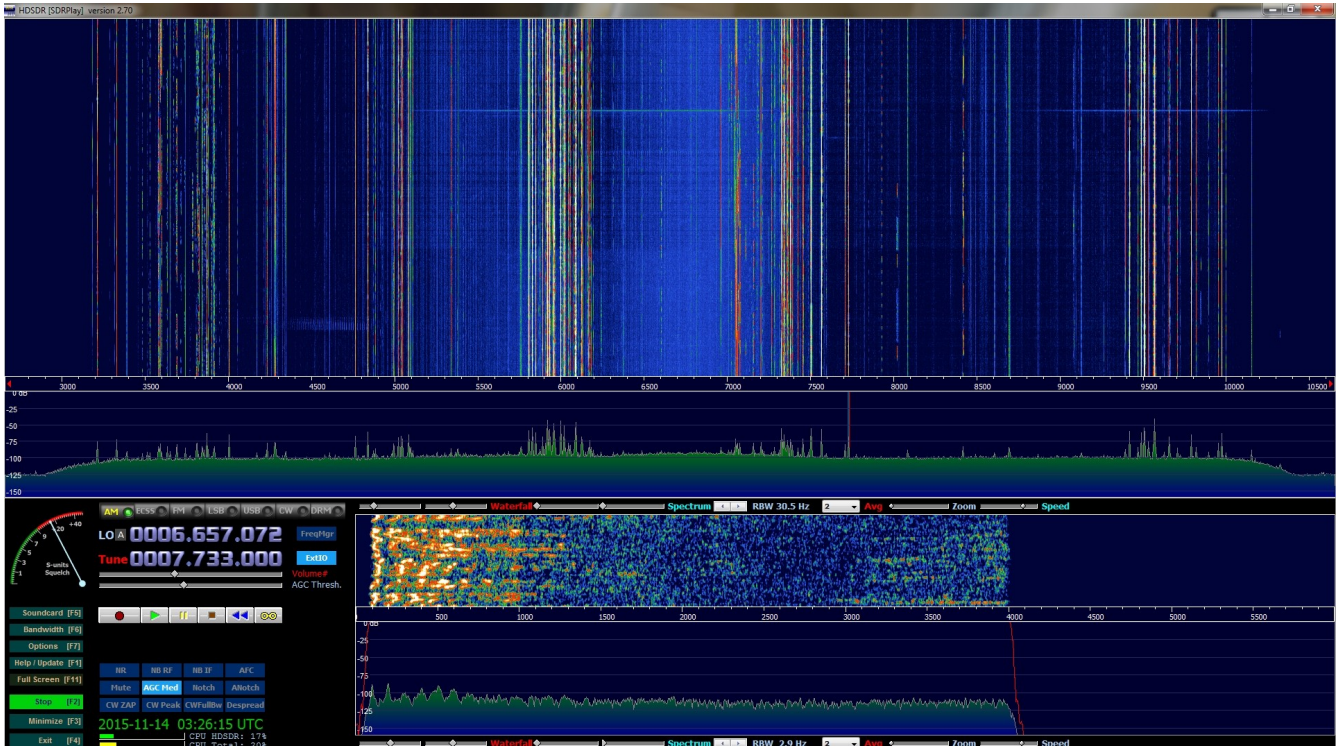


SDRPlay RSP-HSDR HANDBOOK v1.11.2016
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This is the newly revised edition of the HSDR-SDRPlay RSP setup guide. This guide will help you setup the RSP in HSDR as fast as possible and explain most of the key features of the RSP EXT/IO & most of the functions of HSDR.

My instructions are not set in stone. This is the way I have my RSP setup using HSDR for HF listening (shortwave). My settings are not optimized for listening to VHF/UHF listening. If you run into any issues you can reach me at the above email address or in the SDRPlay Facebook group.

HSDR SETTINGS THAT I WILL COVER

Soundcard settings
Volume settings
Bandwidth settings
Filter adjustments
Center spike removal
PPM correction
Tuning options
Adding frequencies
Plus a whole lot more

Please note: SDRPlay is actively developing the EXT/IO and API driver for the RSP SDR. Always check www.sdrplay.com for the latest EXT/IO and API drivers.

What is a SDR radio:

A SDR is a radio communication receiver where components that have been typically implemented in hardware (e.g. mixers, filters, amplifiers, modulator/demodulator, detectors, etc.) are instead implemented by software run on your desktop, laptop and even your tablet. The software we are using to drive the RSP is HSDR. All the knobs and dials of a traditional radio are now shown on the screen

What is the SDRPlay RSP:

The RSP is a USB powered 12bit full coverage SDR that can process a maximum of 8MHz of bandwidth. Basically it's the best SDR you can buy for about \$160.00. Keep in mind that any SDR receiver is only as good as the antenna you attach to it. If you are a first timer to the world of SDR'S then I would suggest you join us on the SDRPlay Facebook group so we can further help you. The Facebook group is a one stop shop we cover everything and anything RSP related.

Mike Ladd?

First and foremost I'm a Radio/SDR nut. I love everything and anything SDR related. I have been in this hobby for about 20 years. I moved to SDR'S from traditional radios when the RF Space SDR-IQ was released. My shack has seen a huge number of radios come and go. Fast forward to today and my SDR of choice is the RSP. I could not believe the power of this little black box. I really feel that the RSP is the best SDR you can buy when it comes to price and features.

The SDRPlay Facebook Group:

I'm not sure what date I joined the group but after talking to Paul Jones (admin and founder of the SDRPlay Facebook group) we became good friends as we both share many interests. One thing is for sure...We both love the SDRPlay and we both enjoy helping everyone in the group. Paul and myself are in constant contact with the SDRplay team. We really try to push the RSP as far as possible from the end-users perspective. Some of the new functions of the v3 EXT/IO is because of features I felt would truly help all RSP owners. Thank you Paul for trusting me and believing in our joint passion for the airwaves.

Why HSDR:

HSDR is an extremely popular and powerful app for running your RSP SDR. I personally have used almost all the available apps to power up the RSP and in my opinion none of them can match the speed and efficiency of HSDR. With this guide I hope to share my knowledge. HSDR has a lot of tricks up its sleeve.

RSP Specs:*Frequency Range:*

Continuous coverage 100kHz – 2GHz

ADC Characteristics:

Sample frequency 2MSPS – 10.66MSPS

12 bit native ADC

10.4 ENOB

60dB SNR

67dB SFDR

IF Modes:

Zero IF, All IF bandwidths

Low IF, IF bandwidths @ 1.536MHz

IF Bandwidths:

200kHz

300kHz

600kHz

1.536MHz

5.0 MHz

6.0 MHz

7.0 MHz

8.0 MHz

*Automatically configured front end filtering**Low Pass:*

12MHz

Band Pass:

12–30MHz 30–60MHz 60–120MHz 120–250MHz 250–420MHz 420–1000MHz

High Pass:

1000MHz

Typical Noise Figures:

12.5dB @ 3MHz

12.0dB @ 10MHz

11.5dB @ 20MHz

12.0dB @ 40MHz

4.5dB @ 100MHz

4.5dB @ 200MHz

5.0dB @ 360MHz

3.5dB @ 600MHz

3.5dB @ 1300MHz

4.0dB @ 1800MHz

To get the RSP up and running with HSDR there is a 4 step process.

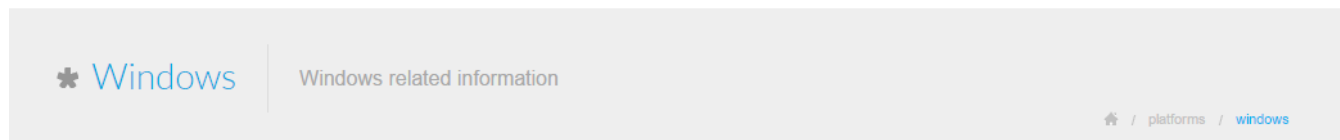
- 1: Update your computer via Windows Update
- 2: Download and install the API v1.8.1
- 3: Download and install HSDR v2.70
- 4: Download and install the EXT/IO v3.7

The very first thing you want to do before you unpack the RSP is run windows update and make sure all "Critical" updates have been downloaded and installed. If your machine has pending updates to install then please do it before making any physical connection with the RSP.

Now that all the updates are downloaded and applied it is extremely important that you reboot your machine. Now that we got that out of the way let's download the latest API & EXT/IO & HSDR.

The API & EXT/IO: This software allows the RSP to make a communication connection to your computer. Without the API & EXT/IO the SDR software would have no way of controlling the RSP'S low level functions. The latest API & EXT/IO at the time of this writing is v1.8.1 & v3.7

Download the API & EXT/IO from sdrplay.com, Select platforms and then windows. On the right side of the page you want to select the following drivers to download to your system. *Current EXTIO* and then *Current API Installer*



New customers should use the "Start Here" guide for software installations.

Generic Documentation

- RSP Single Page Datasheet (English)
- RSP Single Page Datasheet (French)
- Detailed Technical Specification
- API Specification
- AGC Technical Note
- RSP Conceptual Block Diagram
- RSP Schematics

Windows Specific Documentation

- Getting Started with the RSP and HSDR (English)
- Getting Started with the RSP and HSDR (French)

API/Drivers

WARNING: You may download the API/Driver here without providing any details but without any support. Support will require registration via the Start Here system



USB Cables: Not all USB cables are created equal. I would strongly suggest you buy a high quality name brand Male A/Male B USB cable with ferrite chokes on both ends. You want to try and keep the cable as short as possible but as far away from the computer as you can get it. I would not use anything more than 10ft.

Tripp Lite makes a great cable that cost under \$10.00. Amazon always has this cable in stock and you can purchase it via the link below.

<http://www.amazon.com/dp/B003MQ29B2>



SMA Male



SMA Female

Antennas: Having the proper antenna will really make the difference if you are going to hear local shortwave stations (100 to 500 miles away) or pick up stations that are well over 15,000 miles away. I can not suggests which one to buy. It would be another e-book in itself.

I would suggest you do a Google search for "random wire antenna" or copy and paste the link below. No matter what antenna you choose the RSP uses a SMA female port so please make sure your antenna coaxial uses a SMA-Male at the end of it

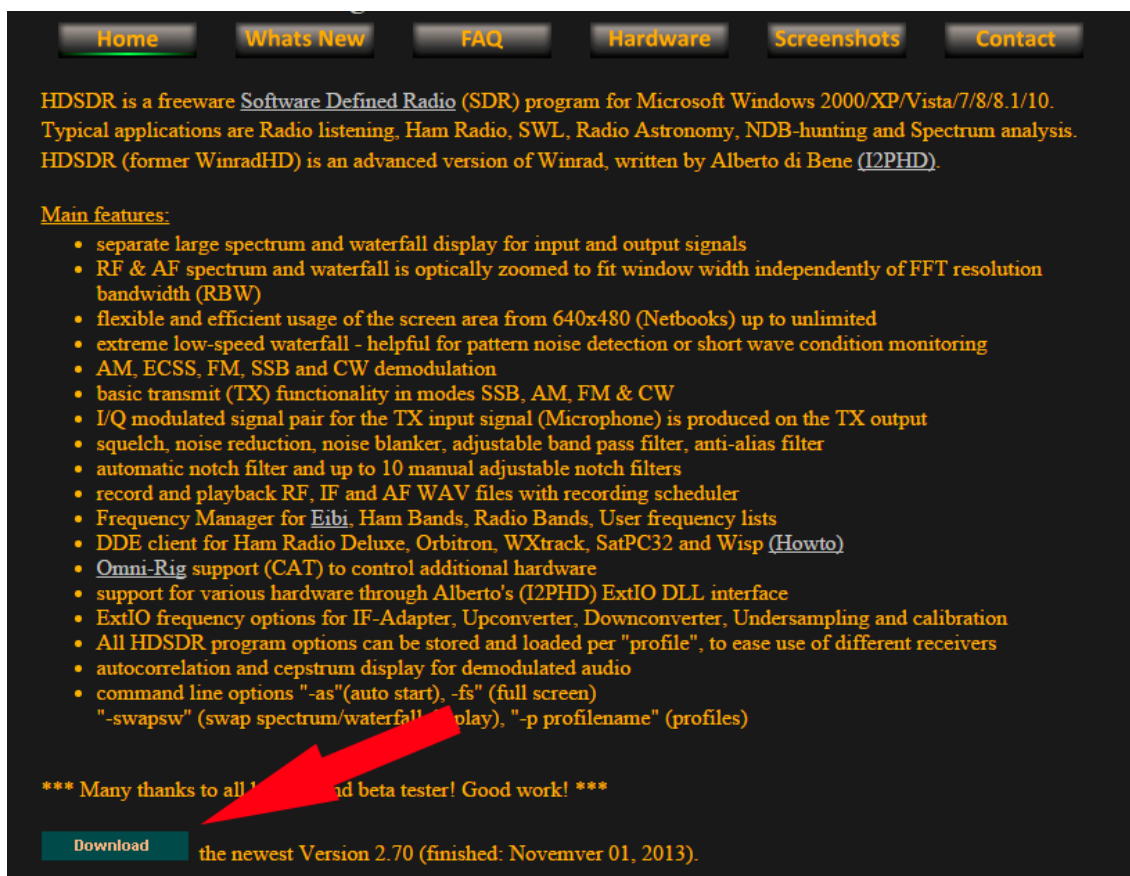
<https://www.google.com/#q=random+wire+antenna>

YOU CAN NOW CONNECT THE RSP TO YOUR MACHINE VIA THE USB CABLE.

Let's finish up with the API installer. Some people would say to double click the file to install it but I would suggest you right click it and select Run as administrator. After the API installer is complete you should now run windows update again and apply any critical updates the updater finds. If nothing is found then reboot the machine. If critical updates are available then download them and reboot the machine.

This might seem like a P.I.T.A. but this is the best way and the common way I setup all new users on the Facebook group. I have had zero issues or complaints with my style of installation and configuration. Taking the long steps now helps to prevent any possible headaches down the line. Now that the API is installed and the RSP is connected lets Download the EXT/IO.

Download HSDR. Go to www.hdsdr.de and scroll down to the bottom of the home page and select download.



After the download is complete you will need to locate the HSDR installer in your download directory which is usually (C:\Users*YOUR USER NAME*\Downloads). After locating the installer you want to right click (not the default left click) on the HSDR_installer.exe and select Run as administrator. After the setup is complete you can now install the EXT/IO from SDRPlay.

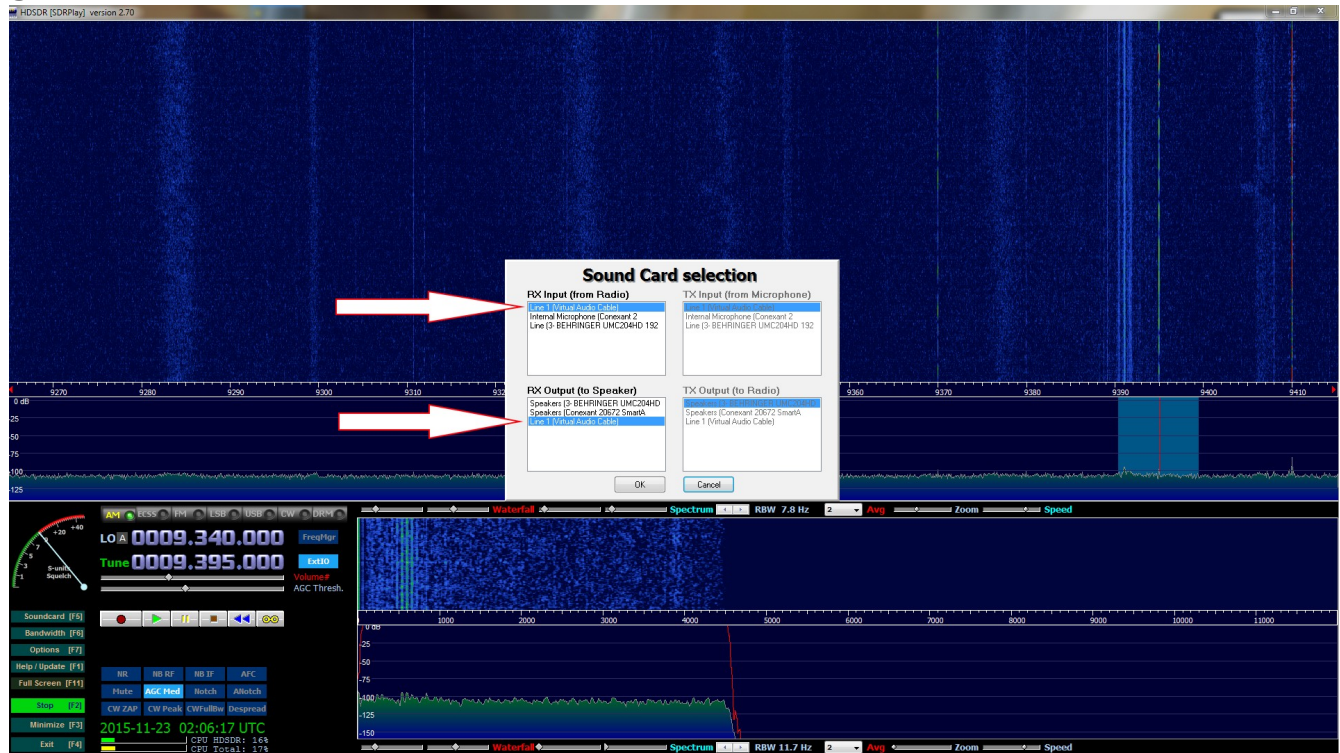
To install the EXT/IO Driver. Double click on the file SDRplay_EXTIO_Installer_v3.7 it will then ask you for the location of HSDR. Hit browse and tell the installer to look in the following default locations.

Windows 32bit
C:\Program Files\HSDR
Windows 64bit
C:\Program Files (x86)\HSDR

After all three main steps have been completed (API, HSDR & EXTIO) I would recommend rebooting the machine one last time. Soon as your machine completes the reboot then we are ready to start listening to signals.

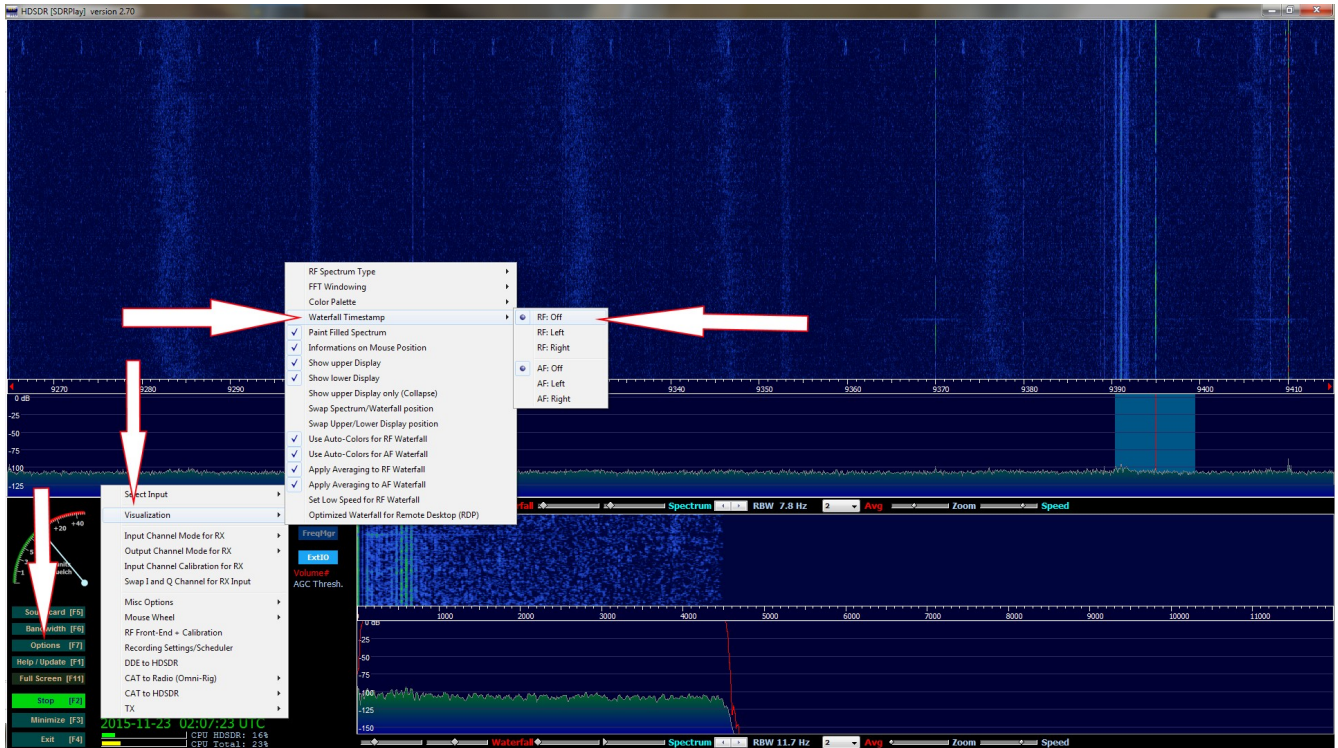
You can now launch HSDR. We will now setup HSDR to run perfectly with the RSP. The main setup process is broken down into 7 parts. Each step will be on a single page.

STEP-1



Set your RX input and RX output to match your computer's audio settings.
This setting tells HSDR how to use your audio input's and output's

STEP-2

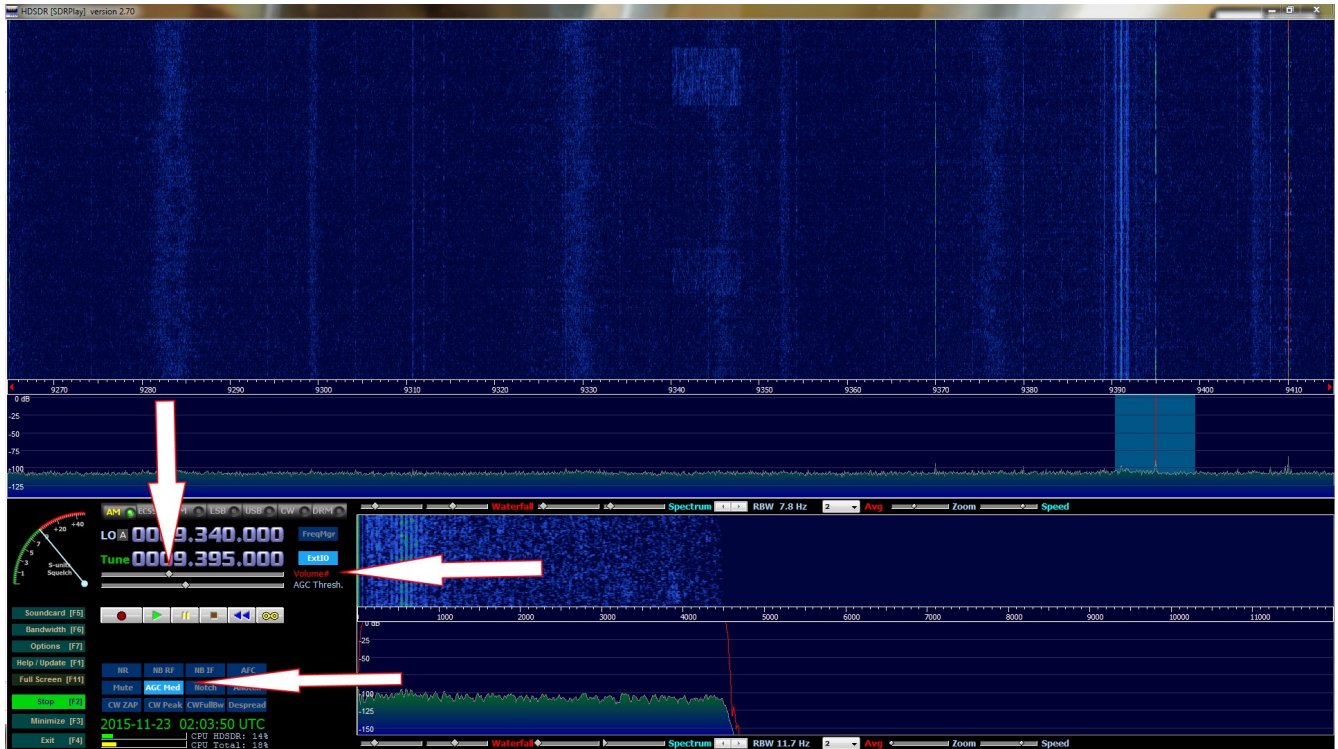


Remove the waterfall time stamp:

- 1: Options
- 2: Visualization
- 3: Waterfall Time stamp
- 4: Select RF: Off

This setting tells HSDR that you do not want a time stamp in the main waterfall.

STEP-3

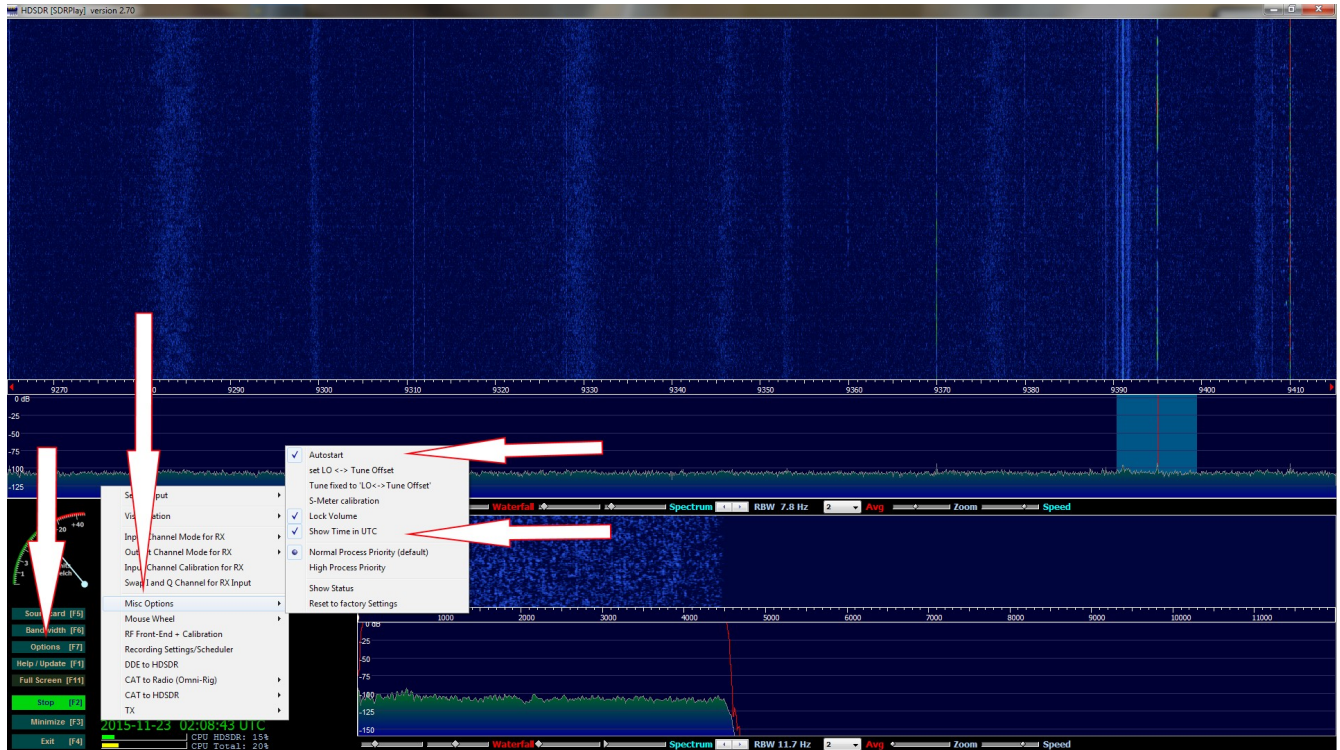


Set the main volume output and AGC:

- 1: Move the volume slider to almost the mid way point
- 2: Right click on Volume to lock it in place (turns red)
- 3: Hit the AGC button until it reads AGC Med.

This setting tells HSDR how you want to process the automatic gain for audio in the bandpass. I prefer Medium or Slow for most shortwave listening.

STEP-4

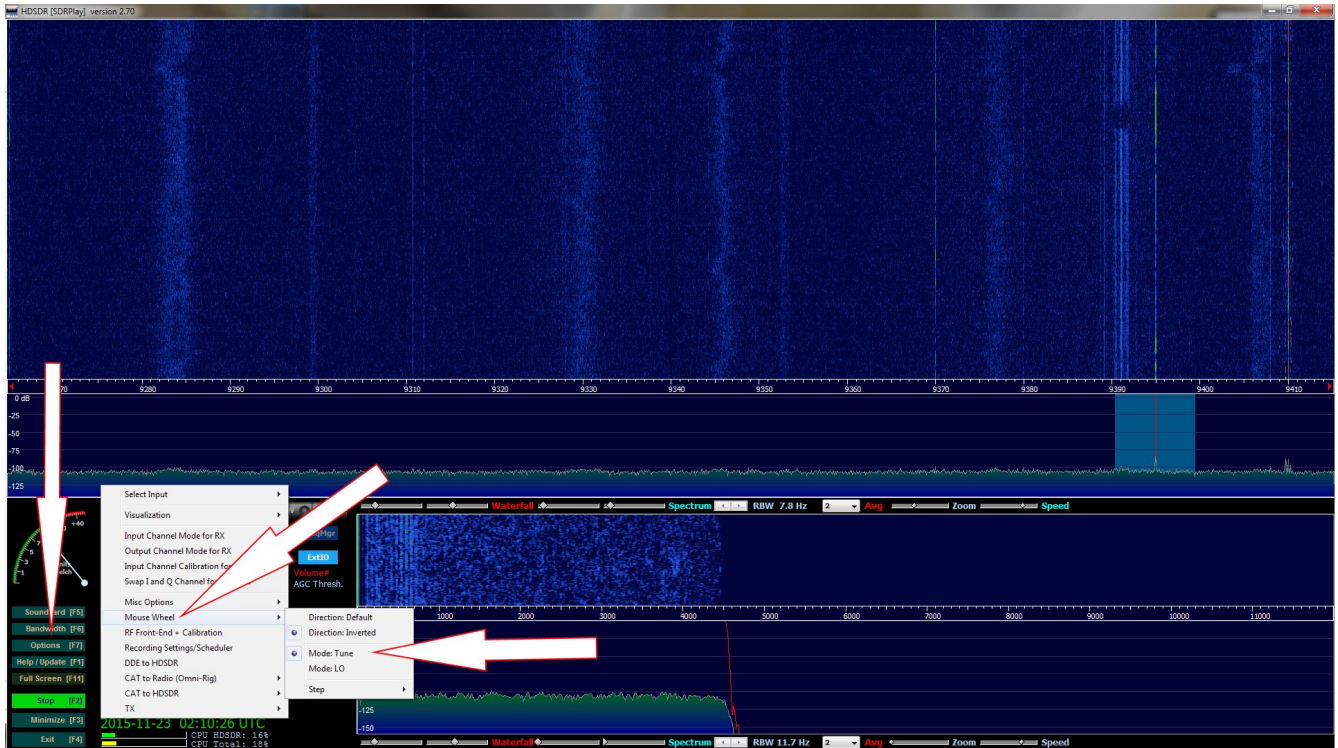


Set the clock the UTC and have HSDR auto start on start-up:

- 1: Select Options
- 2: Misc Options
- 3: Check auto start
- 4: Show Time in UTC.

This setting tells HSDR to start the RSP as soon as you launch it and convert the time on the main screen (lower left) from standard time to universal time display.

STEP-5

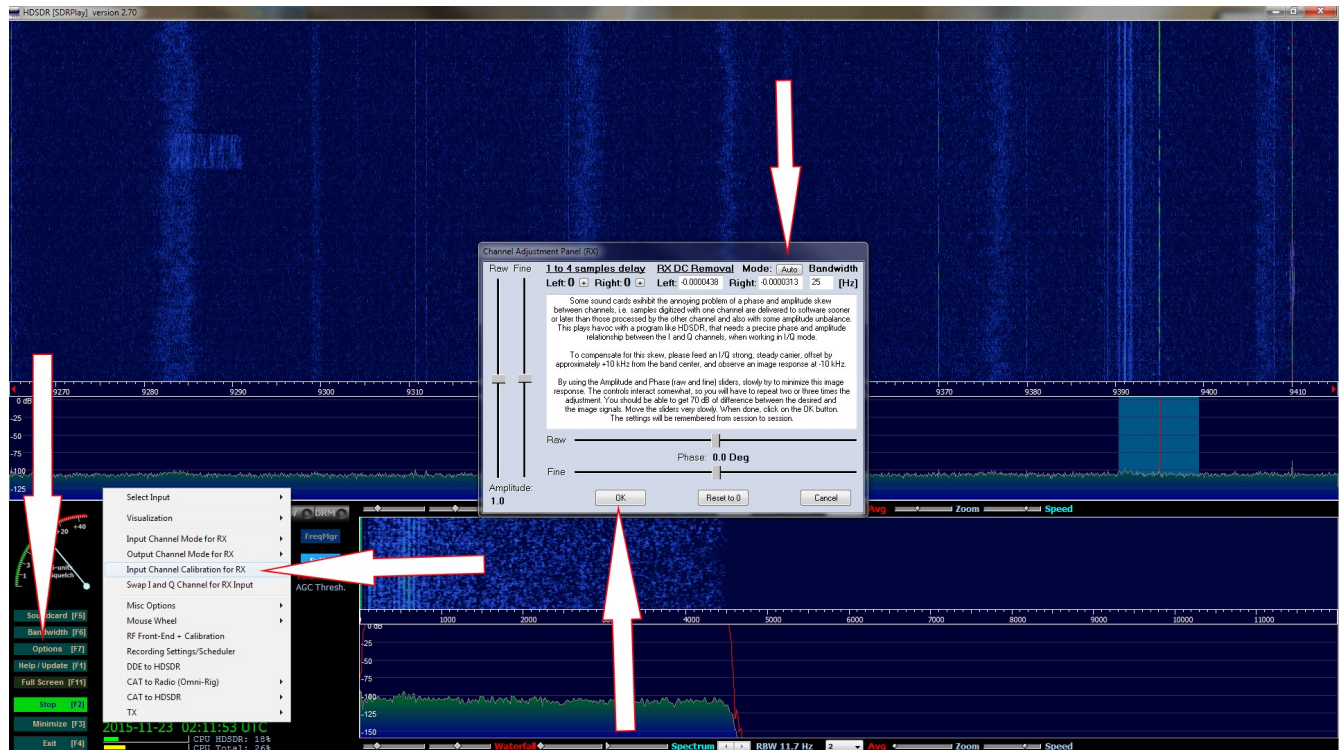


Set your mouse wheel tuning within the band and not LO:

- 1: Options
- 2: Mouse Wheel
- 3: Select Mode: Tune.

This setting tells HSDR to tune within the current range selected and operating the RSP in HSDR much smoother via the mouse wheel.

STEP-6

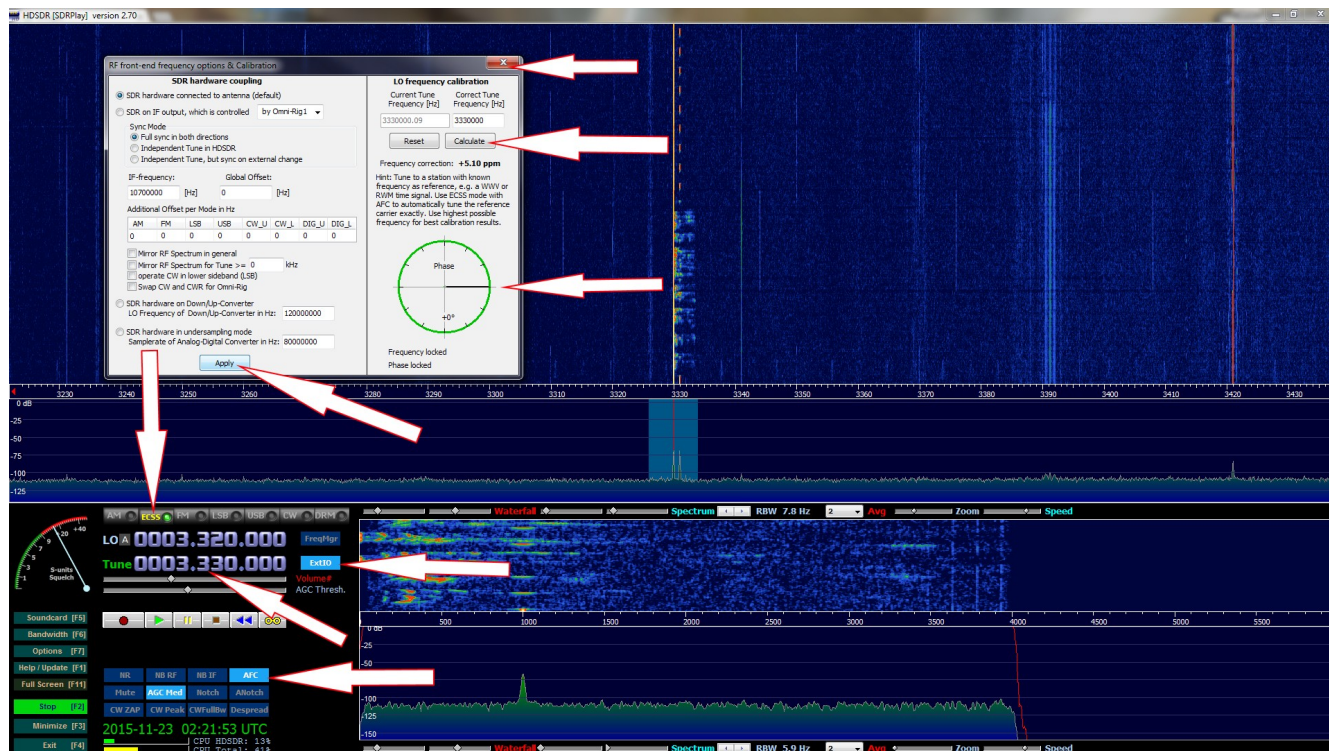


Remove the center DC spike:

- 1: Options
- 2: Input Channel Calibration for RX.
- 3: Change Mode at the top from Off to Auto
- 4: Click OK.

This setting tells HSDR to calculate the best settings it thinks to remove the DC spike in the center of the waterfall display.

STEP-7 (FINAL STEP)



Calibrate the offset of your SDR:

1: Tune to the following time stations WWV (5,000 10,000 or 15,000 KHZ) or CHU Canada (3330 or 7850)

2: Change the mode to ECSS (To the right of the AM button) and make sure AFC is selected (Turns Blue).

3: Right click on the EXT/IO button. Wait for it to get into 0 or as close to zero Phase (Zero phase in the 3 o'clock position)

4: Click Calculate

5: Hit apply

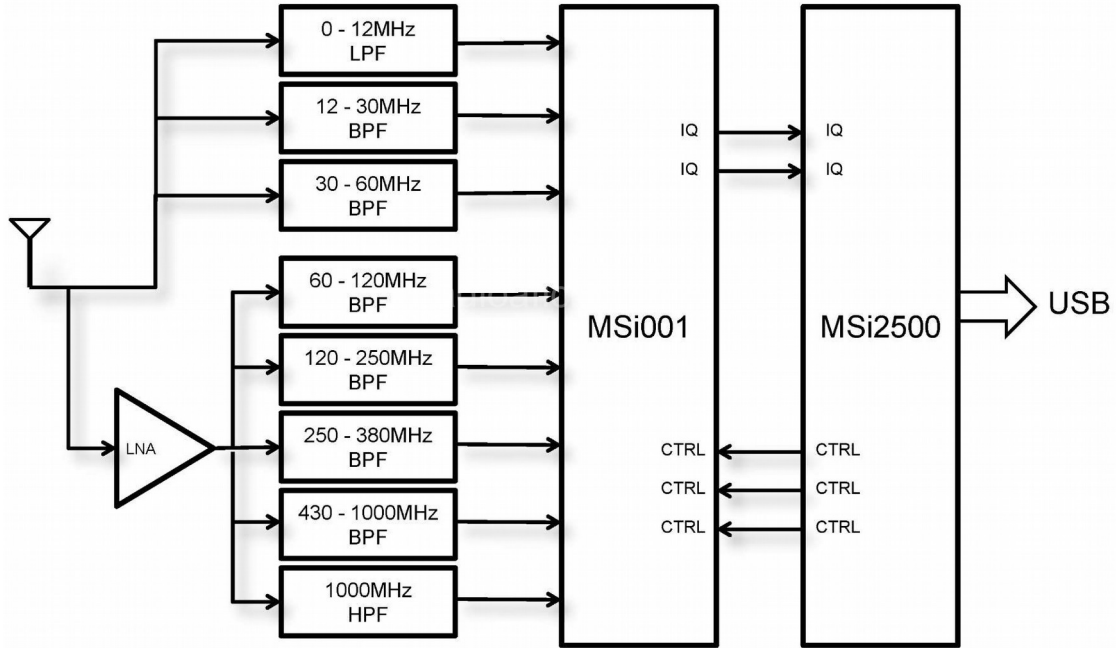
6: Click the X to close it.

7: Change your mode back to AM.

This setting tells HSDR how to adjust the offset/frequency correction that almost all SDRs have. Without this setting you will be off frequency by a few hertz.

The EXT/IO:

Conceptual Block Diagram



The screenshot shows the SDRplay RSP Device Controller software interface. The window title is "SDRplay RSP Device Controller". The interface is divided into several sections:

- LNA:** Includes an LNA EN checkbox (unchecked) and a status indicator showing "LNA OFF" and "LNA GR 24 dB".
- Mixer:** Includes a "Frequency Trim (ppm)" control set to 0.00.
- IF Amplifier:** Includes an "IF Mode" dropdown set to "Low IF" and an "IF Bandwidth" dropdown set to "1.536 MHz". A status indicator shows "IF Gain Reduction 50 dB".
- ADC:** Includes a "Sample Rate (MHz)" dropdown set to 8.20 and a "Setpoint (dBfs)" control set to -30.
- IF Gain Control:** Includes a vertical slider and a "Gain Reduction (dB)" control set to 50. An "Enable Tuner AGC" checkbox is present and unchecked.

At the bottom of the interface, it displays "SDRplay Ltd", "Version 3.7 Build 0109", and "Current Profile:". Navigation buttons include "Profiles", "Advanced" (highlighted), "Load Defaults", "Help", and "Exit". A status bar at the bottom indicates "Total System Gain Reduction 74 dB".

SDRPlay EXT/IO Optimization

Let's setup the EXT/IO provided by SDRPlay. The EXT/IO configuration panel is not a one setting fits all. The most overlooked but least understood setting for any new SDR user is the Gain Control. This important setting is shown in the EXT/IO pop-up window. Knowing the proper number to set the gain is key to getting the best signal to noise ratio manually.

If your scratching your head with these buzz words then the easiest way to explain it would be to say we are trying to obtain the best sounding signal with the least amount of noise and or static.

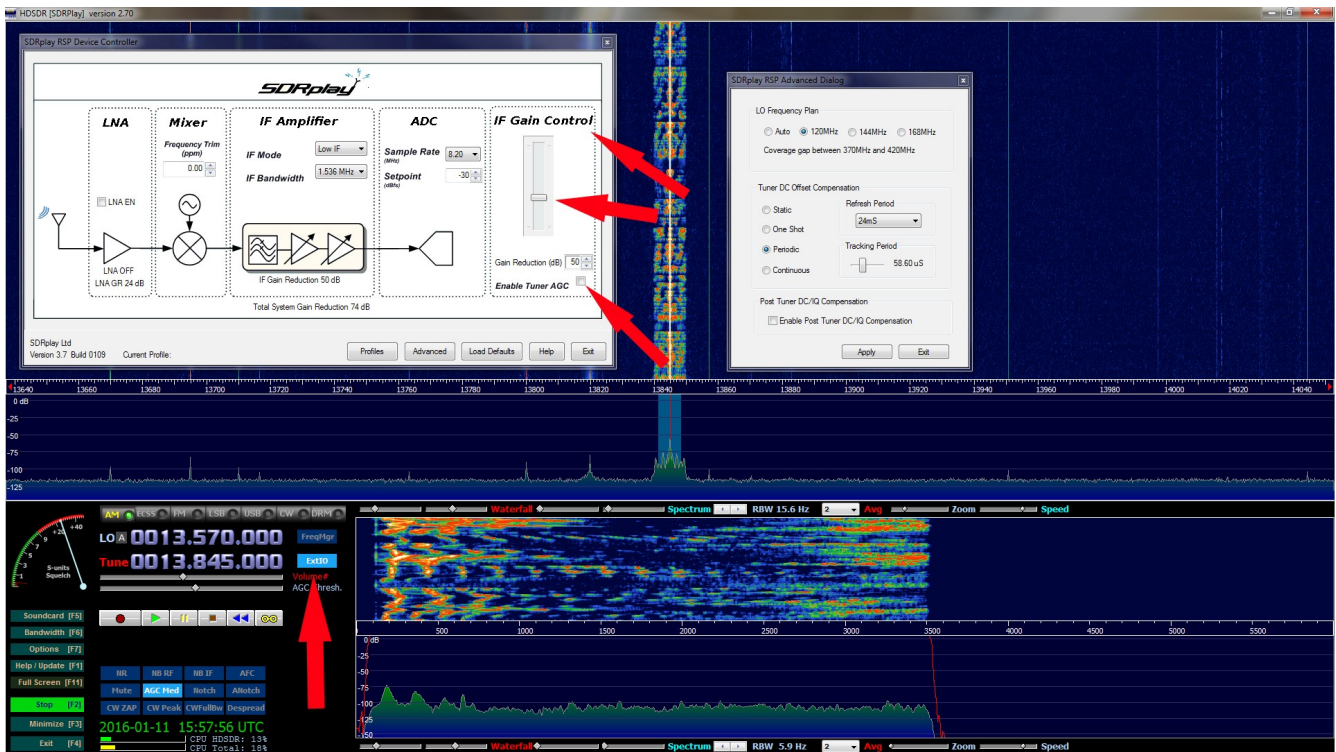
Think of the gain control settings as a valve. Adjusting the gain slider up and down will tell the RSP how much or how little signal to get into the RSP's circuits for processing from your antenna. If you apply too much gain you will have vertical lines all over the waterfall and possibly hear 2 to 3 stations at 1 time. This intermixing of stations is called intermod. Think of intermod as having the valve opened way too much. Now if we lower the gain setting then it will result in not being able to see or hear any stations at all. Same as shutting a valve.

The EXT/IO by default will enable the AGC. When the Automatic gain control is checked and enabled it's job is to try and figure out the best value for the gain and apply it in real time. I personally never enable any type of AGC for HF listening. I suggest you disable it and here is why.

9 times out of 10 AGC is going to raise the noise floor(white noise/static) way too high for HF listening. You can adjust the value at which it triggers which is called the set-point value.

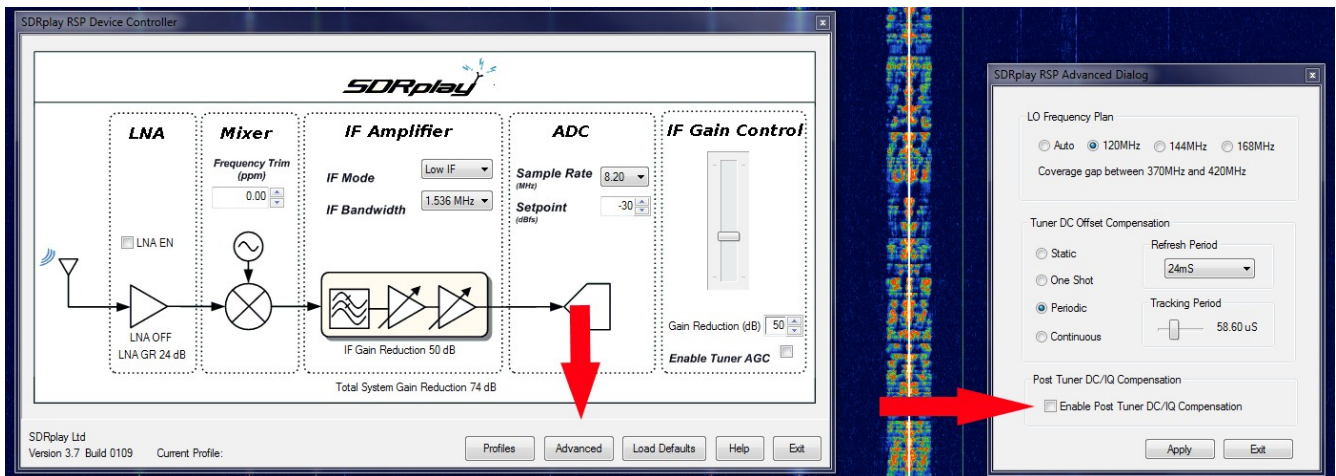
If you really want to use AGC then I strongly suggest a setpoint in the range of -40 -30. Anything higher than the lowest number (-30) will just trigger the gain to a higher value and we don't want that. Try the AGC option and see how you like it. If you are a DX hunter like myself then I honestly feel that having the AGC on will put you at a huge disadvantage for finding weak and distant stations.

To disable the RSP'S AGC click on the EXT/IO button and uncheck the box that says "Enable Tuner AGC".



For HF listening I would suggest a gain in the 60-70 range. A lower number means it will allow more signal into the RSP. A higher value has the opposite effect

SDRPlay's developers enabled what they thought would be the best EXT/IO settings for you. Every time you launch HSDR the stock RSP settings are used. If you make any changes in the EXT/IO then the new settings will be applied every time you run HSDR. I feel that these stock out of the box settings are good but we will get them set even better by making a few changes.



The next setting I suggest you disable is "Enable Post Tuner DC Compensation". This settings does the following. The EXT/IO will tell HSDR what it thinks is the optimal setting to remove the DC center spike. We do not need to enable this setting because we told HSDR to take care of this earlier with STEP-6.

To Disable "Enable Post Tuner DC Compensation" click on the EXT/IO button. Select Advanced and uncheck the box that says "Enable Post Tuner DC Compensation" and hit OK and then exit in the main EXT/IO panel.

Later on in this guide we will go over the other EXT/IO settings. I want to bring you up to speed on how to use HSDR vs confuse you with settings we basically wont touch for HF listening. One very important things is The RSP receives radio signals over a very wide range. However when it is compared with other radios or receivers specifically designed for a certain frequency range, its sensitivity, may on may not be inferior within that range. This is because their circuit designs are completely different then the RSP.

LO Frequency Plan: This option will tell the RSP internally how to shift the gap which is present in the Mirics processor. The options are as follows

Auto: You will have continuous coverage without any frequency gap.

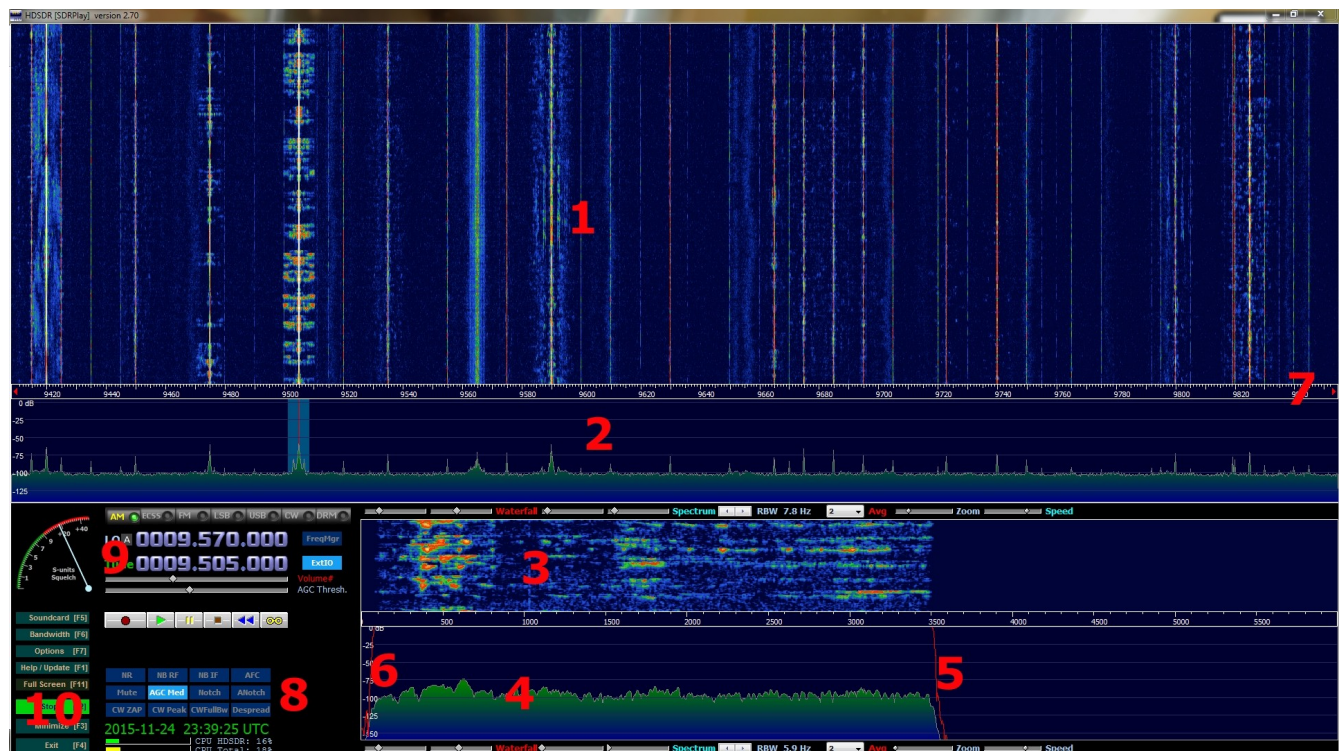
120Mhz: A frequency gap between 370Mhz and 420Mhz

144Mhz: A frequency gap between 250Mhz & 255Mhz also 400Mhz & 420Mhz

168Mhz: A frequency gap between 250Mhz & 2265Mhz

If your are using the RSP for HF listening then I would suggest a lockout of 168Mhz. This is just a personal preference and not 100% mandatory. If you notice any images or spurious signals try shifting the LO to what works best for you.

Getting around HSDR:



HSDR is broken down in to 5 sections and a bunch of sub sections. The good thing about HSDR is that everything you want to do with the RSP I up on the screen at all times. Lets now break down the main screen that you will always see.

- 1: RF Waterfall
- 2: RF Signal Spectrum
- 3: Audio Spectrum
- 4: Audio Passband
- 5: Left edge of Passband filter limit
- 6: Right edge of Passband filter limit
- 7: Tuning up & down. Amount is based on RF sample rate
- 8: Received signal audio functions
- 9: Center Frequency & Local Oscillator
- 10: HSDR Command Area & Preferences

S-Meter Calibration (Eyeballing it):

- 1: Tune to a station with a known signal strength (NOAA or a loud local FM station)
- 2: In HSDR Click Options -> Misc Options -> S Meter calibration.
- 3: You will be presented with a dialog box which outlines the instructions
- 4: Once you click OK you will see the S meter now read S-Units calibration
- 5: By left clicking you can set the meter to the known reference.
- 6: Right click to finish the S-Meter calibration.
- 7: The meter will now read S-Units Squelch again

Propagation:

This should help you with the basics of propagation. This is just a primer to get you started. Reading and understanding propagation charts goes much further than this basic introduction.

Solar Flux ranges from 30-300. A higher number is better.

30-70 Bad

80-90 Low

90-100 Average

100-150 Good

150-300 Ideal

A-Index ranges from 0-400. A lower number is better.

1-5 Ideal

6-8 Average

10-400 Bad

K-Index ranges from 0-9. A lower number is better.

0-1 Ideal

2-3 Good

4-5 Average

5-9 Bad

You have lots of resources on the internet to learn about radio propagation along with semi real-time space weather prediction & charts. One of the sites I would recommend is <http://www.hamuniverse.com/hfbeaconpropagation.html>