ExtIO Plugin User Guide

Overview

The SDRplay Radio combines together the Mirics flexible tuner front-end and USB Bridge to produce a SDR platform capable of being used for a wide range of worldwide radio and TV standards. This document provides an overview of the installation process and operation of the SDRplay ExtIO plug-in.

The SDRplay ExtIO plugin provides a bridge from the SDR application that supports the ExtIO interface to the RSP hardware device. It handles the stream data between the application and the hardware as well as control of the hardware parameters either directly via the GUI panel or via ExtIO commands between the application and the hardware.

Contents

1. Installation

Download the SDRplay ExtIO plug-in from either the SDRplay Windows section of the website (http://www.sdrplay.com/downloads/#tab-tab-5037-0-0-2-5037-0) which is shown below, or via the online "Start Here" system (http://www.sdrplay.com/start-here/)

Downloads

SOFTWARE

Windows	Linux x86	Mac	Raspberry Pi
Android	ARM64		

SDRUNO – VERSION 1.21 (13TH NOVEMBER 2017)
(**RSP1/RSP2**) Includes hardware driver

HDSDR – VERSION 2.76
(**RSP1/RSP2**) Includes hardware driver/API/EXTIO plugin

EXTIO PLUGINS – VERSION 1.0
(**RSP1/RSP2**) Includes hardware driver/API

SDR-CONSOLE – V2.3 2760
(**RSP1/RSP2**) Includes hardware driver/API

SDR-CONSOLE – V3.0 PREVIEW 7
(**RSP1/RSP2**) Includes hardware driver/API (26th October 2017)

DOCUMENTATION

Software	App Notes	Community Guides	How To Guides
Video guides & Media	Links	Datasheets	

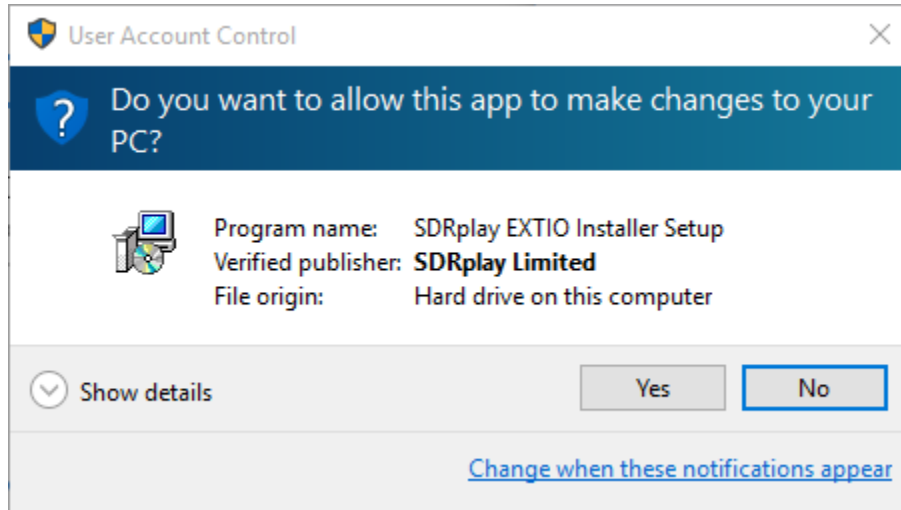SDRUNO USER MANUAL
(version 1.21 / 13th November 2017)

SDRUNO RELEASE NOTES
(version 1.21 / 13th November 2017)

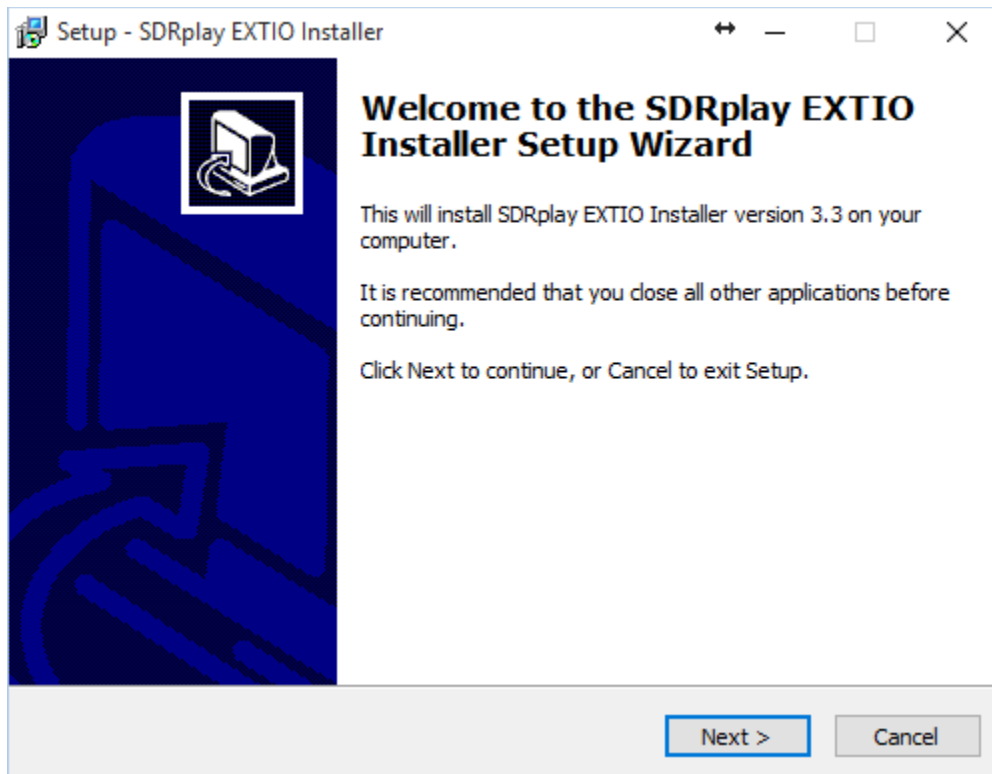API SPECIFICATION
(version 2.09 / 23rd December 2016)

API RELEASE NOTES
(version 2.10 / 11th April 2017)
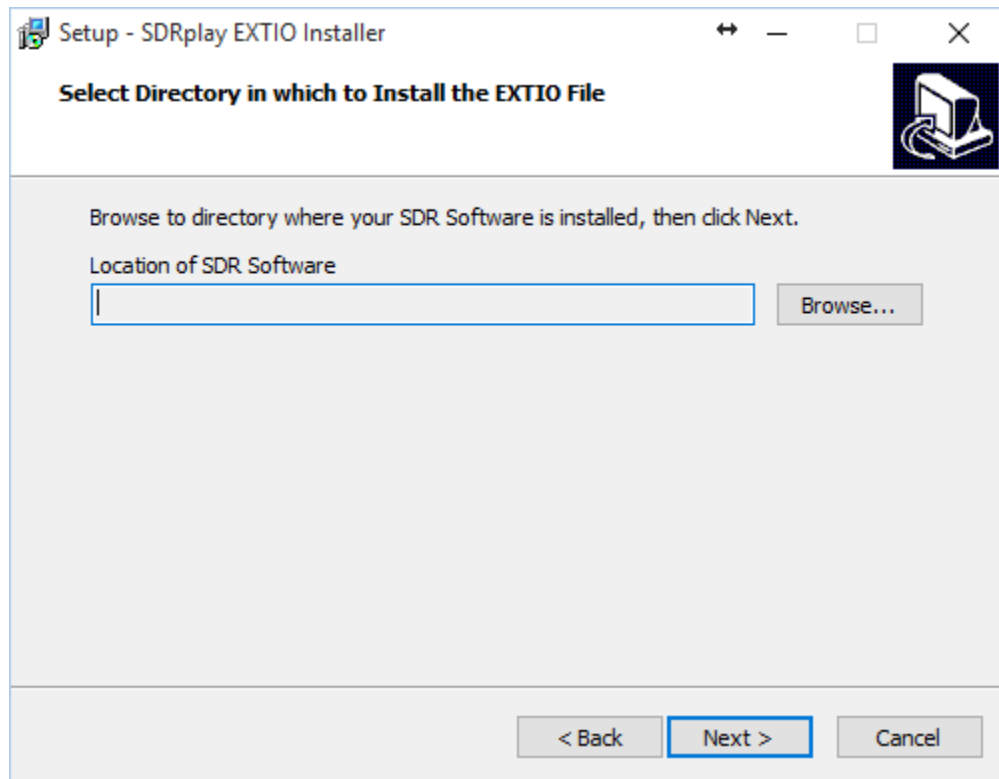
ADS-B USER GUIDE
(version 1.13 / 1st October 2016)

Save and run the executable. Allow the installer to make changes…

The initialisation of the SDRplay ExtIO plug-in will begin, click Next to continue…

In order to install the plug-in, the installer needs to know the location of your chosen SDR application. To do this click browse…

Navigate to the SDR application installation directory, then click on the executable (this example is for HDSDR.exe) and then click Open to identify to the correct path to the installation program.
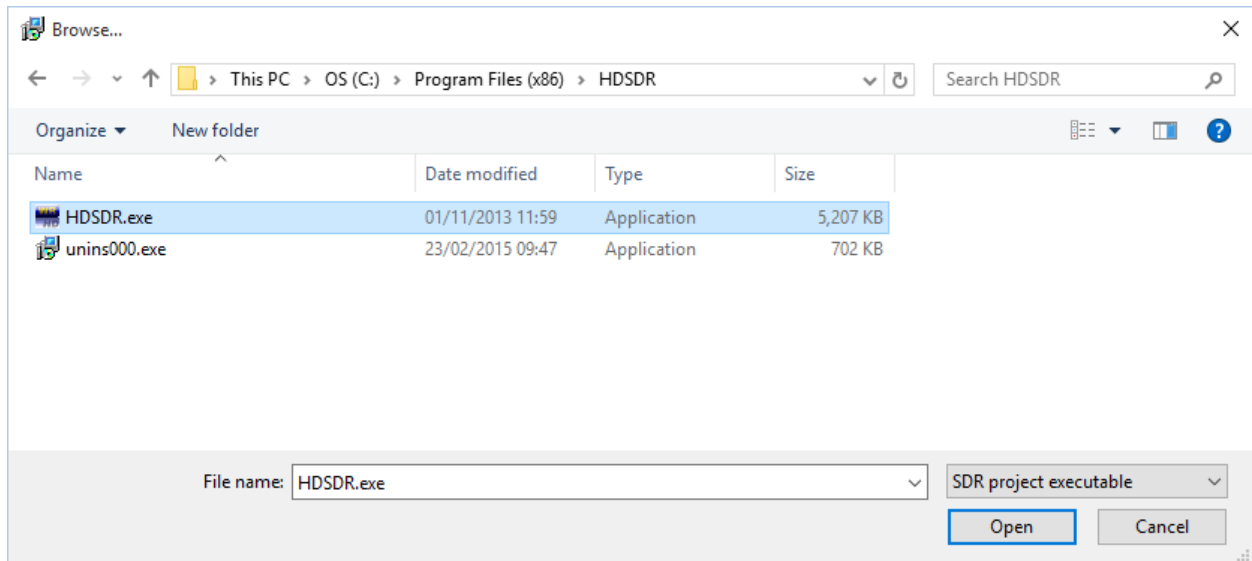
After Open has been clicked you should see the path presented in the installation dialog box, as shown below. Click Next…
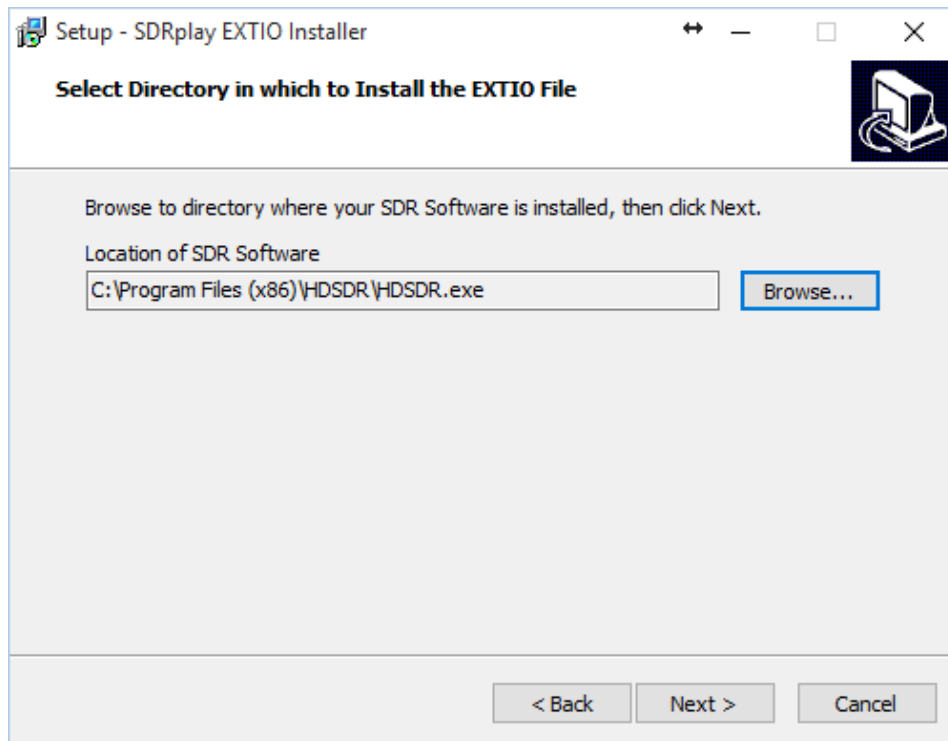
The installation of the plug-in will commence when you click Install…
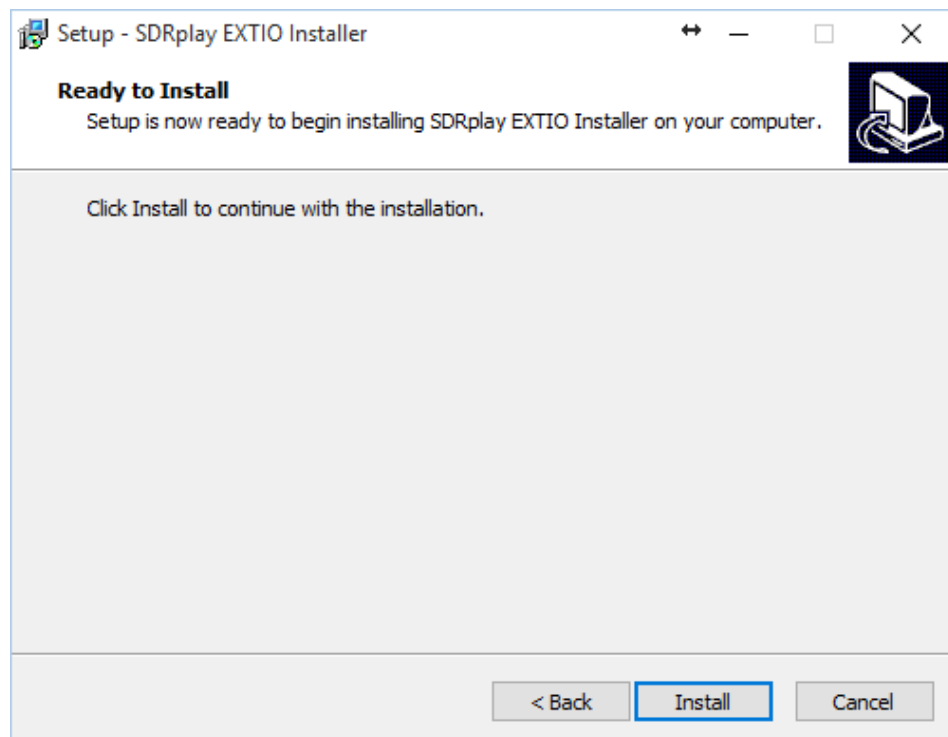
This completes all the steps that are necessary to get SDRplay working with the SDR software that support the ExtIO interface.
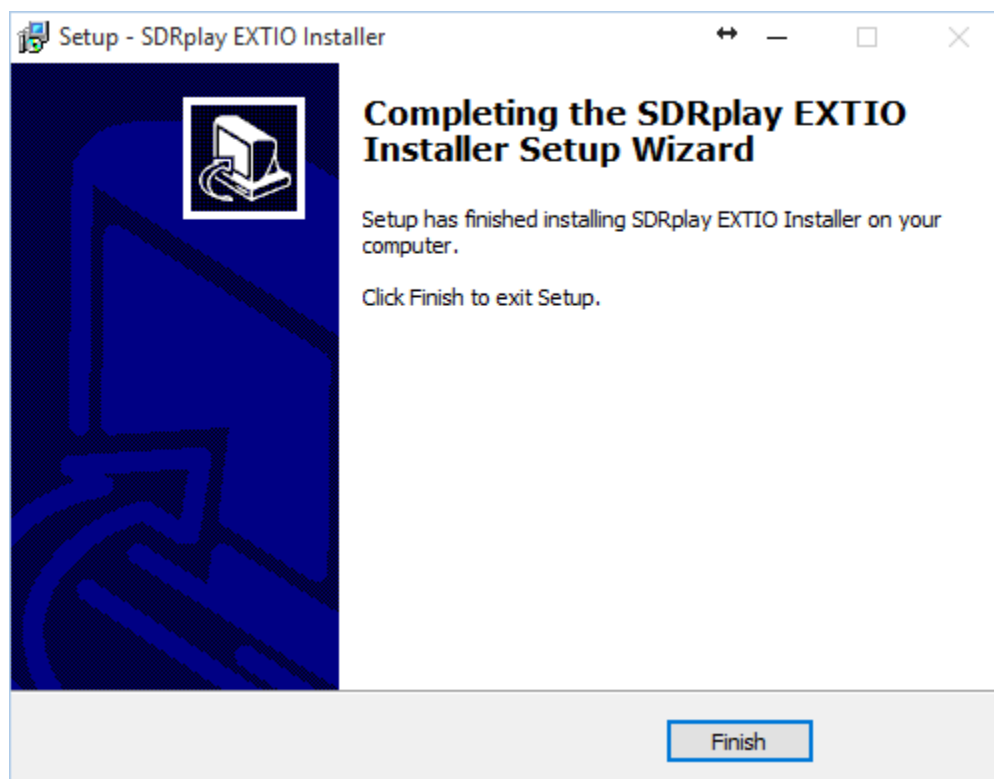
2. Configuration

To configure SDRplay specific settings follow the SDR application instructions to bring up the ExtIO controller dialog. The ExtIO controller dialog gives an overview of the SDRplay receiver architecture coupled with the different parameters that can be configured.

2.1 Main Dialog Panel

2.1.1 RSP1

LNA EN – The LNA can be turned on and off at any time by checking or unchecking this box.

Frequency Trim (PPM) – The SDRplay RSP uses a crystal as its reference and as such there will be some inherent frequency offset. The frequency trim allows trimming of the reference crystal frequency to adjust errors in absolute frequency.
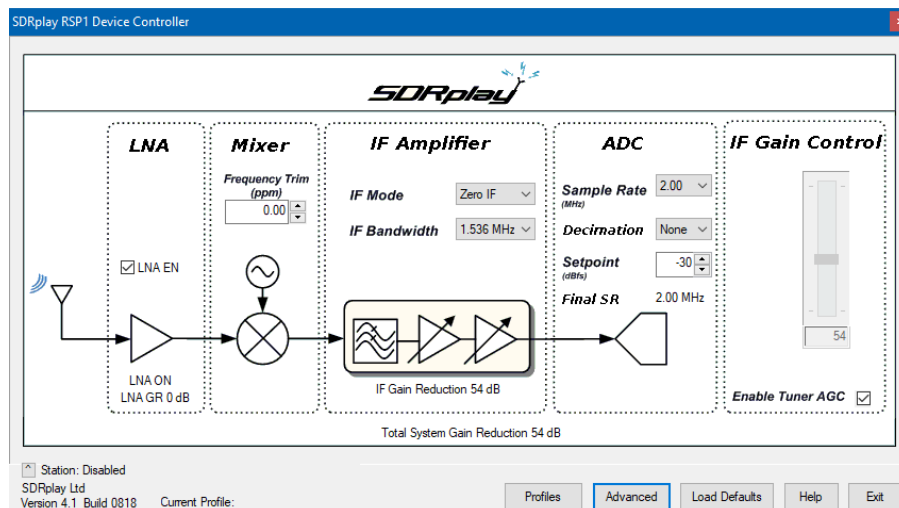
IF Mode – Sets the tuner into either Zero IF mode or Low IF mode. The IF bandwidth drop down menu will automatically update with the appropriate selection of IF filter bandwidths.

IF Bandwidth (MHz) – Sets the bandwidth of the IF filter. The selections available will depend on the IF mode selected. For the full range of IF bandwidths selections then the tuner must be operating in ZIF mode.

Sample Rate (MHz) – Sets the sampling frequency of the ADC. When operating in Low IF mode the sample rates choice is restricted.

Decimation – The sample rate can be decimated by either 2, 4, 8, 16, 32 or 64 to achieve better noise performance. The final sample rate must be equal or greater than the IF bandwidth selected.

Setpoint (dBfs) – Sets the target level power at which AGC routine will attempt adjust the power on the ADC input. A larger value will position the signal near the top of the ADC range. A lower value will reduce the signal power and hence levels at the ADC input.
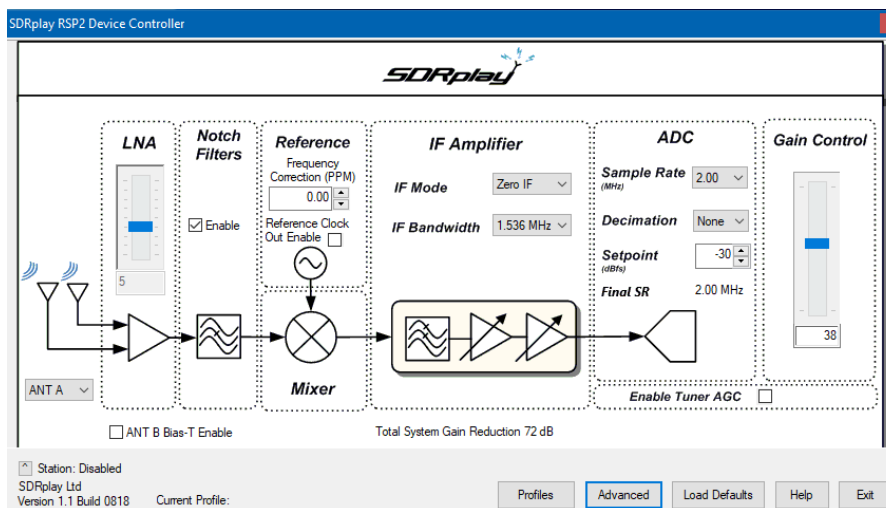
Gain Control Slider – The gain control slider can be used to set the IF gain of the receiver. Maximum gain occurs at the top of the slider, minimum gain at the bottom of the slider.

Gain Reduction (dB) – The gain reduction value controls the amount of gain, in dB, that the maximum tuner gain will be reduced by. For example a gain reduction of 50 represents 50dB below maximum receiver gain. This value is tied to the gain control slider. Hotkeys + and – can also be used for this control.

Enable Tuner AGC – This enables a software AGC leveling routine within the plug-in that attempts to change the gain reduction value to achieve a specified signal power at the ADC input. The level which the routine will adjust the ADC input power towards is defined in the Setpoint control box. In this mode it is not possible to adjust the tuner gain reduction manually.

The Tuner AGC function is designed to work on the full composite signal present at the ADC input. This may contain many different signals of varying amplitude. This function should not be confused with the AGC function used in various SDR software packages which are designed to work with a single signal after it has been selected via digital filtering. The tuner AGC should not be used as a substitute for the SDR AGC, rather it should be used in conjunction with it.

2.1.2 RSP2

LNA state – Range varies depending on frequency and port.

Notch filters – Enables the medium wave and FM broadcast band notch filters.

Frequency Trim (PPM) – The SDRplay RSP uses a crystal as its reference and as such there will be some inherent frequency offset. The frequency trim allows trimming of the reference crystal frequency to adjust errors in absolute frequency.

Reference clock – Enables both an input and an output for the reference clock synchronization.

IF Mode – Sets the tuner into either Zero IF mode or Low IF mode. The IF bandwidth drop down menu will automatically update with the appropriate selection of IF filter bandwidths.

IF Bandwidth (MHz) – Sets the bandwith of the IF filter. The selections available will depend on the IF mode selected. For the full range of IF bandwidths selections then the tuner must be operating in ZIF mode.

Sample Rate (MHz) – Sets the sampling frequency of the ADC. When operating in Low IF mode the sample rates choice is restricted.

Decimation – The sample rate can be decimated by either 2, 4, 8, 16, 32 or 64 to achieve better noise performance. The final sample rate must be equal or greater than the IF bandwidth selected.

Setpoint (dBfs) – Sets the target level power at which AGC routine will attempt adjust the power on the ADC input. A larger value will position the signal near the top of the ADC range. A lower value will reduce the signal power and hence levels at the ADC input.

Gain Control Slider – The gain control slider can be used to set the IF gain of the receiver. Maximum gain occurs at the top of the slider, minimum gain at the bottom of the slider.

Gain Reduction (dB) – The gain reduction value controls the amount of gain, in dB, that the maximum tuner gain will be reduced by. For example a gain reduction of 50 represents 50dB below maximum receiver gain. This value is tied to the gain control slider. Hotkeys + and – can also be used for this control.

Enable Tuner AGC – This enables a software AGC leveling routine within the plug-in that attempts to change the gain reduction value to achieve a specified signal power at the ADC input. The level which the routine will adjust the ADC input power towards is defined in the Setpoint control box. In this mode it is not possible to adjust the tuner gain reduction manually.

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2.1.3 RSP1A
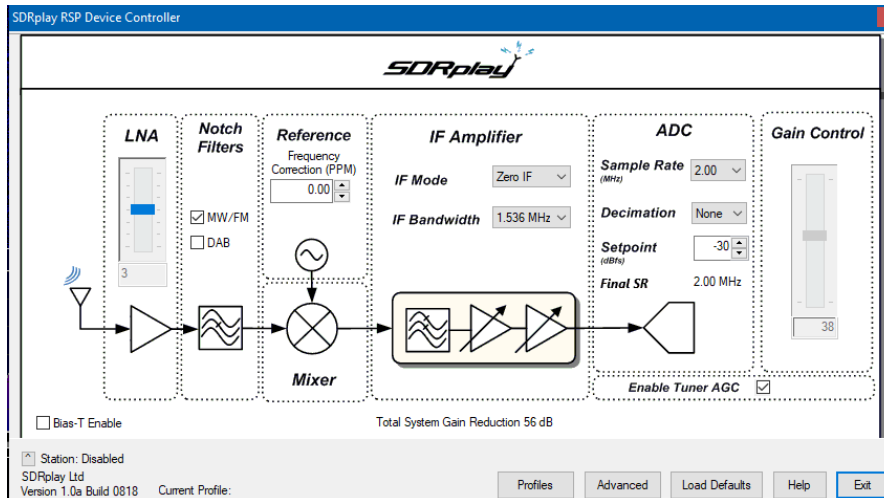
LNA state – Range varies depending on frequency and port.

Frequency Trim (PPM) – The SDRplay RSP uses a crystal as its reference and as such there will be some inherent frequency offset. The frequency trim allows trimming of the reference crystal frequency to adjust errors in absolute frequency.

Notch filters – Enables the medium wave, FM broadcast band and DAB notch filter.

IF Mode – Sets the tuner into either Zero IF mode or Low IF mode. The IF bandwidth drop down menu will automatically update with the appropriate selection of IF filter bandwidths.

IF Bandwidth (MHz) – Sets the bandwidth of the IF filter. The selections available will depend on the IF mode selected. For the full range of IF bandwidths selections then the tuner must be operating in ZIF mode.

Sample Rate (MHz) – Sets the sampling frequency of the ADC. When operating in Low IF mode the sample rates choice is restricted.

Decimation – The sample rate can be decimated by either 2, 4, 8, 16, 32 or 64 to achieve better noise performance. The final sample rate must be equal or greater than the IF bandwidth selected.

Setpoint (dBfs) – Sets the target level power at which AGC routine will attempt adjust the power on the ADC input. A larger value will position the signal near the top of the ADC range. A lower value will reduce the signal power and hence levels at the ADC input.

Gain Control Slider – The gain control slider can be used to set the IF gain of the receiver. Maximum gain occurs at the top of the slider, minimum gain at the bottom of the slider.

Gain Reduction (dB) – The gain reduction value controls the amount of gain, in dB, that the maximum tuner gain will be reduced by. For example a gain reduction of 50 represents 50dB below maximum receiver gain. This value is tied to the gain control slider. Hotkeys + and – can also be used for this control.

Enable Tuner AGC – This enables a software AGC leveling routine within the plug-in that attempts to change the gain reduction value to achieve a specified signal power at the ADC input. The level which the routine will adjust the ADC input power towards is defined in the Setpoint control box. In this mode it is not possible to adjust the tuner gain reduction manually.

The Tuner AGC function is designed to work on the full composite signal present at the ADC input. This may contain many different signals of varying amplitude. This function should not be confused with the AGC function used in various SDR software packages which are designed to work with a single signal after it has been selected via digital filtering. The tuner AGC should not be used as a substitute for the SDR AGC, rather it should be used in conjunction with it.

2.1.4 Common Controls

Current Profile – this field displays the name of the current profile loaded and activated in the system.

Profiles – this brings up the Profiles management dialog panel. Information on the Profiles section can be found below. Note: Hotkey ALT-P will toggle the display of the Profiles panel.

Advanced – This button loads the advanced dialog box allowing manipulation of the advanced tuner settings. Details of the advanced panel can be found below.

Load Defaults – This button loads a predefined set of defaults back into the receiver.

Help – This button brings up the quick help panel to show the hotkey bindings. It also has a link to the online user guide (this document).

Exit – Close the SDRplay RSP control dialog panel.

^ - the small button next to the Station display will open a small popup window that can be left open to check what station you are tuned to. This is shown here:
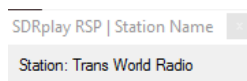
2.2 Help Dialog Panel
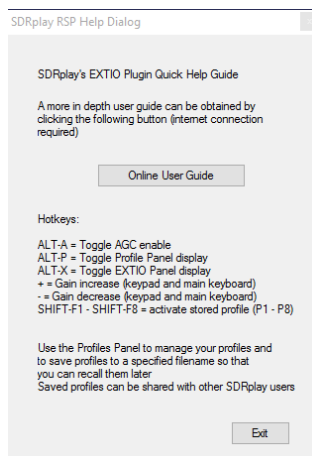
The Help Dialog Panel has a link to the online users guide (this document) and also shows the current hotkey bindings.

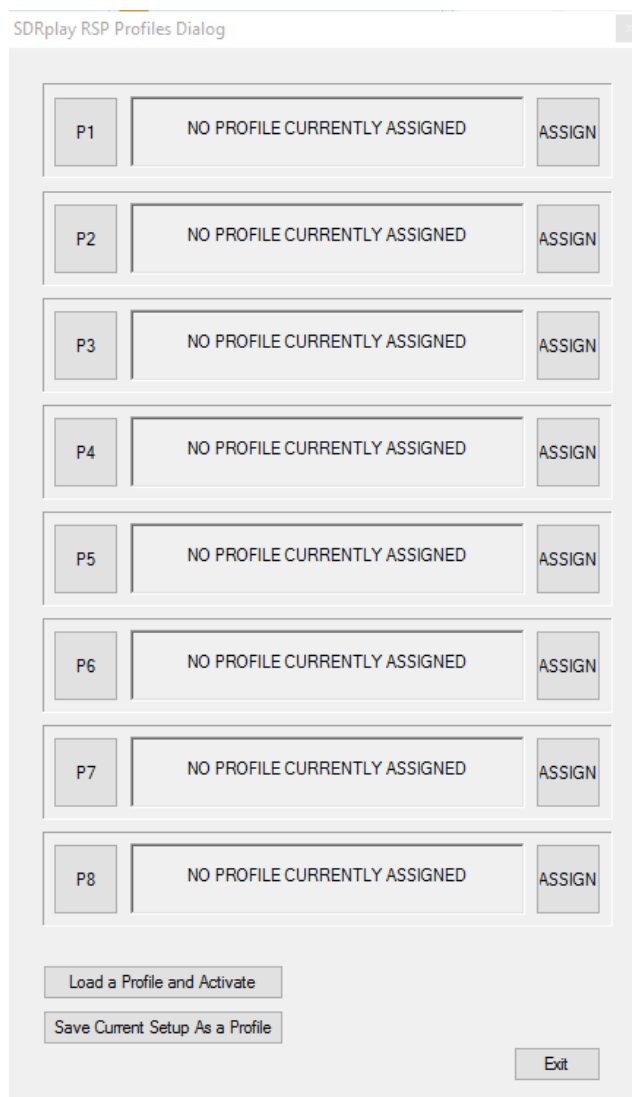## *2.3 Profiles Dialog Panel*

The Profiles dialog panel enables you to load and save profiles and to assign and recall previously created profiles. You can exchange profiles with other people and just navigate to those profiles with Assign in order for them to be able to be loaded.

P1 – P8 these are buttons that can be clicked to activate the profile currently loaded into the corresponding profile location. When the profile is active in the system, square brackets [ ] surround the P number. These profiles can also be activated using hotkeys. The hotkey bindings are shown on the Help Dialog Panel.

ASSIGN – these buttons will prompt the user to locate a profile to be loaded from the file system. It is stored in the registry ready to be activated at a later time.

Load a Profile and Activate – this button will load a profile from the file system and activate it immediately. It is not stored in a registry setting, but is a way to load and activate profiles on the fly.

Save Current Setup As a Profile – a Save File As… dialog box will appear and allow you to save the current ExtIO configuration in a file to either load back into one of the memory locations with the Assign buttons or to share with other users.

Exit – this button closes the Profiles dialog. A hotkey can also be used for this (ALT-X).

2.4 Advanced Dialog Panel
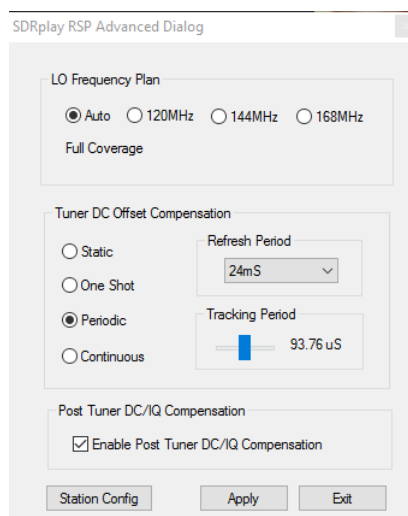
The Advanced dialog box allows manipulation of the tuner DC compensation options and the Block Converter LO frequency. You can also enable/disable the DC & IQ compensation.

LO Frequency Plan

For frequencies below 60MHz and between 250MHz and 420MHz the SDRplay receiver uses a block converter to convert the spectrum to a useable frequency range. There are three LO's that can be applied to the block converter when it is in use. Each one gives a different frequency coverage range when operating between 250MHz and 420MHz. For frequencies below 60MHz any of the LO's can be applied and coverage maintained. In AUTO mode the 120MHz LO setting will be applied below 60MHz and between 250MHz and 420MHz the LO will be automatically changed to provide continuous coverage. In addition to the AUTO mode you can also fix a particular LO frequency. This can be particularly useful to move any image frequencies around which appear in band from the block converter. Care will need to be taken though as the LO will need to be applied bearing in mind any coverage gaps. These gaps are highlighted when a particular LO is selected.

Tuner DC Offset Compensation – Used to select an appropriate DC compensation mode for the tuner. Four possible modes are available

- **Static** – The tuner will take a single measure of the DC offset and maintain this value. Care should be taken to avoid large DC offsets when changing frequencies or gain settings. A change in mode to either continuous or periodic will be required to remove any DC offsets after large frequency or gain changes have been applied.

- **One Shot** – In this mode a short sample of the DC offset will be measured and corrected every time the receiver gain is updated using the gain slider. The length of the sample taken can be set using *Tracking Period* slider. This mode can be useful when using the AGC as the correction will be applied as the signal is leveled by the AGC routine. The system will then hold this value static until further gain changes are made. Care should be taken in this mode to not to build up large DC offsets when the AGC is off and the gain is not being adjusted.

- **Periodic** – This is the mode we recommend as a default. In this mode the DC offset will be compensated for at regular periodic intervals. The compensation interval can be selected using the *Refresh Period* drop down menu. Much like in one-shot mode the *Tracking Period* slider can be used to set the length of the sample window. In this mode the DC compensation is regularly applied so gain and frequency changes can be made freely.

- **Continuous**– In this mode the DC compensation will be applied all the time. Whilst this provides the most robust solution in term of minimizing the DC offset, the disadvantage is that it will produce a "hole" in the centre of the spectrum as the compensation works to cancel out any signals present within the bandwidth of the compensation loop.
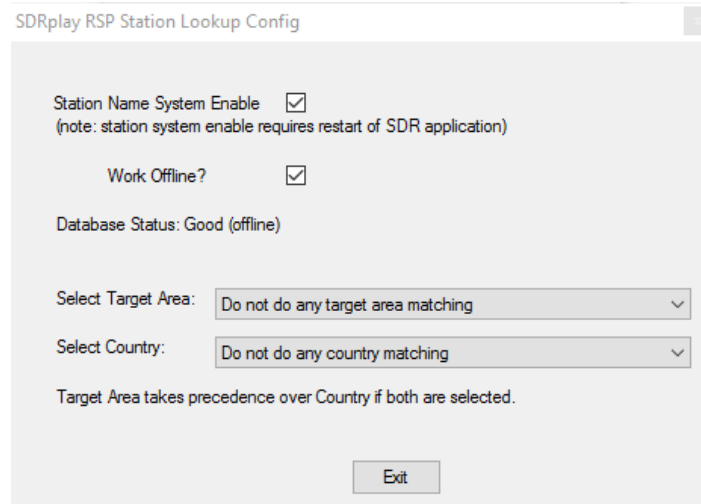
Post Tuner DC/IQ Compensation

The Tuner DC offset compensation is an essential function to prevent DC offsets from overloading the receiver in Zero IF mode. It will not however, completely removed DC offsets all together and some residual DC offset will remain, leading to a spur at the centre of the selected spectrum. This remaining DC offset may be substantially reduced further by ensuring that the Post Tuner DC/IQ compensation function is enabled. As well as largely removing any residual Tuner DC offsets, this function will also correct small amplitude and phase

quadrature errors present in the I/Q signal paths which would otherwise lead to in-band image responses when operating in Zero IF mode. It is recommended that when using zero IF mode, this function is enabled. In Low IF mode, this function has no effect.

Station Config – this button opens the Station configuration panel. The station lookup feature provides a display of likely stations transmitting on the frequency selected.

2.5 Station Config Dialog Panel

This panel allows control over the station display and whether the feature is used or not.

Station Name System Enable – by default the system is disabled, check this box to enable the system. There will be a slight delay to the start of the SDR application whilst the system initialises itself and synchronises the database.

Work Offline – this enables you to use the database that has been previously downloaded and the plugin will not connect to the server to try to update the database. Please note that the database could get out of date in this mode.

Database Status – Shows the status of the local cached database. If there are internet issues in downloading the database, they will show here.

Select Target Area – Use this pulldown to select the target geographic area of interest.

Select Country – This pulldown can be used to select the country of interest.

Exit – close the configuration window.

The Station name display system uses an online database to display stations that are known to transmit on various frequencies. There are over 12,000 station entries in the database and it is growing all the time. If a station name doesn't appear that you expect, it's likely to just be missing from the database.

It is recommended to leave the target area and country pulldowns to their default unless you are constantly seeing multiple stations matching on a given frequency. Then you can use those fields to filter out the stations not transmitting in your receive area.

The database is maintained by www.eibispace.de - you can support the work they do in maintaining the database via their website.

For more information contact support
http://www.sdrplay.com/support

3. Legal Information

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