FREQUENCY MANAGER SUITE

Frequency Manager + Scanner

User's Guide

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Introduction

The **FMSuite Frequency Manager + Scanner** (called FM in the rest of this guide) is a free plugin designed for use within the SDR# software application. It delivers a full-featured frequency management tool permitting you to edit 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.

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.

- **Operating Systems:** Windows 7, Windows 8.x, and Windows 10. The binaries are compiled for a 32-bit environment for the broadest compatibility but run equally well in an x64 environment.

  Windows 10 Installation
  Installing FM Suite into Windows 10, or upgrading an existing installation of Frequency Manager + Scanner v1.x on Windows 10, requires some extra steps due to security changes in Windows 10. Please see Appendix section “Installing or Upgrading in Windows 10” for instructions.

- **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 feature-rich

multi-threaded applications, which means they perform multiple tasks simultaneously. As a result you may have performance problems if your processor cannot execute at least 24 threads.

- **Memory:** 1 gigabyte or more total in the computer.
- **Hard Disk:** The software requires about 254KB; the frequency database size is dependent on the number of records. 1000 records will fit in a 268KB database.
- **.NET:** Version 4.6 runtime as required by SDR Sharp.
- **SDR Sharp:** Revision 1430 or newer.

> **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.

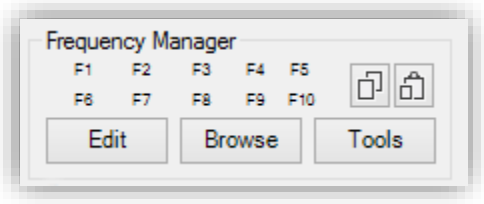
Using the Frequency Manager

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

The Frequency Manager permits you to automatically record frequencies to a database as they are found, or permits you to hand-enter and edit frequencies. It provides 10 presets that you can define for different frequencies, editing tools for the various dropdown lists it uses, and a very flexible database browser that you can use to find, edit, and send to the radio the frequencies you are interested in.

After your first startup of SDR# with the plugin installed, 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 Preferences.

The Frequency Manager Panel



The FM collapsible panel contains two groups of controls.

- The Frequency Manager group contains the buttons that open FM editing windows and tune the radio to preset frequencies.
- The Scanner group contains the controls for the scanner. These allow you to select a scan mode, start/stop/pause the scanner, skip a frequency that has the scanner busy, flag a frequency for later attention, and lock a frequency out of the scanner. The Scanner group will be described fully later in this document.

Functions in the Frequency Manager Group

Presets

At the top of the panel are two rows 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.

Using a Preset will put SDR# into Free Tuning mode in an attempt to honor your Preset's Frequency and Center Frequency values.

Copy

To the right of the Presets is a button that, when clicked, will copy the current frequency to the clipboard for use in documents or in other applications. If the copy is successful a small tooltip stating "Copied OK" will be briefly displayed.

Paste

This button located to the right of the Copy button 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 may also tell the plugin to continuously monitor the clipboard for text that could be interpreted as a frequency; see the section on the Preferences window for how to enable that feature.

Edit

The Edit button displays the Edit window, described below. The Edit window 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 window is given after this section. You may also open the Edit window from the Frequency Manager by pressing `Ctrl + Alt + E` simultaneously.

Browse

The Browse button displays or hides the Browse window. The Browse window can be displayed and be used at the same time as other plugin features. Details of the Browse window are described below.

Tools

This button opens a menu that allows you to select Edit Groups, Edit Protocols, Edit Services, or Edit Preferences. 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 name of the current frequency database, the database version number, and a copyright notice. Access this function by clicking your mouse anywhere in the SDR# plugins area and then pressing the three keys `Ctrl + Alt + I` simultaneously. In a few seconds a popup will display the application information.

Round Up / Round Down

When manually tuning frequencies, especially on shortwave and lower frequencies, you might not always click *exactly* on the center of the frequency. By pressing `Ctrl + Alt + PgUp` or `Ctrl + Alt + PgDn` you can tune the radio to the nearest step size in order to center the radio.

The Edit window

Editing Single Records

Clicking the Edit button on the FM panel displays the Edit window. The Edit window 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:

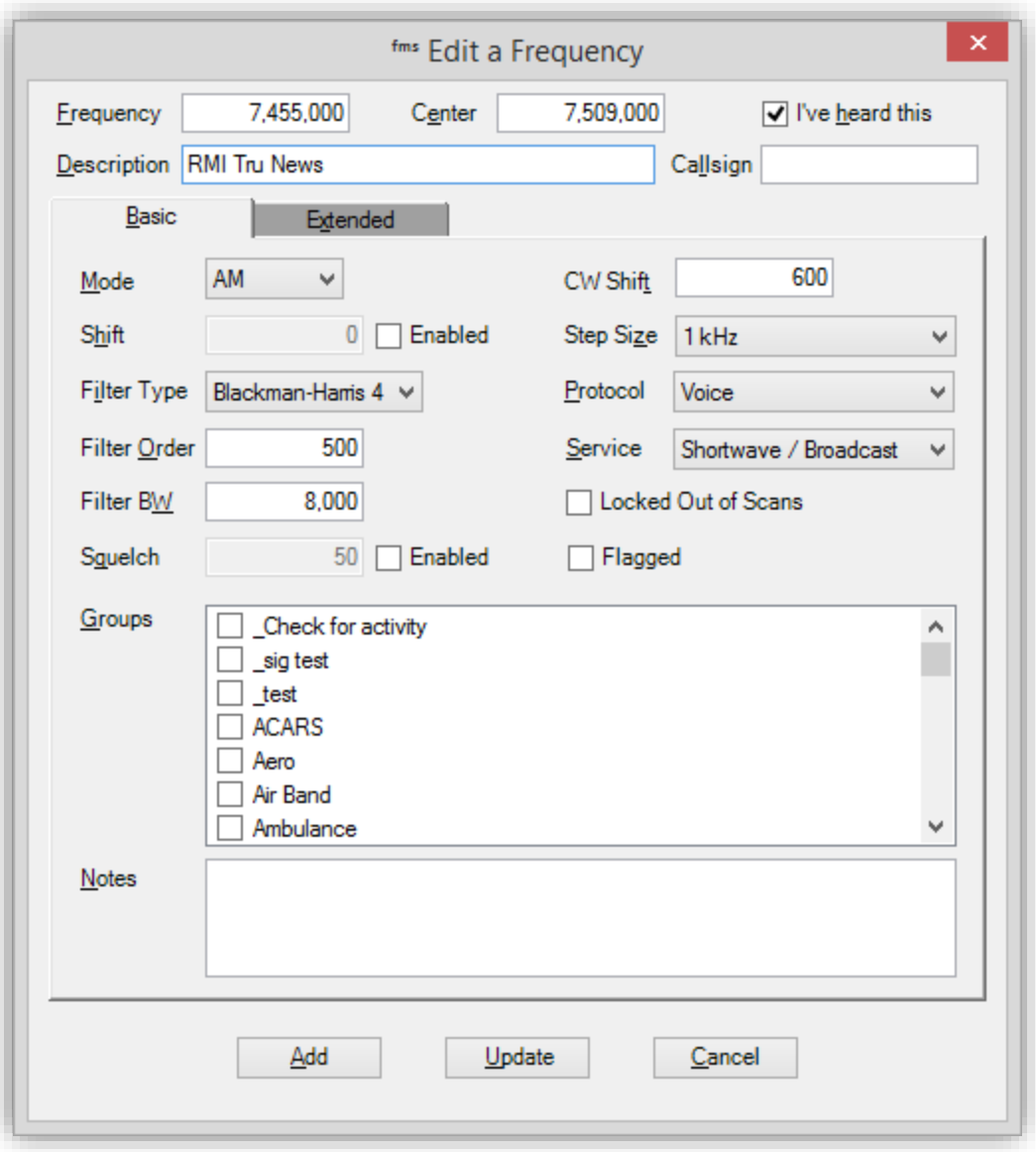
- Frequency
- Center Frequency
- I've Heard This
- Description
- Callsign
- Mode (NFM, AM, etc.)
- Frequency Shift
- Filter Type
- Filter Order
- Filter Bandwidth
- Squelch
- CW Shift
- Step Size
- Protocol (Voice, P25, POCSAG, etc.)
- Service (Business, EMS, Transportation, Federal, Law Tactical, etc.)
- Frequency is locked out of scans
- Frequency is flagged for attention
- Groups to which the frequency is assigned
- Notes
- City
- Country
- Latitude
- Longitude
- Azimuth
- Target
- Start Time
- Stop Time
- Days
- Language
- Power
- Last Update date

The Edit window contains two tabs: Basic and Extended.

- The Basic tab contains the most commonly used fields – Mode, Shift, Notes, etc.
- The Extended tab contains info about the transmitter location and to whom it is transmitting, along with City and Country, Days it transmits, Start and Stop times, Target region of the world, etc.

The Edit window has simple error checking on the Basic tab 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.

The Extended tab contains fields that are more free-form and that are designed to contain imported data from



various internet sources; since not all these sources format the same data the same way, most of the fields have no error checking. The exceptions to this are the Start Time and Stop Time fields, which require times in 24-hour format.

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.

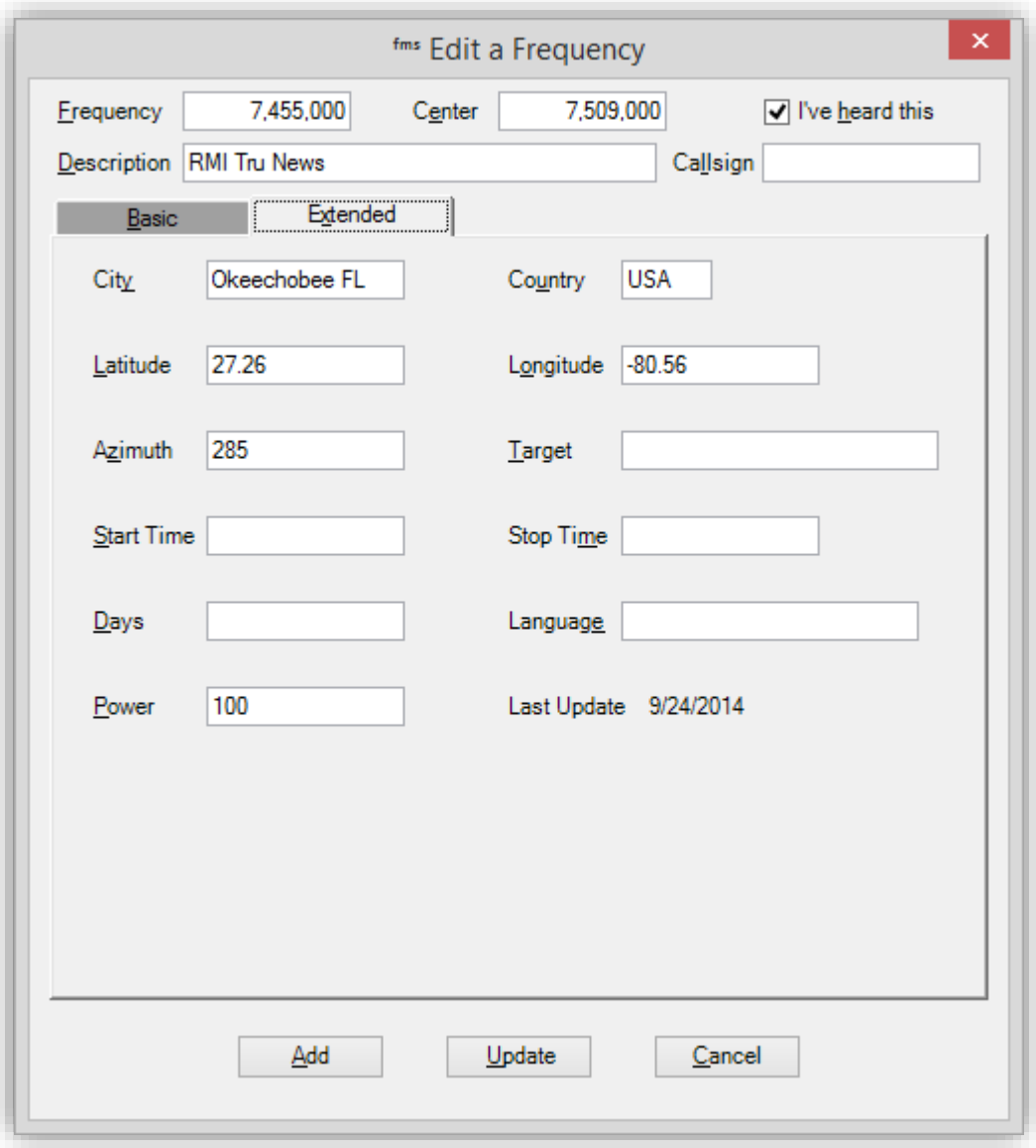
If the Edit window was launched from the FM panel, and if you are editing a frequency that is not yet in the database, the Update button will be disabled. If the frequency is already in the database both the Update button and the Add button will be enabled. This permits you to change the current record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

> **Design Change Note**
> When updating a record after opening the dialog from the FM panel, the database values are read from the database; then the current radio settings are replace those database values. This behavior is different from previous versions.

Some notes about the fields in the Edit window:

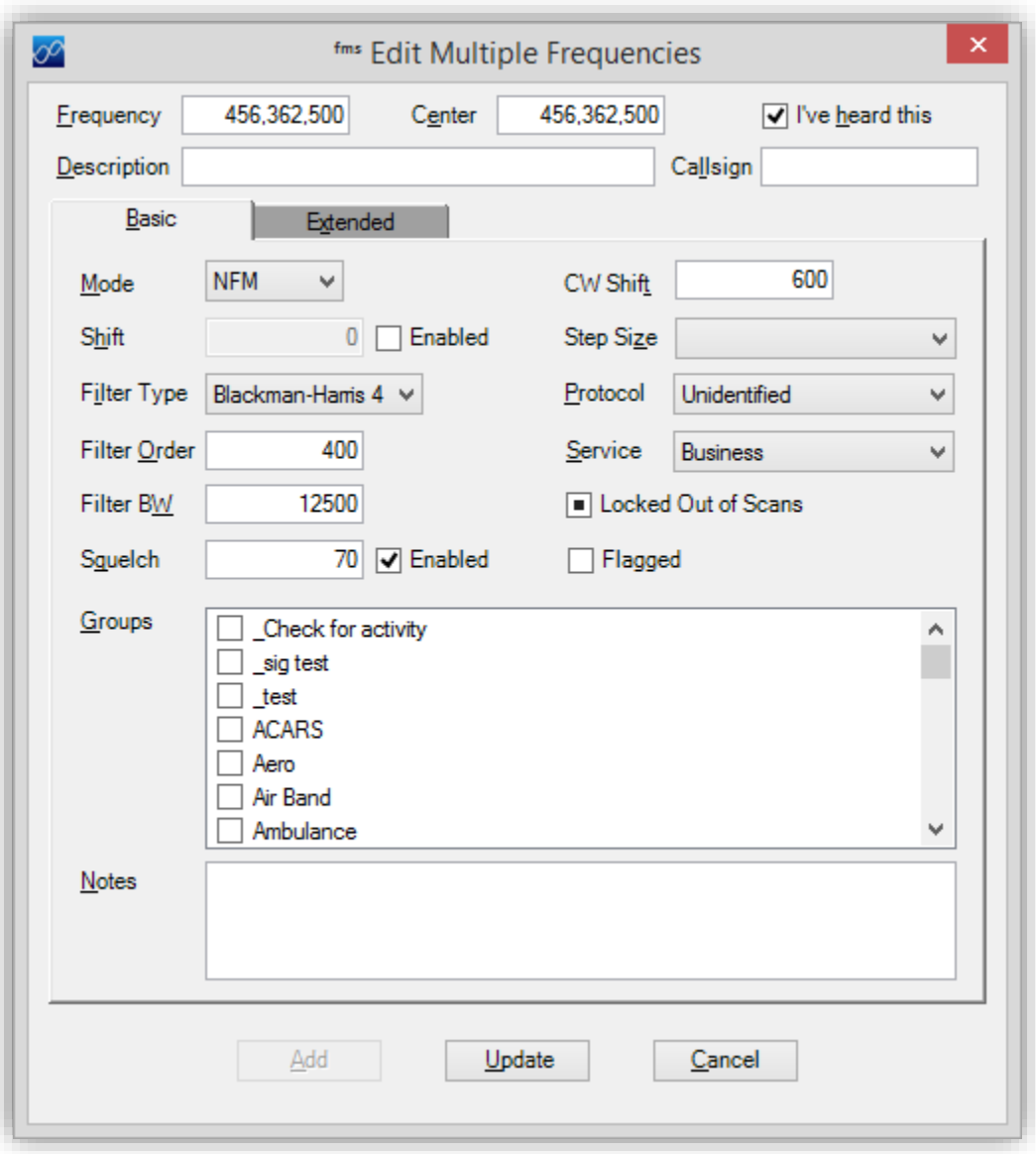
- "I've heard this" indicates whether or not the frequency has been monitored. If you are Adding or Updating a frequency you may optionally check this box. When a frequency is "heard" by the scanner, and Preference > Scan Rules > "Update a frequency's Date when monitored" is checked, then the "I've heard this" checkbox is checked automatically. This field will also be set to True when you click the Flag button on the scanner.

- 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. Protocols that you add using the Protocols editing window will be added to that list.
- 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. Services that you add using the Services editing window will be added to that list.
- Mode and Filter Type provide the same options as SDR Sharp. If you have a record in an older (and upgraded) database with "Blackman-Harris" as the Filter Type 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 add or remove 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 window 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 window 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 this Edit window screenshot.

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

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

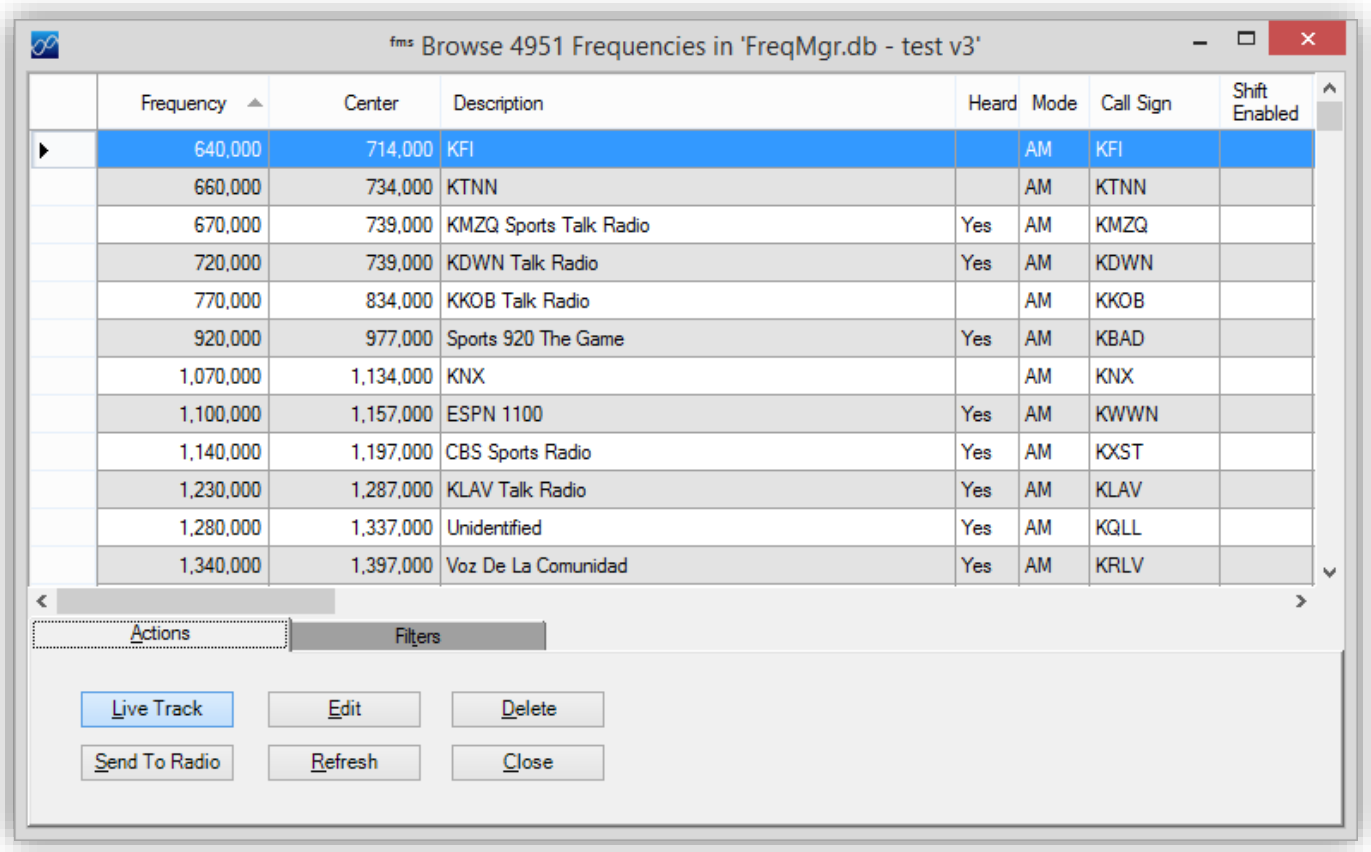
Please note the Locked checkbox in this example. In this dialog all checkboxes (Locked, Shift Enabled, etc.) are what is called "Three-State" checkboxes – meaning they can be checked, unchecked, or 'indeterminate'. When some of the selected frequencies have a checkbox checked and others don't, the result 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.

Bulk Edits also change the Date field of each record to the current Date and Time if "Allow Bulk Edits to change Last Update field" is checkmarked in the Frequency Manager tab of the Preferences window.

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 and the Source of the data.

- 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 and hold on its header text, pause 3-5 seconds, and then drag the header to a divider 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

The Browse window now contains two tabs of controls.

Actions Tab

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.

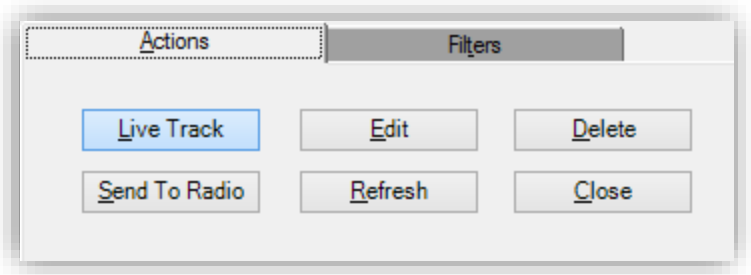
> **Hint**
> If you find that the radio pauses during Browse window scrolling, or if the Browse window contents get garbled, this may be an indication of performance problems; turn off Live Track and instead use the Refresh button periodically to force the grid to reload from the database.

Edit

You may launch the Edit window 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 in SDR# behaves differently when using Send to Radio. When using Send to Radio, SDR# is set to Free Tuning mode and the center frequency and frequency recorded in the database are sent to the radio, which may cause the red line to change position.

Refresh

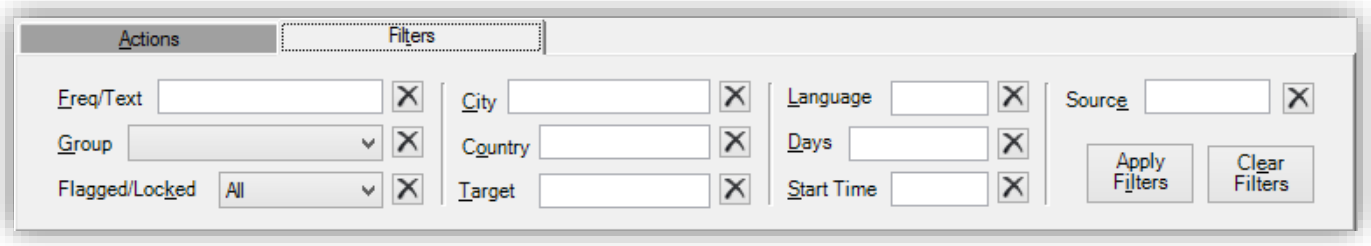
This button tells the grid to throw away all of its data and completely reload from the database. Use of the Refresh button is always optional, but if you have Live Track turned off during a frequency range scan this can update the grid with the latest frequency data.

Close

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

Filters Tab

In this version of FM the filtering ability has been greatly expanded. There are now 11 fields upon which the database can be sorted. For each of these fields, click the ✕ button at the right end of the field to remove that filter.



- **Freq/Text** will let you enter a Frequency, text from the Description field, or text from the Notes field.
- **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.
- **Flagged/Locked** dropdown lets you ignore either attribute, show only the Flagged frequencies, or show only the Locked frequencies.
- **City, Country, Target, Language, Days, Start Time** are fields from the Extended tab of the Edit window. You may enter complete or partial text from the same field in the database.
- **Source** is a special non-editable field. FM now records the source of each record. For example if a record is hand-entered using the Edit window, or if it was automatically entered by the scanner, the Source will be set to "FMSuite". If the record was imported from an internet database, the Source field will reflect that database, e.g. "Aoiki", "Eibi", etc.

The filters are additive; the more filters you create, the more specific the filter becomes, so you will get fewer results. To filter the list, click the Apply Filters button after entering your filter choices. To remove all of the filters at once, click the Clear Filters button.

Dynamic Filtering. You may also filter by frequency by typing digits into the frequency grid; the grid will dynamically filter your database to display matching frequencies. As you type a partial frequency all frequencies that start with the same digits will be displayed. The more digits you type, the more specific the filtering. Click any row in the grid to get started, then type frequency digits. The grid will filter to display frequencies in your database that start with the same digits. For example typing "854" will show frequencies in your database that start with 854, such as 854000, 854250000, 854987500, etc.

To remove a digit, just press Backspace. To reset the grid and remove the dynamic filter, press "r".

Context Menu

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

- **Edit:** Displays the Edit window.
- **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.
- **Toggle Flagged / Toggle Locked**: These choices flip the state of the Flagged and Locked fields; not-Flagged becomes Flagged, Locked becomes not-Locked, etc.
- **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 chosen group will be removed from all of them.

The Groups Window

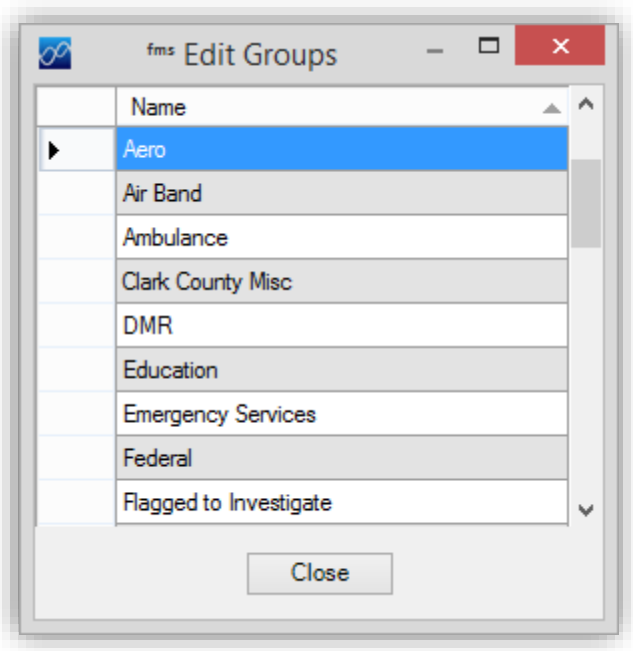
The Groups window lets you create and edit labels by which you can group frequencies. The Name of a Group can be anything meaningful to you; for example in Las Vegas where I live I have groups for Metro Police, Resorts, and County government, among others.

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 Data Display

The Frequency Manager also includes this section of the spectrum window that is used to display information about the currently-tuned frequency.

Frequency Description

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

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 running. The signal strength does not display S-units, nor signal levels over zero dB, because S-units and levels over zero dB are not supported by the design of SDR#.

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 when the timer runs out.

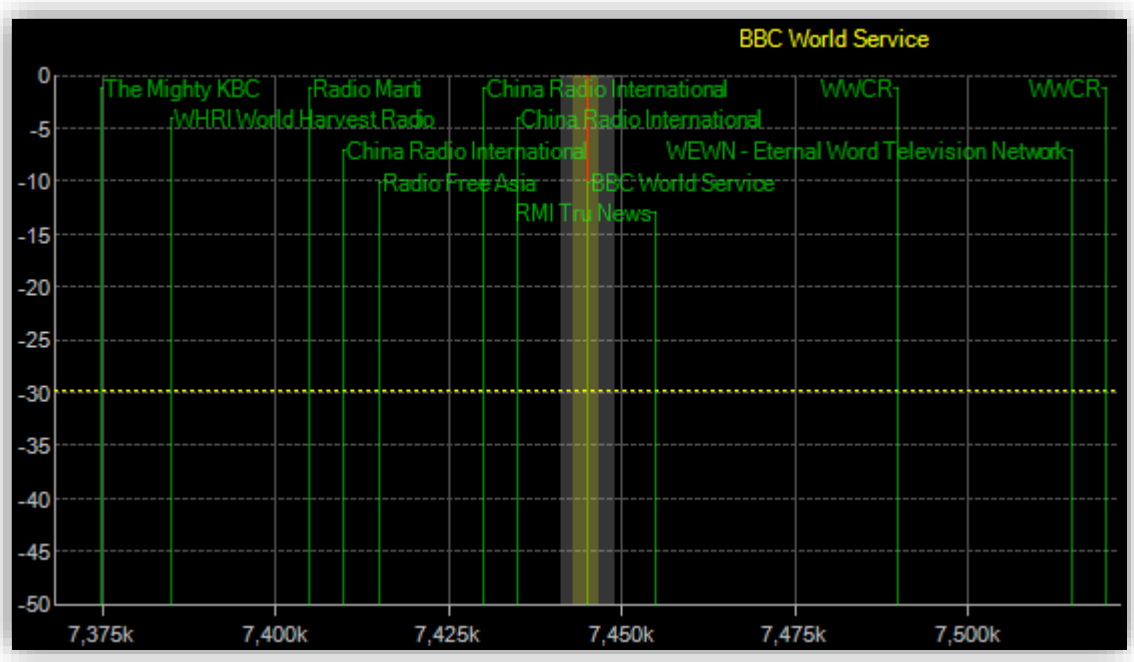
Some notes on the operation of the Data Display:

- 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 timers are only displayed when the scanner is running.
- 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.

Database Frequency Spectrum Display

This option, controlled in the Frequency Manager tab of the Preferences window, will dynamically display the description field of the frequencies in your database that fall within the current frequency range of the spectrum

analyzer. You may choose your own colors for frequency text and the indicator line, as well as the transparency of the text and the vertical space between rows of text.



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 run 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 current 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 current 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.

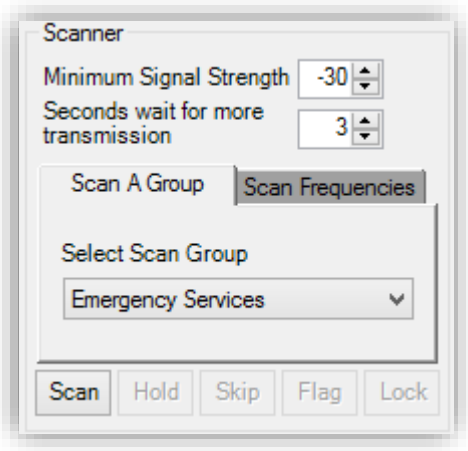
Personally, with a cheap dongle having a 2MHz spectrum, I get the fastest scanning by putting that red line almost all the way to the left, usually about 20% into the spectrum from the left edge.

If the Browse window is open and Live Track is enabled, you will see frequencies highlighted 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 frequency 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 <u>stronger</u> 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, any positive number that you type 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

The Minimum Signal Strength is shown as a horizontal line in the spectrum display, if enabled in the Preferences window. The horizontal line corresponds to your Minimum Signal Strength setting. By default this is a yellow line, but you can change the color easily using the Preferences window. The goal of this indicator is to provide you information about the current signal strength versus the minimum that you defined.

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 while the watchdog timer is counting down this value is ignored but it will be used when the scanner stops on the next active frequency. For more information on this timer and how to use it, see the section "Scanner Timers and how they affect each other" in the Appendix.

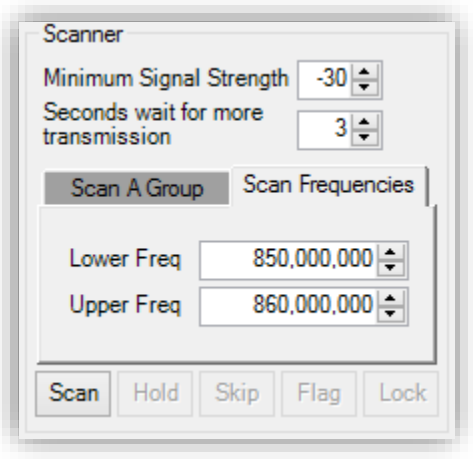
Scan Mode

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. Select the "Scan A Group" tab. 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. Your database settings for Mode, Shift, etc. for each frequency will be applied to SDR# when the scanner stops on an active frequency in the group.

> **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 the "Scan Frequencies" tab.
    2. Enter the starting Lower Frequency and the ending Upper Frequency. If rule "In a frequency range scan, round the lower and upper limits to the step size when scanning starts" is checked in the Preferences window, then whatever you enter will be adjusted to a correct figure based on the currently selected Step Size in the radio when you click Scan. 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.



> **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 section of this document that describes the Preferences dialog.

> **Hint**
> When performing a frequency range scan, the scanner tries to match the frequency in the radio to one in your database. 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 transmissions 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.

Please note that the red line in the SDR# spectrum window 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 from the Browse window, 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 stop the scanner and restart scanning when done. Clicking this button will cause the scanner to ignore the "Seconds wait" value and the watchdog timer, and its caption to change to "Rls" (Release). The scanner will stay on the current frequency. The button stays pressed until you click it again, at which time the "Seconds wait" value is applied and the scanner electronically clicks the Skip button when the timer expires.

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

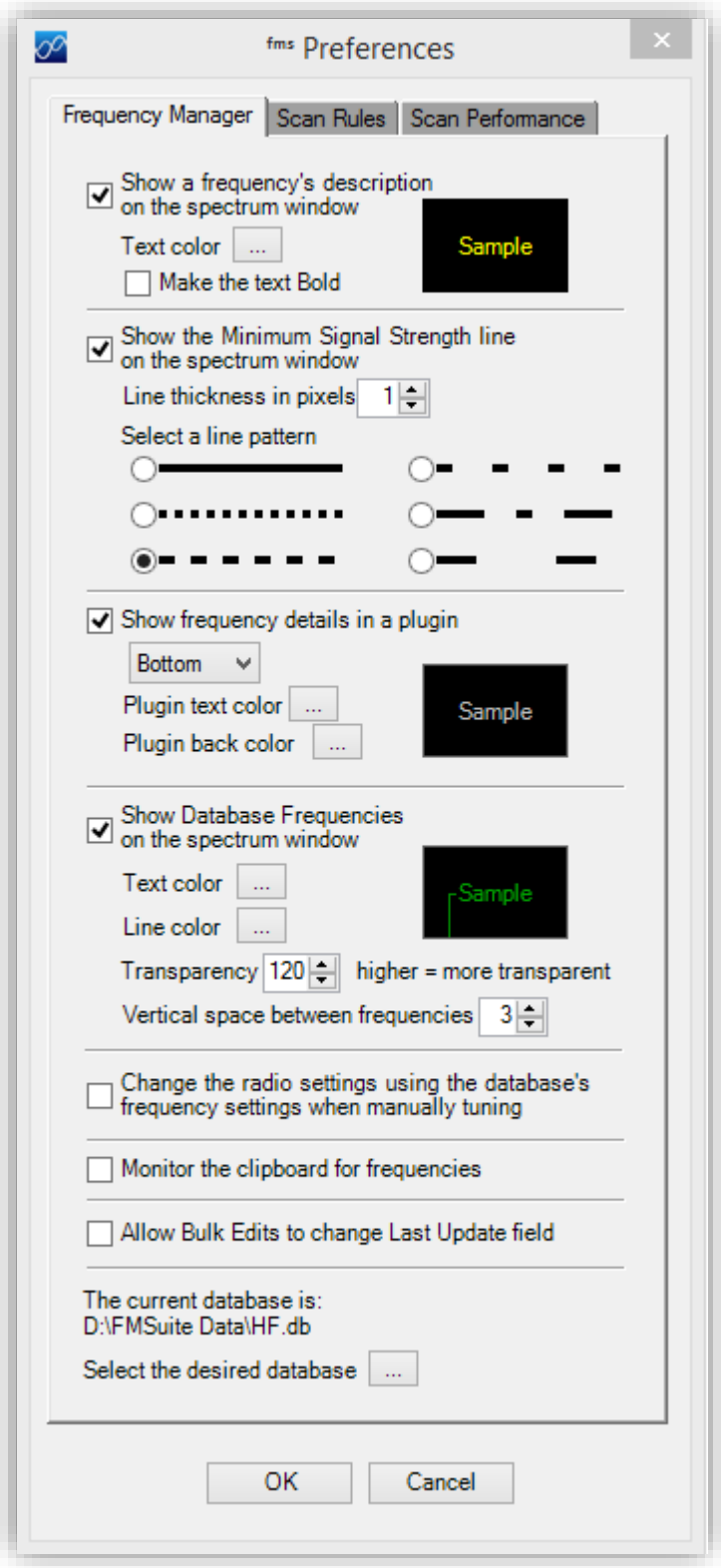
restarts the scan at the current frequency + the step size. Skipping an active frequency works best when "Snap to next Step Size" is turned on. The Skip button does not prevent you from scanning that frequency again.

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 of this document that describes the Preferences dialog. When you click the Flag button, the frequency in the database has its Heard value set to True.

Lock button

The Lock button marks the current frequency as locked out of future scanning 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 some Windows colors are used but the colors can be customized to your liking. See the section of this document that describes the Preferences dialog.



The Preferences Window

This window is opened from the Tools button menu in the Frequency Manager group. Preferences contains 3 tabs that you can use to customize the way FM works for you.

Frequency Manager Tab

- **Show a frequency's description on the spectrum window**: Checking this option enables the Data Display that shows the current frequency's description from the database, its signal strength, and the condition of the timeout and watchdog timers. You may also use controls here to change the color of the text and make the font bold.

- **Show the Minimum Signal Strength line on the spectrum window:** Checking this will enable the horizontal line on the spectrum that indicates the Minimum Signal Strength you have set. You may also change the line thickness and choose from one of 6 preset line patterns. The line will be the same color as the text defined in "Show a frequency's description on the spectrum window".
- **Show frequency details in a plugin:** This option enables the Frequency Details plugin that shows the Description, Callsign, Location, Service, Protocol, and Notes of a frequency if that frequency has a record in the database. You may also select the position of the plugin and its foreground and background colors.

> **Hint**
> If you wish to close the Frequency Details plugin quickly, just right-click on it with the mouse and click the pop-up Close button. This change is only valid in the current session; the next time you start SDR# the Frequency Details plugin will be displayed again.

- **Show Database Frequencies on the spectrum window:** This will display the Description field from each of your database frequencies on the spectrum along with a line indicating where on the spectrum that frequency sits. This allows you to visually relate an active frequency to a known transmitting station. You may change the colors of the text and the connecting line, adjust the transparency of the text and line, and adjust the vertical space between entries to improve readability. Please note the transparency value; a higher number means more transparency and the more difficult it will be to read the text.
- **Change the radio settings using the database's frequency settings when manually tuning:** Prior versions of FM would set Mode and other radio controls if you manually tuned to a frequency and that frequency was in the database. Doing so often changed manual radio settings you had made during that session. This new option will only update the radio settings when manually tuning and the checkbox is checked. When scanning, the radio will always be updated from a database record if one exists.
- **Monitor the clipboard for frequencies:** When checked, FM will monitor the clipboard; if it finds a value that might be a frequency, it will tune the radio to that frequency.

> **Important Note**
> This feature is not available for Windows operating systems prior to Windows Vista. If you computer is using Windows XP or earlier, this feature will be disable.

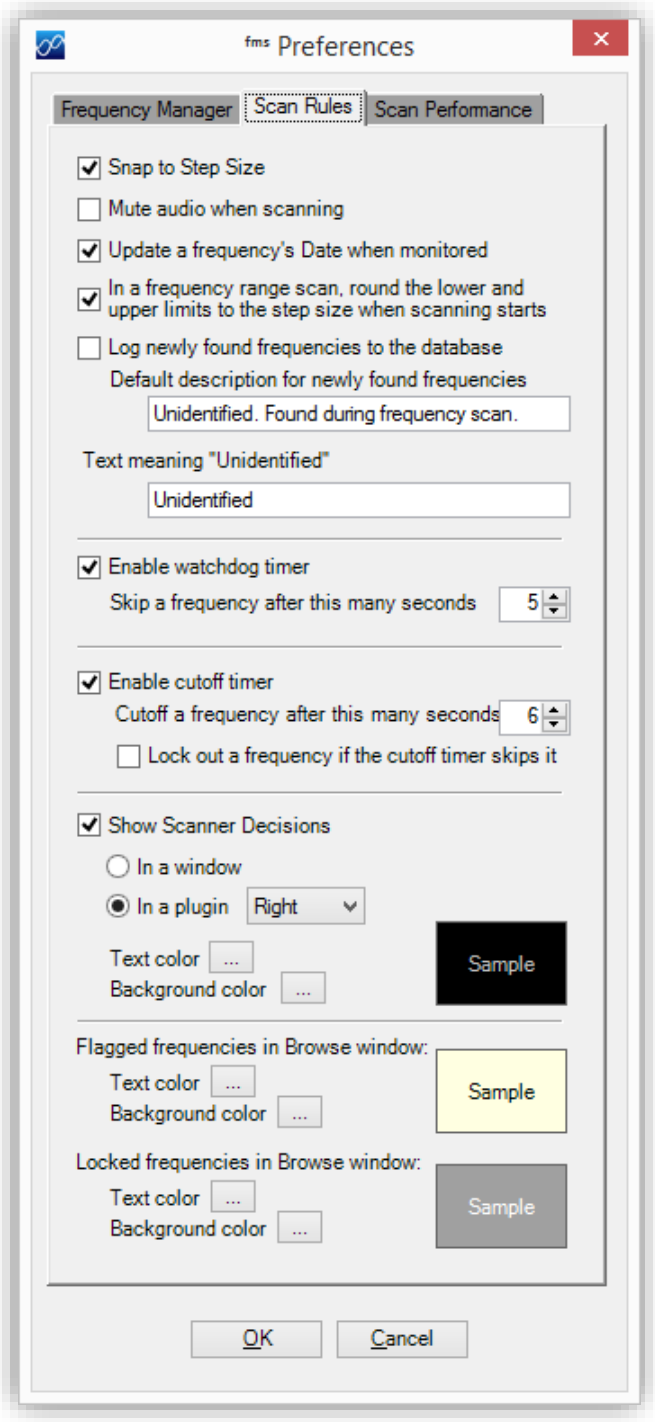
- **Allow Bulk Edits to change the Last Update field**: Leaving this unchecked will cause the Edit window to retain the original date and time the records were added to the database.
- **The current database is:** This new feature allows you to have multiple databases in multiple locations on your computer. You may now have separate databases for types of monitoring or types of transmitting entities; for example one for HF and another for VHF and UHF; or maybe one for shortwave broadcasts and another for shortwave utility stations. If you specify a database name that doesn't exist, FM will prompt you for permission to create an empty database by that name.

Scan Rules Tab

- **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 NFM or WFM radio signals because at any given millisecond the signal'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.
- **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. In addition, the "I've Heard This" flag will be turned on because the frequency was actually monitored.
- **In a frequency range scan, round the lower and upper limits to the step size when scanning starts:** A checkmark here will cause the values you entered as the range scan's lower and upper frequencies to be rounded down and up respectively to the nearest step size as selected in the radio panel.
- **Log newly found frequencies to the database:** A checkmark here will cause the scanner to automatically add a record to the database when a previously-unknown frequency is found. You may also customize the text that is inserted in the Description field of the record.
- **Enable watchdog timer:** a checkmark here will cause the scanner to force scanning to continue after stopped on an active frequency for a period of time. If the Scanner Decisions window or plugin is open, a line with the text "watchdog timed out; scanning resumes" will be displayed. For more information on this timer and how to use it, see the section "Scanner Timers and how they affect each other" in the Appendix.
    - **Skip a frequency after this many seconds:** how long the watchdog timer will wait on an active frequency before forcing the scanner to continue.

  A couple of notes about how the watchdog timer works:
    - On NFM and WFM 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 in the center of 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 Signal Strength 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. This situation can be fixed by using the Cutoff timer.

- If the watchdog timer never takes effect, this is usually an indication that either the Minimum Signal Strength is set too close to zero dB or the Adjacent Frequency Detection is set to too low a value (see Adjacent Frequency Detection below).

- **Enable cutoff timer**: This timer is a last resort for getting the scanner off of a frequency that bounces rapidly between busy and not busy. In that situation the "Seconds wait for more transmission" and the watchdog timer battle for control of the scanner. The Cutoff timer breaks the deadlock and forces the scanner to move on regardless of whether or not the frequency is active. When the Cutoff timer is enabled the letter "**C**" will appear on the Signal Strength indicator. For more information on this timer and how to use it, see the section "Scanner Timers and how they affect each other" in the Appendix.
  - **Cutoff a frequency after this many seconds:** how long the cutoff timer will wait before forcing the scanner to continue.
  - **Lock out a frequency if the cutoff skips it:** a checkmark here will cause watchdog-skipped frequencies to be locked out of future scanning.
- **Show scanner decisions:** Why did the scanner skip that frequency? Putting a checkmark here will open a new window or plugin after clicking the Save button. As the scanner runs it will describe 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.

  If you select "In a Plugin" you may also select the plugin position within SDR#. Regardless of whether you select a window or a plugin, you may also select the text and background colors of the plugin or window.

  > **Hint**
  > If you wish to close the Scanner Decisions plugin quickly, just right-click on it with the mouse and click the pop-up Close button. This change is only valid in the current session; the next time you start SDR# the Frequency Details plugin will be displayed again.

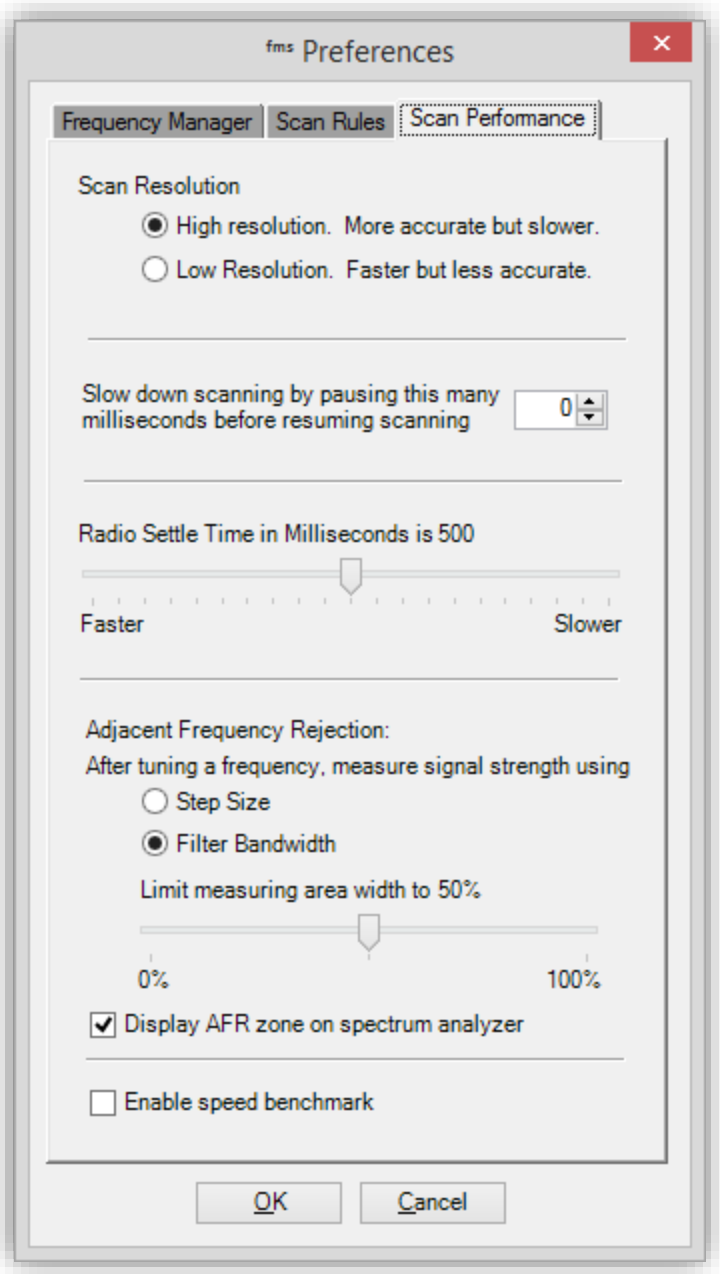
  Scanner Decisions supports copying text from its list. To do so:

  1. Click the Copy button. This will copy the selected lines to the Windows clipboard. A successful copy will result in a small "Copied OK" popup to appear.
  2. 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.

  Scanner Decision also allows you to change the text size in its windows to improve readability. Just click the small and large "A" buttons at the bottom to change the text size. Larger text improves reability at the expense of the number of rows of text displayed and the size of the window or plugin; smaller text will display more rows (up to 200) at the expense of readability.
- **Flagged Frequencies in Browse window:** Here you may define the colors you want to use to indicate flagged frequencies in the grid of the Browse window.
- **Locked Frequencies in Browse window:** has the same color choices.

Scan Performance Tab

- **Scan Resolution:** Select High Resolution or Low Resolution. The difference is the number of discrete frequencies that will be scanned as a block.
    - High Resolution contains more individual frequencies so it will be more accurate; but scanning will be slower. The number of frequencies is the greater of the FFT Resolution or the radio's RF bandwidth. For example if the FFT Resolution is 4096 and the RF Bandwidth is 2.4MHz, the scanner will search 2.4 million frequencies.
    - Low resolution contains fewer frequencies so it scans faster but will be less accurate. The number of frequencies is lesser of the FFT Resolution or the radio's RF bandwidth. For example if the FFT Resolution is 4096 and the RF Bandwidth is 2.4MHz, the scanner will search only 4096 samples which equates to checking 1 frequency out of about every 586 frequencies.



- **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 activated 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 scanning settings. When set above zero, this feature can cause repetitive entries in the Scanner Decisions window or plugin.
- **Radio Settle Time in Milliseconds:** 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, 300ms is a good balance. This feature is not activated until the scanner finds an active frequency.

- **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.

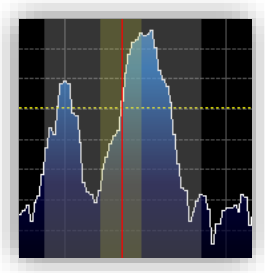
  The checkbox "Display AFR zone on spectrum analyzer" will cause a shaded area to appear around the active frequency when you have used the SDR# Zoom slider to magnify the frequency. This shaded area will be the same color that you selected for the frequency's description on the spectrum analyzer.

  For example, here's a snapshot of two adjacent frequencies. The frequency on the left is inside the filter bandwidth of the frequency on the right (the area with a white shading). As a result the *left* frequency's signal strength can influence the *right* frequency's busy detection. This is an undesireable situation.

  In this example the AFR is set to 50%. The area inside the yellow shaded area will be used for monitoring the frequency for activity, and the adjacent frequency's signal strength will be ignored.

  Important Information
  When "Display AFR zone on spectrum analyzer" is checked, SDR# may crash if your computer hasn't enough computing power. If you find that SDR# crashes when this choice is checked, clear the checkbox to resolve the issue.

  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 to next Step Size" can cause the radio to tune to something other than the received signal's center. Also be aware that inexpensive dongles tend to use oscillators that drift over time, causing your calibration to become variable while the dongle is warming up. Simply having your dongle powered up 24 hours a day is not enough to warm it up; scanning activity is required to warm up an inexpensive radio.
  - 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 may immediately give up and resume searching for an active frequency. This issue is most prevalent on NFM scans.
  - Setting the AFR value too low can also prevent the Watchdog timer from working correctly because it will not detect a signal as an active one.
  - A bandwidth or step size too large, with the AFR percentage set too high, can cause the AFR to lock onto a signal that is outside the correct step size for a given reception mode.

  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 OK button saves the settings in the Preferences window. If you instead wish to abandon your changes without saving them, just click the Cancel button.

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)
SDR# crashes unexpectedly.	When "Display AFR zone on spectrum analyzer" is checked on the Performances window's Scan Performance tab, SDR# may crash if your computer hasn't enough computing speed. If you find that SDR# crashes when this choice is checked, clear the checkbox to resolve the issue.
A popup appears with the message "*An error occurred. The error was: Cannot set the center frequency when no front end is connected*".	You cannot scan unless a radio is selected as the signal source. Drop down the Source list (in the SDR# Source panel) and select a radio.
A popup appears with the message "*An error occurred. The error was:*" followed by some text then "SQLite error no such column" or "SQLite error no such table".	The 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. • You are trying to use a database that was created by an older Frequency Manager + Scanner and is not compatible with FM Suite. When you installed FM Suite it would have upgraded your database automatically; if you had another database elsewhere it would not have been upgraded. You can fix this by using the Data Tools Wizard to export the old database to a CSV file, then use it again to import that file into a new database in the new format.
A popup appears with the message "*An error occurred. The error was:*" 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 program 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 1st page of this document.

Problem	Potential Solution(s)
A popup appears with the message "*The Frequency Manager database exists but it is damaged. Do you want to delete it and create a new database?*"	During startup FM detected that the database exists but appears to be corrupt. Your options are: • Click Yes to continue and replace the damaged database with an empty one. You will have to rebuild your data. • Click No, exit SDR Sharp, and restore the database from a backup. • You may attempt to use the Data Tools Wizard to export the data from the damaged database to a CSV file, and then import it into a new database. If the corruption is bad enough this will not succeed.
Other 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. I will attempt to identify and fix the problem.

Operational Issues

Problem	Potential Solution(s)
I installed into Windows 10 and I cannot run SDR# or plugins correctly	Please see the troubleshooting section in the Appendix article "Installing or upgrading in Windows 10".
The Frequency Manager + Scanner panel does not appear.	SDR# file "Plugins.xml" has been altered or corrupted. You may need to use The Pluginator to uninstall and then reinstall the plugin.
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: • The FM database is unusable. • 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.
I looked in FMSuite.FreqMgr.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 stops on an active frequency.	Check these settings: • The Minimum Signal Strength is set too high. • In Preferences > Scan Performance, the Radio Settle Time in Milliseconds is set too low. • In Preferences > Scan Performance, the Adjacent Frequency Rejection percentage is set too low.

Problem	Potential Solution(s)
The scanner changes frequencies slowly, especially during a Group scan.	• 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 or plugin and watching the frequencies as they are scanned. • In Preferences > Scan Performance, 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. • In Preferences > Scan Performance, the "Slow down scanning" etc. value is greater than zero.
The scanner changes frequencies after stopping on an active frequency.	• 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". • The Watchdog timer is enabled and set to too low a value. Disable it or set the delay to a larger number. • The AFR percentage 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: • You are doing a Group scan and the frequency to the left is not in the group. The scanner stopped on a frequency that *is* in the group. • 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. • 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. • 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". • The "Radio Settle Time" value is set too low. Try increasing the value 50ms at a time until the scanner stops correctly.

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: • The Minimum Signal Strength is set too high for that frequency – the actual signal strength at the time it was measured after tuning was below the minimum. You can see the measured signal strength in the Scanner Decisions plugin or window. • In the Scanner Configuration window, the "Radio Settle Time" is set too low (the scanner didn't have enough time to measure the signal). • The radio's Frequency Correction (PPM) value is incorrect, and although the frequency looks centered under the red line in SDR# it is not on the correct frequency. If you use the SDR# Zoom slider you might be able to see this in action. • 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. Correcting this might require changes to the AFR percentage and calibration of the radio. • Automatic Frequency Rejection's percentage measuring area is too small and the "busy" portion of the signal is outside the measurement area. If you use the SDR# Zoom slider you might be able to see this in action.
The scanner jumps to a frequency and stops. The frequency is not active.	Possible reasons for this: • The frequency was busy when the scanner was stopped, but fell below the minimum immediately after tuning. The scanner is waiting for the frequency to have additional transmissions before moving on. The "T" symbol will display in the upper right of the spectrum analyzer. • The AFR percentage is too large for the step size chosen in SDR#. When the AFR area is too large, active frequencies adjacent to the desired one fool the scanner into thinking the frequency is active. Configure AFR for a smaller percentage of step size or bandwidth. • 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 for a smaller percentage of step size or bandwidth.
The scanner stops on an active frequency but there is no sound.	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.	Possible reasons for this: • 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 Signal Strength you set, and the frequency's strength bounces below and above that Minimum Signal Strength, the watchdog will never fire because it gets reset every time the signal strength goes below the Minimum Signal Strength. Fix this by changing the Minimum Signal Strength 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. • The Adjacent Frequency Rejection percentage is too small and the Watchdog never detects that the frequency is active for too long a period.
I changed the position of the Scanner Decisions plugin or the Frequency Details plugin, and now a white box appears next to the plugin	This is caused by SDR# and the way it hosts plugins and is not an issue with the FM Suite plugin. Restarting SDR# sometimes fixes this, as does using The Pluginator to change the loading sequence of plugins.
I click in the Lower Freq or Upper Freq boxes to type a frequency, but nothing happens.	SDR# has a trick: whenever your mouse is over the spectrum display or the waterfall display, it "helpfully" removes the focus from the Freq entry boxes to the display. Try clicking in one of the Freq boxes and then move the mouse *up* and out of the way instead of to the right and over the waterfall.

Known Issues

None.

Appendix

Default Protocols supplied with Frequency Manager

- 110A
- 1382
- 141A
- 4285
- ACARS
- ALE400
- AM
- AMTOR-ARQ
- AMTOR-FEC
- ARQ-E
- ASCII
- BPSK125
- BPSK250
- BPSK31
- BPSK63
- CCW
- CHIP
- CONTESTIA8/250
- Contestia8/500
- Contestia16/500
- Contestia3211000
- Contestia4/125
- Contestia4/250
- Contestia4/500
- Contestia8/1000
- Contestia16/1000
- Contestia8/2000
- Contestia16/2000
- Contestia3212000
- Contestia64/2000
- COQUELET
- CW
- DAB
- DominoEX-11
- DominoEX-16
- DominoEX-22
- DominoEX-4
- DominoEX-5
- DominoEX-8
- DominoF
- DTMF
- ERMES
- FEC31
- FELDHELLX5
- FELDHELLX9
- FSKHELL105
- FSKHELL245
- FLEX
- FMHELL
- FMNARROW
- FMWIDE
- GMDSS
- HELL80
- HFFAX
- HFDL
- IEC870-5
- JT65
- Lentus
- LSB
- MFSK-16
- MFSK-32
- MFSK-4
- MFSK-64
- MFSK-8
- MOBITEX
- MT63-1000
- MT63-2000
- MT63-500
- NAVTEX
- NWR
- Olivia8/250
- Olivia8/500
- Olivia16/500
- Olivia32/1000
- Olivia4/125
- Olivia4/250
- Olivia4/500
- Olivia8/1000
- Olivia16/1000
- Olivia8/2000
- Olivia16/2000
- Olivia32/2000
- Olivia64/2000
- P25
- PACKET
- PACTOR
- PAX
- POCSAG
- PSK10
- PSK220F
- PSK63F
- PSKHELL
- PSK63FDIGISSTV
- PSKAM10
- PSKAM31
- PSKAM50
- QPSK125
- QPSK250
- QPSK31
- QPSK63
- QRSS
- RTTY100
- RTTY110
- RTTY150
- RTTY200
- RTTY45
- RTTY50
- RTTY75
- RTTYM8/250
- RTTYM8/500
- RTTYM16/500
- RTYM32/1000
- RTTYM4/125
- RTTYM4/250
- RTTYM4/500
- RTTYM8/1000
- RTTYM16/1000
- RTTYM8/2000
- RTTYM16/2000
- RTTYM32/2000
- RTTYM64/2000
- SELCAL
- SITORA
- SITORB
- SLOWHELL
- SSTV
- SYNOP
- THOR16
- THOR4
- THOR8
- THROBX-1
- 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

Scanner Timers and how they affect each other

There are three timers in the scanner:

- Seconds wait for more transmission
- Watchdog timer
- Cutoff timer

How they work and interact is as follows:

- The Seconds wait for more transmission timer, after a frequency stops transmitting, waits to give the frequency another chance to transmit before resuming scanning of frequencies. This action is taken so that you can catch both sides of a conversation that occur on the same frequency.
- The Watchdog timer starts when a frequency starts transmitting. If the frequency is still transmitting when the timer counts down to zero, the timer forces the scanner to leave the frequency and resume scanning. This prevents the scanner from getting trapped on a frequency that is continuously active (e.g. a digital transmission that never stops)
- The Cutoff timer is a referee between the other two timers. In some circumstances a frequency can be barely above the Minimum Signal Strength that you set, and its signal strength (especially on an NFM signal) can bounce above and below the Minimum Signal Strength. In these cases the Seconds wait timer and the Watchdog timer take turns switching on and off rapidly with neither timer being active long enough to allow scanning to resume. The Cutoff timer is the absolute maximum in seconds that the scanner will wait on a frequency. In the case where the Seconds wait and Watchdog timers are battling for control of the scanner, the Cutoff timer breaks the tie and forces the scanner to resume.

For the best performance you should set the timers as follows:

- Set the Seconds wait for more transmission timer to the maximum number of seconds you want to wait to allow a frequency to resume transmission, before the scanner resumes scanning.
- Set the Watchdog timer to the maximum amount of time you want the scanner to stay on an active frequency.
- Set the Cutoff timer a little more than the Watchdog timer, so that scanning resumes even if the other two timers don't run down.

Put another way:

- The Seconds wait for more transmission timer should have the smallest number of seconds.
- The Watchdog timer should have a larger number of seconds.
- The Cutoff timer should be 1 second longer than the Watchdog timer.

WFM DXing with the Frequency Manager + Scanner

This article was written and graciously provided by longtime FM+S user and beta tester David Bunyan.

A popular use of SDR radios and software is DXing for WFM stations and capturing the RDS/RBDS [Radio (Broadcast)Data System] information for station identification and proof of reception. DXing means listening to far-away — usually foreign — radio stations.

A comprehensive list of FM broadcast stations throughout the world is available on FMList.org. Anyone interested can access it and can set up a personal database to log reception.

Using the Vasili's SDR# MPXOutput Plug in[1] , the Virtual Audio cable (VAC) program[2], and the program RDSSpy[3] you can capture the RDS data to a csv file and marry it up with the frequency data in FMSuite's Activity Log. RDSSpy is noticeably more sensitive than the in-built RDS decoder in SDR#.

I won't get into capturing RDS data in this guide as you can get all the needed information off the web, but here are some tips for configuring the Frequency Manager + Scanner for DX-ing WFM broadcast stations.

Create a WFM DX Group

Add the frequencies you want to search in the appropriate FM database and then create a group just for those frequencies. You want to avoid including local frequencies in this group in order to minimise scanning time. You can also create a group containing all the frequencies for testing purposes in order to optimise performance with your individual set-up.

Configure SDR#

- In the **Radio panel**, set the Step Size to the channel spacing for the WFM band you are searching. This value varies by country although most countries use 100kHz or 200kHz spacing. Note: the OIRT band uses 30 kHz spacing, but these stations don't generally carry any RDS data.
- In the **FFT panel**, set the resolution to 16384 – the lower the figure the less CPU load but the poorer the resolution.

Configure Frequency Manager + Scanner

Make the following settings to the Scanner group in the Frequency Manager + Scanner plug-in.

- **Minimum Signal Strength** should be set to a value suitable for the expected signal strength of DX stations. A minimum signal strength of around 12dB above the noise floor is a good place to start. You can adjust this when the scanner is running to ensure the scanner stops on active stations.
- **Seconds wait for more transmission** should be set to 1. This will prevent the scanner moving to the next frequency due to brief changes in the signal strength when the modulation changes, but still allow the scanner to move on if the signal fades.
- **Make the following settings in the Preferences window**.

  ### *In the Scan Rules tab*

  - Put a check mark next to **Snap to Step Size**.
  - Remove a check mark next to **Enable watchdog timer.**
  - Put a check mark next to **Enable cut-off timer** and set its value to 6 seconds – as this will give ample time for the RDS signal to be decoded without slowing the scanning down too much

  ### *In the Scan Performance tab*

  - Set **Scan Resolution** to Low Resolution. If using an SDR with a wide bandwidth you may use the Zoom feature in SDR# to show only around 1 MHz of the spectrum if you are more comfortable with that.

- Configure **Slow down scanning by pausing...** to 200 milliseconds. Ordinarily this should be set to zero; we do this for WFM DX to improve the chances of catching the next station when it is very close to the current one.
- Configure **Radio Settle time...** to whatever works best for your particular radio – default is 500 mS.
- **Adjacent Frequency Rejection** should be set to 25% of the **step size** – to make a 25kHz wide window for 100 kHz step size. This reduces the likelihood of the scanner stopping on splatter from an adjacent channel.

Configure the Activity Logger

Enable the Activity Logger plug-in so that it records the frequencies that the scanner stops on – otherwise you will not be able to match the data in the RDSSpy log with a frequency.

- Put a check mark next to **Write Column Headings to log.**
- Put a check mark next to **Don't log activities shorter than.**
- Choose the value – suggested figure **1 second.**
- Click the **Auto Start Logging** button.

The log is saved to a file in the format yyyy-mm-dd in a sub-folder under the sdrsharp folder called FMSuite.Activity.Logs.

Optional Settings

You can choose to display the following – but they add to the CPU load:

- The minimum signal strength line on the spectrum.
- The station name recorded in the database on the spectrum.
- The scanner decisions plugin or window. These are useful when optimising FM Suite.

When you are ready, select the group you created containing the target frequencies you wish to monitor and start a Group scan.

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[1] http://rtl-sdr.ru/

[2] http://software.muzychenko.net/eng/vac.htm

[3] http://rdsspy.com/

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 many 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 signals 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 plugin and the Signal Strength Indicator will help you understand when a frequency is a mere 1dB in signal strength lower than the minimum required. You may also use the SDR# Zoom slider to magnify a specific frequency to see its strength in relation to the Minimum Signal Strength that you defined.

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 4 GHz with Hyper-threading enabled, resulting in 8 logical processors.
- 32GB 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 value, the more frequencies on which the scanner will stop. Conversely as the minimum moves up towards zero, only the stronger signals are detected and the scanner will not stop as often.

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 ways 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 on the new frequency, the scanner checks the frequency again to make sure its signal strength is still greater than the minimum.

The problem in step 6 is that the scanner measured the signal strength *right now* in step 4; 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# can'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 arbitrarily 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 has to try only 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 after which the scanner resumes scanning.

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 Preferences window put a checkmark next to "Show Scanner Decisions" on the Scan Rules tab so that you can watch what the scanner is doing.
3. Start a Group scan using a value of 500 for Radio Settle Time and with a Minimum Signal Strength set low enough to successfully detect the frequencies in your Group when they are active.
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 the scanner 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), then 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. Open the Preferences window and check Enable Speed Benchmark on the Scanner Performance tab.
2. Select Hi Resolution or Low Resolution in the Preferences window on the Scanner Performance tab. Low Resolution will result in faster scanning but will skip frequencies in the process. Close the Preferences window.
3. 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.
4. Start SDR#.
5. Using the SDR# Configure button, set the tuner's signal strength to zero.
6. 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.
7. 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.
8. Put the frequency cursor in the spectrum window where you would typically have it during normal scanning. I find having the frequency cursor all the way to the left gives me the fastest scanning.
9. 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.
10. 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.
11. I suggest running the benchmark at least 5 times and then taking the average result as your speed rating.
12. When you are finished, open the Preferences window and uncheck Enable Speed Benchmark on the Scanner Performance tab.

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.

On my equipment I average 1.2 GHz per second in a benchmark in Low Resolution scanning with 4096 FFT Resolution, and 105MHz per second in High Resolution with radio sample rate of 2.4MSPS.

Installing or upgrading in Windows 10

Creating a new Windows 10 installation of FM Suite

Please note that Windows 10's file security is more aggressive than in previous versions of Windows. As a result you may not be able to install into folders that were previously acceptable.

The FM Suite installer cannot be executed from C:\. You must create a temporary folder elsewhere and run the installer from there. It is also recommended that you run the installer as administrator (right-click and choose "Run as administrator").

Some users have reported that SDR# and the plugins cannot be installed into C:\Program Files or C:\Program Files (x86) due to Windows 10 security measures.

In addition you may need to select a folder for databases that is not under your Windows User Profile due to security limitations.

Upgrading an existing Frequency Manager + Scanner v1.x installation after upgrading to Windows 10

The recommended process is:

1. Move your databases from their default location under your User Profile (c:\users\<username>\AppData\Local\SDRSFM) to a new folder elsewhere.
2. Uninstall Frequency Manager + Scanner v1.x.
3. Install FM Suite using the instructions above.
4. Start SDR#. Open the Preferences dialog in the new Frequency Manager + Scanner (Tools > Edit preferences).
5. At the bottom of the Frequency Manager tab, find and select the FreqMgr.db file you moved in step 1.

Troubleshooting a Windows 10 installation

Almost all of the issues reported with Windows 10 installations are caused by user permissions. Most of these can be solved by running the Windows Compatibilty Troubleshooting Wizard. Follow these steps:

1. Locate file SDRSharp.exe in your SDR# folder. Right-click it.
2. Click the *Troubleshoot Compatibility* option in the popup menu.
3. When *Select Troubleshooting Option* appears, select *Troubleshoot Program*.
4. Place a checkmark in the box next to *The program requires additional permissions* and click Next.
5. When *Test compatibility settings for the program* appears, click *Test the program*.
6. SDR# will run. You may be prompted by Windows to allow SDRSharp.exe to make changes to your computer. If this happens, click *Yes*. SDR# will not make changes to your computer; it will only update its own configuration files.
7. Test SDR#. You should find that all functions work correctly. Close SDR#.
8. In the *Program Compatibility Troubleshooter* window, click the *Next* button.
9. Assuming that SDR# worked correctly, click *Yes, save these settings for this program* when you are prompted *Troubleshooting has completed. Is the problem fixed?*
10. Click *Close the Troubleshooter* when the *Troubleshooting has completed page* appears.

If this did not solve the issue, please try installing SDR# and the plugins in another location on your computer. The best choice would be on a drive other than C: because Windows 10 is aggressive about protecting that drive. If that is not possible, create a new folder in C: and install SDR# and the plugins there; because this is a user-created folder Windows 10 will be less aggressive with security.

If you continue to have problems please write to me at the email address on the first page of this document.

Notices