14.000000 MHz, -24.13 dB
-10.00
-30.00
-50.00
-70.00
-90.00
Start 100.000000 kHz
Center 20.050000 MHz
Span 39.900000 MHz
Stop 40.000000 MHz
400 pts in 1263 ms

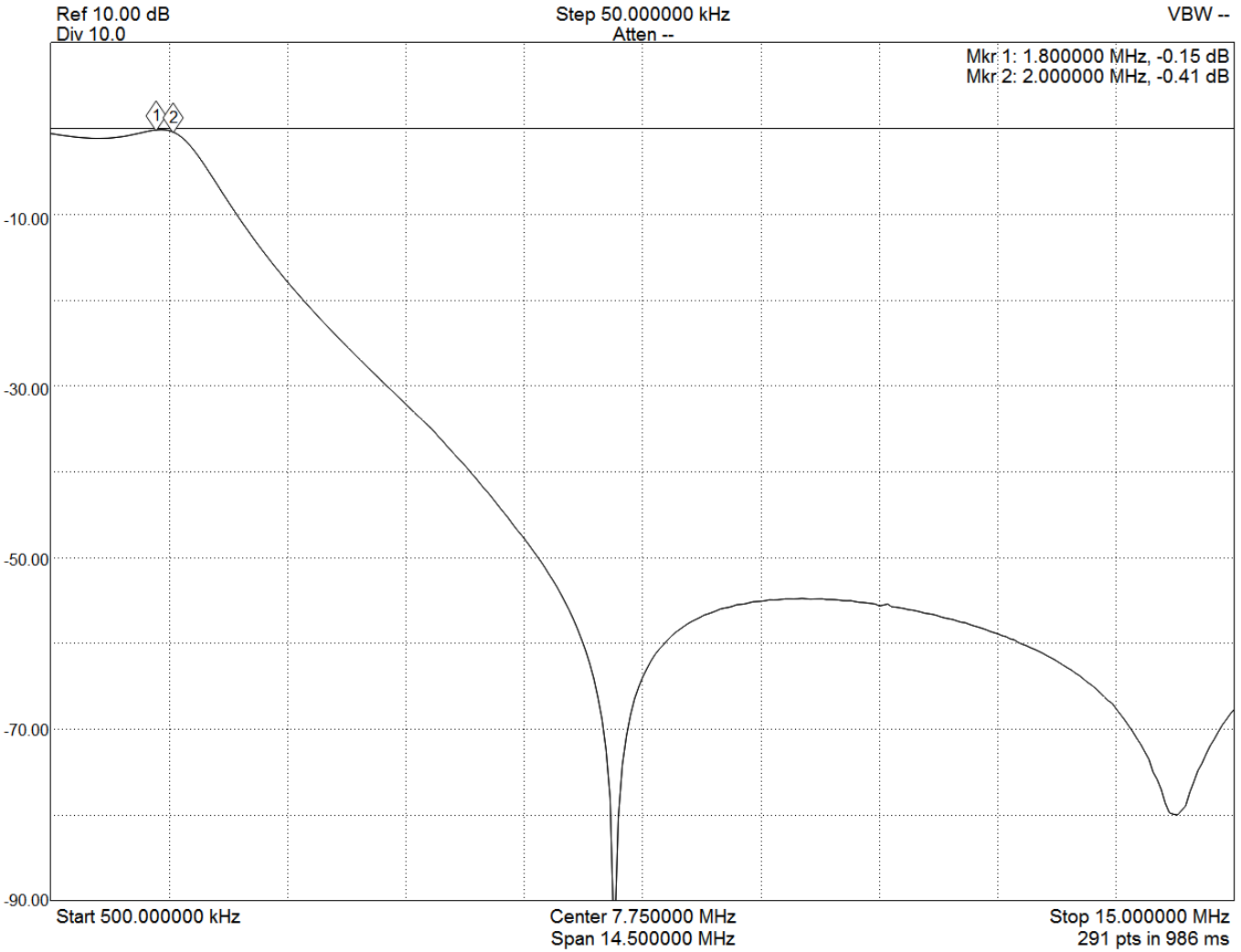
60M


Ref 10.00 dB
Div 10.0
Step 50.000000 kHz
Atten --
VBW --
Mkr 1: 5.300000 MHz, -0.16 dB
Mkr 2: 5.450000 MHz, -0.25 dB
-10.00
-30.00
-50.00
-70.00
-90.00
Start 100.000000 kHz
Center 10.050000 MHz
Span 19.900000 MHz
Stop 20.000000 MHz
399 pts in 1262 ms

80M


Ref 10.00 dB
Div 10.0
Step 50.000000 kHz
Atten --
VBW --
Mkr 1: 3.500000 MHz, -0.18 dB
Mkr 2: 4.000000 MHz, -0.17 dB
1
2
-10.00
-30.00
-50.00
-70.00
-90.00
Start 100.000000 kHz
Center 10.050000 MHz
Span 19.900000 MHz
Stop 20.000000 MHz
399 pts in 1264 ms

160M


Ref 10.00 dB
Div 10.0
Step 50.000000 kHz
Atten --
VBW --
Mkr 1: 1.800000 MHz, -0.15 dB
Mkr 2: 2.000000 MHz, -0.41 dB
-10.00
-30.00
-50.00
-70.00
-90.00
Start 500.000000 kHz
Center 7.750000 MHz
Span 14.500000 MHz
Stop 15.000000 MHz
291 pts in 986 ms