

SDR # Frequency Manager + Scanner v1.6.1

User's Guide

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Important! Please note the change in System Requirements on page 3

Table of Contents

Introduction.....	2
Features Summary.....	2
New features or improvements in this version.....	3
Frequency Manager.....	3
Scanner	3
System Requirements.....	3
Installation.....	4
Installing the software.....	4
Uninstalling the software	4
Modifying/Repairing/Updating the software.....	4
Using the Frequency Manager	4
The Frequency Manager Panel.....	5
Functions in the Frequency Manager Group.....	5
The Data Display.....	6
The Edit Dialog.....	7
Editing Single Records	7
Bulk Editing of Frequencies	8
The Browse Window	9
Functions in the Browse Window.....	10
The Groups Window.....	11
Functions in the Groups Window	11
The Protocols Window	12
The Services Window	12
The Scanner Panel	12
Functions in the Scanner Group	12
The Database	18
Customization.....	19
Troubleshooting	21

Error Messages	21
Operational Issues	22
Known Issues	26
Appendix.....	26
Default Protocols supplied with Frequency Manager	26
Default Services supplied with Frequency Manager	27
RGB Numbers for Colors.....	27
The Spectrum Analyzer Lies to You	27
Scanner Performance Tuning	28
Overview.....	28
Minimum Signal Strength.....	28
Radio Settle Time in Milliseconds.....	28
Recommended Process for Performance Tuning.....	29
Benchmarking the Scanner.....	29
Notices.....	30

Introduction

The **SDR # Frequency Manager + Scanner** (called FM in the rest of this guide) is a free plugin designed for use within the SDR Sharp software application. It delivers a full-featured frequency management tool permitting you to manage and browse frequencies and to scan ranges of frequencies or groups of frequencies that you define. Written in C#, it is designed for performance and flexibility.

Features Summary

FM adds a Frequency Manager, a Scanner, and these six windows to SDR #:

- The Edit dialog allows you to add and update frequency records.
- The Browse window lets you browse through your database, selecting and sending frequencies to the radio. You can also filter your database 5 different ways to limit the scope of frequencies that are displayed.
- The Groups window lets you define, edit, and delete frequency group definitions. Frequencies are assigned to groups using the Edit dialog.
- The Protocols window lets you define, edit, and delete transmission protocol definitions, which are assigned to frequencies using the Edit dialog.
- The Services window lets you define, edit, and delete station service-type definitions, which are assigned to frequencies using the Edit dialog.
- The Scanner Configuration window lets you define scanner settings and tune scanner performance to suit your equipment.

New features or improvements in this version

There are several improvements in this version.

Frequency Manager

- The **Frequency Description** is now displayed in the upper-right corner of the spectrum analyzer, along with the indicator for multiple database entries for that frequency.
- As a result of moving the above information to the spectrum analyzer, the Frequency Manager panel is now 35% smaller.
- The **Clipboard Monitor** now optionally watches the clipboard for frequencies you might have copied from the internet; and if that can be converted to a Mhz value it tunes the radio to that frequency.
- **Function Keys F1-F10** can now be used to tune to a preset frequency.
- Bugs fixed:
 - With the recent UI design changes of SDR#, a section at the bottom of the panel was cut off. This new version of the plugin fixes that problem.
 - The reception modes (NFM, WFM, etc.) and the filter types (Hamming, Youssef, etc.) are now loaded from SDR# dynamically, meaning that future versions of SDR# should not break those parts of FM.
 - The watchdog timer would sometimes not start counting down on a busy frequency.

Scanner

- A new **Minimum Signal Strength Line** is displayed on the spectrum display. This, along with real-time display of the current signal's strength when the scanner is running, let you see at a glance how that signal compares to your scanner settings. In addition you can use customize the line with one of 6 line patterns.
- **Current Signal Strength** in dB is displayed in the upper right corner of the spectrum analyzer, just after the Frequency Description.
- **Timeout and Watchdog timers'** indicators are now displayed in the upper right corner of the spectrum analyzer.

System Requirements

Basically if you can run SDR Sharp, you can use the Frequency Manager. As with any software, the more capable your hardware the better the software will run.

- **OS:** Windows XP Pro SP3, Windows 7, or Windows 8. The binaries are compiled for a 32-bit environment for the broadest compatibility but run equally well in an x64 environment.
- **Processor:** 1-gigahertz processor or faster; **2 or more cores is recommended.** Hyper-threading/Multi-threading should be enabled for the best performance. **NOTE:** SDR# and my plugins are multi-threaded applications, meaning they perform multiple tasks simultaneously. As a result you may have performance problems if your processor cannot execute at least 4 threads simultaneously. When all Frequency Manager + Scanner windows are open and the scanner is active, 9 threads are required plus the number of threads used by SDR#.
- **Memory:** 1 gigabyte or more total in the computer.
- **Hard Disk:** The software requires 1MB; the frequency database size is dependent on the number of records. 2000 records will fit in a 620KB database.
- **.NET:** Version 3.5 SP1 runtime as required by SDR Sharp.
- **Important! SDR Sharp: Revision 1294 or newer is required due to changes in SDR#.**

Important Note

SDR# is a hobby project created by other people and I am not involved in it. I have no control over changes made to SDR#. I am completely at their mercy as to how their changes affect FM. They are under no obligation to inform me of changes; I won't know if their changes will break my plugins until the plugins are run with the new version of SDR# and you tell me there is a problem. As a result there will be a period after they make a breaking change in which my plugins may not work. Please be assured I will make any necessary changes, and release updates, as soon as practical after SDR# is changed and I have identified the issue.

Installation

Installing the software

Installation is extremely easy, but you may be required to run the setup program as Administrator. PluginsSetup.exe is a typical software installer; use the Next and Back buttons to walk through the setup wizard. Just follow these steps:

1. Unzip the freqmgr.zip file to a convenient folder. Do not unzip it to the SDR# folder for this will cause the plugin installation to fail.
2. Run installer program PluginsSetup.exe. Click Next. Do not install the documentation to the same folder as SDR#.
3. Select the plugins and tools that you wish to install. Click Next.
4. Define the folders into which the software will be installed. Click Next.
5. View the installation summary page and confirm your choices. Click Next.
6. Click Next as needed to complete the installation.

PluginsSetup will copy the required files into the targeted folders, alter the SDR# configuration to run the plugins, and create an "SDR# Plugins" folder in your Start Menu.

If you get error messages on starting SDR# after installing the plugins, see the Troubleshooting section of this document.

Hint

Think about making some language-specific customizations before you run FM for the first time. See the Customizations section below.

Uninstalling the software

Run PluginsSetup.exe again and clear the checkboxes for the software you want to uninstall.

Modifying/Repairing/Updating the software

Run PluginsSetup.exe again. To modify, check or un-check the software you want to add or remove. To repair or update, leave the checkboxes alone; it remembers your last choices and will re-install them as previously selected.

Using the Frequency Manager

Because of the way FM works, you may be required to run SDR# as Administrator.

After installing the plugin, and the first time you ever run SDR Sharp, a Success popup message will appear stating *"The Frequency Manager database was created successfully."* Click the OK button and SDR Sharp will be displayed with the new collapsible panel containing the Frequency Manager. At this point you may go ahead

and use FM, entering and saving frequencies as you work, or you may convert other sources of frequency data and import the frequencies. Please see document “Frequency Manager + Scanner Tools.pdf” which is included with the Frequency Manager + Scanner Tools application for more info on importing data.

After your first startup, and before you start monitoring, is a good time to begin customizing Groups, Services, Protocols, and some of the text that goes into dropdown lists or in default texts. See the sections of this document on Groups, Services, Protocols, and Customizations.

The Frequency Manager Panel

The FM collapsible panel contains two groups of controls.

- The Frequency Manager group displays information about the current frequency and contains the buttons that open FM function windows.
- The Scanner Functions group contains the controls for the scanner. These allow you to fine-tune the scanner performance, select a scan mode, start/stop, and pause the scanner, skip a frequency that has the scanner blocked, flag a frequency for later attention, and lock a frequency out of the scanner.

Functions in the Frequency Manager Group

Presets

At the top of the panel is a row of buttons labeled “F1” through “F10”. Right-clicking a button will display a menu that allows you to assign the current frequency to that preset, or to remove the stored frequency from that preset. To recall a preset and tune the radio to its frequency, simply click that button. Each button also displays a tool-tip that shows the frequency and description stored in that preset. You may also press the keyboard function keys F1 through F10 as long as the SDR# window is the active window on the desktop.



Paste

This small button located to the right of the Multiple-Record Indicator allows you to paste a frequency from the clipboard into the radio. It will attempt to convert what's on the clipboard to a compatible number. If the clipboard contents are not compatible, nothing will happen.

You can also tell the plugin to continuously monitor the clipboard for text that could be interpreted as a frequency; see the section on Customization on how to make the setting.

Edit

The Edit button displays the Edit Dialog, described below. The Edit dialog requires you to interact with it before it can close, and it can block other program activities from happening until you close it. The full description of the Edit Dialog is given after this section.

Browse

The Browse button displays or hides the Browse window. The Browse window can be displayed and can have activity at the same time as other components. Details of the Browse window are described below.

Manage

This button opens a menu that allows you to select Groups, Protocols, or Services for management. The menu choice you take will open the editor for that set of data.

Info

This “hidden” function displays information about FM: the version, the date and time it was last modified, the path to the frequency database, the database version number, and a copyright notice. Access this function by

clicking your mouse anywhere in FM and then pressing the three keys `Ctrl + Alt + I` simultaneously. In a few seconds a popup will display the application information.

The Data Display

Older versions of FM displayed the identity of the currently-tuned frequency, its transmission mode, whether or not you have more than one record in the database for that frequency, the timeout timer status, and the watchdog timer status, in the Frequency Manager panel. With the exception of the transmission mode, all of these are now displayed in the upper right corner of the spectrum display. The transmission mode can be viewed in the Radio collapsible panel provided by SDR#. The screenshot shows the new Data Display.

Frequency Description

If the tuned frequency has a record in the FM database the Description from that record will be displayed here.

A screenshot of a software interface showing a data display. The text is yellow on a black background. It reads: "Southern Nevada Area Communications Council [-42dB] M T W". The "M T W" part is slightly larger and more prominent than the rest of the text.

Current Signal Strength

The signal strength of the tuned frequency is displayed next in a dB scale between zero and the maximum display range of your radio. This is only displayed when the scanner is enabled.

Multiple-Record Indicator

The **M** to the right of the signal strength indicates that your database contains multiple records for this frequency. This is useful because, when hand-entering a frequency into the radio or when scanning by frequency range, the Description shown will be that of the first record found in the database for that frequency. Therefore any transmission you listen to may or may not be correctly attributed to the Description shown. There's no way FM can tell from a transmission which licensee is transmitting it; the best it can do is tell you that you have multiple records for that frequency so that you can decide for yourself who is transmitting.

Timeout Timer Activity

The **T** to the right of the Multiple-Record Indicator, when displayed, indicates that the signal's strength has fallen below the minimum that you defined and the scanner is waiting for an additional transmission. It will wait as many seconds as you defined in "Seconds wait for more transmission" and if the frequency does not resume activity, the scanner will start searching for the next active frequency.

Watchdog Timer Activity

The **W** to the right of the Timeout Timer Activity indicates that (a) you have enabled the watchdog timer and (b) the frequency has been active for a long enough time that the watchdog is prepared to stop listening and move on to the next frequency.

The Edit Dialog

Editing Single Records

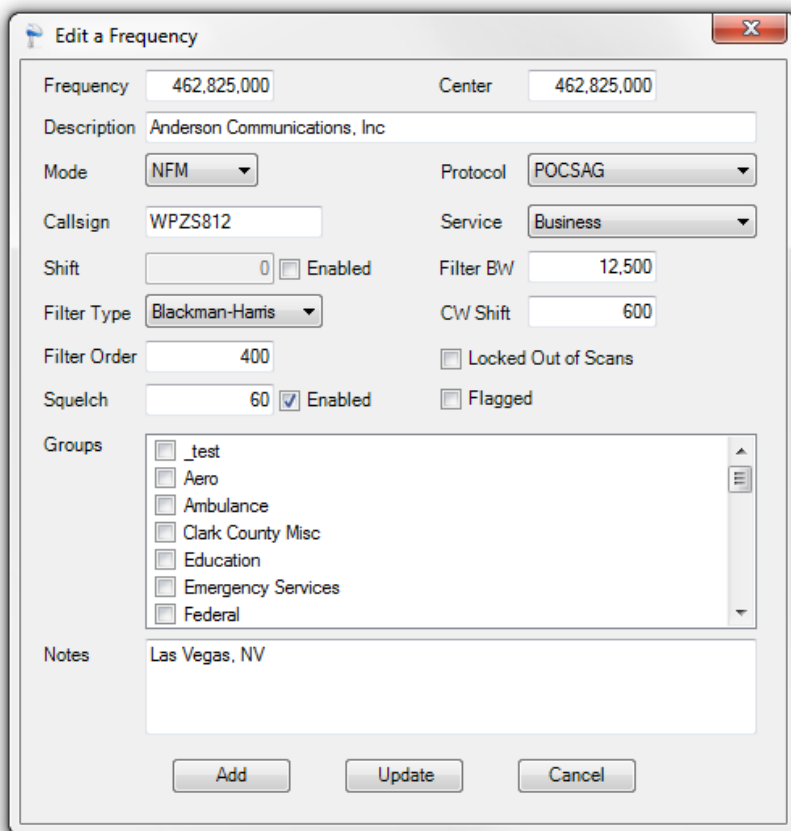
Clicking the Edit button on the FM panel displays the Edit dialog. The Edit dialog allows you to add and update frequency records. You can also copy the information from an existing record to create a new record. The fields for each frequency are:

- Frequency
- Center Frequency
- Description
- Mode (NFM, AM, etc.)
- Protocol (Voice, P25, POCSAG, etc.)
- Service (Business, EMS, Transportation, Federal, Law Tactical, etc.)
- Callsign
- Frequency Shift
- Filter Type
- Filter Bandwidth
- Filter Order
- Squelch
- CW Shift
- Frequency is locked out of scans
- Frequency is flagged for attention
- Groups to which the frequency is assigned
- Notes

The Edit dialog has basic error checking to ensure that you are entering data appropriate to the field. If you enter inappropriate data, a red circle with an exclamation mark  appears next to the field. If you let your mouse pointer hover over the red circle it will display a message about the error. You cannot move to another field until the error is corrected, and you cannot save a record when there are errors. Not all fields require “correct” input; for example you can enter any text in Description or even leave it blank. Every numeric field except Shift requires a value in a range compatible to that required by SDR Sharp.

Clicking the Add button will create a record. Clicking the Update button will update an existing record, and clicking the Cancel button will exit without saving any data.

If the Edit dialog was launched from the FM panel, and if you are editing a frequency that is not yet in the database, the Update button will be disabled. If the frequency is in the database both the Update button and the Add button will be enabled. This permits you to change the current record or to create a new record while copying data from the existing one. The Edit dialog will not prevent you from Adding a record identical to one



The screenshot shows the 'Edit a Frequency' dialog box with the following fields and values:

- Frequency: 462,825,000
- Center: 462,825,000
- Description: Anderson Communications, Inc
- Mode: NFM
- Protocol: POCSAG
- Callsign: WPZS812
- Service: Business
- Shift: 0
- Filter Type: Blackman-Harris
- Filter Order: 400
- Squelch: 60
- Filter BW: 12,500
- CW Shift: 600
- Groups: A list box containing checkboxes for _test, Aero, Ambulance, Clark County Misc, Education, Emergency Services, and Federal.
- Notes: Las Vegas, NV

At the bottom of the dialog are three buttons: Add, Update, and Cancel.

already in the database having the same frequency; the design assumption is that there will be cases where you will find two or more stations on the same frequency because this situation is common in HF reception.

Some notes about the fields on the Edit dialog:

- Description and Notes are free-form text and support up to 32,767 characters.
- The Notes field supports multiple lines of text; just press the Enter key to start a new line.
- The Protocol field is prepopulated with over 140 popular transmission types from which to choose, including those commonly used in HF through UHF frequencies. See the Protocols Window section in this document to get info on how to edit this data. See the Appendix for a list of the default protocols provided.
- The Service field is prepopulated with over 30 popular services from which to choose, broadly based on the services defined by the U.S. Federal Communications Commission. See the Services Window section in this document to get info on how to edit this data. See the Appendix for a list of the default services provided.
- Mode and Filter Type provide the same options as SDR Sharp. If you have a record in the database with “Blackman-Harris” as the Filter Type, and you are using a newer version of SDR Sharp, it will be treated as “Blackman-Harris 4”.
- The Groups field will be blank until you create groups, at which point it will be populated with a list of checkboxes that you can use to assign or dissociate groups for the frequency. You may select no groups for a frequency or as many as you please; do what is meaningful to you. If you add or edit a group name using the Groups window while Edit is open you will need to close and reopen the Edit dialog to pick up the Groups change.

When you close the Edit window, its position is remembered for the next time you use it.

Bulk Editing of Frequencies

You may edit multiple frequencies at once when you select multiple records in the Browse window and click its Edit button or Edit context menu. An example of this might be when you want to change the Service type for a number of frequencies simultaneously.

Caution

You can ruin quite a lot of frequency records at one time if you aren't careful with the bulk editing feature. **Anything you change here will be changed in all the selected records.** Be sure of your changes before you commit them by clicking the Update button.

When bulk editing, the Edit dialog behaves a little differently. When all the frequencies being edited have the same value in a field, the field will display the common value. If the frequencies have *different* values in a field, the field will display as a blank. As an example consider the following Edit dialog:

In this illustration the selected records all share the same Frequency, Center, Mode, Service, Shift, Shift Enabled, Filter BW, Filter Type, CW Shift, Filter Order, Squelch, and Squelch Enabled.

However they have different Description, Protocol, Callsign, and Locked values, so those text boxes and dropdowns are blank.

Please note the Locked checkbox in this example. In this dialog all checkboxes (Locked, Shift Enabled, etc.) are what is called “Three-State” checkboxes – meaning they can be checked, unchecked, or ‘indeterminate’. When some of the selected frequencies have a checkbox checked and others don't, the result is indeterminate. How this state is displayed depends on your version of Windows. On my Windows 7 computer these are shown as a checkbox filled with a solid color. On other Windows operating systems, they are shown with a ‘ghosted’ checkmark in the box. So, in this example some of the selected frequencies were Locked and others were not.

Whatever you change in this dialog will be changed in all the selected frequencies – the original values will be permanently overwritten, except for Groups which are a special circumstance. When editing multiple frequencies all the Group selections are shown as unchecked regardless of what groups are assigned to those frequencies. If you check one or more Groups when bulk editing, the Group(s) will be added to those of each of the frequencies rather than replacing them. So if one of the edited frequencies already has Education, and you select Transportation in the bulk edit, that frequency will end up with both Education and Transportation.

To abandon any bulk-edit changes, click Cancel. To apply bulk-edit changes, click Update. You will be prompted to confirm that you want to change multiple records.

When bulk editing, the same data validations apply as when editing a single record.

The Browse Window

This window displays a grid of all frequencies in the FM database. All of the data entered for a Frequency is displayed plus the date the record was added or last updated.

- The grid scrolls vertically and horizontally so you can access the information. You may also change the size of the window, which will adjust the size of the grid accordingly.
- You may sort the contents of a column in ascending or descending order by clicking the column's header. The default sort order is by Frequency ascending.
- You can reorder the columns. To move a column left or right in the grid, left-click on its header text and drag the header to a divider

Frequency	Description	Mode	Protocol	Call Sign	Service	Groups
72,060,000	Citipage Plus Inc	NFM	Unidentified	WPAU835	Business	Paging
72,100,000	Citipage Plus Inc	NFM	Unidentified	WPAU835	Business	Paging
72,100,000	Southern Hills Hospital	NFM	Unidentified	WQAC271	Business	Hospitals
72,100,000	St. Viator School	NFM	Unidentified	WQCS300	Business	Education
72,120,000	Citipage Plus Inc	NFM	Unidentified	WPAU835	Business	Paging
72,120,000	Nevada Power	NFM	Unidentified	WQCS287	Business	Utility, Sca
72,120,000	Southern Hills Hospital	NFM	Unidentified	WQAC271	Business	Hospitals
72,140,000	Citipage Plus Inc	NFM	Unidentified	WPAU835	Business	Paging
72,140,000	Nevada Power	NFM	Unidentified	WQCS287	Business	Utility
72,180,000	Citipage Plus Inc	NFM	Unidentified	WPAU835	Business	Paging
72,200,000	Nevada Power	NFM	Unidentified	WQCS287	Business	Utility
72,200,000	University Of Nevada Las Vegas	NFM	Unidentified	WQEE266	Business	Nevada S
72,220,000	Nevada Power	NFM	Unidentified	WQCS287	Business	Utility
72,220,000	Novum Research Services	NFM	Unidentified	WQBV636	Business	
72,240,000	North Las Vegas Justice Facility	NFM	Unidentified	WQFV610	Public Safety	Municipal

between two other columns. The target divider will change color to help you see the drop point. When the column header is in the desired position, release the mouse.

- You can resize the columns by letting your mouse pointer hover over the divider line between two column headers. The mouse pointer will become a left-right pointing arrow. Left-click the divider and drag it left or right to narrow or widen the column. You may also make a column fit its contents by double-clicking the divider. Column sizes and order are remembered for use the next time you open the Browse window.

A helpful feature of the Browse window is that it can track the frequency in SDR Sharp “live”; when you enter a frequency in SDR Sharp, or select one by panning the spectrum window, or scan to a known frequency, the Browse Window positions itself to that frequency if it is in your database.

Functions in the Browse Window

Live Track

This button enables or disables the live track feature that makes the grid auto-scroll to the frequency currently being monitored. This button latches state as either pressed or released - when it is pressed the grid tracks the frequency changes of the scanner or the spectrum analyzer; when released it does not, and this makes it easier to browse or bulk edit frequencies while the scanner is running.

Hint

If you find that the radio pauses during Browse window scrolling, or if the Browse window contents get garbled, this may be an indication of performance problems; turn off Live Track and use the Refresh button periodically to force the grid to reload from the database.

Edit

You may launch the Edit dialog from the Browse window. It behaves the same as when launched from the FM panel, with the exception that the Add and Update buttons are always enabled when editing a single frequency.

Delete

The Delete button allows you to delete a frequency or a set of selected frequencies. A confirmation popup will appear. Deleting a frequency whose data is currently set in the radio will not result in changes to the radio settings. Deleting a frequency cannot be undone.

Send to Radio

You can send the selected record to the radio using the Send to Radio button; but you can also do this by just double-clicking the selected row. The button is disabled if you have selected multiple rows in the grid. Please note that the red line indicating the current frequency behaves differently when using Send to Radio versus when scanning. When scanning, the frequency difference between the current center frequency and the current frequency is maintained to keep the red line at the same position in the spectrum analyzer. When using Send to Radio, the center frequency and frequency recorded in the database are honored and sent to the radio, which may cause the red line to change position.

Refresh

This button tells the grid to throw away all of its data and completely reload from the database. Use of the Refresh button is always optional, but if you have Live Track turned off during a frequency range scan this can update the grid with the latest frequency data.

Close

Closes the Browse window; the window remembers its current size and position for your future convenience.

Filter

You have three filtering fields in the window which provide five filters:

- **Filter by Freq/Text** will let you enter a Frequency, text from the Description field, or text from the Notes field; the filter will dynamically narrow the list of results. You can click the ✕ button at the right end of the field to remove the text filter.
- The **Filter by Group** dropdown will allow you to choose a group from those you have defined. The grid will then display only those Frequency records which are assigned to the chosen group. Remove the group filter by changing your choice to “None”. You can click the ✕ button at the right end of the field to remove the filter.
- The **Filter by Flagged/Locked** dropdown lets you ignore either attribute, show only the Flagged frequencies, or show only the Locked frequencies. You can click the ✕ button at the right end of the field to remove the filter.

Context Menu

Right-clicking a row or selected rows on the grid displays a context menu with the following options:

- **Edit:** Displays the Edit dialog.
- **Delete:** Displays the Delete confirmation, which will prompt you to approve deletion of the selected record(s). Upon confirmation the record(s) will be deleted.
- **Add to Group:** Displays a sub-menu listing all of the available Groups. If you have selected multiple frequencies in the grid all will be assigned to the selected group.
- **Remove from Group:** Displays a sub-menu listing all of the available Groups. If you have selected multiple frequencies in the grid the selected group will be removed from all of them.

The Groups Window

The Groups window lets you create and edit labels by which you can group frequencies. This is a traditional editable grid. The text can be anything meaningful to you; for example in Las Vegas where I live I have groups for Metro Police, Resorts, and County government, among others.

Adds, Edits, and Deletions of groups are automatically propagated to the Scanner’s Scan Group list, and to the Browse window’s Group list if the Browse window is open.

Functions in the Groups Window

Add

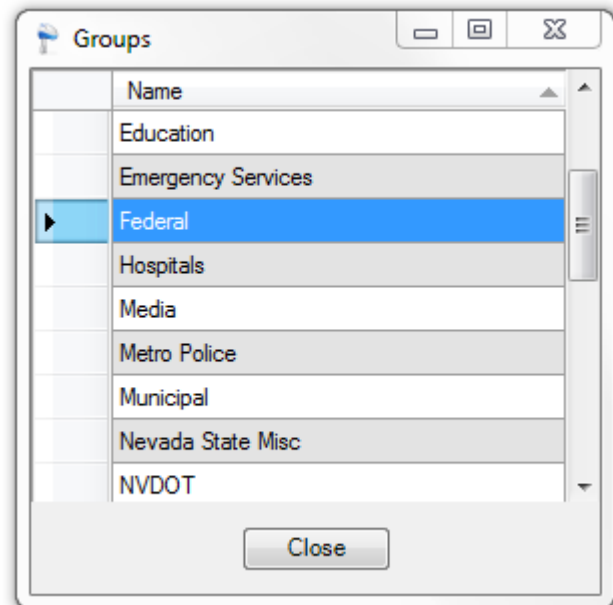
To create an entry, select the last row of the grid (by default it is empty) and start typing. The entry will be saved automatically when you move off the row. If you need to abandon your entry before saving, press the Escape key on your keyboard.

Edit

To edit an entry, select the desired row and start typing. The entry will be saved automatically when you move off the row. If you need to abandon your change before saving, press the Escape key on your keyboard.

Delete

To delete a row, select it and press the Delete key on your keyboard. A confirmation prompt will be displayed.



Close

This button closes the Groups window; the window remembers its current size and position for your future convenience.

The Protocols Window

This window works the same way as the Groups window (see above) but displays the different transmission protocols you can assign to a frequency – like Voice, POCSAG, RTTY, etc.

The Services Window

Likewise the Services window works the same way as the Groups window (see above) but displays the different Services you can assign to a frequency – like Business, Law Dispatch, Aero, etc.

The Scanner Panel

The scanner allows you to select and scan a Group of frequencies that you have previously defined, or to scan a range of frequencies that you specify. Scanning speed depends on the performance of your computer and your receiver. The scanner cannot be used when using “IQ File” or “Other” signal sources.

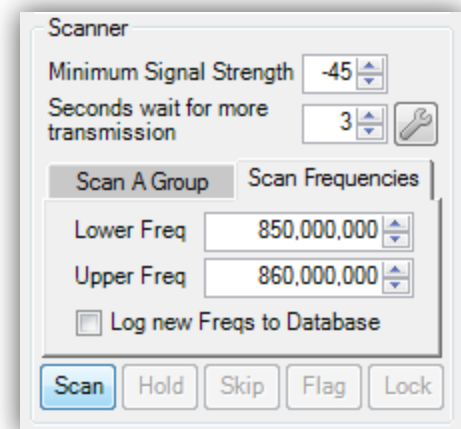
The scanner achieves its speed by looking ahead at the spectrum to the right of the SDR# vertical red line that indicates the current frequency. So the further to the left of the spectrum the red line is located, the more spectrum the scanner can search in one large block, and the faster overall the scanning will be.

A Group scan looks for the next frequency of the Group in the adjacent block of spectrum; if the frequency is not active the spectrum is advanced to the next frequency in the group; if no frequency is found in the adjacent block of spectrum the spectrum is advanced to the next block of frequencies. A Range scan searches the adjacent spectrum for the next frequency whose signal strength is higher than the specified minimum; if no frequency is found the spectrum is advanced to the next block of frequencies.

Personally, with a cheap dongle having a 2MHz spectrum, I get the fastest scanning by putting that red line all the way to the left. That’s the fastest but not necessarily the most “user-friendly”, so usually I put the SDR# red line about 20% into the spectrum from the left end.

If the Browse window is open and Live Track is enabled, you will see frequencies selected in the Browse window as the scanner tunes them.

The scanner stops on a frequency when it detects the frequency is stronger than a minimum decibel level that you define. This permits scanning at a high speed (especially during range scans).



Functions in the Scanner Group

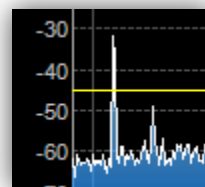
Minimum Signal Strength

This control lets you define the minimum signal strength in dB that will cause the scanner to stop on a frequency. This value governs both Group and Range scans. I won’t go into what dB is (you can look that up) but keep in mind **the closer to zero, the stronger the signal**. You may type a number in this field or use the up and down buttons to change the setting. Because the dB level is defined as a negative number, a positive

number that you enter will be converted to a negative number when you leave the field. This value can be changed while the scanner is running and the change takes effect on the next frequency scanned.

Signal Strength Indicator

As opposed to version 1.4 of these plugins, the Minimum Signal Strength in this new version is shown as a horizontal line in the spectrum display. By default this is a yellow line, but you can change the color easily (see the section on Customizations). The goal of this indicator is to provide you information about the current signal strength versus the minimum that you defined.



Some things to know about the Signal Strength Indicator:

- The horizontal bar corresponds to your Minimum Signal Strength setting.
- The signal strength of the current signal, in dB, is shown in the Data Display. This value is only displayed when the scanner is enabled.
- The T and W timers are controlled by the signal strength of the tuned frequency and are mutually exclusive; they cannot both be active at the same time because their purposes are the opposite of each other. The timeout timer waits on a previously-active but now inactive frequency to become active again and then forces the scan to resume when time runs out. The watchdog timer waits on an active frequency to stop transmitting and forces the scan to resume when the signal is active for too long. These are only displayed when the scanner is enabled.
- The T and W indicators may not always display during times of fast signal strength changes that cross the minimum signal strength; they can flicker on and off so fast that your computer may not be able to keep up.
- The signal strength does not display S-units, nor signal levels over zero dB, because the maximum possible signal strength in SDR# is zero dB. S-units and levels over zero dB are not supported by the design of SDR#.

Seconds wait for more transmission

Transmissions are sometimes conversations, often between a base station and a mobile unit. You probably want to hear both sides of the conversation, and there is often a couple of seconds of pause between each side of the conversation, so set this value to wait long enough to allow a response in the conversation before moving on. The minimum value is 0 seconds and the maximum is 600 seconds (10 minutes). This value can be changed while the scanner is running and the change takes effect immediately; however this value gets ignored if it is set to a lower value while the watchdog timer is counting down but will be used after the watchdog timer finishes.

Scan Mode

This is a pair of tabs that allow you to select the scan mode: scan by a specified group or scan by a specified range of frequencies.

- **Scan A Group:** In order to use this function, you must first have created a group and assigned frequencies to the group as described previously. The group you wish to scan can be selected in the dropdown list. As a practical matter, keep your groups small enough to improve your chances of detecting an active frequency in a reasonable length of time in scanning.

Hint

Group management is a key part of group scanning. I find it useful to have a group containing all the frequencies I can find for that group just so they are organized for the Browse window; and I make a *second* group containing a subset of the first group, limited to the most active or interesting frequencies. For example I have a group named "Emergency Services" that contains 100 frequencies and a subset named "Scan Emergency Services" that contains the 20 most active frequencies. By limiting the scope of a Group scan you improve Group scanning performance.

- **Scan Frequencies:** To scan a range of frequencies take the following steps:
 1. Select a Mode in the Radio (NFM, AM, etc.).
 2. Select the desired step size for that mode.
 3. Set the Squelch threshold as desired.
 4. Enter the starting Lower Frequency and the ending Upper Frequency. Whatever you enter will be normalized when you click Scan to a correct figure based on the currently selected Step Size in the radio. For example with a Step Size of 12.5 KHz, a Lower Freq of 160,606,000 Hz will be normalized downward to 160,600,000Hz and an Upper Freq of 161,117,205 will be normalized upward to 161,125,000 Hz. This normalization feature can be disabled; see the Customizations section of this document.
 5. Putting a checkmark next to “Log new Freqs to Database” will cause the scanner to automatically create new frequency entries in the database when a previously-unrecorded frequency is found.

 Hint

By default automatically-logged new frequencies have a Description of “Unidentified. Found during frequency scan”. This text can be changed to suit your preferences or language; please see the Customization section of this document.

 Hint

When performing a frequency range scan, the scanner tries to match the frequency in the radio to one in your database. If there is a match, the radio-specific database contents are copied to the radio – Mode, Squelch, Filter Type, etc. If “Snap to next Step Size” is turned off and you are tuning an NFM or WFM frequency, a database match may not be found because in NFM and WFM the peak frequency moves left and right around its center; at any given moment the peak will be off-center and therefore will not have a match in the database.

Scan button

The scan button starts and stops the scanning action. If the radio is not playing, scanning begins after a 1-second delay to allow the radio to start. When scanning, some controls in the Scan Functions group are disabled. The button latches state as pressed or released.

Please note that the red line in SDR# indicating the current frequency behaves differently when using Send to Radio from the Browse window versus when scanning. When scanning, the frequency difference between the current center frequency and the current frequency is maintained to keep the red line at the same position in the spectrum analyzer. When using Send to Radio, the center frequency and frequency recorded in the database are sent to the radio, which may cause the red line to change position.

Hold button

Sometimes when scanning you hear a particularly interesting conversation and want to listen to it without needing to restart scanning from the beginning. Clicking this button will cause the scanner to ignore the “Seconds wait” figure and the watchdog timer and its caption to change to “RIs” (Release). The scanner will stay on the current frequency. The button stays pressed until you click it again, at which time the scanner electronically clicks the Skip button.

Skip button

Sometimes when scanning you will land on a busy frequency or one that has a long-winded and boring conversation. Clicking the Skip button tells the scanner to move on to the next frequency. The Skip button restarts the scan at the current frequency + the step size. Skipping an active frequency works best when “Snap to next Step Size” is turned on. The Skip button does not prevent you from scanning that frequency again.

Flag button

The Flag button marks the current frequency as something “interesting” that you wish to follow up on later. These frequencies can be easily found in the Browse window by using the Flagged/Locked filter. In the Browse window these are also colored differently than “normal” frequencies; by default standard Windows colors are used but the colors can be customized to your liking. See the section on Customization in this document.

Lock button

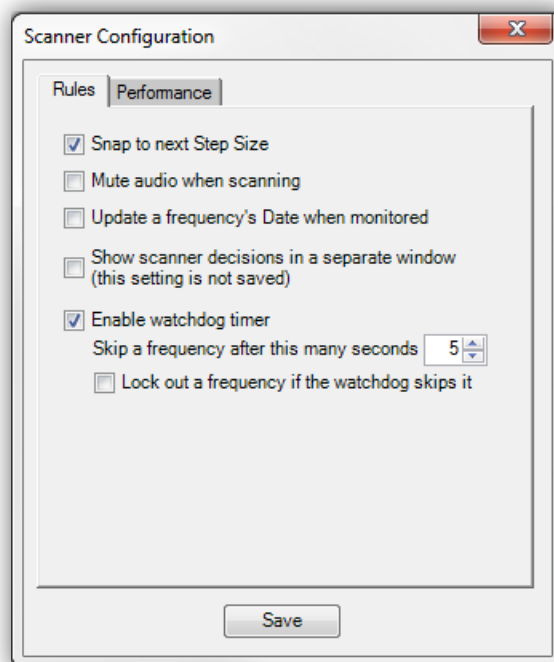
The Lock button marks the current frequency as locked out of future scans by Group or by Frequency Range, and then electronically clicks the Skip button. The lock takes effect immediately; the next time the current scan hits a locked frequency it will be skipped. These frequencies can be easily found in the Browse window by using the Flagged/Locked filter. In the Browse window these are also colored differently than “normal” frequencies; by default standard Windows colors are used but the colors can be customized to your liking. See the section on Customization in this document.

Scanner Configuration

This button with the wrench/spanner on it, next to the “Seconds wait...” field, opens a new window in which you can configure additional scanner settings and where you can fine-tune scanner performance on your equipment. The settings are organized into Rules, which you might change frequently, and Performance, which you would seldom change after your initial configuration.

In the Rules tab are the following settings:

- **Snap to next Step Size:** This enables or disables the automatic centering of tuned frequencies to an even step size. The results of enabling this are most evident when tuning FM signals because at any given millisecond an FM’s peak signal strength is not on the frequency’s center frequency. When enabled, the scanner will always round up or down to the nearest even step size. When disabled, the scanner will stop on the strongest frequency; when scanning NFM or WFM, this may not be the center of the frequency.
- **Mute audio when scanning:** Putting a checkmark here will cause the scanner to mute the audio during scanning, and restore the audio when the scanner stops on a frequency. Note that it remembers the starting AF Gain and restores it when unmuting; so if that starting AF gain is zero, it will return to zero when unmuting the audio and you won’t hear anything.
- **Update a frequency’s Date when monitored:** A checkmark in this box will cause the Date of a monitored frequency that is already in the database to be updated to the current local Date.
- **Show scanner decisions in a separate window:** Why did the scanner skip that frequency? Putting a checkmark here will open a new window after clicking the Save button. As the scanner runs it will describe



856,925,000	-40dB detected but is locked
857,775,000	-34dB tuned
857,775,000	listening
857,775,000	timed out waiting for more
857,850,000	-40dB detected but is locked
857,937,500	-40dB detected but was -55dB after tuning

in the window the decisions it made while scanning. For example: a frequency was found but its signal strength was too low; a frequency timed out while the scanner waited, etc.

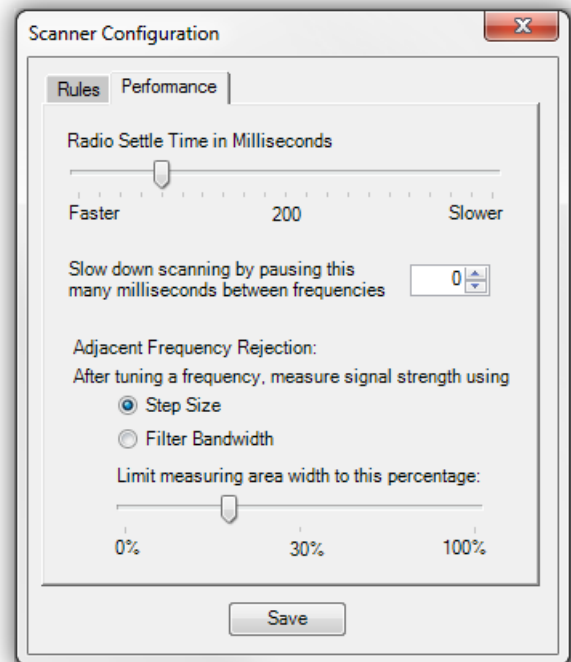
This window is meant for debugging by observing what the scanning engine is doing; it does not have robust programming and is not intended for extended use. This setting is not saved and the window will not be displayed after it is closed or after SDR# is closed, unless you return to Scanner Configuration to put another check in the box.

Scanner Decisions supports copying text from its window. To do so:

1. Hold or Stop the scanner. Scanner Decisions will not permit text selection while the scanner is active and updating its content.
 2. Using your mouse, select a number of rows. They will be highlighted when you do so.
 3. On the keyboard, press Ctrl + C simultaneously. This will copy the selected lines to the Windows clipboard.
 4. Paste the clipboard contents where desired. A caution, however: Windows Notepad ignores the new-line character at the end of each line of text, so the text pasted there will be displayed as one continuous line.
- **Enable watchdog timer:** a checkmark here will cause the scanner to force scanning to continue after a period of time stopped on an active frequency. If the Scanner Decisions window is open, a line with the text “watchdog timed out; scanning resumes” will be displayed.
 - **Skip a frequency after this many seconds:** how long the watchdog timer will wait on an active frequency before forcing the scanner to continue.
 - **Lock out a frequency if the watchdog skips it:** a checkmark here will cause watchdog-skipped frequencies to be locked out of future scanning. This takes effect immediately. If the Scanner Decisions window is open a line with the text “watchdog timed out; scanning resumes” will be displayed.

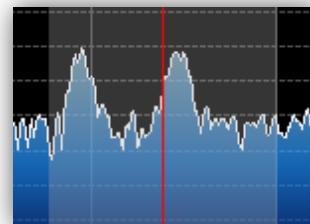
A couple of notes about how the watchdog timer works:

- On FM signals, the watchdog works best with “Snap to next Step Size” turned on and the radio’s calibration accurate so that the center of the signal is on the step size.
- If a frequency rapidly bounces below and above the minimum dB settings the watchdog timer will not engage; every time a frequency falls below the minimum the watchdog is turned off and the “Seconds wait” timer is turned on. A frequency must be consistently at or above the minimum dB for the entire number of seconds you defined for the watchdog, before the watchdog will force scanning to resume. You can see these decisions being made by looking for the watchdog “W” on the Signal Strength Indicator.
- If the watchdog timer never takes effect, this is usually an indication that the Adjacent Frequency Detection is set to too low a value (see Adjacent Frequency Detection below).



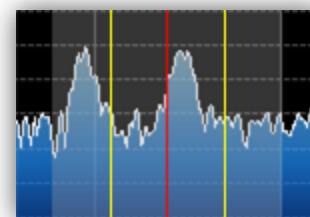
The Performance tab contains these settings:

- **Radio Settle Time:** This slider lets you balance scanning speed against scanning reliability. Lower values will give you higher speeds but the scanner may miss some active frequencies. This is because SDR# does not provide a way for plugins to know when the radio has successfully tuned to a specific frequency. So this value is used to introduce some delay between the time the scanner tells SDR# to tune the radio and the time the scanner starts measuring the actual signal strength. This is the *maximum* time the scanner will use to tune a frequency; in most cases it will take less time, as little as zero milliseconds, because the scanner is continuously sampling the radio to check the signal strength. On my equipment, 200ms is a good balance. This feature is not used until the scanner finds an active frequency.
- **Slow down scanning by pausing, etc.:** This causes the scanner to pause the specified number of milliseconds just before searching for the next frequency. This feature is only used after stopping on an active frequency and just before scanning for the next active frequency. You would not set this above zero for daily use; it is used solely so that you can examine the scanning action without changing your optimized settings. When set above zero, this feature can cause weird or repetitive entries in the Scanner Decisions window.
- **Adjacent Frequency Rejection (AFR):** This is a method of fine-tuning the central area of a frequency to determine its “busy” state. You can select to use the Step Size or the Filter Bandwidth on which to base the measurements, and a slider lets you set the percentage of the frequency, around the frequency’s center, from which to measure. In the Performance tab snapshot above, the measuring area is set to 30% of the Step Size.



For example, here are snapshots of two adjacent frequencies. In the first snapshot, the frequency on the left is inside the filter bandwidth of the frequency on the right (the area with a white tint). As a result the *left* frequency’s signal strength can influence the *right* frequency’s busy detection. This is an undesirable situation.

The second snapshot shows the effect of setting AFR to 50%. The area inside the yellow lines will be used for monitoring the frequency for activity; the adjacent frequency’s signal strength will be ignored.



Some notes on how to get the best out of AFR:

- If your radio supports frequency adjustment (PPM), and you use “Snap to next Step Size”, make sure the radio has been calibrated to known accurate signals. If the radio is not calibrated, Snap can cause the radio to tune to something other than the signal’s received center. Also be aware that inexpensive dongles tend to use oscillators that drift over time, causing your calibration to become inaccurate the longer the scanner is active.
- If the AFR value is set too small the scanner may pause on an active frequency only long enough to measure its signal strength but by using too small an area; as a result the scanner will immediately give up and move on to the next frequency.
- Setting the AFR value too low can also prevent the Watchdog timer from working correctly because it will not detect the signal as an active one.

If you don’t want to use AFR, simply set the pointer all the way to the right to use 100% of the available spectrum around a frequency.

The Save button (obviously) saves the settings on this window. If you instead wish to abandon your changes without saving them, just click the Close X in the upper-right corner of the window.

For more information about the controls in this window and how to use them, see the Appendix article “Scanner Performance Tuning.”

The Database

The database is built using the [SQLite database engine](#), version 3.7.12.1. If you did not previously use the `alternateFMDB` key to customize your database name and location, your database should be in one of these folders:

- In Windows 7 the default folder is `C:\Users\<username>\AppData\Local\SDRSFM\FreqMgr.db`, where `<username>` is your user login.
- In Windows XP the default folder is `C:\Documents and Settings\<username>\Local Settings\Application Data\SDRSFM\FreqMgr.db`, where `<username>` is your user login.

Folders `AppData`, `Local Settings`, and `Application Data` are hidden folders, so you will need to either enable Show Hidden Folders in Windows Explorer or type the path into the address bar of Explorer instead of clicking on folders with the mouse.

If you wish to use a different location or want to use different databases for different copies of SDR# with FM, instructions are in the Customization section of this document.

You must have adequate permissions to the database folder to create or update the database.

Customization

I've provided a number of customization points in the configuration. You may edit these to suit your preferences. **EDIT THE CONFIGURATION FILE AT YOUR OWN RISK.** You can cause enough damage and make so unusable that SDR# will not run. If you break it, neither the authors of SDR# nor I will be able to help you; you will have to restore from a backup or re-install SDR# and the plugins.

The configuration file is named "SDRSharp.exe.Config". It is located in the same folder as SDR#.

BACK UP YOUR CONFIGURATION FILE NOW.

The configuration file can be edited with any simple plain-text editor. Notepad or something equivalent will work fine. The fancier the editor (for example Microsoft Word) the more chances you have to break something. You may need Administrator permissions to edit the file.

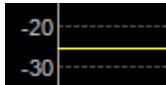
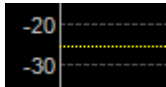
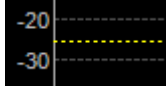
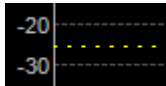
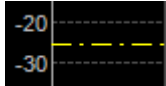
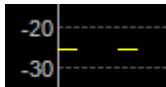
All of the FM customizations that you can edit start with `<add key="freqMgr`. These entries each have a *key* which is its name between double quotes, and a *value* which is also between double quotes.

- When editing, do not change the key. If you do, that feature will no longer work.
- Change the value as desired. The value must be enclosed in double quotes, even if it is a number.
- Do not change any other lines in the configuration; you may break the plugins or SDR#.
- Do not remove the empty double quotes when there is no value. They are required for proper operation.
- Save the file when you are finished and start SDR#.

The following table describes the customizations you can make. In the configuration file look for `<add key="` followed by the name in the Key column below.

Option	Key	Default Value	Customization
Use alternate database	freqMgrAlternateDb	Empty quotes	Enter the full path and name to the desired database file.
Flagged Frequencies colors	freqMgrFlaggedFreqBackColor freqMgrFlaggedFreqForeColor	Empty quotes; the Windows default colors will be used	Enter RGB numbers for the desired values. See the Appendix for more information.
Locked Frequencies colors	freqMgrLockedFreqBackColor freqMgrLockedFreqForeColor	Empty quotes; the Windows default colors will be used	Enter RGB numbers for the desired values. See the Appendix.
Text meaning "None", used in dropdown lists	freqMgrNoneText	"None"	Enter the desired text instead of the word "None".

Option	Key	Default Value	Customization
Enable scan frequency normalization	freqMgrNormalizeScanFreqs	"true"	When true, the entered frequencies will be rounded to match the step size. Set to false to disable this feature. You may need to also clear the "Snap to Grid" checkbox in SDR# for this configuration to be effective.
Text meaning Unidentified frequency found during scan	freqMgrUnidFoundMessage	"Unidentified. Found during frequency scan."	Enter the desired text.
Text meaning "Unidentified", used in dropdown lists	freqMgrUnidText	"Unidentified"	Enter the desired text.
Choose whether the Data Display is shown in Bold	freqMgrDescFontIsBold	Empty quotes; the default is True	Change to False to display normal font strength.
The color of the Data Display text and the Minimum Signal Strength line	freqMgrDescColor	Empty quotes; the default colors will be used	Enter RGB numbers for the desired values. See the Appendix.
Choose to have the plugin monitor the clipboard for data that could be a frequency	freqMgrMonitorClipboard	False	Change to True to make the plugin monitor the clipboard.
Choose to show the Data Display	freqMgrShowSignalDesc	True	Change to False to turn off the Data Display.
Choose to show the Minimum Signal Strength target bar	freqMgrShowMinSigStrBar	True	Change to False to turn off the target bar.
Define the thickness of the Minimum Signal Strength target bar	freqMgrMinSigStrBarThickness	1	Change to the desired thickness in pixels.

Option	Key	Default Value	Customization
Change the pattern of the Minimum Signal Strength target bar. By default this is a yellow horizontal solid line.	freqMgrMinSigStrBarPattern	0 (zero)	Choose from these available patterns: 0  1  2  3  4  5 

Troubleshooting

I wish I could say that there will never be any challenges, but in reality stuff happens. Please try the following remedies if you have these problems.

Error Messages

Problem	Potential Solution(s)
A popup appears with the message <i>"An error occurred. The error was: Cannot set the center frequency when no front end is connected"</i> .	You cannot scan unless a radio is selected as the signal source. Drop down the source list (next to the Play button) and select a radio.
A popup appears with the message <i>"An error occurred. The error was:"</i> followed by <i>"Method not found"</i> .	Your copy of SDR# is too old to be used with this version of the plugin. Please refer to the System Requirements section of this Guide. Older versions of SDR# do not contain the software necessary to support the scanner.

Problem	Potential Solution(s)
A popup appears with the message <i>"An error occurred. The error was:"</i> followed by some text then "SQLite error no such column".	File System.Data.SQLite.dll did not get installed into the SDR# folder, or was installed but is locked by Windows so that it cannot be used. • If it was not installed, uninstall all of the plugin software. Make sure you have Modify or Full Control access to the SDR# folder, and attempt to install the software again. • If instead the file was locked by Windows, right-click the file and select Properties from the menu. On the General tab, if there is an "Unblock" button, click it – then close the Properties window and try to use the plugin again.
A popup appears with the message <i>"An error occurred. The error was:"</i> followed by some technical information.	This is rare and usually happens when there is a problem with the database. Stop and close SDR Sharp. Make sure no other processes are using the database – for example a backup or database editor. Restart your computer if necessary to be sure. If that doesn't fix the problem, ensure that you have sufficient Windows permissions to alter the database and the folder that contains it. If the problem continues please send an email which includes all of the text in the popup plus the steps you took to get to the error to the address on the 1 st page of this document.
A popup appears with the message <i>"The Frequency Manager database exists but it is damaged. Do you want to delete it and create a new database?"</i>	During startup FM detected that the database exists but appears to be corrupt. Your options are: 1. Click Yes to continue and replace the damaged database with an empty one. You will have to rebuild your data. 2. Click No, exit SDR Sharp, and restore the database from a backup.
Popup Errors are shown.	If it is an FM error, it will contain details. Copy the details and email them to the address at the top of this document.
Some other popup or error appears.	Uninstall FM and restart SDR Sharp. If the problem continues it must then exist only in SDR Sharp and its related software, and not in FM.

Operational Issues

Problem	Potential Solution(s)
The Frequency Manager + Scanner panel does not appear.	File "SDRSharp.exe.config" has been altered or corrupted. You may need to uninstall and then reinstall.
The Frequency Manager + Scanner panel is disabled; no controls can be used.	Some critical error was detected that would prevent FM from working correctly. When this happens you normally will see an error message before SDR# finished loading. Some reasons for this can be: 1. The FM database is unusable. 2. FM could not be loaded, usually due to a configuration error or a problem with the database software or the .NET runtime software. You may need to reinstall FM or .NET.

Problem	Potential Solution(s)
I looked in SDRSharp.exe.config and found an entry named "freqMgrBrowseColumnsConfig" and there is a lot of garbage text after it.	This is intentional! That "garbage text" is actually the configuration data of the Browse window columns (their position and size) converted into text so that it can be stored in the configuration file.
The scanner never changes frequency and never stops on an active frequency	The scanning range you specified fits within the current SDR# spectrum segment, and the minimum dB is set too high.
The scanner changes frequencies slowly, especially during a Group scan.	1. The VFO frequency doesn't change unless an active frequency is found or the next target frequency is outside of the current spectrum, so it might appear that the scanner is slow but it is actually searching the current spectrum window for activity. You can confirm that the scanner is working correctly by opening the Scanner Decisions window and watching the frequencies as they are scanned. 2. The "Radio Settle Time" value is set too high. This causes the scanner to wait longer than necessary to detect that the frequency is inactive and then move on.
The scanner changes frequencies after stopping on an active frequency.	1. The Minimum Signal Strength value is too high, and the signal level fell below the minimum for longer than the "Seconds wait..." value. For more information, see the Appendix article "The Spectrum Analyzer Lies to You". 2. The Watchdog timer is enabled and set to too low a value. Disable it or set the delay to a larger number. 3. The AFR value is set too low, or is configured to use the wrong standard: step size versus filter bandwidth.
The scanner stops just to the right of an active frequency.	There are several common causes for stopping to the right of an active frequency: 1. You are doing a Group scan and the frequency to the left is not in the group. The scanner stopped on a frequency that <i>is</i> in the group. 2. You are doing a Range scan and the frequency's strength did not meet the minimum signal strength, so the scanner moved on. The scanner stopped where it did because the second frequency's signal strength qualified it for stopping. 3. The skipped frequency is not eligible for scanning – for example it may be locked out. If it "splatters" into the adjacent step size and "Snap" is enabled the scanner may stop on the empty frequency. 4. The frequency is correct and eligible but the scanner doesn't stop on it because its bandwidth is too narrow for the step size; the scanner doesn't "see" the frequency in the spectrum. For more information, see the Appendix article "The Spectrum Analyzer Lies to You". If the frequency was active but didn't qualify for scanning, you can select Mute Audio when scanning and disqualified frequencies will have no sound.

Problem	Potential Solution(s)
The scanner skipped over a frequency that I know is active and which should have been selected.	Even though the frequency apparently qualified for scanning it could be skipped for the following reasons. See the Appendix articles “The Spectrum Analyzer Lies to You” and “Scanner Performance Tuning” for more information. Assuming the frequency was not locked out: 1. The Minimum Signal Strength is set too high for that frequency – the actual signal strength <u>at the time it was measured</u> after tuning was below the minimum. 2. In the Scanner Configuration window, the Radio Settle Time is set too low (the scanner didn’t have enough time to measure the signal). 3. The radio’s Frequency Correction (PPM) value is incorrect, and although the frequency looks centered under the red line in SDR# it is not. 4. The transmission has a bandwidth that is smaller than the step size, and is too far away from the center of the bandwidth, resulting in too little of the transmission being measured for signal strength – the scanner thinks the signal is too weak because it can’t “see” the entire signal. 5. Automatic Frequency Rejection’s percentage measuring area is too small.
The scanner jumps to a frequency and stops. The frequency is not active.	1. The frequency was busy when the scanner was searching, but fell below the minimum after tuning. The scanner is waiting for the frequency to have additional transmissions before moving on. 2. The step size is too large for the mode chosen in SDR#. The scanner doesn’t search using the step size, but it does use the step size to define a “window” around a frequency in which it measures the strength of any signal found in that window. When the step size is too large, active frequencies adjacent to the desired one fool the scanner into thinking the frequency is active. Reduce the step size, or configure AFR, and restart the scanner. 3. An adjacent frequency takes up more spectrum than it should (it “splatters”) and the scanner senses enough of that waveform to think that the frequency that it stopped on is the active one. Configure AFR and restart the scanner.
The scanner stops on an active frequency but there is no sound.	1. If you have Mute Audio checked, and the scan started with the AF Gain set too low, the AF Gain will be returned to that too-low-to-hear value when the scanner stops on a frequency. Stop the scanner, set the AF Gain to a comfortable level, and restart the scanner. 2. The transmission could simply have no audio – an open carrier meeting the minimum dB will cause the scanner to stop and listen.

Problem	Potential Solution(s)
The watchdog timer never restarts the scanning.	1. The watchdog only works when a frequency's signal strength is at or above the minimum dB for the number of seconds set for the watchdog. If a frequency's peak is very near the minimum dB level you set, and the frequency's strength bounces below and above that minimum dB, the watchdog will never fire because it gets reset every time the signal strength goes below the minimum dB level. Fix this by changing the minimum dB to a figure lower than the lowest dB a particular frequency falls to while it is active. You may also watch this happen by looking for the "W" symbol on the Signal Strength Indicator; if the "W" doesn't appear, the watchdog timer is not engaged. 2. The Adjacent Frequency Rejection value is too small and the Watchdog never detects that the frequency is active for too long a period.
The installer has no buttons for Next, Back, or Cancel.	The DPI of your computer is set higher than 100%.

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Known Issues

- Browse window: on some PCs with older video cards or slower video drivers, the browse grid doesn't grow properly when the Browse window is enlarged. The workarounds are:
 - Minimize and restore the window, or...
 - Close and reopen the window, or...
 - Click the Refresh button to force the grid to reload from the database.
- When scanning, and after clicking the Skip button, the scanner may stop to the right of the next active frequency.

Appendix

Default Protocols supplied with Frequency Manager

- | | | | |
|--------------------|---------------|------------------|----------------|
| • 110A | • DominoEX-11 | • MT63-2000 | • QPSK63 |
| • 1382 | • DominoEX-16 | • MT63-500 | • QRSS |
| • 141A | • DominoEX-22 | • NAVTEX | • RTTY100 |
| • 4285 | • DominoEX-4 | • NWR | • RTTY110 |
| • ACARS | • DominoEX-5 | • Olivia8/250 | • RTTY150 |
| • ALE400 | • DominoEX-8 | • Olivia8/500 | • RTTY200 |
| • AM | • DominoF | • Olivia16/500 | • RTTY45 |
| • AMTOR-ARQ | • DTMF | • Olivia32/1000 | • RTTY50 |
| • AMTOR-FEC | • ERMES | • Olivia4/125 | • RTTY75 |
| • ARQ-E | • FEC31 | • Olivia4/250 | • RTTYM8/250 |
| • ASCII | • FELDHLLX5 | • Olivia4/500 | • RTTYM8/500 |
| • BPSK125 | • FELDHLLX9 | • Olivia8/1000 | • RTTYM16/500 |
| • BPSK250 | • FSKHELL105 | • Olivia16/1000 | • RTTYM32/1000 |
| • BPSK31 | • FSKHELL245 | • Olivia8/2000 | • RTTYM4/125 |
| • BPSK63 | • FLEX | • Olivia16/2000 | • RTTYM4/250 |
| • CCW | • FMHELL | • Olivia32/2000 | • RTTYM4/500 |
| • CHIP | • FMNARROW | • Olivia64/2000 | • RTTYM8/1000 |
| • CONTESTIA8/250 | • FMWIDE | • P25 | • RTTYM16/1000 |
| • Contestia8/500 | • GMDSS | • PACKET | • RTTYM8/2000 |
| • Contestia16/500 | • HELL80 | • PACTOR | • RTTYM16/2000 |
| • Contestia3211000 | • HFFAX | • PAX | • RTTYM32/2000 |
| • Contestia4/125 | • HFDL | • POCSAG | • RTTYM64/2000 |
| • Contestia4/250 | • IEC870-5 | • PSK10 | • SELCAL |
| • Contestia4/500 | • JT65 | • PSK220F | • SITORA |
| • Contestia8/1000 | • Lentus | • PSK63F | • SITORB |
| • Contestia16/1000 | • LSB | • PSKHELL | • SLOWHELL |
| • Contestia8/2000 | • MFSK-16 | • PSK63FDIGISSTV | • SSTV |
| • Contestia16/2000 | • MFSK-32 | • PSKAM10 | • SYNOP |
| • Contestia3212000 | • MFSK-4 | • PSKAM31 | • THOR16 |
| • Contestia64/2000 | • MFSK-64 | • PSKAM50 | • THOR4 |
| • COQUELET | • MFSK-8 | • QPSK125 | • THOR8 |
| • CW | • MOBITEX | • QPSK250 | • THROBX-1 |
| • DAB | • MT63-1000 | • QPSK31 | • THROBX-2 |

- THROBX-4
- THROB-1
- THROB-2
- THROB-4
- Unidentified
- USB
- Voice
- WEFAX-IOC288
- WEFAX-IOC576

Default Services supplied with Frequency Manager

- Aeronautical
- Business
- Broadcast
- Corrections
- Data
- Emergency Ops
- EMS Dispatch
- EMS Tactical
- EMS Talk
- Federal
- Fire Dispatch
- Fire Tactical
- Fire Talk
- Ham
- Hospital
- Interop
- Law Dispatch
- Law Tactical
- Law Talk
- Maritime
- Media
- Military
- Multi-Dispatch
- Paging
- Public Safety
- Public Works
- Schools
- Security
- Standard Frequency
- Transportation
- Trunked
- Unidentified
- Utilities

RGB Numbers for Colors

RGB is an acronym for “Red, Green, and Blue”, and describes a color model in which those three colors can be added together to get all other colors. It is beyond the scope of this guide to tell you how to create RGB colors, but there are many sites on the Internet that allow you to select a color and then will tell you the RGB value. In FM these values are always entered in 6 hexadecimal digits (0 through 9 and A through F), for example “FFFF00” for a bright yellow. Do an Internet search for “RGB color selector” to try out some sites. If you completely mess it up, delete all the digits in the value leaving only the double quotes; FM will once again use the Windows color defaults for your desktop theme.

The Spectrum Analyzer Lies to You

But it is not a bug, it is not a design problem, and SDR# is doing exactly what it should. It’s a matter of physical limitations.

SDR# reads the full spectrum of available frequencies from your radio. For many \$20 dongles, this comes to 2,048,000 frequencies in one huge block. SDR# simply cannot fit that 1.95MB of frequencies into the small spectrum analyzer graph. On my 1920 pixels-wide monitor, with the SDR# window maximized, the spectrum analyzer is 1300 pixels wide. That is the just the graph area and does not include the black border space or the X and Y axis labels. 2,048,000 won’t fit into 1300; in fact in this case SDR# is plotting only about 1 out of every 1575 frequencies of spectrum. So there are active frequencies that may not even show up on the spectrum analyzer, and frequencies that show up but are only partially displayed.

The point is that the spectrum analyzer is *representative* of the spectrum but does not display the *actual* spectrum, and you need to keep this in mind when using the spectrum analyzer to watch the actions of the scanner. The scanner is looking at the raw data that supplies the graph, not at the graph itself; and it may see active frequencies that you don’t – and you might think it was a false positive.

Another issue of which you need to be aware is that frequencies lose and gain strength quite rapidly, and due to the reduced resolution of the spectrum display a frequency looks like it meets the minimum signal strength for the scanner but in actuality it may vary in strength and be close to, but below, the minimum at the time of measurement. Using the Scanner Decisions window and the Signal Strength Indicator will help you understand when a frequency is a mere 1dB in signal strength lower than the minimum required.

Scanner Performance Tuning

Overview

Tuning the scanner for maximum performance is as much an art as a science. I'm going to explain your options for tuning and will cover some technical background so that you understand the impact of your choices.

To give you some perspective in later discussion, here's the information about my equipment relevant to performance.

- Quad-core CPU at 2.66 GHz with Hyper-threading enabled.
- 8GB memory.
- A \$20 DVB-T dongle with an E4K tuner.

Minimum Signal Strength

The scanner will not stop for a frequency whose signal strength is less than this value. Remember: **the closer to zero dB, the stronger the signal**; the closer to -130 dB, the weaker the signal. Put another way: the higher the peak on the spectrum analyzer graph the stronger the signal.

When the scanner is running it examines every frequency it detects and compares its instantaneous signal strength as reported by SDR# against the "Minimum Signal Strength" value. The more negative the minimum signal strength target, the more frequencies the scanner will stop on. Conversely as the minimum moves up towards zero, only the stronger signals are detected.

Many frequencies' signal strengths jump up and down during a transmission so you should set the minimum signal strength for the lowest acceptable value, not the peak value. Here are a couple of scenarios to illustrate the importance of a proper setting:

- **Scenario 1:** You set the minimum at -30dB. A signal is found that is at -28dB so the scanner stops. The signal then drops to -31dB which disqualifies it. The signal never goes above -30db again so the signal gets timed out and the scanner moves on.
- **Scenario 2:** You set the minimum at -30dB. A signal is found but it is at -31dB so the scanner skips it. In the next millisecond the signal jumps up to -25dB but it is too late; the scanner has moved on.

In each of these scenarios a minimum of around -35dB would have given more reliable results. It may take some trial and error for you to determine the "typical" signal strength variations in your location.

Take care not to set your minimum so that it is in the "noise floor"; doing so will cause the scanner to stop on static and it will not move on.

Radio Settle Time in Milliseconds

This control sets the sensitivity as a balance between speed and reliability. The way this works is:

1. The scanner asks SDR# to set the VFO frequency to a specific frequency.
2. The scanner software asks SDR# for a copy of the spectrum containing the new frequency range.
3. The software searches that spectrum and finds an active frequency.
4. The software compares the signal strength of the target frequency against the value set in the Minimum Signal Strength.
5. If the signal strength is greater than the minimum, the scanner tells SDR# to tune to that frequency.
6. After arrival, the scanner checks the frequency again to make sure it's signal strength is still greater than the minimum.

The problem in step 6 is that it measures the signal strength *right now*; and because the scanner is so fast, “right now” could mean that it measures the signal strength before the radio has actually tuned to the target frequency. SDR# doesn’t confirm to us that the radio actually tuned to the requested frequency so we have no way of knowing when we have a valid signal. So the scanner has a flexible delay mechanism to prevent prematurely deciding the frequency is not active.

Radio Settle Time is divided by 20 to define the maximum number of times we will measure the frequency strength before giving up and moving on. For example, a Radio Settle Time of 500 means that the scanner will try a maximum of 25 times, with a short delay between each try. Most of the time (on my equipment) the scanner only has to try 0 to 9 times before confirming that the frequency is active. If the frequency is never active, the maximum delay would be (in this example) 500 milliseconds.

Smaller Radio Settle Time values improve the scanning speed at the risk of missing active frequencies because the scanner didn’t wait for the radio to tune; larger values mean a longer pause before confirming the signal strength but that setting sacrifices scanning speed. You need to set this at the lowest value possible for reliable signal detection to give you a balance between speed and reliability. It may take time and testing for you to decide on the best setting.

Recommended Process for Performance Tuning

You should follow this process for getting the most speed and reliability from the scanner:

1. Build a Group of known active frequencies that you can depend upon to start and stop transmitting so that you can exercise the signal measurement and decision-making processes.
2. Using the Scanner Configuration window put a checkmark next to “Show scanner decisions...” so that you can watch what the scanner is doing.
3. Start a Group scan using a value of 250 for Radio Settle Time and with a Minimum Signal Strength set for successful detection given the frequencies in your Group.
4. If the scanner reliably stops on frequencies that meet the Minimum Signal Strength, you can stop the scanner and lower the Radio Settle Time value. If it doesn’t stop reliably, increase that value.
5. Scan the Group again.
6. Repeat steps 4 and 5 until you get reliable scans. If you see active frequencies being skipped (and they aren’t locked out), the Radio Settle Time is too low.

You won’t get both fast and reliable performance on your first try; for the best results you should determine what appears to be reliable, observe it for an hour or so to confirm that fact, and then re-tune the settings if necessary until frequency detection is reliable in the long term.

Benchmarking the Scanner

I don’t recommend trying to benchmark the scanner until you have it tuned for the best performance on your equipment. Of course you can turn everything to its fastest setting but that won’t give a fair or accurate measurement.

You can benchmark both Group and Range scanning. To perform either benchmark:

1. Edit the configuration file as described in the Customizations section of this document. Look for this line in the file:

```
<add key="freqMgrScanEnableBenchmark" value="false" />
```

Change “false” to “true” and save the file.
2. Stop all unnecessary software running on the computer. You want to give the benchmark a fair opportunity for speed so exit any media software, other copies of SDR# or other radio software, etc. – basically anything that uses enough CPU that it could negatively impact SDR# performance.
3. Start SDR#.

4. Using the SDR# Configure button, set the tuner's signal strength to zero.
5. Select "Scan a Group" or "Scan Frequencies". If you chose Group, then select a group name in the dropdown. A group with lots of adjacent or nearby frequencies will give the fastest scanning speed. If you chose range scan, a wide range of frequencies has already been entered for you. You can adjust that range as you desire.
6. You will note that the Minimum Signal Strength has been pre-set to zero and the squelch to 100. This is so that the scanner doesn't get stopped during the benchmark by an active frequency.
7. Put the frequency cursor where you would typically have it during normal scanning. With my particular dongle I find having the frequency cursor all the way to the left gives me the fastest scanning.
8. Click the Scan button. A warning box will open stating that the scanner has been configured for benchmarking. Click the OK button start the benchmark or Cancel to exit without benchmarking.
9. If you clicked OK the benchmark will start. It will run for about 10 seconds and will then display the resulting scanner speed. The scanner speed is placed on the Clipboard for your convenience. You can cancel the benchmark while it is running by clicking the Stop button.
10. I suggest running the benchmark at least 5 times and then taking the average result as your speed rating.

When we do a benchmark, nothing in the scanner is turned off or disabled in order to improve the scanning speed – other than the Minimum Signal Strength, the Squelch, and the RF Gain being set there are no changes made to the scanner.

You might note that the FFT resolution affects the scanning and benchmark speed – the lower the FFT resolution the faster the scanning, at least on my equipment.

On my equipment I average 161 "channels" per second in a Group scan 1.6 GHz per second in a Range scan. Why is a Range scan so much faster? Remember that in a Range scan the software searches all the frequencies to the right of the frequency cursor, and it does that in one big gulp of data, up to 2 MHz at a time on my equipment. When no active frequency is found, it advances the radio frequency to what was previously the end of the displayed spectrum then takes another big gulp and searches again. Conversely a Group scan is restricted to specific frequencies and requires a lot of jumps to the next frequency in the Group, which may not be in the current spectrum. Having to tell the radio to change the spectrum takes time and thereby slows down a Group scan.

When you are finished with the benchmark close SDR#, edit the config file again, and return the value indicated above back to "false".

Notices

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