GenesisRadio.com.au
Software Defined Radio Kit

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GSDR calibration

For proper GSDR operation is necessary to make several different types of calibration. For this we need a good quality signal generator with the precise level adjustment signal and an external receiver (preferably a spectrum analyzer).

We start from the Si570 signal generator calibration which must performed at least half hour after the powering radio equipment:
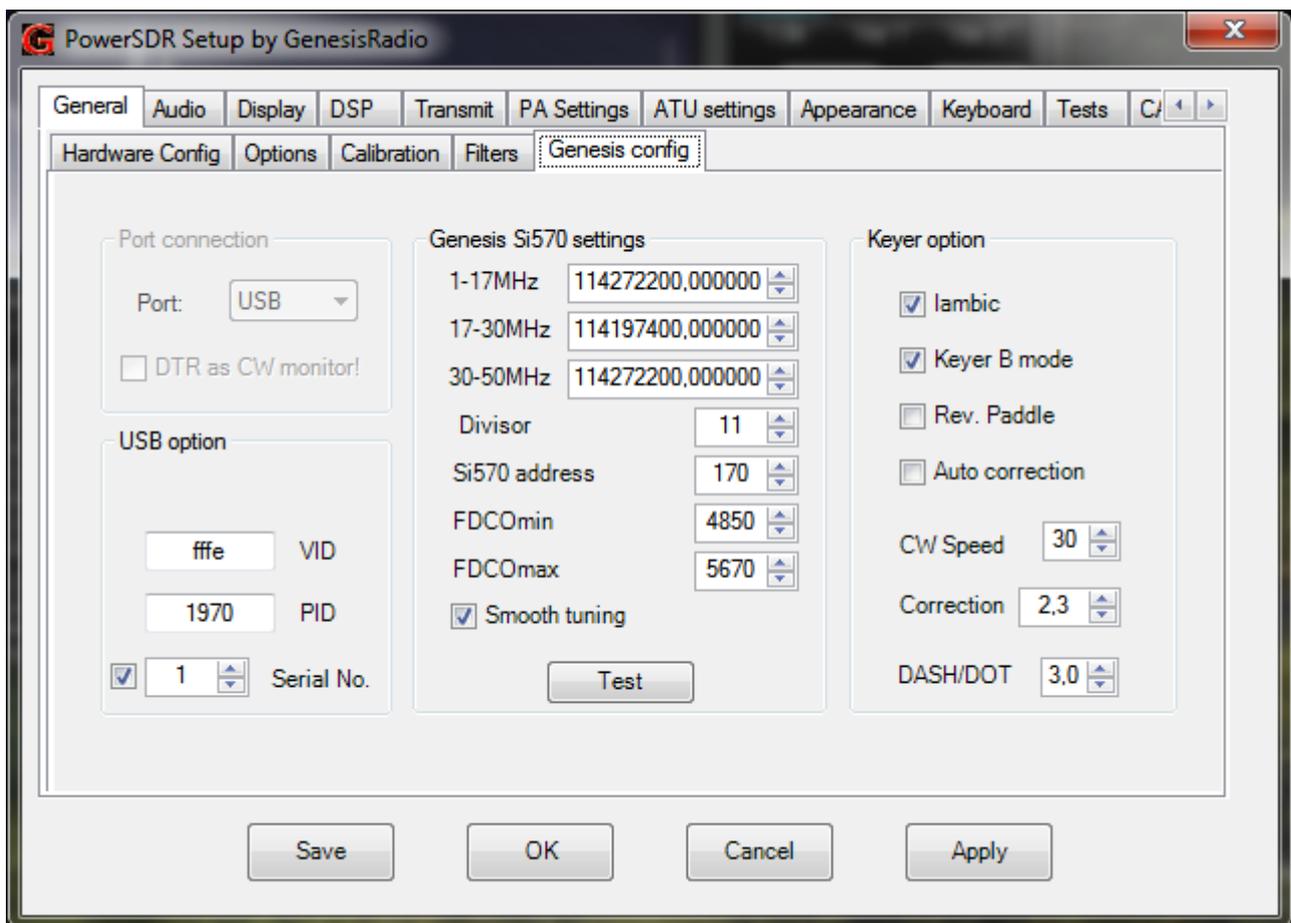

Here we set the value for the Si570 internal reference, which is about 114MHz (initially 114272200.0 Hz). The easiest way is to use WWV signal as a reference and CW for receiver mode. After each change, press the Test button and watch how signal moves left/right on the screen.

Put GSDR in Panadapter mode.
During calibration process:
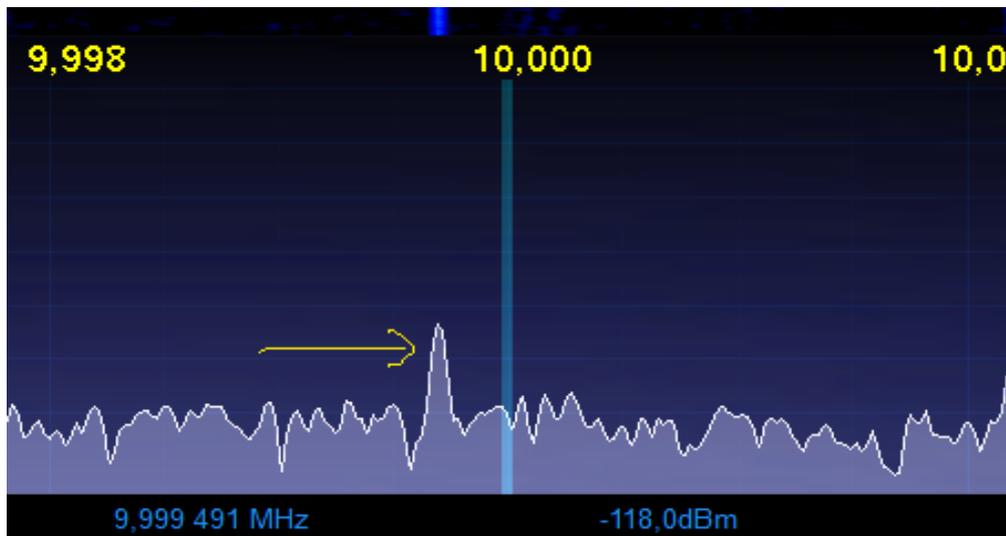
When you done(Si570 reference is set to 114275700,000000):
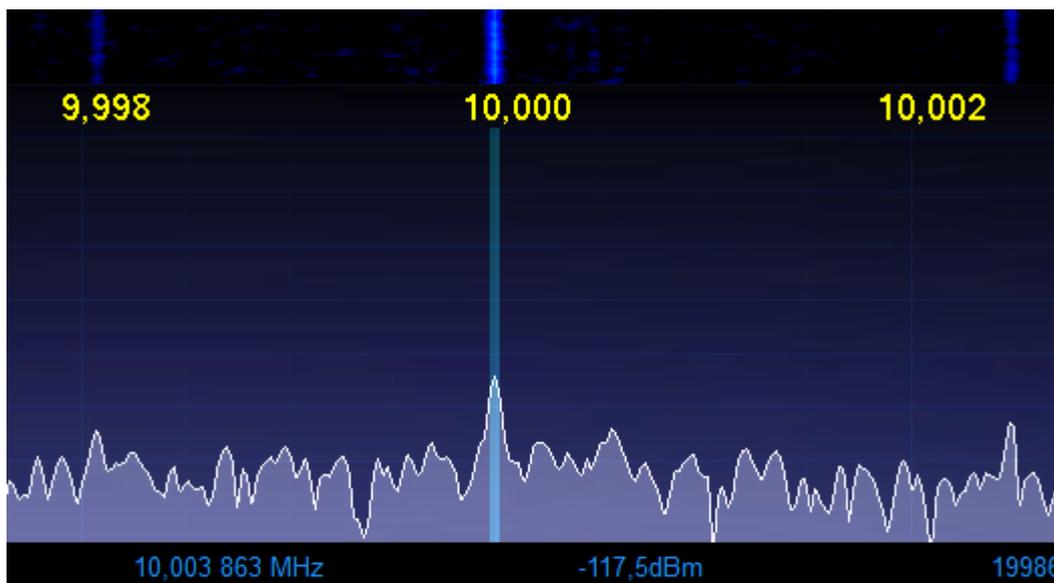
Si570 calibration can be done also using Phase display mode. On the screen you will see a circle that spins. Its size corresponds to a recived signal strength and rotation speed is represent difference in frequency. If you are careful with this procedure you can nearly stopp the circle. Described procedure refers to the G59 and G11 and for other radio devices with external Si570 (like QRP2000) follow instructions for a particular model.

Put GSDR in Phase mode and reduce Main Display FPS to 5-8.
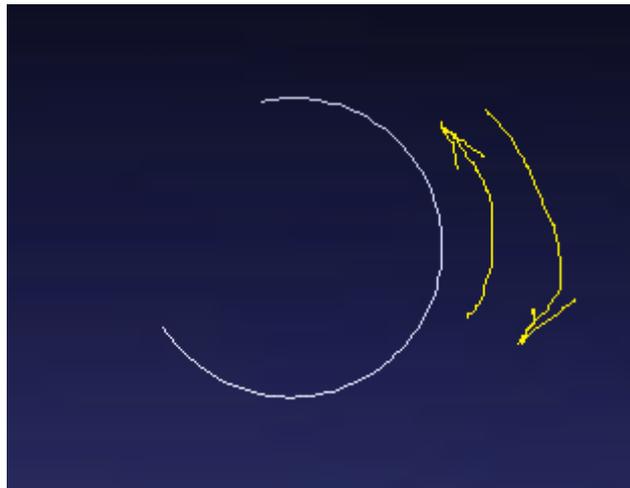
When circle almost stopping calibration is done.

For displaying correctly signals on the GSDR display and correct S-meter indication needs to be done "Level Calibration". Open GSDR and establish connection to your radio device. Then open the Setup-> General-> Calibration:
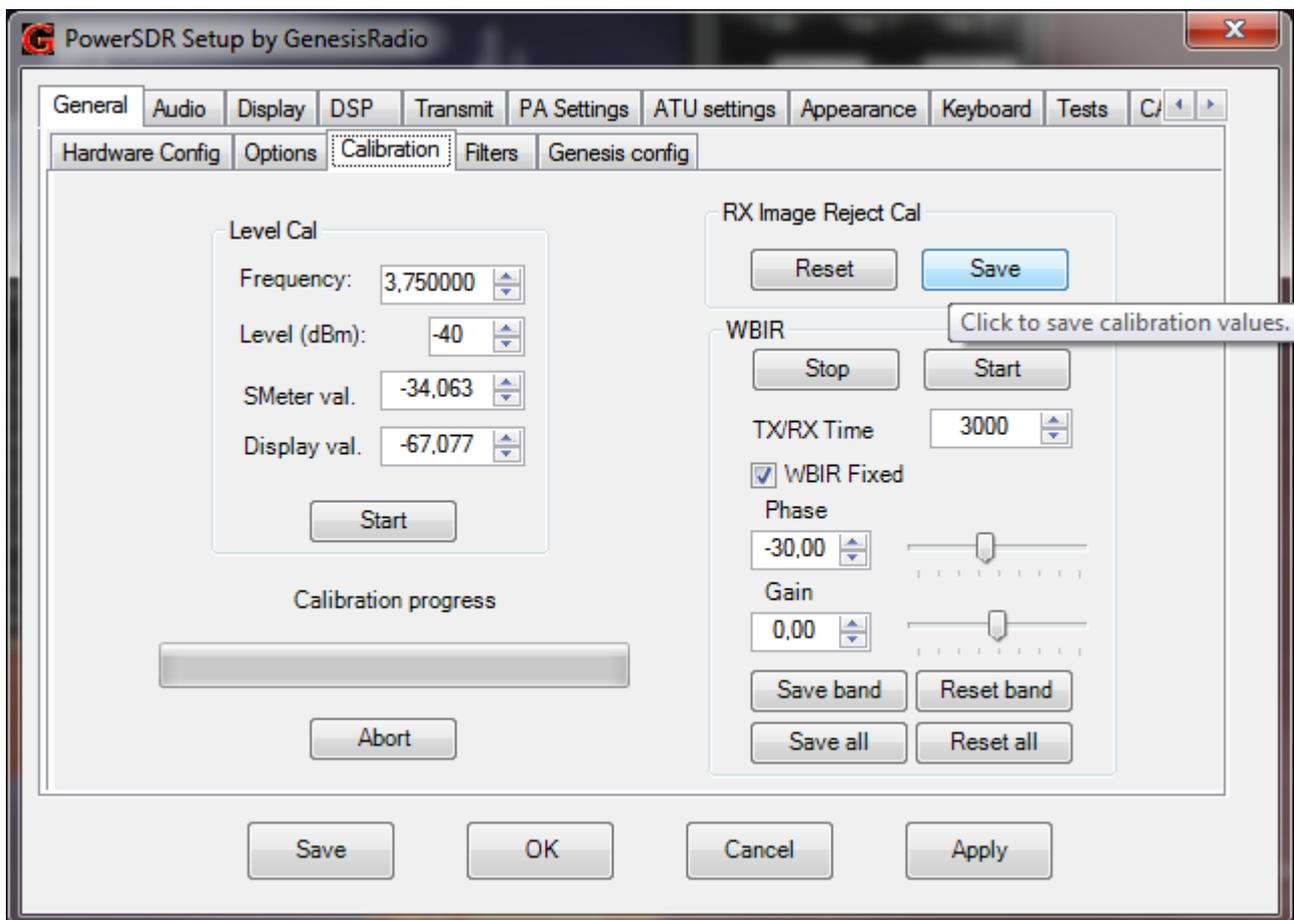
In the Frequency box enter frequency with an accuracy of +/- 1KHz and in Level (dBm) box signal level which is used for calibration. Calibration starts by pressing the Start button. After completing the procedure in the box "Display val." is entered, calibration value. Now, the GSDR displays correct signal levels. If you are not happy with settings chage them manually.

Calibration "RX Image Reject" is necessary for nulling unwanted signal image (results of imperfection in I/Q IF chain, A/D conversion, I/Q is not the ideal angle of 90 degrees). It is necessary to bring the signal to the input of radio equipment not weaker than -40dBm and the first adjust hardware. This can be done only if we first stop WBIR function by pressing the Stop button. By only adjusting the radio device hardware we can obtain 35-40dB suppression of unwanted signal in the wide frequency range. If you are unable to do so make sure you adjust the audio subsystem.

Only after this you can continue with the rest of the calibration by pressing the Reset button. Now the WBIR functions should fully null the unwanted signal and to suppress it more than 80dB! Press the Save button and obtained values will be stored into the database. This procedure must be repeated for each band!

If you have problem with automatic WBIR function or working only on fixed frequency (WSPR,JT65HF,PSK....) use WBIR fixed option. It will use one Phase/Gain per band.Procedure is similar: connect strong signal to radio input and place him on the centre of one side of the Panadapter screen.Then with adjusting Phase/Gain sliders reduce unwanted signal image.WIth little patience -60dB rejection on entire band can be obtain.After calibration is done press "Save band" or "Save all" (bands) button for saving Phase/Gain values to database.
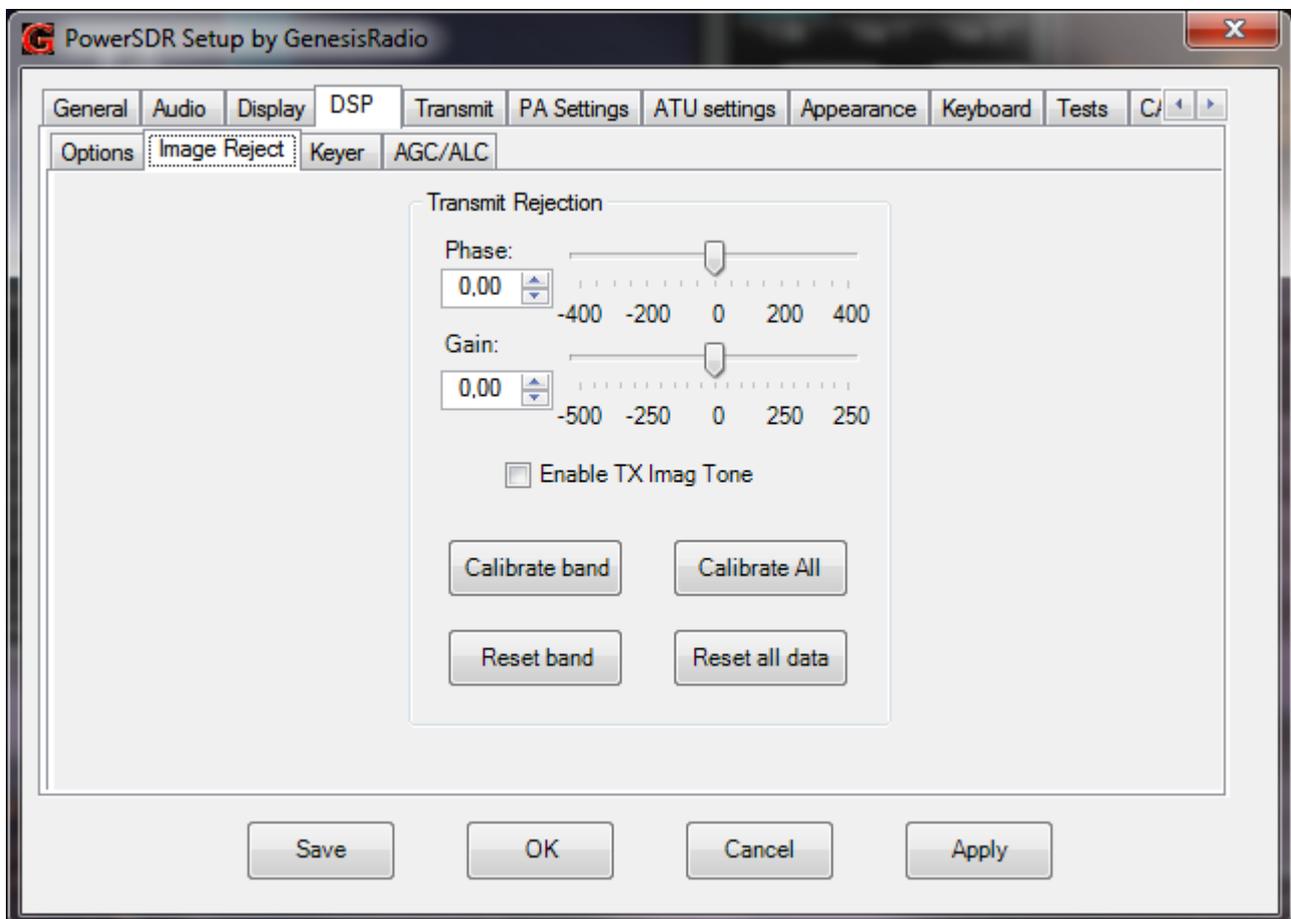
Before calibration:
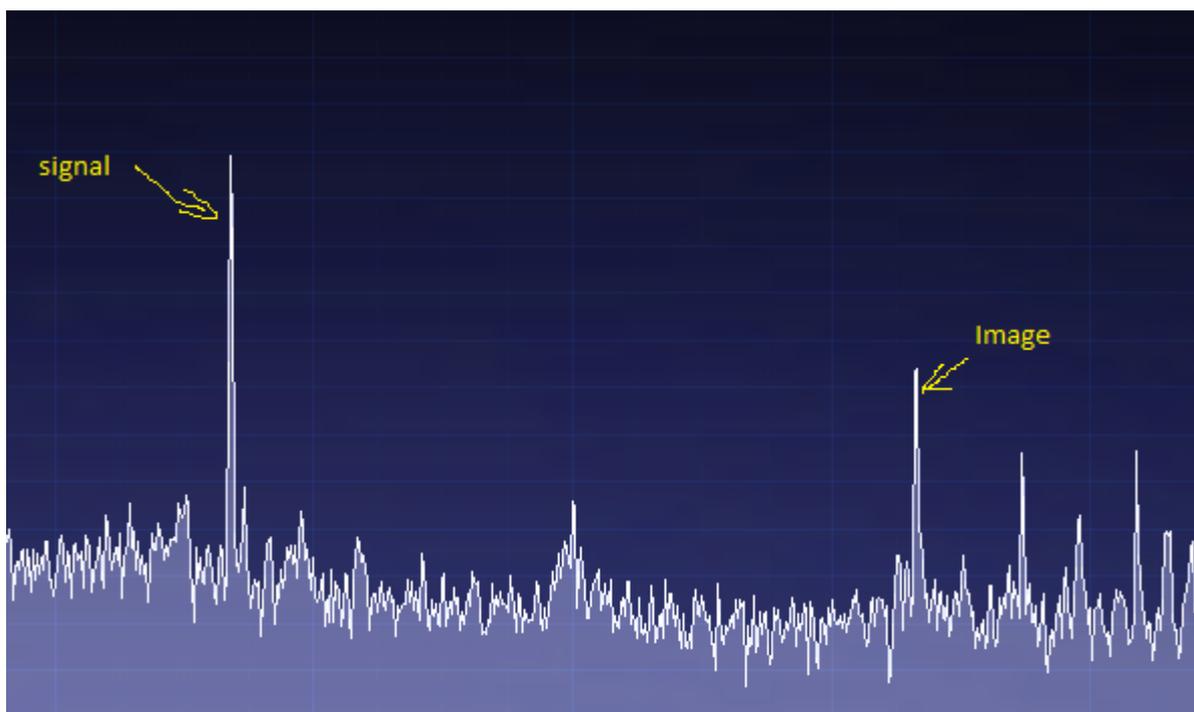
After finished calibration:
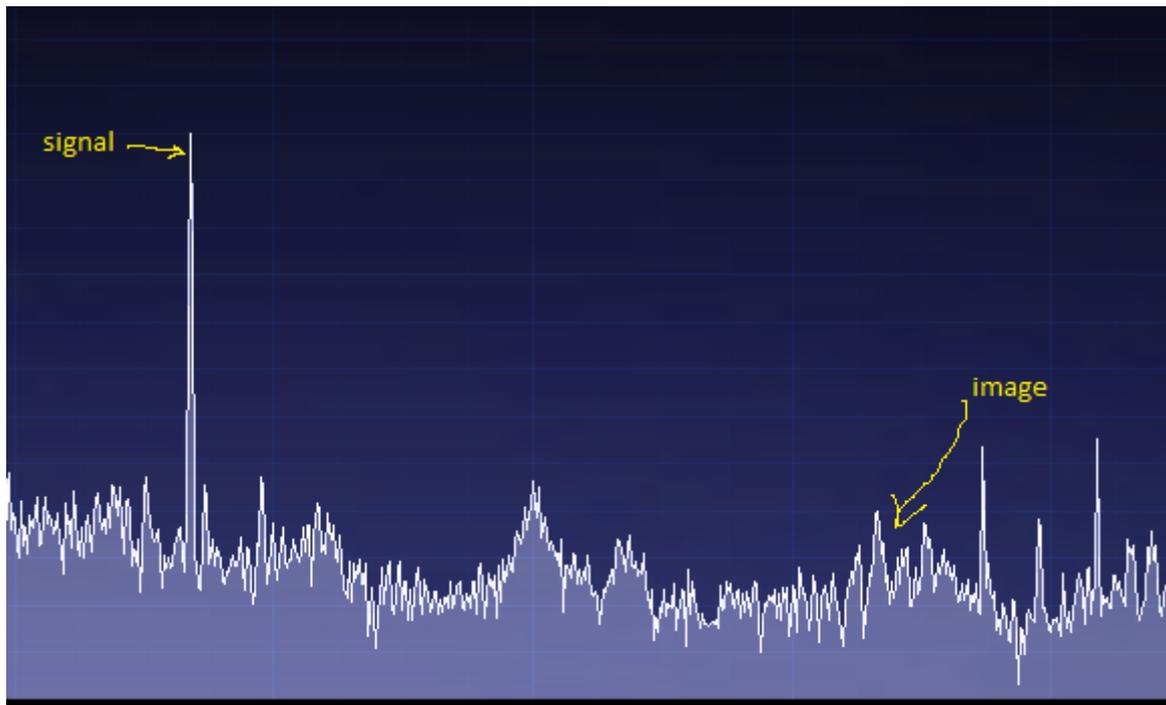
During transmit unwanted signals appears and we need to supress them in hardware and software.

As with the receive calibration it is necessary to adjust hardware to suppress unwanted image signals and local oscillator. For specific procedures refer to the manual for your radio model. After hardware suppression software calibration must be done. You need an external receiver which is set to the frequency of unwanted image (eg, if the transmit signal is 14.040MHz, TX IF Shift 15000Hz unwanted signal will be at 14.010MHz). Change the value of Gain and Phase until maximum suppression is achieved. Final value depends on the used audio driver and the radio hardware. In practice it is very easy to achieve values of -80dB! To store obtained value in the database, click "Caibrate Band" for the current band or 'Calibrate All" to fill complete table for all bands. Best results are achieved if this procedure is repeated for each band.
If you image signal is not changed try to reverse I/Q signals by turning on "TX swap I/Q".

 For constant power output on all bands it is necessary to calibrate the output level. For G59 and G11, this option will work automatically.
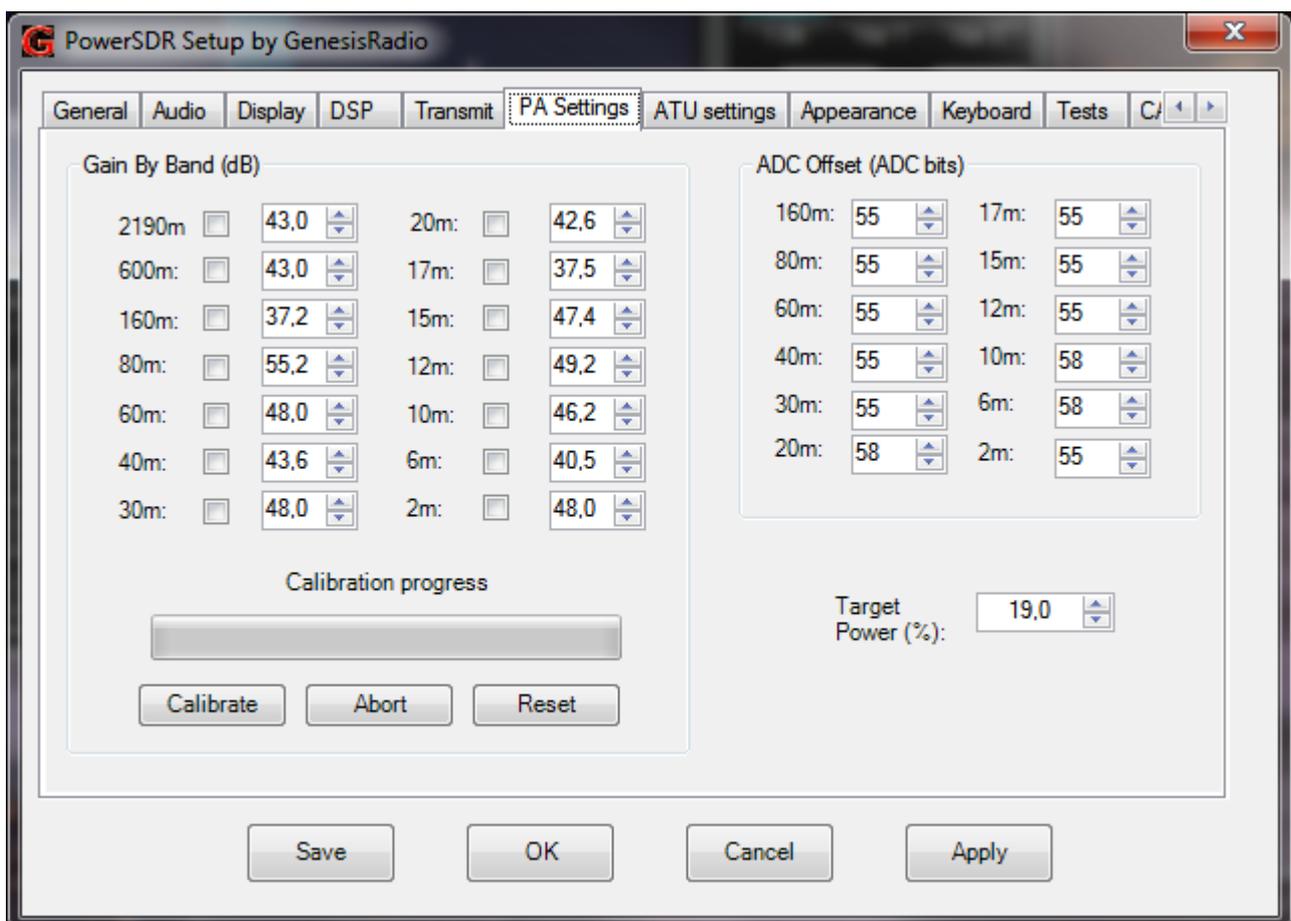
First, conncet artificial load of 50 ohms to the output of PA. We then need to enter the correct value for the "Audio Output Voltage" in the Audio section (obtained by measuring the audio signal with True RMS voltage meter). Connect an external SWR/PWR meter to the output of PA and start TUN function. Set PWR slider to 100% and change the value of gain for the current band, until extern PWR meter display 10W of output power. Then change ADC offset correction for the current band until GSDR S-meter also shows 10W. Rewrite this value to ADC Offset for all bands. It is now possible to do the calibration for other bands. Select the bands you want to calibrate and press the "Calibrate" button. If you entered the wrong value for "Audio Output Voltage" or having problem with the BPF PA procedures will not be able to complete its task.