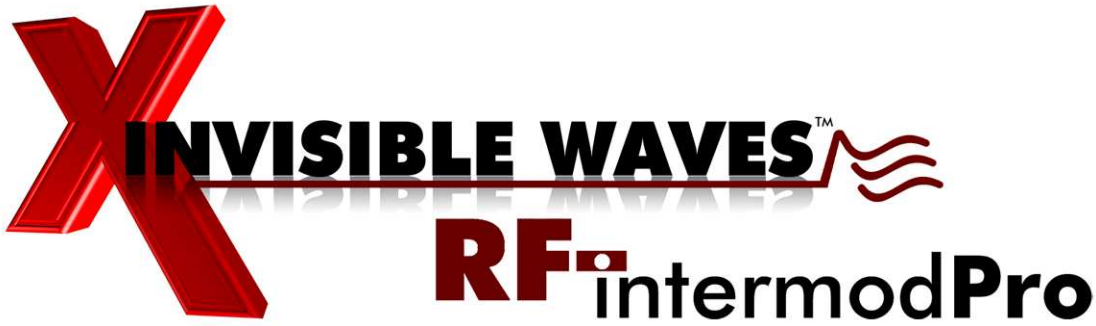


User Manual

Version 1.0.6

Table of Contents

Introduction

The PC-based RF-*intermod* PRO™ refines and simplifies the process of identifying intermodulation distortion (IMD) frequencies in a given RF spectrum and is designed for professional audio wireless microphone users, AV installers of wireless devices, frequency coordinators, and broadcasters.

What is Intermodulation Distortion?

Intermodulation distortion is created when two or more transmission frequencies mix together and form new additional signals. Sometimes referred to as 'spurious emissions', these newly created frequencies are both harmonic frequencies and also the sum & difference of the original frequency. And, these newly generated frequencies may be strong enough to cause interference to any transmitter that tries to occupy the same RF-spurious emissions space.

RF-*intermod* PRO™ does it all with One-Click

The new RF-*intermod* PRO™ graphically displays on the screen the predicted locations of these intermod components and assists in the frequency coordination process. Based on the user's selection of transmitter models from a model selection list, the software will advise the user on the best selection of transmitters/frequencies. Additionally, based on zip code entry, the software automatically defines and identifies unusable RF spectrum spaced around local DTV channels and other local interference. What makes this software standout over other intermod prediction software is the intuitive ease-of-use; 'One Click' calculations, Click, Drag & Place, spectral graphical representation, customizable TX inventory profiles, DTV blocks, and stable reliability.

One of the more powerful and unique functions of the RF-*intermod* PRO™ is the RF Risk Assessment™ feature. This feature evaluates the potential interference conditions based on the user's tolerance level and selects, assigns, and performs the whole frequency coordination process for the user. It's a 'one button push' process, based off of the user's wireless inventory which greatly speeds up frequency coordination with added accuracy. Naturally the user can override and/or modify the computers automatic suggestions by manually inserting transmitters' right onto the graphic RF spectral display, and thereby still avoid RF interference hazards.

Another unique and power feature is the weighted RF Density Congestion Scale™ which displays the predicted severity of the local RF environment. One of the many advantages of this feature is the ability to gauge and predict the RF severity and then decide on the best transmitter models to use in the environment or to supplement with wired devices in extreme cases.

RF-*intermod* PRO™ Configurations

The RF-*intermod* PRO™ is available as a standalone PC-based software product or as a plug-in option for the Invisible Waves™ RF Command Center. As a plug-in, the RF-*intermod* PRO™ works in conjunction with the RF Command Center's Frequency Coordinator, scanning the local RF environment in real-time, identifying open and usable RF spectrum, and at the same time performing real-world intermod calculations. When the RF-*intermod* PRO™ is used as a plug-in with the RF Command Center, the combination becomes the most power RF coordination solution available.

Overview

RF Intermod Pro is a powerful, graphical-based interactive tool to assist in coordinating frequency assignments for wireless transmitters. Frequency assignment takes into consideration the placement of existing transmitters as well as the 3rd and 5th order intermodulation interference caused by the placement of transmitters as they interact with each other and with selected wireless devices.

The following features are provided to simplify the setup of frequency coordination:

Location Database

The user can enter information on any number of geographical locations. Information includes:

- A unique name identifying the location.
- The physical address (street, city, state, zip code, longitude & latitude) of location.
- Local NTSC and DTV stations that may interfere with wireless transmitters (see ***FCC Transmitter Database***, below).
- Additional (non-TV) frequencies at the location.
- An optional spectral frequency plot for the location.
- Wireless transmitters assigned by the user at that location.
- Written notes on the location.

FCC Transmitter Database

RF Intermod Pro includes a database of over 25,000 NTSC and DTV transmitters in the United states. Enter in a zip-code (or enter longitude and latitude directly if you have it), and RF Intermod Pro will automatically determine which local stations have the potential to interfere with your wireless devices. You can also select NTSC and DTV channels manually if you desire.

Wireless Device Library

Also included is a library of commonly available wireless transmitter devices from a variety of different manufacturers. You can edit the database to add your own wireless devices as required.

Wireless Inventory and Inventory Groups

Using the devices from the Wireless Device Library, the user can create their own custom device inventory. Inventory can also be assigned to groups that define different venues, location or application types. Inventory groups allow automatic assignment of multiple inventory items with one or two clicks.

Interactive Frequency Plot

A fully interactive frequency plot lets you graphically view all of the frequencies that come into play as you coordinate you wireless device assignments.

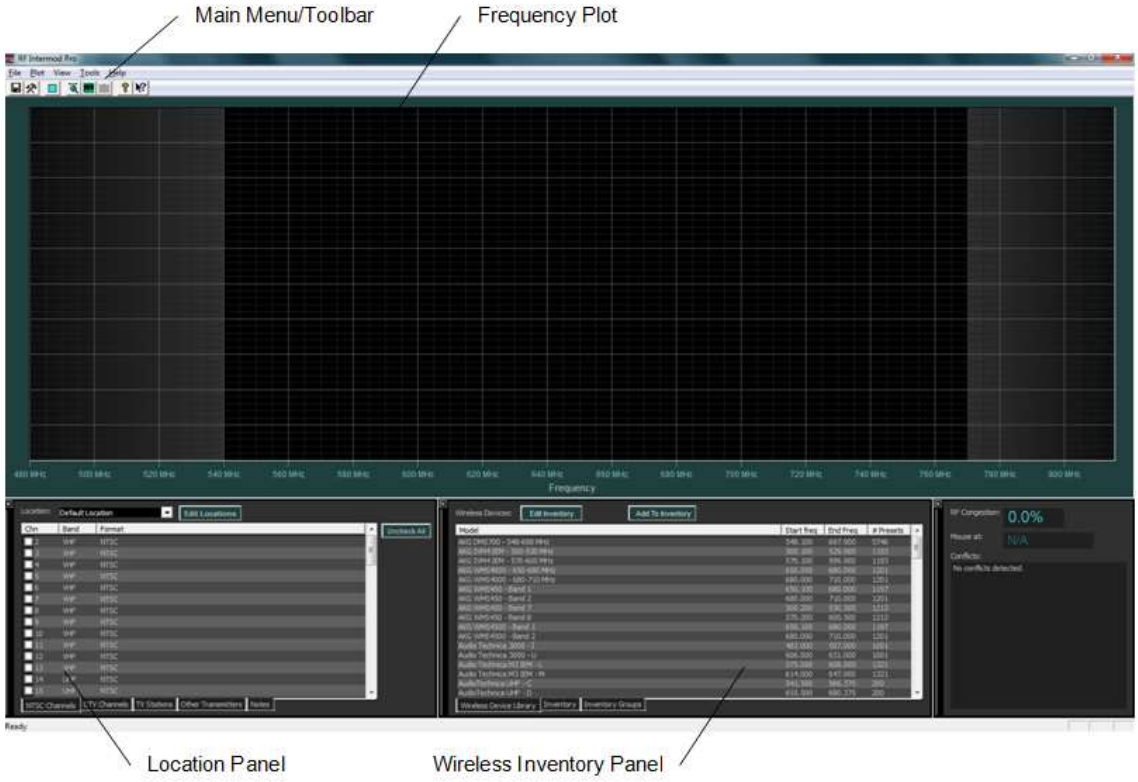
Select local NTSC and DTV stations from the Location Panel and watch them immediately appear on the plot, along with any intermodulation distortion they may cause (note: DTV stations are not included in intermodulation calculations).

Drag wireless devices from the Wireless Inventory Panel onto the plot and move them around, selecting from a graphical representation of candidate frequencies that are free of interference for that device.

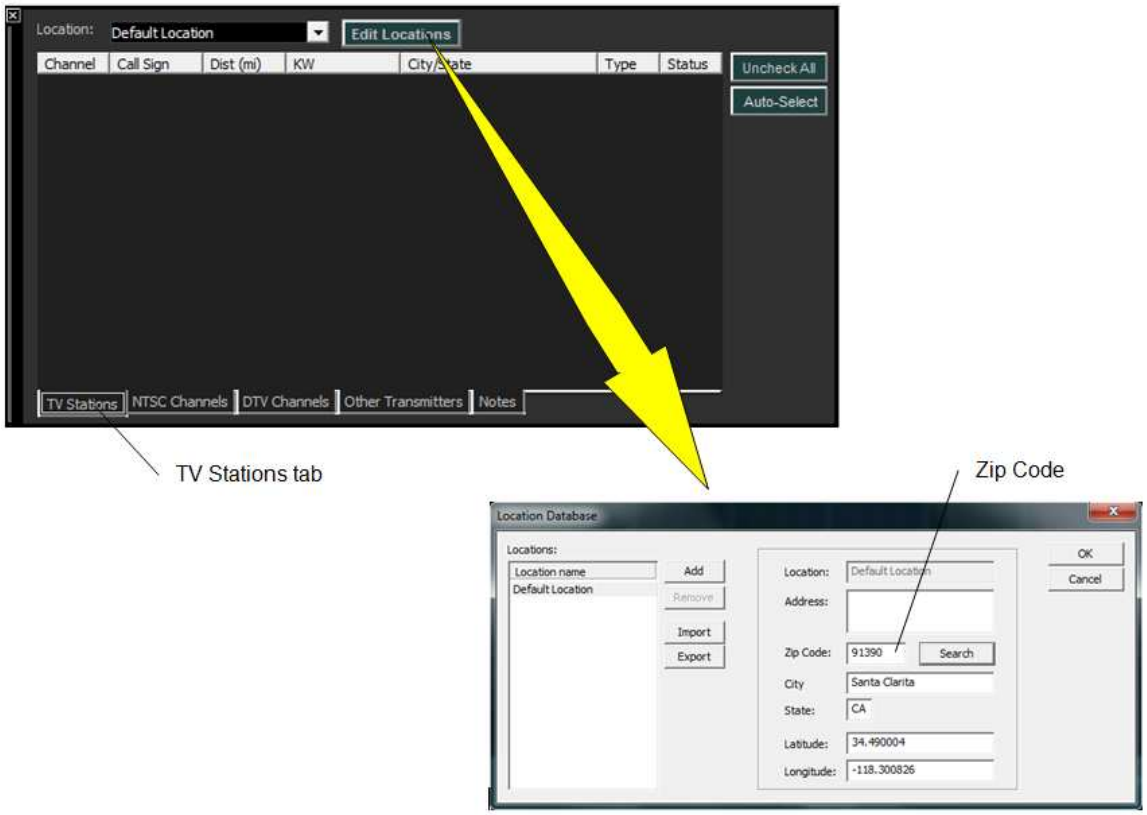
Using RF Intermod Pro for the First Time

Here are some quick steps to getting you started using RF Intermod Pro:

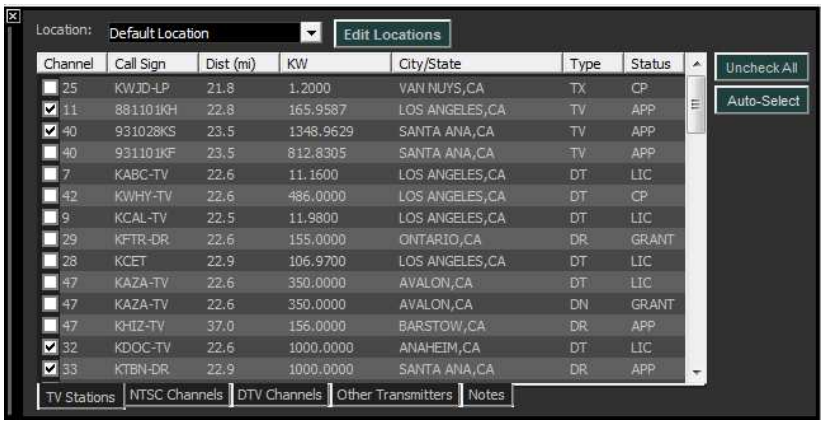
1. Install and run RF Intermod Pro. This is how the main screen should look:



2. In the Location Panel, click the TV Stations tab. Then click *Edit Locations* to bring-up the Location Database Window.

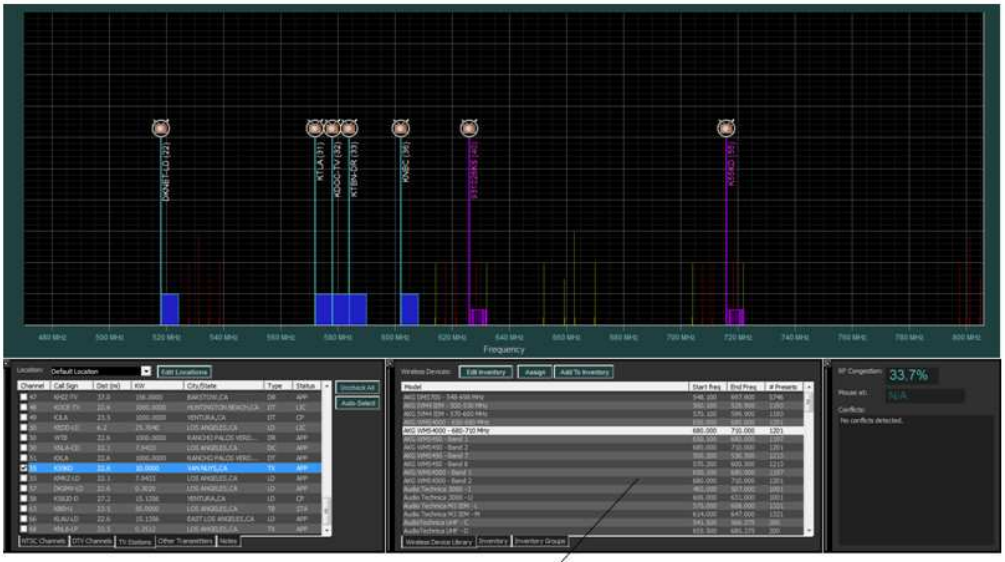


3. Enter in your zip code and click on *Search*. If you entered a valid U.S. zip code, the City, State and Latitude/Longitude fields will be filled-in automatically.
4. Now, click OK, and then click *Yes* when prompted for auto-selecting TV stations. Your Location Panel should now look something like this:

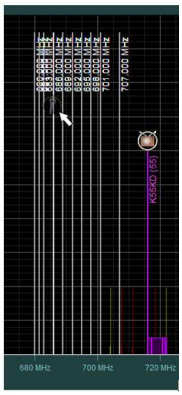


As you can see, the list has been filled with information on TV stations within a certain radius of your location. Based on the RF Intermod Pro's internal risk assessment calculations, some of the stations include a check mark in the Channel column indicating that a channel is strong enough to potentially interfere with wireless transmitters you might assign. Feel free to go through the list and check/uncheck stations as you feel appropriate.

You will also notice that the selected TV stations now appear in the Frequency Plot.



5. Now, click on any item in the Wireless Devices Library list and drag it onto the frequency plot. While you are dragging, you will notice that the frequency plot displays optimum candidate frequencies where the device can be placed and avoid interference.



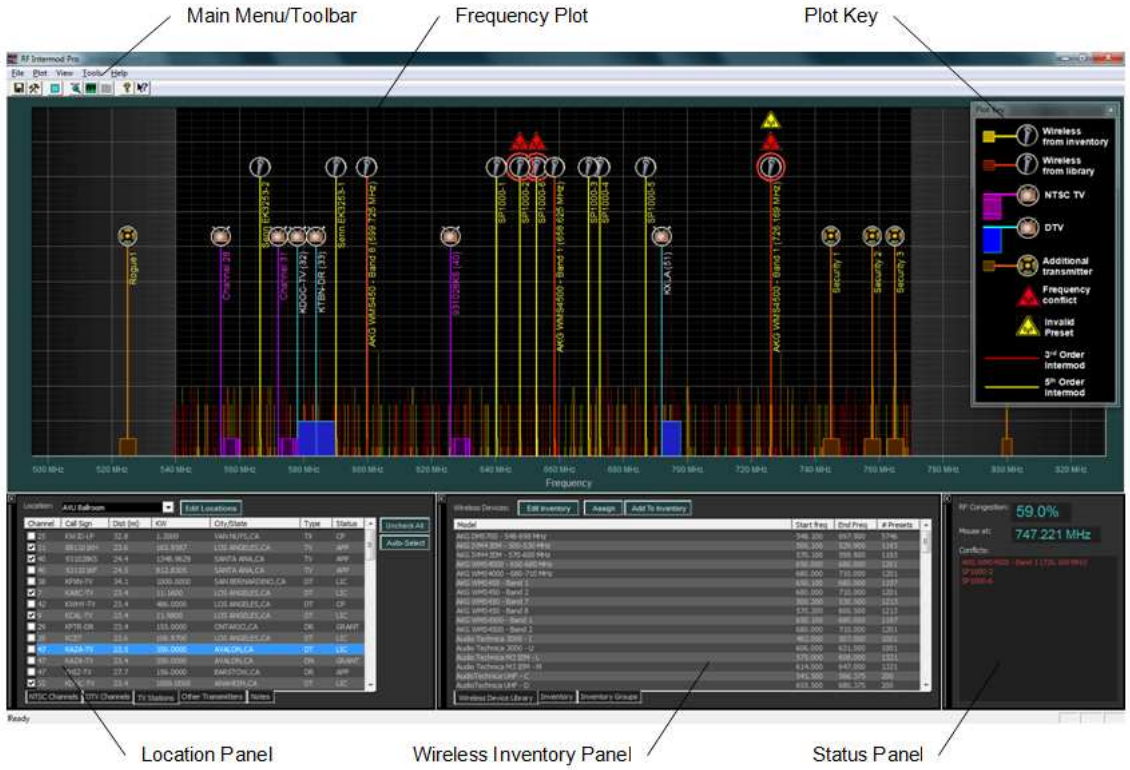
6. You can also highlight any item(s) in the Wireless Devices Library and then click the “Assign” button. The RF Intermod Pro will place the devices into the frequency plot at the optimum location based on best intermodulation calculations and best spacing from other transmitters. You can repeatedly click on the “Assign” button over and over to continue to place the devices into the frequency plot at the optimum locations.

7. Once assignments are complete, you can create a report of the assigned transmitters by selecting (from the main menu) Files→Reports→Transmitter Assignments. Click save when prompted with a file browser. The transmitter assignment report will appear in an editor.

Now that you’ve assigned transmitters directly from the Wireless Device Library, try creating inventories and inventory groups to make managing your RF coordination even easier.

RF Intermod Pro Main Screen

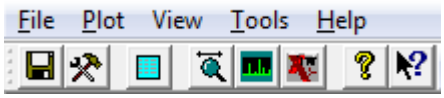
Below is how the RF Intermod Pro main screen may typically appear while in full usage, showing all panels and windows.



The main screen includes the following elements:

Item	*Description*
Main Menu/Toolbar	Quick access to features and functions.
Frequency Plot	Graphical representation of selected TV channels and stations, selected wireless transmitters and calculated intermodulation products.
Plot Key	Legend for identifying symbols found on the Frequency Plot.
Location Panel	Setup panel for selecting TV channels/stations and additional frequencies, in a given location, that are used in the intermodulation calculations.
Wireless Inventory Panel	Provides access to the wireless device library, user inventory and inventory groups.
Status Panel	Shows RF Congestion, mouse cursor position and RF conflict list.

Main Menu and Toolbar



The following lists show all main menu and toolbar functions.

File Menu

Menu Item	*Button*	*Description*
Save Data		Saves all user data, including location and inventory information.
Reports	 *	Creates selected report. Choose from: Transmitter Assignments Report (*button available) Inventory Report Inventory Groups Report
Export	--	Export selected data. Choose from: Transmitter Assignments
Import	--	Import selected data. Choose from: Sweep Data
Settings		Brings up the RF Intermod Pro Settings window.
Exit	--	Exits RF Intermod Pro

Plot Menu

Menu Item	*Button*	*Description*
Show Key	--	Show/Hide the Plot Key window.
Include Sweep Data		Include/exclude sweep data in frequency plot.
Clear Sweep Data	--	Clears current sweep data buffer.
Accept IWx Sweep Data		Display real-time updated spectral sweep data from Invisible Waves software (requires Invisible Waves version 1.1.0 or above). (See Real-time Updates from Invisible Waves.)
Zoom Mode		Enable/disable frequency plot zoom mode (see Frequency Plot.)

Plot Menu

Menu Item	*Button*	*Description*
Location Panel	--	Show/Hide the Location Panel
Inventory Panel	--	Show/Hide the Wireless Inventory Panel.
Status Panel	--	Show/Hide the Status Panel.

Tools Menu

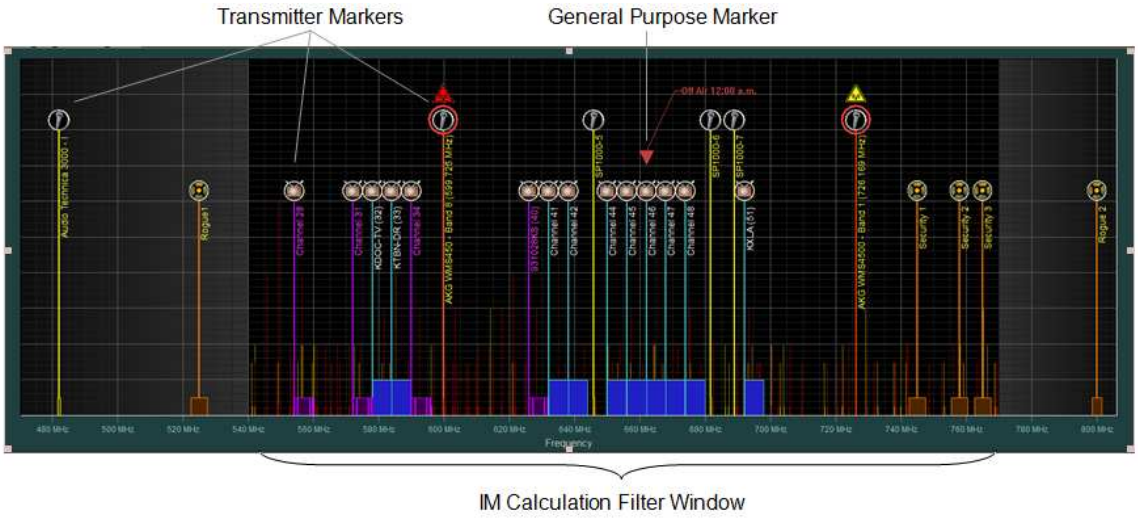
Menu Item	*Button*	*Description*
Wireless Device Library	--	Brings-up the Wireless Device Library Window.

Help Menu

Menu Item	*Button*	*Description*
Contents	--	Shows the Help Table of Contents window.
Search	--	Shows the Help Topic Search window.
Index	--	Shows the Help Topic Index window.
About RF Intermod Pro		Brings-up RF Intermod Pro software version information.
		Click this button to activate *context help* and then click on the item you would like help with.

Frequency Plot

The Frequency Plot is a graphical representation of all of the frequency sources that are used in the intermodulation calculations and in the frequency assignment of wireless devices.



The following items can be displayed in the plot:

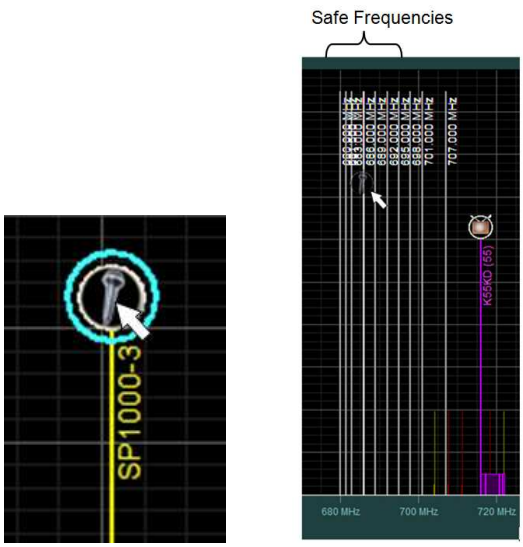
- NTSC and DTV channels/stations selected in the Location Panel.
- Additional frequencies enter in the Location Panel.
- Wireless devices from library added from the Wireless Inventory Panel.
- Wireless devices from the user inventory added from the Wireless Inventory Panel.
- Sweep data imported from a file or updated real-time from Invisible Waves software.
- General Purpose Plot markers for identifying or calling-out other items on the frequency plot.

Transmitter Markers

All transmitter markers are identified in the Location Plot as vertical lines, each capped on the top by a transmitter icon. The Plot Key identifies each transmitter markers icon. The shorter lines represent TV stations, channels and “other” transmitters that have been selected in the Location Panel. The longer lines are wireless transmitter devices that have been added from the Wireless Inventory Panel. Please note: Because the FCC assigns TV station frequencies by their ‘start’ frequency, the lines for TV stations appear on the left side of the TV block.

Selecting and Moving Transmitter Markers

Only transmitter markers for wireless devices can be selected and moved. To select a wireless device, click on its icon. Selected devices will have a light blue ring around its icon.



Click and hold the left mouse button to drag the transmitter to a new frequency. As you drag, additional white marker lines will appear temporarily to show you which frequencies are safe for the selected wireless device to be moved to. For more information on dragging wireless devices see Wireless Inventory Panel.

Multiple wireless devices can be selected, but not moved together. To select multiple devices, hold down the Control key on your keyboard as you select devices with the mouse.

The main purpose of selecting multiple transmitters is to remove them from the plot. To remove selected wireless transmitters, ***right***-click on a selected transmitter and select *Unassign*. If you have selected multiple transmitters, be sure hold down the Control key when you right-click.

Important note on selecting wireless transmitters: There are two types of wireless transmitters devices represented in the Frequency Plot. They are *wireless library devices* (represented by a red line), and *wireless inventory devices* (represented by a yellow line). *You are not allowed to mix these two types while selecting multiple transmitters*. For more information on these two types, see Wireless Inventory Panel.

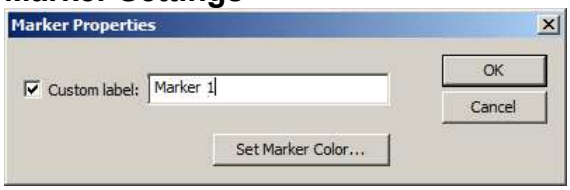
General Purpose Plot Markers

General purpose markers allow you to add notes or comments to point out certain features in the Frequency Plot.

Double click in any open space in the Frequency Plot to add a general purpose marker. Click on the marker pointer and drag to move the entire marker. Click on the marker label to drag just the label. To delete the marker, right-click on the marker and then select *Delete Marker* in the pop-up menu.

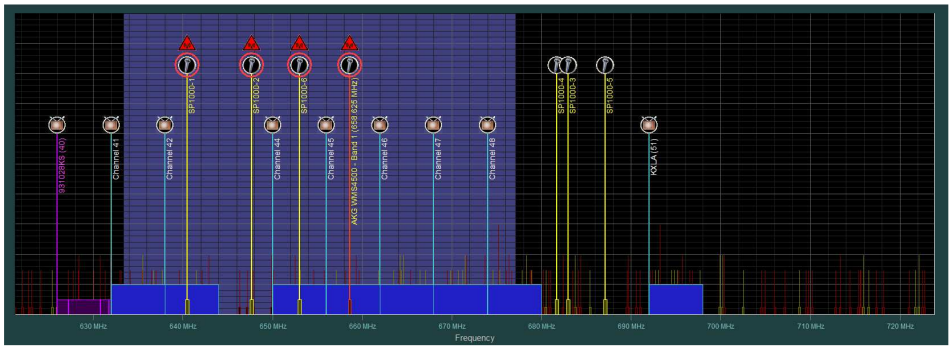
Double click on the marker to bring-up the Marker Settings window.

Marker Settings



This window lets you customize the appearance of a plot marker. By default, the markers label will show the frequency value at the marker's locations, and will change as the marker is moved. To customize the label text, check the *Custom label* box and enter the desired marker label. Click the *Set Marker Color* button to bring-up a color selector from which to choose a new color for the marker.

Plot Zooming



The following methods are provided form zooming in and out in the Frequency Plot:

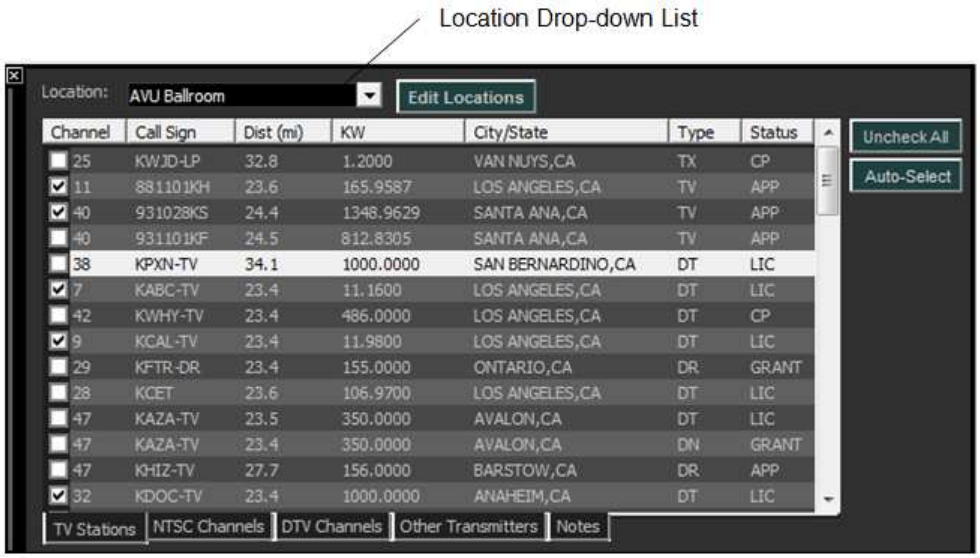
1. Enable plot zoom mode by clicking on the  button in the main toolbar. When in this mode, the mouse cursor turns into a magnifying glass while over the Frequency Plot area. Click the left mouse button to zoom-in around the current position. Click the right mouse button to zoom out.
2. With plot zoom mode *disabled*, left-click any empty space in the Frequency Plot. While holding down the left mouse button, drag the cursor across the plot. A blue rectangle will highlight the selected area. Double click in any empty area within the blue rectangle and the highlighted section of the plot will be expanded to fill the Frequency Plot.
3. Hover the mouse cursor somewhere in the plot. Then, while holding down the Control key on the computer keyboard, rotate the mouse wheel back and forth to zoom in and out around the frequency where the cursor is hovering.

Plot Key

The Plot Key window provides a key/Legend for identifying the symbols and transmitter markers found in the Frequency Plot.

Location Panel

From the Location Panel, the user can keep track of information on local transmitters (NTSC, DTV and other) present at any number of locations, as well as all of the wireless device frequency assignments made in that area. Once setup for a particular location, the user can pull-up this information as needed and use it while coordinating wireless transmitter frequency assignments. The list can be sorted by each of the column headings by simply clicking on any of the headings.



The Location drop-down list shows all of the locations the user has added to the Location Database. Selecting a location in the list will cause this panel, the Wireless Inventory Panel and the Frequency Plot to be updated with data stored for the selected location.

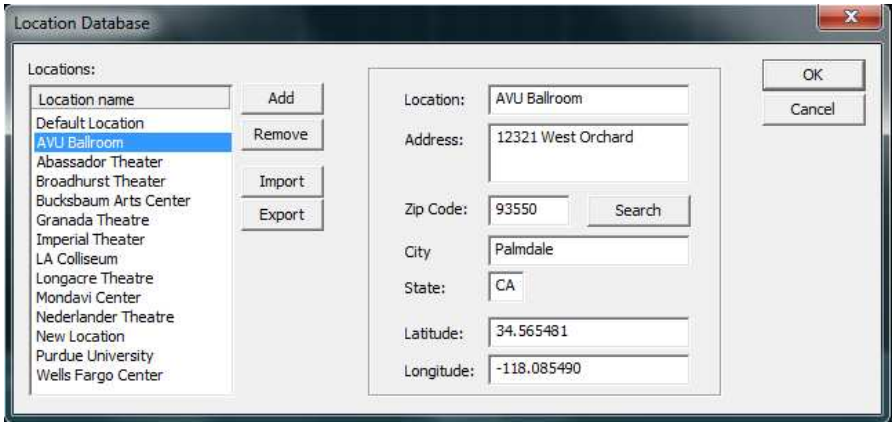
To edit the location list, click *the Edit Location* button to bring-up the Location Database Window.

The location panel is broken into five tabs:

Tab	*Description*
TV Stations	Provides a list of local TV stations provided that a longitude and latitude for a U.S. location is provided for this location.
NTSC Channels	From this tab you can manually select NTSC channels.
DTV Channels	Provides manual selection of DTV channels.
Other Transmitters	Enter a list of additional transmitters to be considered in frequency coordination calculations (Note: this does not include the wireless devices you wish to coordinate as this is handled in the Wireless Inventory Panel).
Notes	User supplies any notes with respect to the location.

Location Database Window

This window lets you add/remove and edit locations in the Location Database.



Adding Locations

Click the *Add* button to add a new location to the database, then fill in the Location and address fields. Enter a valid United States zip code into the *Zip Code* field and click the Search button to automatically populate the *City*, *State* and *Latitude/Longitude* fields.

Removing Locations

Select the locations you wish to remove and click *Remove*. This will remove all selected locations from the list, along with all associated transmitters' and wireless device assignments for that location.

Editing Existing Locations

To edit an existing location, simply select the location in the list and modify the data in the fields on the right.

Default Location

A default location called "Default Location" is automatically added the first time the software is run and cannot be removed. The default location can be edited and used just as any other location and is available for users that do not wish to take advantage of the location database. However, is strongly recommended that the user become accustomed to this powerful feature as it greatly simplifies the coordination process.

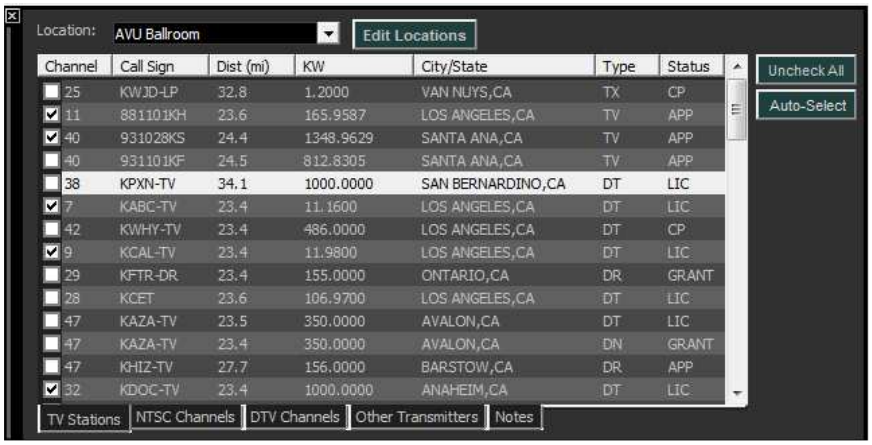
Export and Import

Selected locations can be exported to a file and later imported by other users. This allows sharing of location information between users.

To export locations to a file, first select the desire locations and then click *Export*. You will be prompted for an export path and filename, then click *Save* to perform export.

To import previously exported location information, click on Import, then select the file you wish to import and click *Open*. The imported location information will be immediately added to the *Locations* list.

TV Stations Tab



The TV Channels tab is automatically populated whenever the location is changed or if the longitude or latitude changes in the current location. This list shows all TV transmitters registered in the FCC database, with a specified distance from the longitude and latitude of the currently selected location.

In addition, those stations whose range, power and frequency have the potential to interfere with wireless transmitter placement are automatically checked. Feel free to check or uncheck stations as desired. The automatic selection can be restored at anytime by changing the longitude/latitude of the location, or by clicking on *Auto-Select*.

The TV stations from this list are included in the FCC TV transmitter database included with RF Intermod Pro. This database contains information around 25,000 transmitters and covers the United States only (including Alaska, Hawaii and Puerto Rico). Update version of this database can be downloaded as they become available at www.kaltmancreations.com.

Click on *Uncheck All* to uncheck all stations in the list.

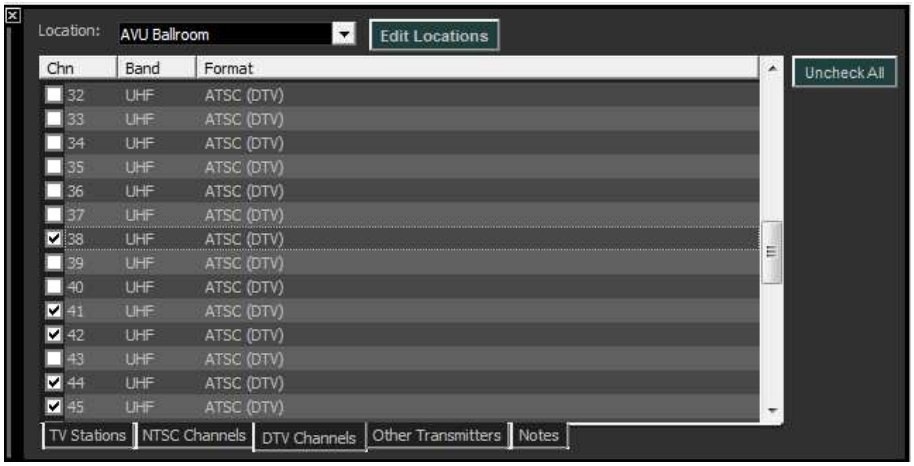
NTSC Channels Tab

Manually check NTSC TV channels you would like to add to the current location to be included in wireless device coordination calculations. Channels appear in the Frequency Plot as soon as they are checked, along with additional intermodulation interference associated with the NTSC

channels. Each NTSC channel includes the luminance, audio and optionally the chrominance carriers.

Click on *Uncheck All* to uncheck all channels in the list.

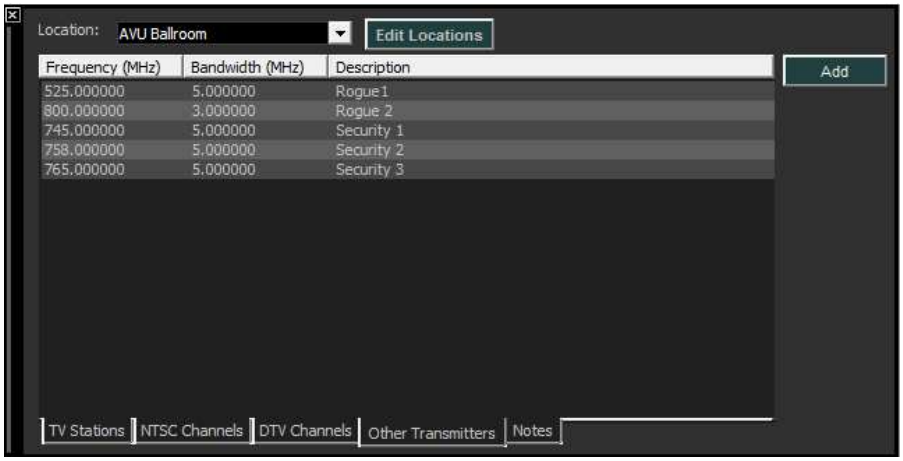
DTV Channels Tab



Manually check DTV channels you would like to add to the current location to be included in wireless device coordination calculations. Channels appear in the Frequency Plot as soon as they are checked. No intermodulation calculations are performed on DTV signals. However, the entire 6MHz block for the channel marked is off limits during coordination calculations.

Click on *Uncheck All* to uncheck all channels in the list.

Other Transmitters Tab



This is the place to add any additional local (non-TV) transmitters that might interfere with RF coordination.

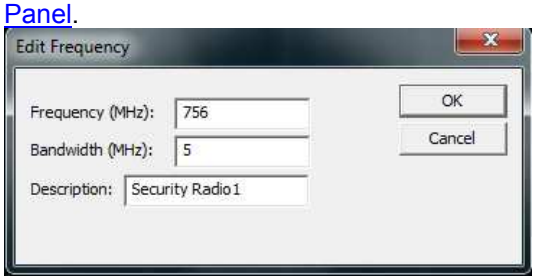
Adding Transmitters
To add a transmitter, click the *Add* button to bring-up the Edit Frequency window. Enter the new transmitter information and click *OK*.

Removing Transmitters
Select the transmitter(s) you wish to remove and click *Remove*.

Edit Existing Transmitters
To change the settings of an existing transmitter, select the desired transmitter and click the *Remove* button to bring-up the Edit Frequency window. Make the desire changes and click *OK*.

Edit Frequency Window

Edit information for new or existing transmitters in the Other Transmitters tab of the Location Panel.

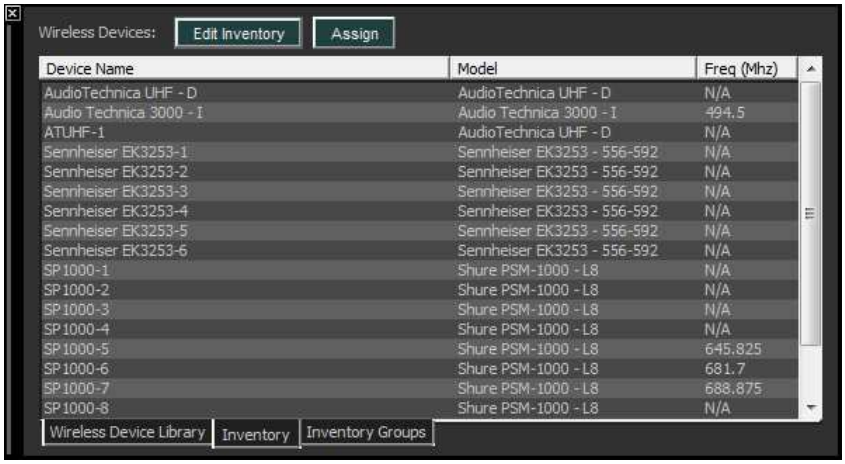


Tab	*Description*
Frequency (MHz)	Enter the frequency of the transmitter in MHz.
Bandwidth (MHz)	Enter the bandwidth of the transmitter in MHz.
Description	Enter a short (1-2 word) description for the transmitter.

Notes Tab

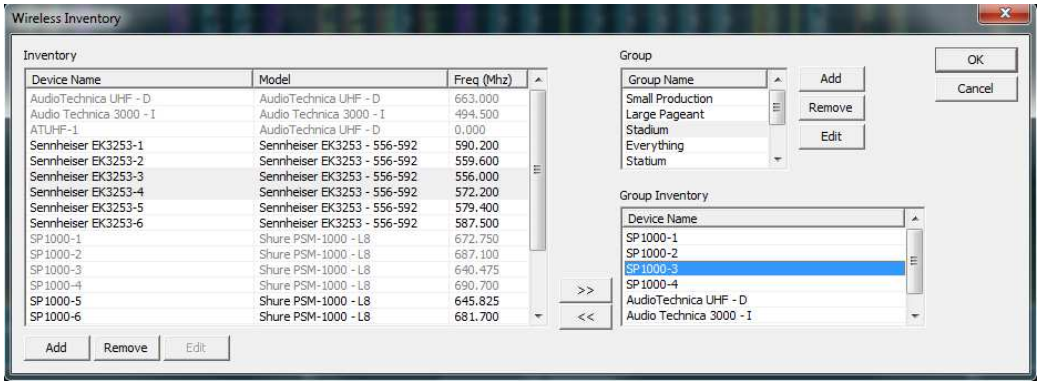
Enter in any notes providing additional useful information about the currently selected location.

Wireless Inventory Panel



Wireless Inventory Window

Use this window to setup your inventory and inventory groups.



The Wireless Device Inventory is a great way to manage your own inventory for coordinating wireless transmitter frequency selection at different locations. Setting up your inventory in advance makes it a lot easier to auto-assign transmitter frequencies using the Wireless Inventory Panel. Please note: These lists can be sorted by each of the column headings by simply clicking on any of the headings.

This window is divided into three lists:

List	*Description*
Inventory	Shows all of the wireless devices in the user's inventory. Add to the list by clicking the *Add* button associated with the *Inventory List*. This will immediately bring-up the Select Wireless Device window, which will give you a list of devices in the wireless device library from where you can select the device(s) you wish to add to the inventory list. If only one device is selected in the Select Wireless Device window, clicking *OK* will immediately bring-up the Edit Inventory Item window, where you can edit information for the device. If multiple devices are selected, they will have to be edited individually.

Edit a selected inventory item by click *Edit*. This will bring-up the Edit Inventory Item window where you can edit the information for the inventory item.

You can remove one or more selected items by clicking *Remove*.

Group

This contains a list of inventory groups that have been created by the user. Click the *Add* button associated with the *Group* list to insert a new group into the list and bring-up the Edit Group Name Window. Likewise, you can *Edit* or Remove selected groups by clicking the *Edit* and *Remove* buttons, respectively.

Group Inventory

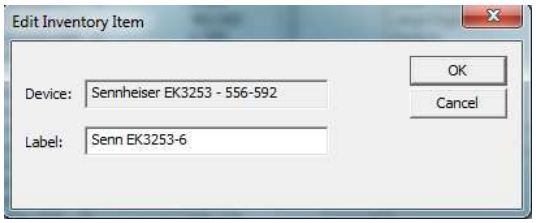
This list shows all of the inventory items that have been added to the currently selected Group. To add inventory items to a group:

1. Select the desired group in the *Group* list.
2. Select the items in the Inventory list that you wish to add to the selected group.
3. Click the >> button.

As inventory items are added to a group, they appear grayed-out in the *Inventory list* when that group is selected, and cannot be added to the same group again. An inventory item can belong to multiple groups.

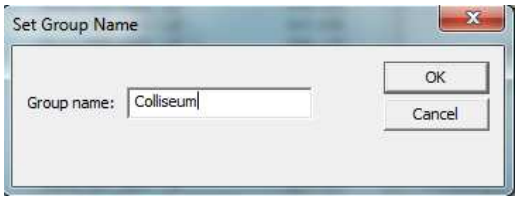
Remove inventory items from the group by first selecting the items in the *Group Inventory* list and then clicking the << button.

Edit Inventory Item Window



Enter a Label for the added/selected device in the *Inventory* list of the Wireless Inventory Window. Then click *OK*. This label can be anything you like and will be used to identify the inventoried wireless device in the Inventory Tab of the Wireless Inventory Panel as well as in the Frequency Plot. If *Label* is left blank, the Device name will be used.

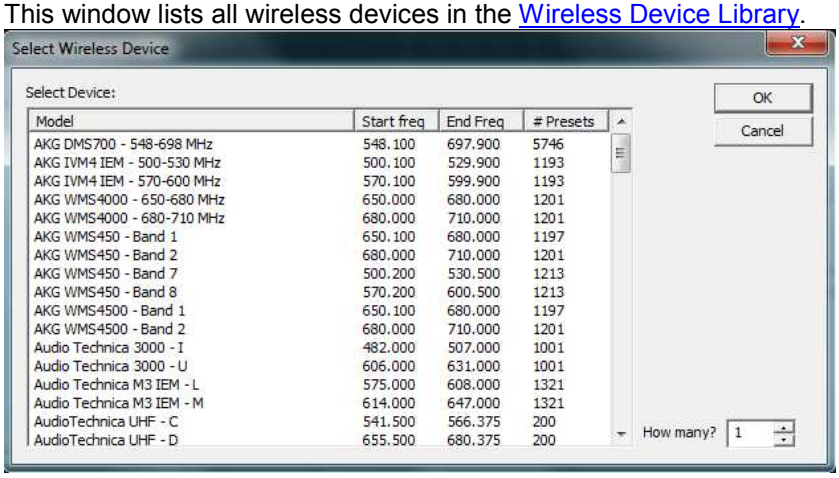
Edit Group Name Window



Enter a group name for the added/selected group in the *Group* list of the Wireless Inventory Window. This name will be displayed in the Inventory Groups Tab of the Wireless Inventory Panel.

Select Wireless Device Window

This window lists all wireless devices in the Wireless Device Library.



Model	Start freq	End Freq	# Presets
AKG DMS700 - 548-698 MHz	548.100	697.900	5746
AKG IVM4 IEM - 500-530 MHz	500.100	529.900	1193
AKG IVM4 IEM - 570-600 MHz	570.100	599.900	1193
AKG WMS4000 - 650-680 MHz	650.000	680.000	1201
AKG WMS4000 - 680-710 MHz	680.000	710.000	1201
AKG WMS450 - Band 1	650.100	680.000	1197
AKG WMS450 - Band 2	680.000	710.000	1201
AKG WMS450 - Band 7	500.200	530.500	1213
AKG WMS450 - Band 8	570.200	600.500	1213
AKG WMS4500 - Band 1	650.100	680.000	1197
AKG WMS4500 - Band 2	680.000	710.000	1201
Audio Technica 3000 - I	482.000	507.000	1001
Audio Technica 3000 - U	606.000	631.000	1001
Audio Technica M3 IEM - L	575.000	608.000	1321
Audio Technica M3 IEM - M	614.000	647.000	1321
AudioTechnica UHF - C	541.500	566.375	200
AudioTechnica UHF - D	655.500	680.375	200

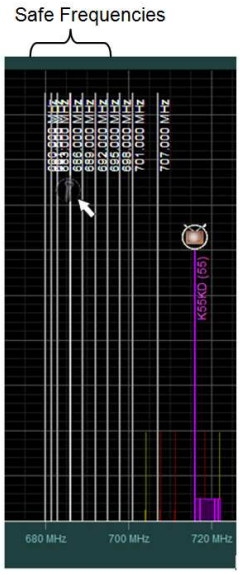
Select one or more wireless devices to be added to the user's inventory. If only one device is selected, specify how many devices of that type to add in the *How Many?* field.

Wireless Device Library Tab

Model	Start freq	End Freq	# Presets
AKG DMS700 - 548-698 MHz	548.100	697.900	5746
AKG IVM4 IEM - 500-530 MHz	500.100	529.900	1193
AKG IVM4 IEM - 570-600 MHz	570.100	599.900	1193
AKG WMS4000 - 650-680 MHz	650.000	680.000	1201
AKG WMS4000 - 680-710 MHz	680.000	710.000	1201
AKG WMS450 - Band 1	650.100	680.000	1197
AKG WMS450 - Band 2	680.000	710.000	1201
AKG WMS450 - Band 7	500.200	530.500	1213
AKG WMS450 - Band 8	570.200	600.500	1213
AKG WMS4500 - Band 1	650.100	680.000	1197
AKG WMS4500 - Band 2	680.000	710.000	1201
Audio Technica 3000 - I	482.000	507.000	1001
Audio Technica 3000 - U	606.000	631.000	1001
Audio Technica M3 IEM - L	575.000	608.000	1321
Audio Technica M3 IEM - M	614.000	647.000	1321
AudioTechnica UHF - C	541.500	566.375	200
AudioTechnica UHF - D	655.500	680.375	200

This tab lists all of the devices in the Wireless Device Library. Select the devices you wish to add to the Frequency Plot and click the *Assign* button. Wireless devices of the selected types are then added to the Frequency Plot—their frequencies automatically selected to avoid existing transmitters and any intermodulation interference.

Alternatively to clicking the *Assign* button, the selected items can be dragged with the mouse directly into the plot. If a single device is dragged, the plot offers a number candidate "safe" (unused) frequencies from which the user can choose to drop the device on.



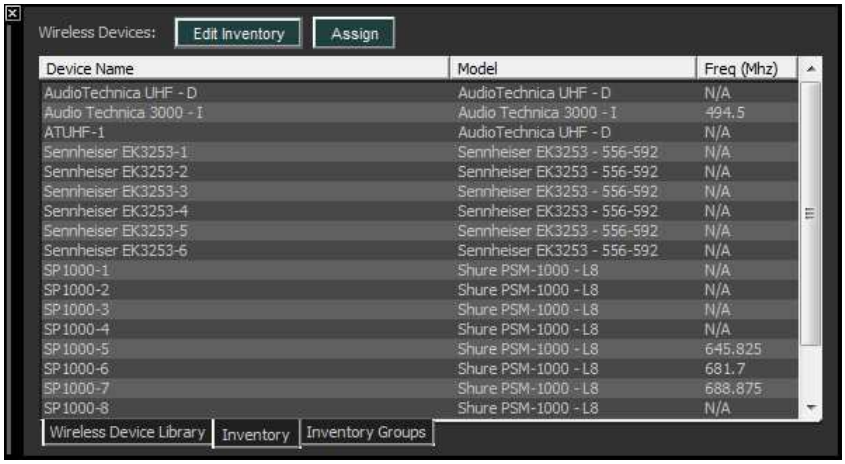
You can add as many wireless devices from the library to the frequency plot as you like as long as there is a safe place to put it. If there are not enough unused frequencies to accommodate all of the selected devices, the Auto-Assign Results Window will appear, listing all of the devices that could not be added to the plot.

To remove a wireless device from the Frequency Plot, right-click on the icon of the desire devices and select *Unassign*.

Adding Wireless Devices to Inventory from Frequency Plot
You can add wireless devices added to the Frequency Plot from this tab can be quickly added to the user's Wireless Inventory by clicking *Add To Inventory*. All wireless device library devices are automatically converted into inventory items. To add only selected devices in the plot, first select the desire frequencies in the plot (click on their icons in the plot window while holding down the Ctrl key) and then click *Add To Inventory.*

For more information about interacting with wireless devices in the plot, see Frequency Plot.

Inventory Tab



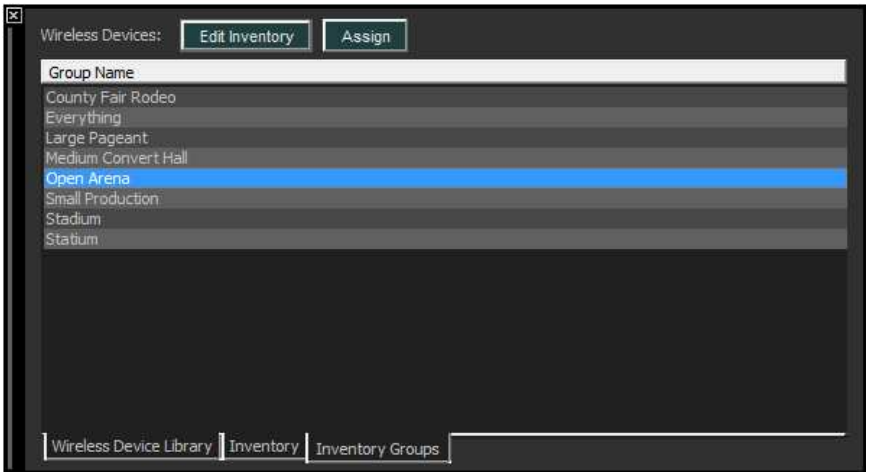
This tab lists all of the devices in the users Wireless Inventory. It functions similarly to the Wireless Device Library Tab in that you can add selected inventory items to the plot by either dragging them onto the plot or by clicking *Assign*. Similarly, single items dragged over are offered multiple candidates frequencies for the user to choose from.

The main difference is that wireless device from the inventory list can only be assigned once per location. Once assigned, the *Freq (MHz)* column in the *Inventory* list shows the frequency that inventory item was assigned to. If no assignment has been made, the column will show "N/A".

If already-assigned devices are selected, the *Unassign* button will replace the *Assign* button and can be clicked to remove selected wireless devices from the Frequency Plot.

If there are not enough unused frequencies to accommodate all of the selected devices, the Auto-Assign Results Window will appear, listing all of the devices that could not be added to the plot.

Inventory Groups Tab

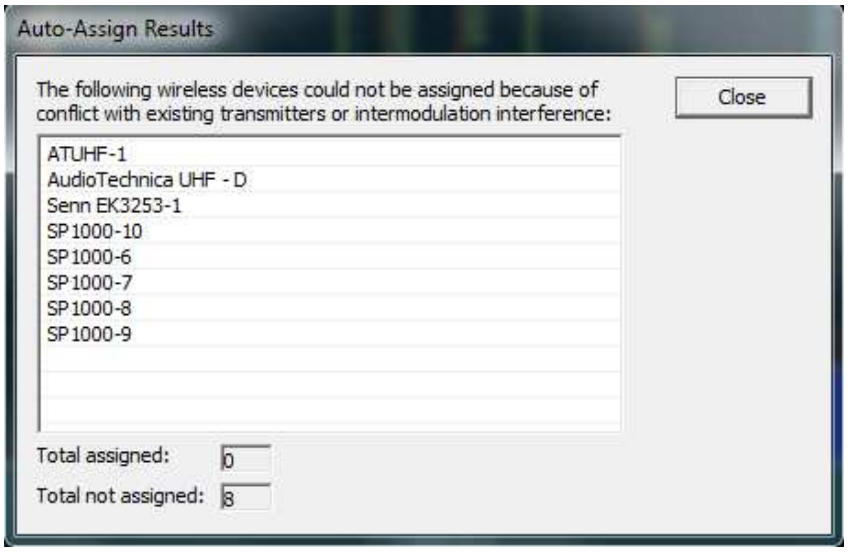


Shown here are all of the Inventory Groups that have been created and assigned inventory items. This tab offers a simple way to automatically add multiple groups of inventory items to the plot at once—either by dragging selected groups or by clicking *Assign*.

Once assigned, Inventory Groups cannot be unassigned directly. Inventory items in groups must be individually removed from the Inventory tab.

If there are not enough unused frequencies to accommodate all of the devices in the selected groups, the Auto-Assign Results Window will appear after *Assign* has been clicked, listing all of the devices that could not be added to the plot.

Auto-Assign Results Window



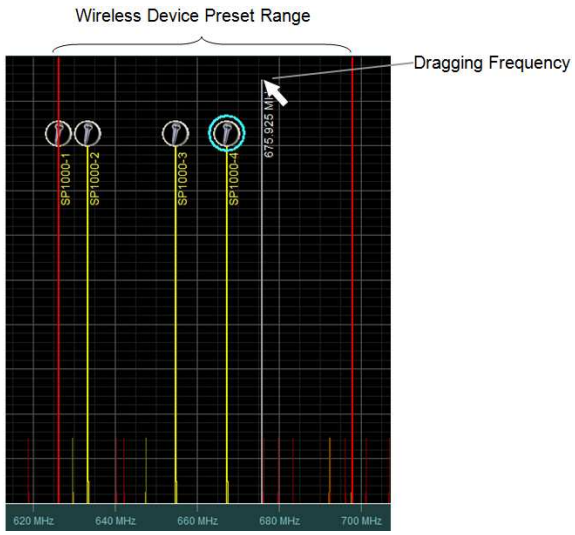
This window lists all of the wireless devices that could not be added to the Frequency Plot when an attempt was made to do so in the Wireless Inventory Panel. A wireless device cannot be assigned if a frequency preset cannot be found that meets all the following criteria:

1. Does not conflict with existing transmitter (TV, wireless or other).
2. Does not conflict with any intermodulation interference.
3. If added, the resulting intermodulation interference will not conflict with already assigned wireless devices.

Overriding Frequency Plot Candidate Selection

Sometimes it may be desired to 'force' a wireless transmitter onto a desire preset frequency regardless of any resulting conflict. This can be done by holding down the Control key on the computer keyboard while selecting a device from the Wireless Inventory Panel or from the Frequency Plot itself and dragging it to a new location on the plot.

Rather than offer a selection of candidate frequencies, a single white bar is shown that follows the mouse cursor.



Two red bars represent the frequency range of the selected wireless device. As long as the device is dropped within that range, it will automatically snap to a frequency that is a valid preset for that device. If dropped outside of the range, a warning icon is placed above the transmitter on the plot to indicate that it is does not reside on a standard frequency preset.

All other considerations are ignored. Therefore is very possible that conflicts will result when the wireless device is dropped into its new location. All wireless device frequency conflicts are marked by an alert icon and listed in the *Conflicts* list of the Status Panel.

Status Panel

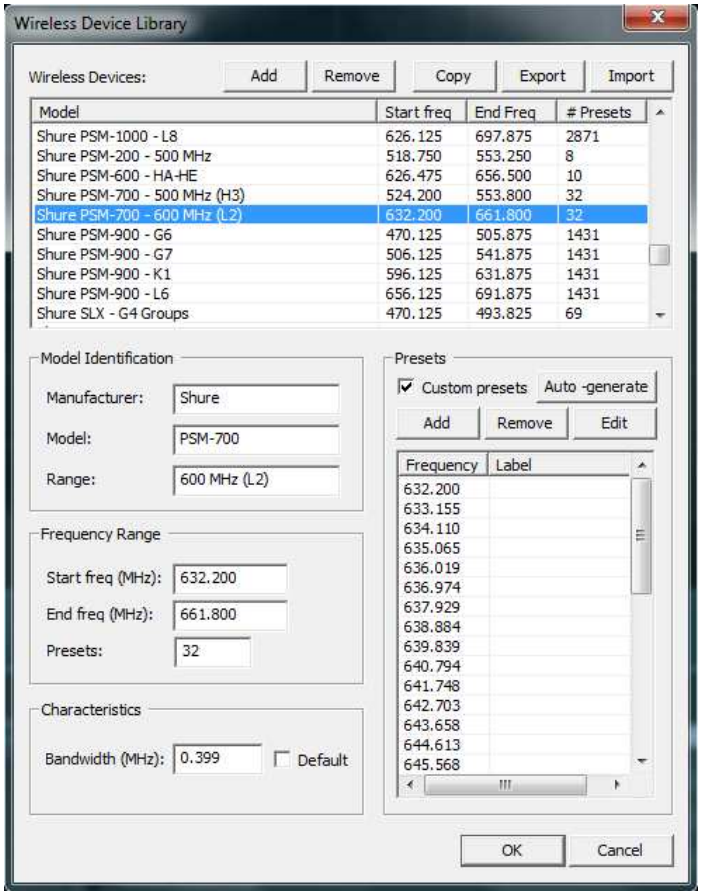
The status panel provides real-time, updated information of the following:

Field	*Description*
RF congestion	This represents the ratio of used bandwidth divided range for the currently displayed range in the Frequency Plot. It's intended to give the user an idea on how much interference potential is present in the displayed range. Calculations includes all transmitters and intermodulation products.
Mouse at	While the mouse cursor is hovering over the Frequency Plot, this field displays the cursors current position as a frequency in MHz.
Conflicts	This list chows all wireless transmitter conflicts that currently exist at the currently selected location. A *wireless transmitter conflict* occurs when a wireless transmitter's frequency occupies part or all of the same frequency space as another transmitter (TV, wireless, etc…) or a calculated intermodulation product. In the normal course of adding wireless transmitter to the Frequency Plot (see Wireless Inventory Panel), RF Intermod Pro automatically makes sure that conflicts do not happen. However, if addition TV channels/stations are added *after* wireless devices have been added to the plot, it is possible that the additional transmitters will generate new conflicts, either directly or through the generation of new intermodulation products. All detected conflicts are listed here. Click on a conflict to select it in the Frequency Plot and selected it.

Wireless Device Library Window

RF Intermod Pro includes a library of commonly used wireless devices from a variety of different manufacturers. This library includes information about each device that is required to perform necessary calculations as frequency assignments are made.

If you are using a wireless device that is not included in the distributed library, you can use this window to add it to the library.



The *Wireless Devices* list shows all of the devices contained in the library, along with its frequency range and number of presets. Click on *Add* to insert a new device into the library and then fill in the following device parameter information:

Device Parameter	*Description*
Model Identification	Includes the *Manufacturer*, *Model* and *Range* of the device. This information is for display purposes only and is not included in any type of calculation.
Frequency Range	Enter the *Start* and *End* frequencies of the wireless device as well as the number of frequency *Presets* the device provides.
Characteristics	Enter the *Bandwidth* of the device. This represents how much frequency space a single preset occupies and is used in wireless conflict calculations. Check the Default box if you wish this value to be taken from the Transmitters Tab of the RF Intermod Pro Settings Window.

Wireless Device Presets
Presets are the discrete frequency values a wireless device can be setup to transmit on. Preset information on the currently selected Wireless Device can be edited in the *Preset* fields.

Custom Vs. Non-custom Presets
There are two ways to specify presets for your wireless device. *Custom* presets are entered one frequency at a time as described below. *Non-custom* presets are automatically determined as a function of the devices frequency range (End freq – Start freq) and the number of presets.

The *Custom presets* checkbox lets you choose how presets for the selected device are to be treated. Leave this box *unchecked* if you want presets to be determined automatically. Check it if you wish to enter the presets manually.

Wireless devices with more than 50 or so presets usually have frequency presets evenly dispersed across the devices frequency range and can be calculated mathematically. Devices with fewer presets may have preset frequencies that are not evenly dispersed and must be setup manually.

If you are not certain how your wireless device divides up presets, check the *Custom presets* box and enter them in manually.

Manually Entering Custom Presets
To manually enter presets, you must first make sure that the *Custom presets* box is checked. Otherwise the *Preset* controls are all disabled.

To add a new preset, click the *Add* button. This will bring-up the Edit Device Preset window, where you can enter a frequency and label for the new preset. The label you enter can be anything you want, though it's likely that the user's manual for the wireless device will provide preset labels for you.

You can also edit the selected (already entered) preset or delete one or more presets by clicking on the Edit and Remove buttons, respectively.

Auto-Generating Custom Presets
Entering in a lot of custom presets can be tedious. Fortunately, another tool is provided to help out. Click on the *Auto-generate* button, and the same mathematical formula used for non-custom presets is applied to automatically populate the custom preset list. Now all you need to do is enter labels, if desired. Always verify the presets generated this way, comparing them with what is in the wireless device's user's manual.

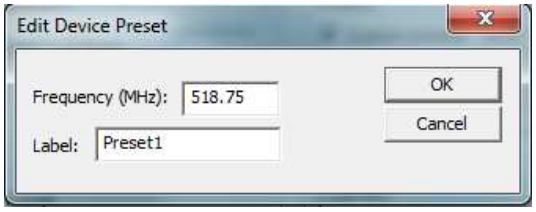
Copying Wireless Devices
If you wish to add a wireless device that is very similar to one that is already in the database, select the similar device in the *Wireless Devices* list and click *Copy*. A copy of the selected device is added to the list and automatically selected so that you can make any necessary changes to it.

Exporting & Importing Wireless Devices
RF Intermod Pro makes it easy to share wireless devices you have added to your library with other users. Simply select the devices you wish to share and click *Export*. Enter the name of the file you would like to export to and click *Save*.

To load an exported wireless device file into your library, click Import. Then select the file you would like to import and click *Open*. The imported files are immediately added to your *Wireless Devices* list.

If the imported file contains any wireless devices that already exist in your library, they will be ignored so that duplicate entries are avoided.

Edit Device Preset Window

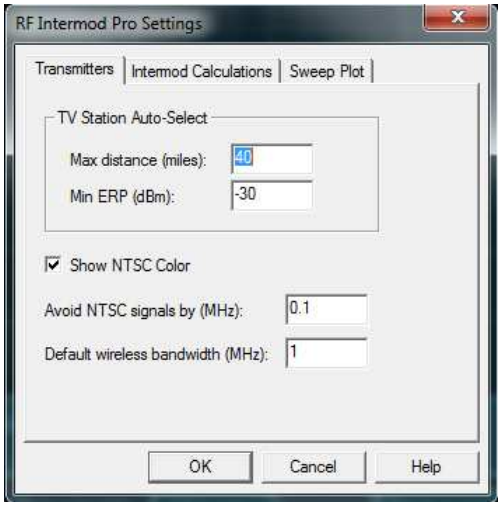


Enter the frequency and Label for a preset in the Wireless Device Library window.

RF Intermod Pro Settings Window

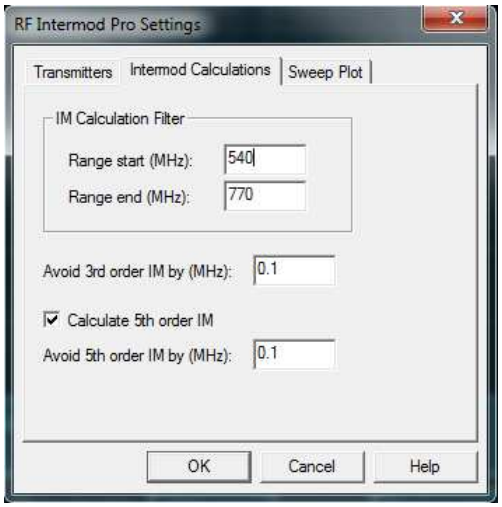
This window gives access to a variety of settings to configure the behavior of RF Intermod Pro. These settings are saved automatically.

Transmitters Tab



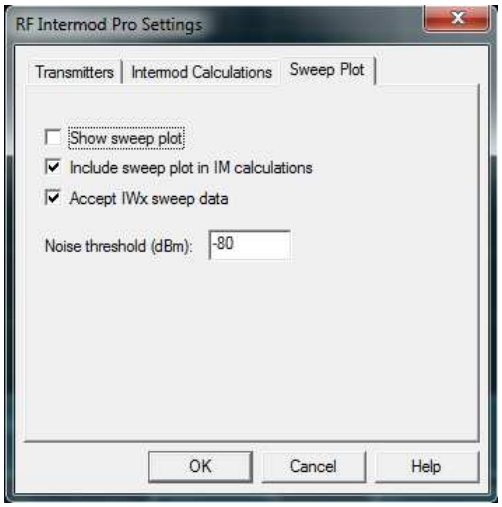
Field	*Description*
Max distance (miles)	This is the value used by the Location Panel to determine which TV stations are displayed in the TV Stations Tab. TV Stations in the FCC database must be this distance or less from the longitude/latitude of the currently selected location to appear on the list.
Min ERP (dBm)	The minimum Effective Radiated Power value is used to determine which stations in the TV Stations tab list are automatically checked as potential interference hazards. Stations with an ERP (relative to the current longitude/latitude) equal to or greater than this value are automatically checked in the list.
Show NTSC Color	Check this box if you wish to include the chrominance carrier of NTSC TV transmitters in intermodulation calculations.
Avoid NTSC signals by (MHz)	Specify the half-bandwidth of NTSC frequencies that is used to identify conflicts.
Default wireless bandwidth (MHz)	If a device in the Wireless Device Library has the default bandwidth specified (rather than an actual value), then this is the bandwidth that will be used for that device in all calculations.

Intermod Calculations Tab



Field	*Description*
Range start (MHz) ***Range end (MHz)***	Specifies the start and end frequencies of a frequency window for the intermod calculation filter. The following applies: 1. All transmitters outside this range are ignored in all calculations. 2. No intermodulation products are calculated outside of this range. This window is shown graphically in the Frequency Plot.
Avoid 3rd order IM by (MHz)	Specify the half-bandwidth of all 3rd order intermodulation products. This is used to identify conflicts with wireless devices.
Calculate 5th order IM	Check this box if you wish to calculate 5th order intermodulation products in addition to 3rd order products.
Avoid 5th order IM by (MHz)	Specify the half-bandwidth of all 5th order intermodulation products. This is used to identify conflicts with wireless devices.

Sweep Plot Tab



Field	*Description*
Show sweep plot	Check this plot if you wish to display sweep data in the Frequency Plot and include it for conflict calculations (see also Importing Sweep Data).
Include sweep plot in IM calculations	Sweep plots can be used in both frequency conflict and intermod calculations. Check this box if you wish to exclude the plot from intermod calculations.
Accept IWx sweep data	If you are running the Invisible Wave RF Command Center software on the same computer that is running RF Intermod Pro, it will detect RF Intermod Pro and send sweep data as it is received. Check this box if you wish RF Intermod Pro to accept the sweep data as it comes in. (requires Invisible Wave X 1.1 or above).
Noise threshold (dBm)	This value is used to determine a signal level at which the sweep data should be considered as potential interference hazards. This is used for conflict detection and intermod calculations.

Reports

RF Intermod Pro offers the following 'save to file' reports which can be viewed using MS Notepad or most any text editor. To generate a report, select (from the main menu) *Files→Reports*, and then select one of the following reports:

Report	*Description*
Transmitter Assignments	Lists all wireless transmitters that have been added to the Frequency Plot along with its assigned frequency and preset setting (if available).
Inventory	Lists all wireless devices in the user inventory. Includes device type, user-given name, range and number of presets.
Inventory Groups	Show the same information as the inventory report, but divided by inventory groups.

Transmitter Assignments Report

Below is a sample of the Transmitter Assignments report. This report is generated from the main menu by selecting *Files→Reports→Transmitter Assignments*.

```
*****************************************
RF Intermod Pro Transmitter Assignment Report
*****************************************
Date: 10/25/12
Location: AVU Ballroom

Transmitter                                    Frequency          Setting
---------------------------------------------  -----------------  ----------------
AKG DMS700 - 548-698 MHz (548.1 MHz)           548.100 MHz        N/A
AKG IVM4 IEM - 500-530 MHz (500.1 MHz)         500.100 MHz        N/A
AKG WMS4000 - 680-710 MHz (701 MHz)            701.000 MHz        N/A
AKG WMS450 - Band 2 (683 MHz)                  683.000 MHz        N/A
AKG WMS450 - Band 7 (503.225 MHz)              503.225 MHz        N/A
AKG WMS450 - Band 8 (599.725 MHz)              599.725 MHz        N/A
AKG WMS4500 - Band 1 (726.169 MHz)             726.169 MHz*       N/A
AKG WMS4500 - Band 2 (707 MHz)                 707.000 MHz        N/A
Audio Technica 3000 - I                        494.500 MHz        N/A
Audio Technica 3000 - I (484.5 MHz)            484.500 MHz        N/A
Audio Technica 3000 - U (611 MHz)              611.000 MHz        N/A
Audio Technica M3 IEM - L (604.7 MHz)          604.700 MHz        N/A
Audio Technica M3 IEM - M (618.95 MHz)         618.950 MHz        N/A
AudioTechnica UHF - C (543.375 MHz)            543.375 MHz        N/A
SP1000-5                                       645.825 MHz        N/A
SP1000-6                                       681.700 MHz        N/A
SP1000-7                                       688.875 MHz        N/A


Total assigned devices: 17

('*' indicates a non-supported frequency preset)
```

Inventory Report

Below is a sample of the Inventory report. This report is generated from the main menu by selecting *Files→Reports→Inventory*.

```
************************************************
RF Intermod Pro Wireless Device Inventory Report
************************************************
Date: 10/20/12

Device                                  Label                           Range (MHz)      Presets
--------------------------------------  ------------------------------  ---------------  --------
AKG WMS4000 - 650-680 MHz               AKG WMS4000-1                   650.000-680.000  1201
Audio Technica 3000 - I                 Audio Technica 3000 - I         482.000-507.000  1001
AudioTechnica UHF - D                   ATUHF-1                         655.500-680.375  200
AudioTechnica UHF - D                   AudioTechnica UHF - D           655.500-680.375  200
Sennheiser EK3253 - 556-592             Senn EK3253-1                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-2                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-3                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-4                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-5                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-6                   556.000-592.000  7201
Shure PSM-1000 - L8                     SP1000-1                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-10                       626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-2                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-3                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-4                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-5                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-6                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-7                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-8                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-9                        626.125-697.875  2871


Total inventory devices: 20
```

Inventory Groups Report

Below is a sample of the Inventory Groups report. This report is generated from the main menu by selecting *Files→Reports→Inventory Groups*.

```
******************************************************
RF Intermod Pro Wireless Device Inventory Group Report
******************************************************
Date: 10/20/12


*** Group: Large Pageant ***
Device                                  Label                           Range (MHz)      Presets
--------------------------------------  ------------------------------  ---------------  --------
Sennheiser EK3253 - 556-592             Senn EK3253-1                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-2                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-3                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-4                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-5                   556.000-592.000  7201
Sennheiser EK3253 - 556-592             Senn EK3253-6                   556.000-592.000  7201
Shure PSM-1000 - L8                     SP1000-1                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-2                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-3                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-4                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-5                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-6                        626.125-697.875  2871

Total devices in group:  12


*** Group: Small Production ***
Device                                  Label                           Range (MHz)      Presets
--------------------------------------  ------------------------------  ---------------  --------
Shure PSM-1000 - L8                     SP1000-1                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-2                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-3                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-4                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-5                        626.125-697.875  2871

Total devices in group:  5


*** Group: Stadium ***
Device                                  Label                           Range (MHz)      Presets
--------------------------------------  ------------------------------  ---------------  --------
Audio Technica 3000 - I                 Audio Technica 3000 - I         482.000-507.000  1001
AudioTechnica UHF - D                   ATUHF-1                         655.500-680.375  200
AudioTechnica UHF - D                   AudioTechnica UHF - D           655.500-680.375  200
Shure PSM-1000 - L8                     SP1000-1                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-2                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-3                        626.125-697.875  2871
Shure PSM-1000 - L8                     SP1000-4                        626.125-697.875  2871

Total devices in group:  7


Total inventory groups:  3
Total inventory devices: 7
```

Exporting Transmitter Assignments

This is and example of how an exported Transmitter Assignments file would look when loaded into MS Excel. Export Transmitter Assignments from the main menu by selecting *Files→Export→Transmitter Assignments*.

	A	B	C
1	Device Name	"Frequency (MHz)"	"Bandwidth (MHz)"
2	Audio Technica 3000 - I (484.5 MHz)	484.5	1
3	Audio Technica 3000 - I	494.5	1
4	AKG IVM4 IEM - 500-530 MHz (500.1 MHz)	500.1	0.399
5	AKG WMS450 - Band 7 (503.225 MHz)	503.225	0.299
6	AudioTechnica UHF - C (543.375 MHz)	543.375	1
7	AKG DMS700 - 548-698 MHz (548.1 MHz)	548.1	1
8	AKG WMS450 - Band 8 (599.725 MHz)	599.725	0.299
9	Audio Technica M3 IEM - L (604.7 MHz)	604.7	0.399
10	Audio Technica 3000 - U (611 MHz)	611	1
11	Audio Technica M3 IEM - M (618.95 MHz)	618.95	0.399
12	SP1000-5	645.825	0.374
13	SP1000-6	681.7	0.374
14	AKG WMS450 - Band 2 (683 MHz)	683	0.299
15	SP1000-7	688.875	0.374
16	AKG WMS4000 - 680-710 MHz (701 MHz)	701	1
17	AKG WMS4500 - Band 2 (707 MHz)	707	0.299
18	AKG WMS4500 - Band 1 (726.169 MHz)	726.169	0.299

Importing Sweep Data

RF Intermod Pro can import a stream of Frequency vs. dBm data created by other software, display it in the Frequency Plot, and even use it for intermodulation calculations. The imported data file must be in a comma-separated value format and have a ".csv" file extension. Each line of the file contains a single frequency and dBm value pair. Example:

```
397.958, -119
398.146, -117.2
398.333, -118.5
```
etc…

To import the sweep data file from the main menu, select *Files→Import→Sweep Data*. Select the desired sweep data file in the file browser and click *Open*. The imported sweep data is displayed

in green, overlaid into the Frequency Plot. To enable/disable the display of sweep data, use the  button in the main toolbar.

How RF Intermod Pro Uses Sweep Data
RF Intermod Pro analyses sweep data to identify potential interference hazards and includes that information in wireless device frequency conflict calculations. It also identifies peaks (indicated in the Frequency Plot by *peak markers*) and uses them when calculating intermodulation products. For more information on this process, see Sweep Plot Tab in the RF Intermod Pro Settings Window.

Display Data from Invisible Waves X Software

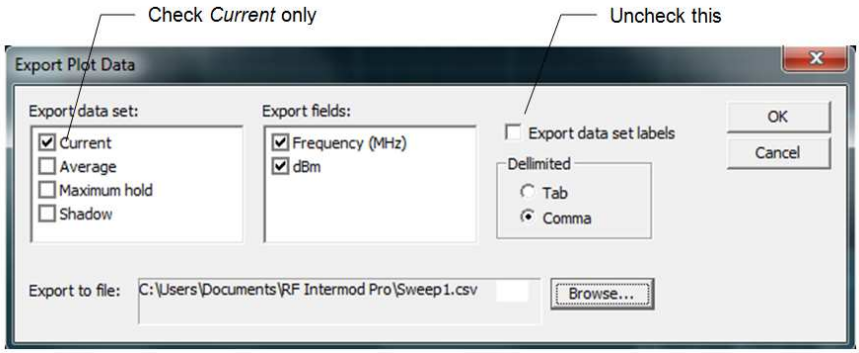
RF Intermod Pro integrates seamlessly with the Invisible Waves X software, offering two ways to obtain that data:

- Import spectral sweep plots exported by Invisible Waves X.
- Real-time display of sweep plot data from Invisible Waves X.

Exporting Sweep Plots from Invisible Waves X Software

The Invisible Waves X software can export ".csv" files that can be imported into the Frequency Plot.

1. Export a ".csv" file of a plot from the Invisible Waves X Spectral Trace View. Consult the Invisible Waves X manual for information on how to do this. In the *Export Plot Data* window, be sure to export only the *Current* plot in the data set and uncheck the *Export data set labels* box. Your settings should look like this:



2. Import file into the Frequency Plot (see Importing Sweep Data).

Real-time Updates from Invisible Waves X Software

If you are running *the Invisible Wave RF Command Center* software on the same computer that is running *RF Intermod Pro*, it will detect RF Intermod Pro and send sweep data as it is received. Enable/disable this feature by clicking on the  button on the main toolbar. Also be sure to enable the displaying of sweep data in the Frequency Plot by clicking on the  button in the main toolbar. See also Importing Sweep Data for more information on displaying sweep data.

(Note: this feature requires Invisible Waves X 1.1 or above).