

## Limit Lines (advanced)

An advanced and powerful tool in the spectrum analyzer Windows application is the ability to work with Minimum and Maximum Limit Lines. These are fully configurable, visual and optionally audible alarm feature with multi-data point lines to determine power limits.

This feature enable these following workflows:

- Fully characterize transmission from a source to guarantee it is within required ranges.
  - An example could be a HAM operator who want to be alerted if the transmitter is going beyond certain power levels, or below certain power level. Additionally, the multi-data point shape can alert the operator if the transmission frequency drift beyond allowable limits.
  - Other example could be a RC FPV pilot who need to guarantee the application quickly alarms when the received Video signal is lower than required level to guarantee reliable operation.
- Alert anytime the environment changes beyond margins.
  - An example could be a Sound Engineer who require certain spectrum areas to be lower noise than certain threshold in order to avoid intermodulation problems with selected wireless microphone channels. If this condition is not met anytime, a visual and optionally audio alarm can alert of this problem.
  - Other example is an EMI test where threshold RF emission is defined by regulations. In this case, a set of limit lines will indicate if the EMI noise is beyond allowable margins at any point in the defined frequency range.

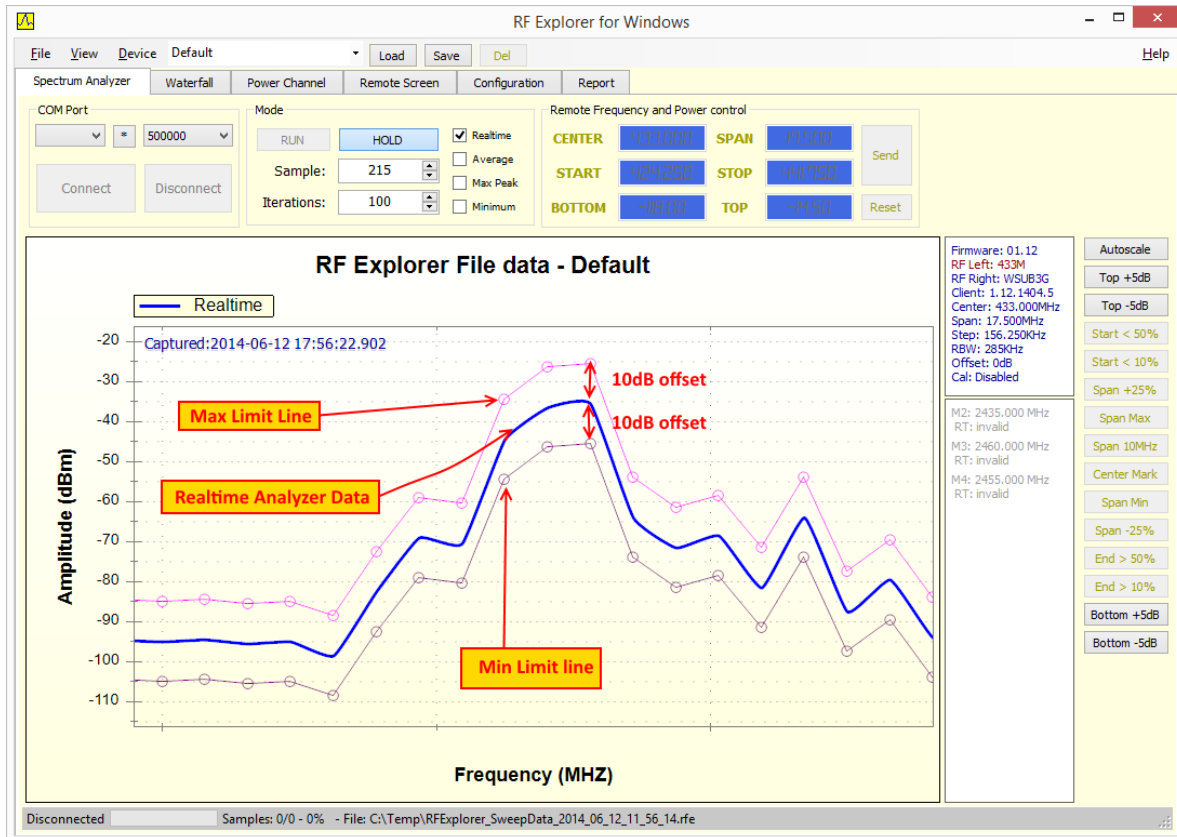
The Limit Lines can be easily generated from with an offset from a currently selected signal trace, or for maximum flexibility, created and modified by hand on simple CSV files.

Note: Limit Lines are fixed thresholds, and only one pair of Max / Min limit lines can be specified at a time. Different limit lines can be loaded from file or generated from signal trace anytime.

## Limit line types

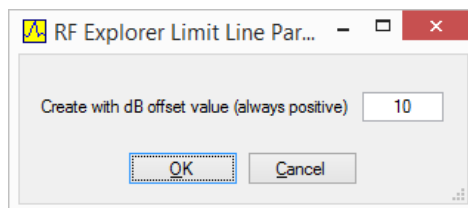
Max and Min limit lines are available.

Max line will alert whenever the signal goes higher than limit line, whereas Min line will alert when the signal goes lower than limit line.



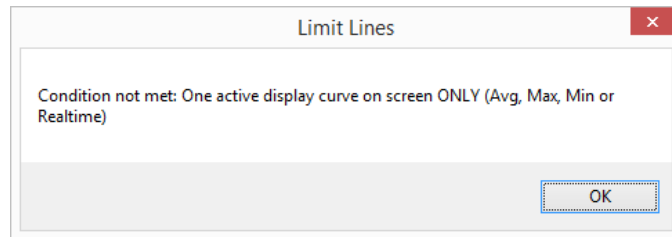
## Creating Limit Lines

In the example image, the Max and Min limit lines were generated from the analyzer data trace, with 10dB offset for Max and Min. To create a Max line like this, use the menu *View -> Limit Lines -> Build from signal -> Max...* and then specify 10dB. Any (positive) value can be specified.



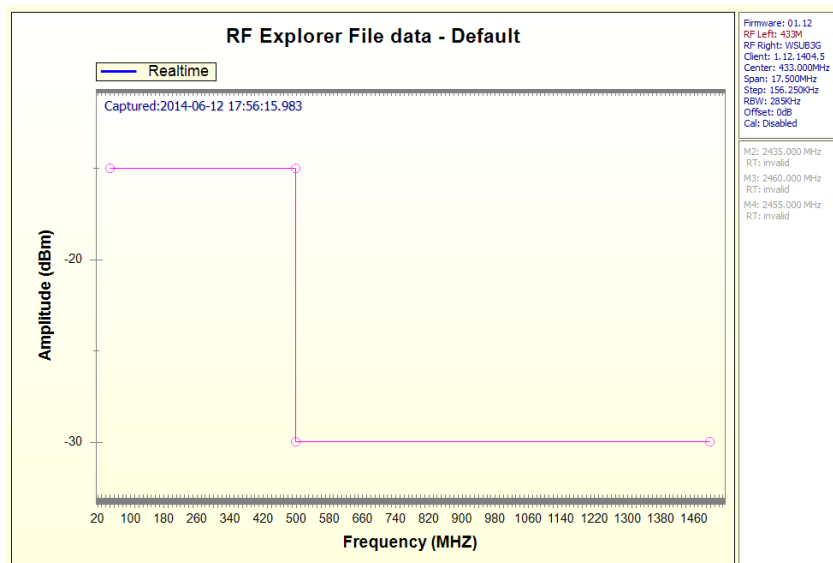
Similarly, to create a Min line use the menu *View -> Limit Lines -> Build from signal -> Min...* Any (positive) value can be specified.

Important: the analyzer graph allows for multiple trace types such as Average, Realtime, etc. In order to use Limit Lines, the analyzer must be configured to use only one signal trace, otherwise it would be ambiguous to know which one is the signal trace to be monitored. Therefore, if this condition is not met, the application will report a message like the one below. To resolve the issue, just select one trace only.



Limit lines can be saved and read to and from limit line files. Use the menu *View -> Limit Lines -> Save to File* and *View -> Limit Lines -> Read from File*.

A different way to create a limit line is by direct manipulation of a CSV file with extension .rfl. For instance you can easily create a limit line file, named MaxThresoldMic25.rfl with a fixed threshold of -15dBm from 50-500MHz and -30dBm from 500-1500MHz.



```
--RFEL01
--Above definition is required to identify the file, then add
--any further comment line this anywhere in the file
50.0      -15.0
500       -15.0
500       -30.0
1500      -30.0
```

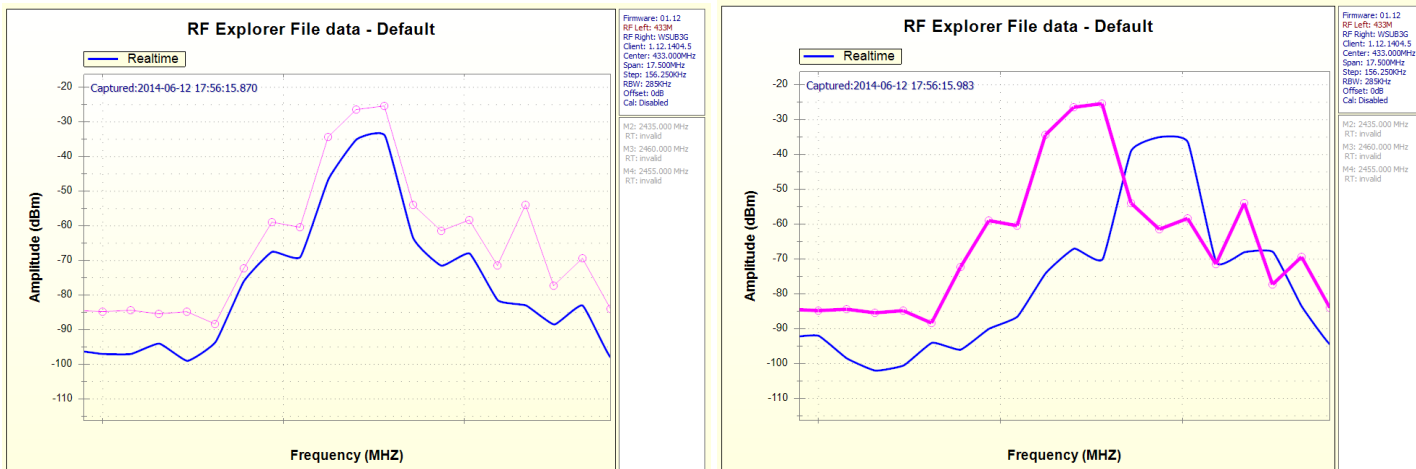
Any text editor (such as Notepad) can be used. The first parameter on each line is the frequency of the limit line data point, and the second parameter is the amplitude in dBm. Valid separation between parameters are blanks and tabs, or a combination of both.

The limit line file may have any number of data points.

## Using limit lines

Once a limit line is configured, it will alert on screen anytime the condition is not met. In that case, the limit line will change from thin line to a thick line, and an audio alarm will optionally sound if configured, for as long as the condition is not met.

In the example below, the trace is initially ok but later drift off frequency and visible thick Max line is displayed.



To enable or disable audio alarm, use the menu **View -> Limit Lines -> Sound Alarm**.

*Note: The alarm sound type is preconfigured, but can be easily customized by replacing the file notify.wav from the RF Explorer application data folder (%appdata%\roaming\rfexplorer). The file can be any valid .wav file. The minimum duration of the audio alarm is that of the duration of the .wav sound file.*

## Amplitude units

RF Explorer default configuration display signal power values in dBm (decibel per milliwatt). The device itself can be configured to alternatively display dBm or dBuV (decibel per microvolt over a 50ohm load).

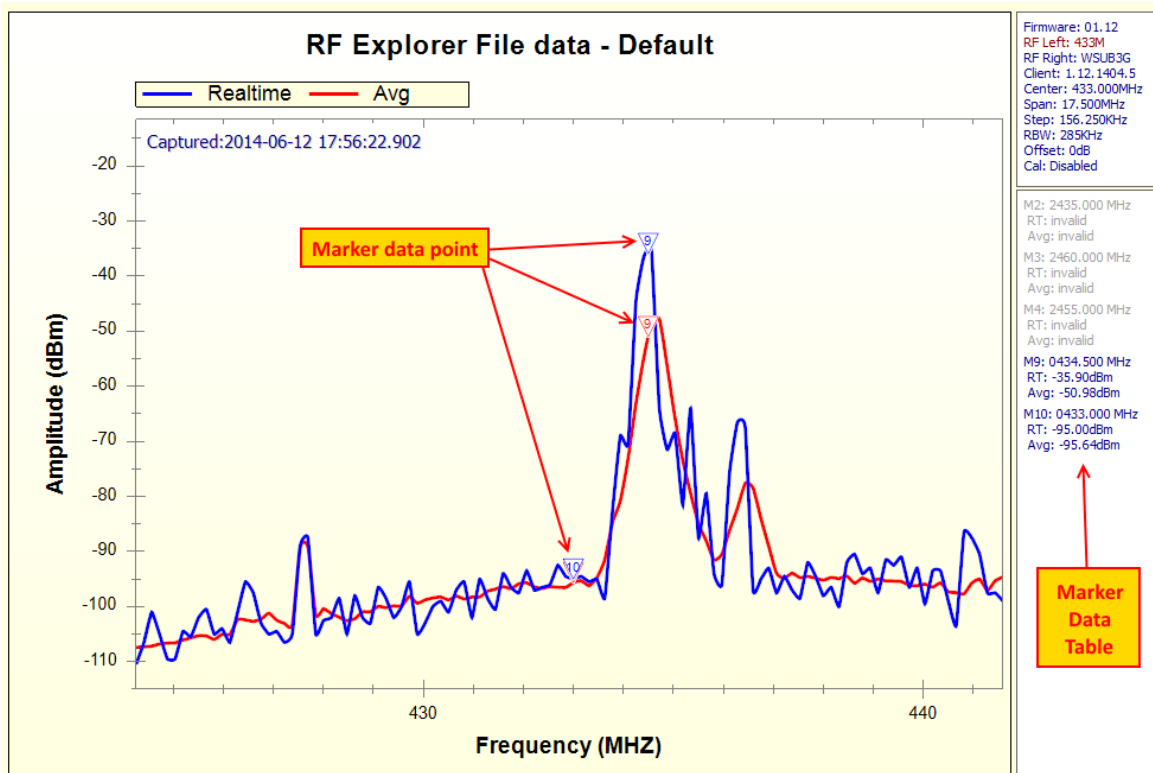
The RF Explorer for Windows can be configured to display dBm, dBuV and also Watt. The amplitude values are used for the vertical Y scale, as well as all markers on screen. Use the menu *View -> Amplitude Units* to select the desired unit.

*Note: the unit selected in the device is independent from the unit selected in the Windows application.*

## Markers

RF Explorer for Windows can display up to 10 markers on screen. This powerful feature is persisted on the *named configuration settings*, enabling easy marker setups for different measurements with a single click.

Markers display amplitude and frequency values on the marker data table.

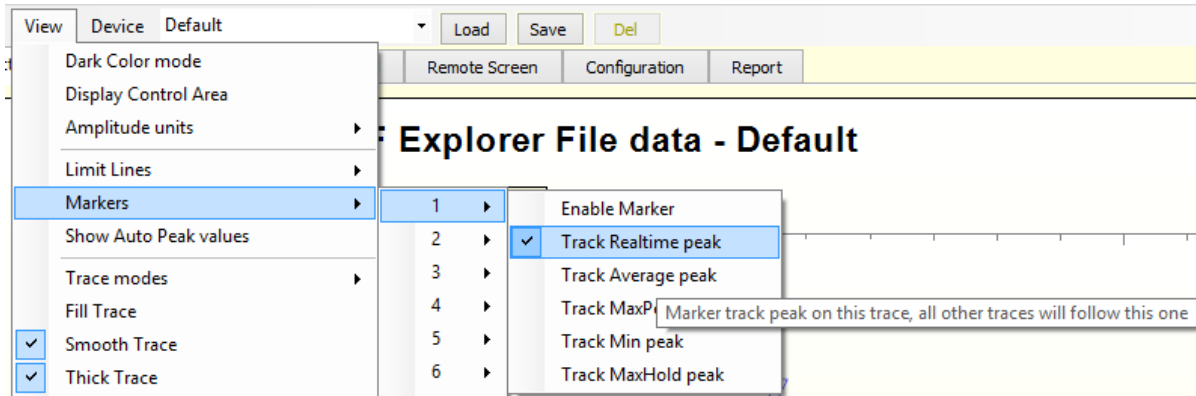


## Auto Peak track Marker 1

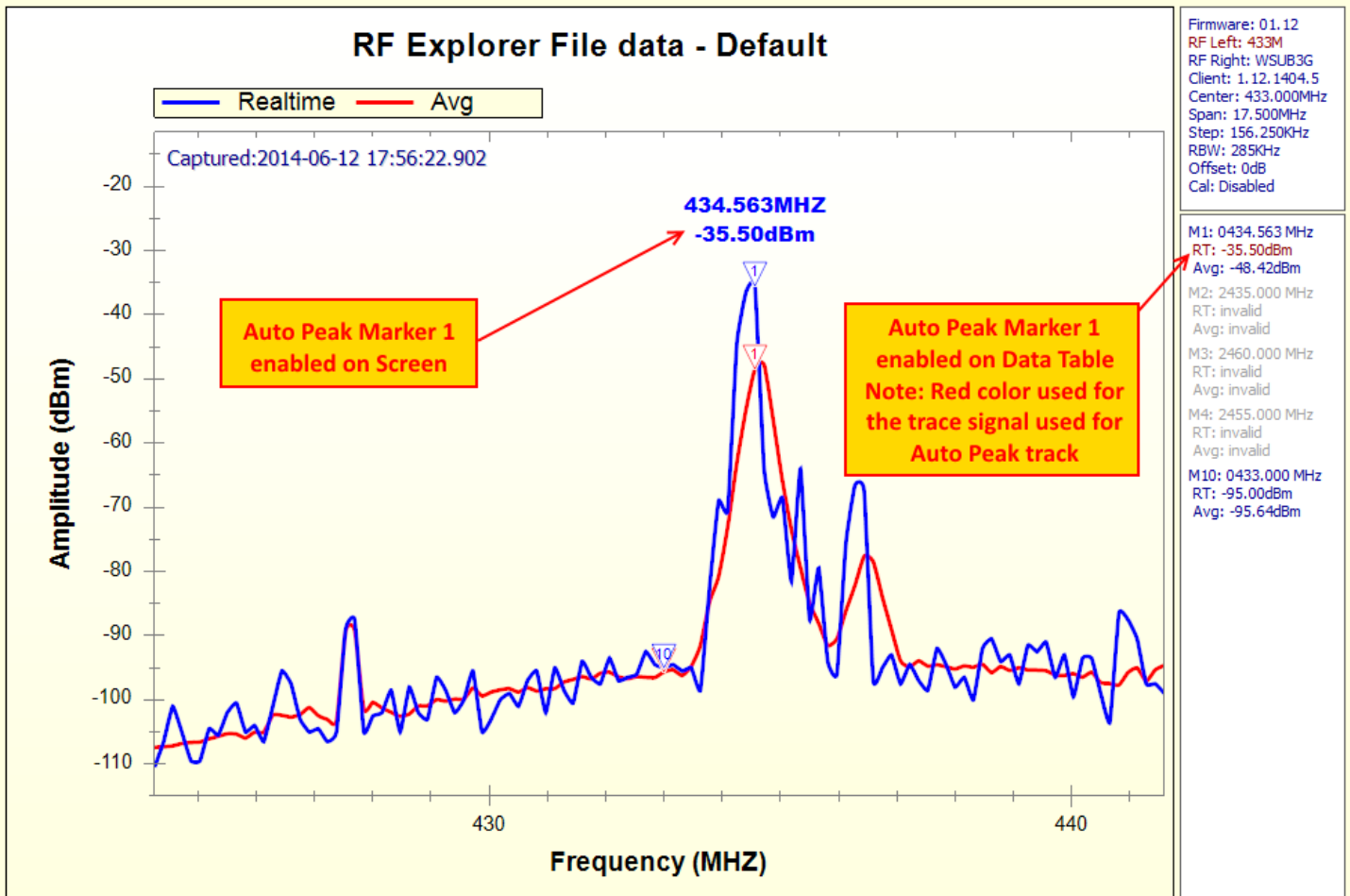
Marker 1 is special marker. It will search for peak trace point on screen and will track automatically. Therefore, frequency point for Marker 1 cannot be defined, will be dynamically updated by the application every sweep.

To enable Marker 1 use menu option *View -> Markers -> 1 -> Enable Marker*.

To define which signal trace the application will use to track peak, use the *View -> Markers -> 1* suboptions. For instance, to select Realtime as the trace to track, click on this option in the submenu.



Marker amplitude values will be updated in the Marker data table. Additionally, the Marker 1 amplitude value can be read directly on screen if option *View -> Markers -> Show Auto Peak values* is selected.



## Markers 2-10

These markers are defined for a specific frequency point, and will show amplitude values for all enabled traces on that frequency. To define frequency, edit the submenu for the marker. For instance to edit frequency for Marker 6, use *View* -> *Markers* -> *6*. Use the same submenu to enable/disable the specific marker.

*Note: if the frequency is currently off the sweep range (either lower or higher than preselected start/stop sweep frequency) the marker will show as "invalid" on marker data table.*