RDS Spy

Freeware RDS Decoder for Windows with Plugin Support

Version 1.08 r4

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1 Installation/Update

1. Download and run the installation exe file.
2. Select the setup language and finish the installation using Next button.
3. Run the RDS Spy and select the RDS source.
4. Arrange the workspace as required and save your settings using menu item File – Save Workspace.

Additional plugins may be installed as described in the Plugin Administration chapter in this document.

The RDS Spy can be installed more times on the same machine if each installation is placed in different subfolder.

For example

C:\Program Files\RDS Spy\

and

C:\Program Files\RDS Spy 2\

2 Hardware and Software Requirements

Recommended minimum configuration

- CPU 1 GHz
- 256 MB of free RAM
- Screen resolution 1366x768 @ 32-bit colors
- Windows XP or higher

Some plugins may have individual hardware and software requirements.

These basic skills may be required but are not discussed in this manual:

- Working with folders and files (especially if Windows 'UAC' is enabled)
- Recording audio via PC sound card (only if using 'sound card' source)
- Soldering and understanding cable wiring (specific RDS sources only)

3 RDS Data Sources

Several RDS data sources are supported for live RDS decoding:

- **Sound card or SDR – Direct MPX or RDS input**
  The RDS or MPX signal is fed directly to the sound card input, either physical or virtual. The sound card must support 192 kHz sampling rate for recording.
- **ASCII G Protocol – P75/P175/P275 FM Analyzer**
  The measuring equipment is connected either via RS232/USB or Ethernet.
- **ASCII G Protocol – P132/P232/P332/P164 RDS Encoder**
  For RDS encoders which support true output monitoring feature. Connected either via RS232/USB or Ethernet.
- **(No source)**
  The software provides **playback** features only, as described in **section 6**. Supported file formats are SPY, WAV, SMP and some others.

Deprecated RDS data sources (still supported):

- **Serial COM Port – Data and Clock**
  Accepts RDS signal as provided by standard RDS decoding integrated circuits. The RDS Data and Clock signals must be converted using a simple adapter described in section 3.3. This ensures compatibility with all RS232 ports and USB to RS232 adapters.
- **Sound card – Data and Clock**
  The Data and Clock signals are fed to your sound card's recording line input.
- **Sound card – Rectifier**
  For old RDS encoder's output data analysis. The RDS encoder output is fed to the sound card through a simple half-wave rectifier circuit.

3.1 Sound card or SDR – Direct MPX or RDS input

Note: *This option is applicable only if your audio device (either physical or virtual) supports* ***192 kHz*** *sampling rate for* ***recording****. Please follow the sound card's documentation or visit the online forum.*

Choosing this option the entire connection becomes as simple as on the picture:

The application automatically configures the audio device as follows:

Sample rate	192 kHz
Resolution	16bit
Mode	Stereo

The RDS Spy provides complete DSP processing of the input signal, including 57 kHz band-pass filtering, subcarrier synchronization and demodulation via Costas Loop equivalent structure, RDS clock regeneration, biphase symbol decoding and differential decoding of RDS data. Thus the RDS Spy entirely removes a need of any external RDS processing circuit.

This option is suitable for RDS encoders, FM tuners, MPX modulation signals as well as for SDR receivers. Please follow the product documentation or online tutorials for details.

Always make sure the input signal has correct level, especially to avoid overload. In the menu, select View – Status Information.

Note: *If your FM tuner does not provide MPX output and no such modification is possible, use the audio line output instead. Although typical FM tuner suppresses RDS signal on the audio output, there are usually some RDS signal residues remaining so the RDS decoding is still possible. Connect both audio channels, right to right, left to left.*

3.2 ASCII G Protocol

This RDS source represents direct support for various FM broadcast equipment, like FM broadcast analyzers, specialized RDS decoders, RDS encoders etc.

Please follow the device documentation for more details.

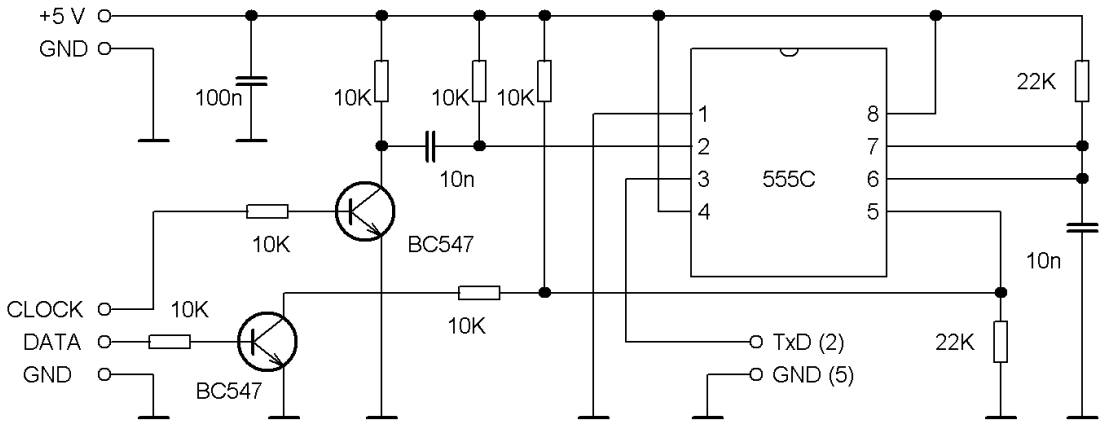
You can buy this equipment at https://pira.cz/

3.3 Serial COM Port – Data and Clock (deprecated)

Old DOS-based RDS decoders use special pins of the RS232 port to feed the Clock and Data signals to the PC. Today this solution has a few big disadvantages like compatibility problems with USB adapters and virtual machines, higher CPU load or gaps in RDS reception when the PC is busy.

Following simple circuit converts the Clock and Data signals to valid ASCII characters on its TxD output. These are received by the PC via RxD pin of the COM port as any other standard serial communication, which includes buffering feature.

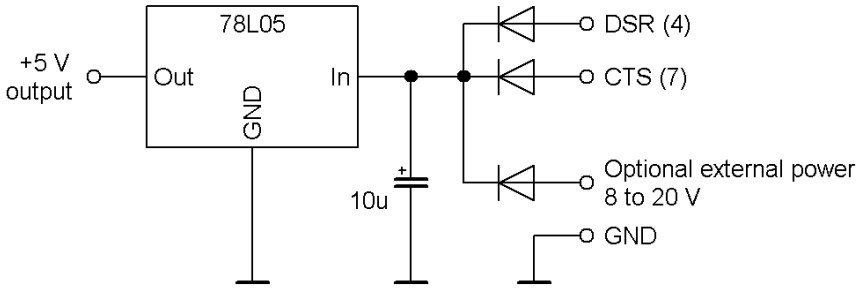
Note: The 10n capacitors should be a plastic foil type.



Pin configuration – RDS demodulators:

	Clock	Data	Ground	+5V
TDA7330	12	13	5	16
SAA6579T	16	2	11	12
SDA1000	10	11	1	?
SAA7579T	9	10	8	?
BU1922	16	2	11	12
LA2230	18	17	12	23
LA2231	18	17	12	23
LC72725K	16	2	11	12
TDA7478	16	2	6	12
TDA7479	16	2	6	12

The converter above can be powered either from the receiver's internal +5V path or using the power supply circuit as follows. This circuit provides +5V directly from the same RS232 port the converter is connected to. If the power supply voltage provided by the port is too weak (especially when using some laptops or USB to RS232 converters), an external power adaptor can be connected:



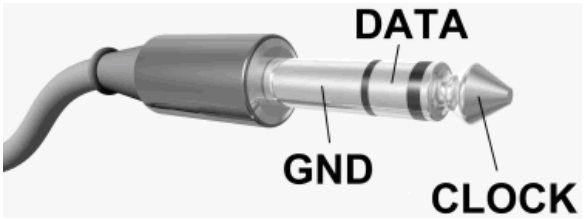
Wiring summary:

Converter wire		PC port pin
TxD	→	**2**
GND	↔	**5**
DSR	←	***4***
CTS	←	**7**

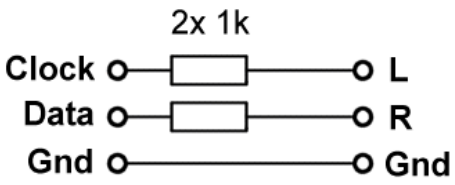
3.4 Sound card – Data and Clock (deprecated)

If your PC is not equipped with any RS232 port or if you do not want to assemble the converter above, you can simply plug the Data and Clock signals to a stereo input of the sound card. The application ensures excellent compatibility with almost any sound card using software defined PLL, numerically controlled oscillator (NCO) and edge detector.

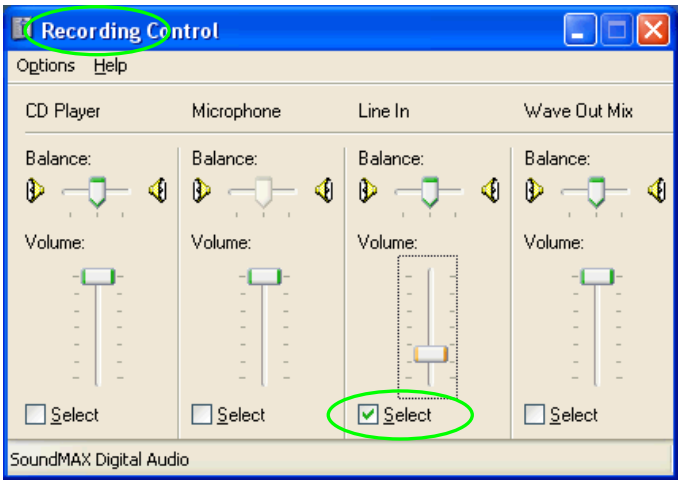
In basic configuration the Data is connected to right channel and Clock is connected to left channel. The Ground must always be connected.



It's recommended to insert 1k resistor to each the Data and Clock signal path rather than connect them directly. This may help to suppress RF interference caused by digital signal edges, protect your sound card and improve frequency characteristics. Do not use longer cable than it's required for the connection.

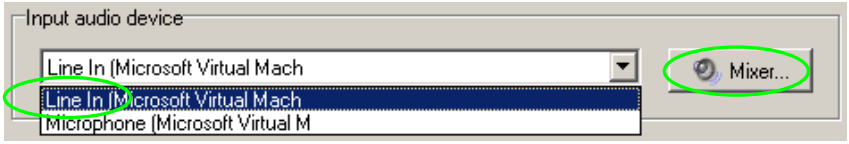


In the audio device control (double-click on tray icon) go to Options – Properties and select **Recording**. Then select the sound card input the cable is connected to. This is usually marked as "Line In" or "External source input". Follow your sound card's user manual for more details.



If you hear the data from the speakers, unselect the Line input in the **Playback** properties or simply mute the sound card.

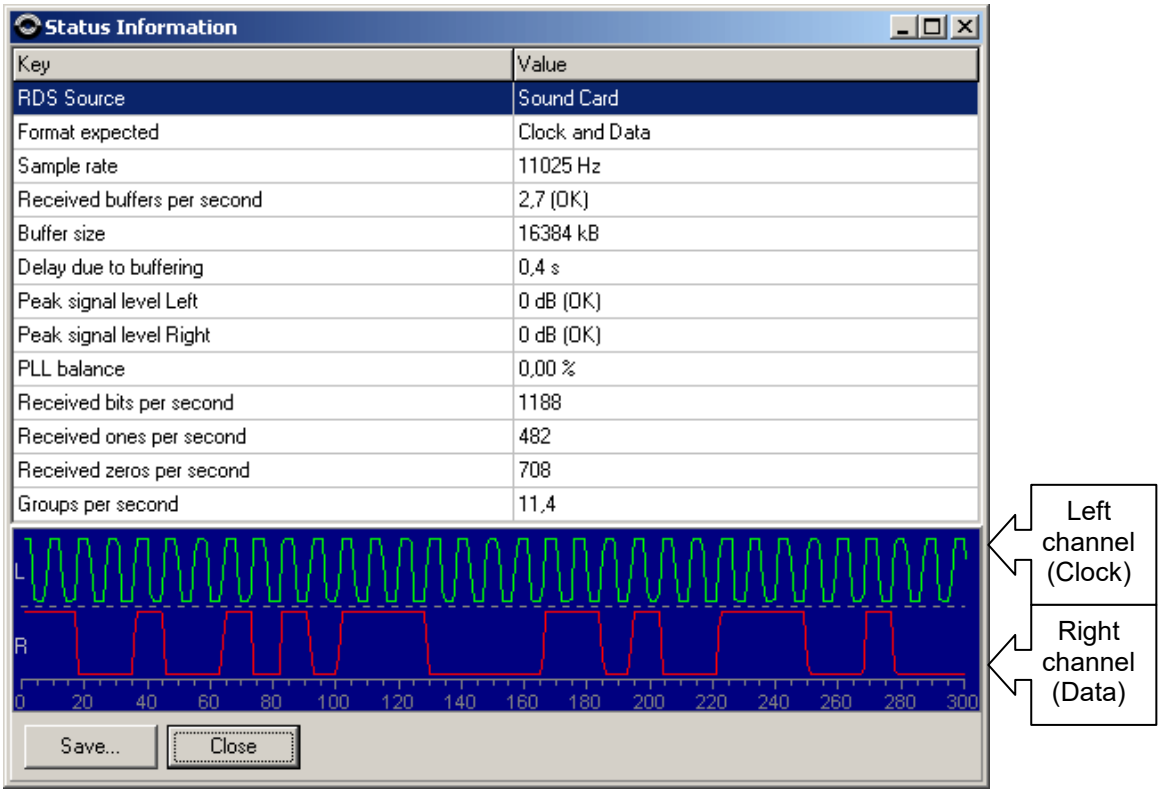
In **Vista, Seven** or later, the sound system is different and a little bit confusing. In these systems the user must select the input directly in the RDS Source dialog. Adjusting of the input level is possible if you open the Mixer and configure appropriate input:



Moreover, in **Windows 10**, make sure that following item is turned **on**:
PC settings / Privacy / Microphone / Let apps use my microphone

In case you cannot get the decoder working, then select View – Status Information and check how the signal looks like.

You should see something like this in the oscilloscope window:



Eventual clipping (overload) has no effect on right functioning. Close any other application accessing the sound card input before running the RDS Spy.

To make your life much easier there is a bit of “intelligence” implemented in the application. The RDS decoding will still work if any combination of these conditions occurs:

- the Left and Right signal wires are exchanged,
- the Clock signal is not connected at all.

However in these cases the RDS Spy performance is not guaranteed.

If you see “steps” (more than two voltage levels) in the oscilloscope window, it’s probably caused by summing the Clock and Data signals into one channel (the sound card input is mono or there’s a short-circuit inside some connector). In this case disconnect the Clock signal and the decoding will work.

By default, the application automatically configures the sound card as follows:

Sample rate	11025 Hz
Resolution	16bit
Mode	Stereo

The sound card source permits the user to select if data is valid at rising or falling edge of the clock signal. Please remember that this option has **no effect** if you use RDS demodulator based on TDA7330, SAA6579 or similar. Which clock transition (positive or negative going clock) the data change occurs in, depends on the lock conditions and it's arbitrary.

In special cases the input signal may require polarity inversion. This may occur for example when using optocouplers, playing from wave file or using specific sound card. For this purpose the Invert option is provided. This option must be selected manually.

Please note that choosing this source, the PC is unable to decode RDS directly from the demodulated audio signal. There must be an RDS demodulator present inside the receiver or connected externally that provides the Clock and Data signals required. For direct RDS decoding, follow the section 3.1.

Note: *Some sound cards do not work correctly with sample rate below 44100 Hz. The user may force the 44100 Hz sample rate using appropriate check box in Options – General. However, enabling this option may consume a bit of CPU time on very slow machines.*

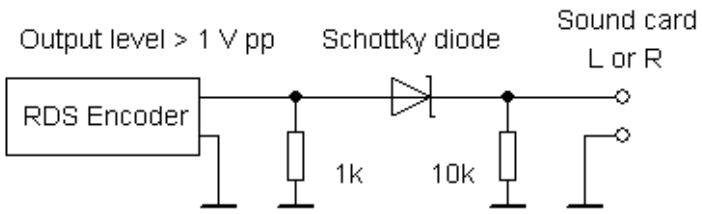
Important note: *If your sound card provides "advanced" functions like noise reduction, automatic gain control, echo cancellation, digital preamplifier or similar,* ***they must be turned off!***

3.5 Sound card – Rectifier (deprecated)

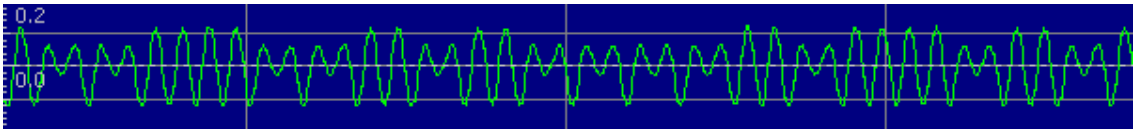
This RDS source is useful for older RDS encoders without true output monitoring feature. For newer encoders, use the ASCII G Protocol source (section 3.2).

The RDS Encoder is a device that puts the RDS signal on-air on the transmitter site. The RDS Spy allows analyzing the RDS data and adjusting all RDS services before final installation of the encoder.

The 57 kHz subcarrier generated by the RDS encoder cannot be directly processed by most of sound cards. However – because the signal is strong enough – a simple half-wave rectifier can provide this possibility and gives a way how to analyze the data from the RDS encoder output without need of any RDS demodulator:



The signal processed by this circuit should look like this:



By default, the application automatically configures the sound card as follows:

Sample rate	22050 Hz
Resolution	16bit
Mode	Stereo

Notes:

- Suitable Schottky diodes are: 1N5711, 1N6263, BAT41-BAT48, BAT85S, etc. Almost any type will apply.
- If MIC input is used instead of Line-in, a separation capacitor may be required due to DC voltage on the MIC input (used as the microphone power supply). In this case connect the circuit output through a 10 µF capacitor.
- Unplug pilot tone or MPX signal from the encoder before use or make sure this signal is not internally fed to the encoder output.

4 Command Line Options

Currently the application supports these command line options:

rdsspy.exe [filename]	Launches the RDS Spy and starts playing the file specified.
rdsspy.exe [/ws:workspacefilename]	Launches the RDS Spy using the settings stored in the workspace file specified.
rdsspy.exe [/rec]	Launches the RDS Spy and starts recording.
rdsspy.exe [/src:no|ascii|mpx]	Launches the RDS Spy and sets either no source, ASCII G source or Sound Card MPX (192 kHz) source.

Examples:

```
rdsspy.exe c:\file1.spy
rdsspy.exe "D:\RDS Files\11-02-06 City FM.spy"
rdsspy.exe stream:localhost:23

rdsspy.exe /ws:myworkspace.rsw
rdsspy.exe /ws:myworkspace.rsw /src:no

rdsspy.exe /src:ascii /host:localhost /port:23 /format:enc
rdsspy.exe /src:ascii /port:COM4 /format:dec /rec
rdsspy.exe /src:ascii /port:COM4 /format:p275 /rec

rdsspy.exe /src:mpx /input:"Virtual Cable Output"

rdsspy.exe /rec
```

Need more command line options? Give us a feedback!

5 RDS Spy Options

To enter the Options dialogue window, select Configure – Options in the main menu.

5.1 General

High priority	Enable this option to assure gap-less operation if some CPU esurient applications are running on the same PC. Don't enable this option if some critical application is running on the same PC or if you use USB sound card. Disabled by default.
Always on top	Brings the main window above others. Has no effect on plugin windows.
Simple LCD	Turns off some graphical elements in order to provide faster operation on very slow machines.
Save workspace on exit	If disabled, the user must save application settings manually (File – Save Workspace).
Development options:	
Consider bad blocks as correct	Causes ignoring CRC mismatch on RDS blocks C and D. Has no meaning for common use – thus leave disabled!
Enable RDS2 tunneling	If enabled, all RDS2 groups from streams 1-3 with FID and FN = 0 are processed like stream 0. Has no meaning for common use, leave disabled.
DX options:	
Enable Super PI Detector	See section 'Super PI Detector' in this manual.
Enable error correction for PS name	This option considerably increases the speed of PS decoding if the signal is very weak. On the other hand, it naturally increases a possibility of false reception. For such a reason, this option is not available to other RDS services and the error correction capability is restricted to 2 bits per block at maximum. *This option is not applicable to ASCII G data source.*

Other options:

Reset RDS data on PI change	Automatically resets all previous RDS data if new station is detected.
Reset RDS data on signal timeout	Automatically resets all RDS data if no signal is received for the time specified.
Use 44.1 kHz sample rate	Some sound cards do not work correctly with sample rate below 44100 Hz. The user may force the 44100 Hz sample rate using this option. However, enabling this option may consume a bit of CPU time on very slow machines. Enabled by default.
Sound card buffer size/latency	The application does not receive data from sound card continuously but in blocks - buffers. Once the buffer is completely filled by audio data, it is processed by the application at the speed which corresponds to normalized RDS bitrate. A bigger buffer ensures gap-less operation, however it increases the delay between signal input and display of decoded data. Increase the buffer size if RDS decoding gets erratic when doing other tasks on the computer. Applies to sound card inputs only.

5.2 Playback

Enable seeking and show total group count	Shows seeking bar when playing a RDS file. Requires processing of the file before play so it may cause a delay on very long RDS files.
Socket streams: synchronize	Check/uncheck this option if the playback from a socket source is not continuous.

5.3 Recording

Stop recording on PI change	Automatically stops recording if a new station is detected.
Start recording of another file on PI change	Automatically starts recording of another file if a new station is detected.
Stop recording on signal timeout	Automatically stops recording if no signal is received for the time specified.
Default path and file name	Default path and file name of the recording file that is used to avoid entering the file name manually for each recording file. See the section 'Recording' for more information.
Add date and time	Allows playing the file with original date and time information associated with each group. Valid for *.spy files only.
Enable time machine	If enabled, the application will start recording the RDS data just before the REC button is pushed. Useful for recording also the data part preceding the point of interest. That feature is possible due to internal circular buffer remembering last RDS groups.

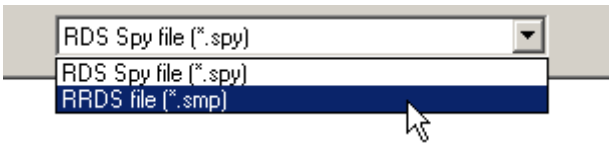
5.4 Reports

Default path and file name	Default path and file name of the report file that is used to avoid entering the file name manually for each report. See the section 'Creating Reports' for more information.
Always confirm frequency	Shows a frequency confirmation window each time the report is written. *Since the RDS Spy usually don't know the frequency of the station (this does not apply to the P75/P175/P275), the user enters the frequency manually in order to show it in the report.*

6 Recording and Playing RDS Files

6.1 File Types

The RDS Spy supports two types of RDS files for recording: RDS Spy files (*.spy) and RRDS files (*.smp). The user may decide for any of them. A few more file formats are supported for playback only (for example wave files in PCM 192 kHz format).



Following table summarizes the file type characteristics:

	RDS Spy files (*.spy)	RRDS files (*.smp)
Data representation	ASCII text	Binary
File size (1 minute)	14 kB / 31 kB	11 kB
Stores checkwords	No	Yes
Benefits	• Simply viewable and editable • May include time information for each RDS group • May include additional information	• Ensuring compatibility with older and still great DOS software RRDS and RDSS • A bit faster on very slow machines

6.2 Recording

Before recording a RDS file check the Recording folder and file name in Options. You may also assign the file name manually before each new recording by pressing the button with three dots next to the REC button. In this case the file name will appear on the LCD.

Start recording by pressing the REC button.

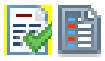
6.3 Playback

To play the RDS file choose menu item File / Play File or click on the PLAY button or simply move the file from the Total Commander or similar file manager to the RDS Spy main window.

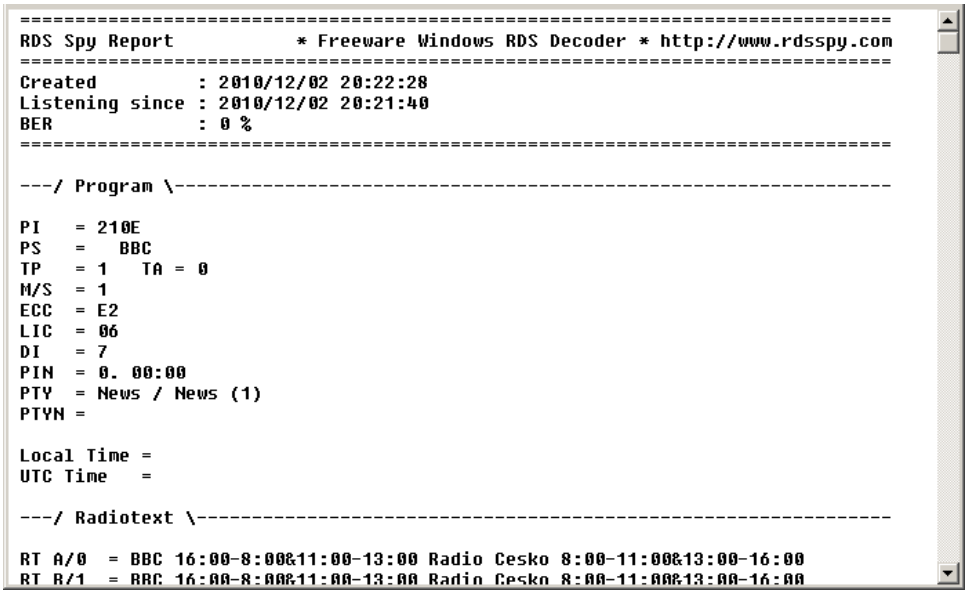
During the playback you may adjust the playback speed or pause the playback using the track bar on the left. If appropriate feature is enabled in Options, you may move to any position in the file using the seeking bar.

After the file reaches its end, you may return to live decoding by pressing the Reset button.

7 Creating Reports and Logs



The application provides two independent text file outputs for decoded RDS data. Their typical purpose is creating reports or logs respectively. Both features are user configurable through items Configure – Options – Reports or Logs.



```
================================================================================
RDS Spy Report           * Freeware Windows RDS Decoder * http://www.rdsspy.com
================================================================================
Created         : 2010/12/02 20:22:28
Listening since : 2010/12/02 20:21:40
BER             : 0 %
================================================================================

---/ Program \----------------------------------------------------------------

PI   = 210E
PS   =   BBC
TP   = 1   TA = 0
M/S  = 1
ECC  = E2
LIC  = 06
DI   = 7
PIN  = 0. 00:00
PTY  = News / News (1)
PTYN =

Local Time =
UTC Time   =

---/ Radiotext \--------------------------------------------------------------

RT A/0  = BBC 16:00-8:00&11:00-13:00 Radio Cesko 8:00-11:00&13:00-16:00
RT B/1  = BBC 16:00-8:00&11:00-13:00 Radio Cesko 8:00-11:00&13:00-16:00
```

To create a report, select the option File / Create Report in the main menu and fill the file name desired. Optionally you may be asked for the tuned frequency which is included in the report.

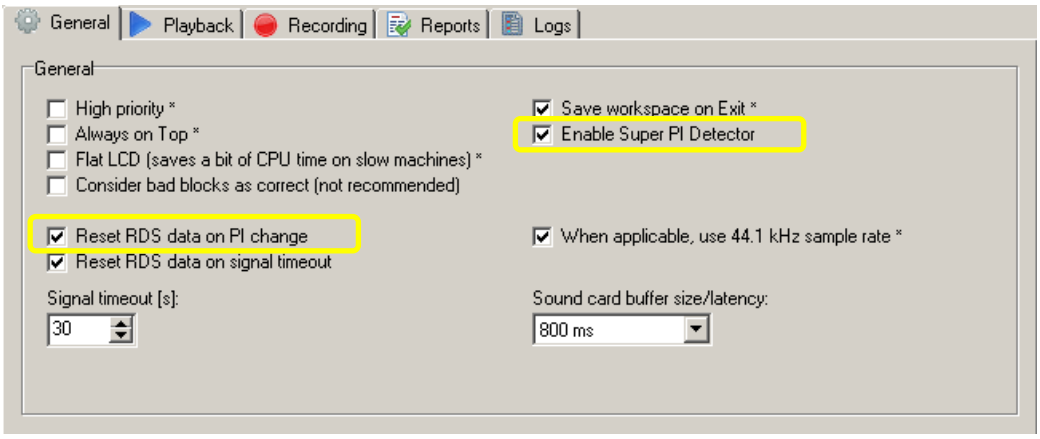
RDS logs can be saved automatically. This is especially useful for logging occasional FM station reception. The logging event occurs before any data reset, for example before PI reset, timeout reset, application exit etc. Note that if a folder is specified in the options, it must be created manually before.

Each report (log) may occupy a separate file or all reports (logs) may append into a single file.

7.1 Simple Automated Logging

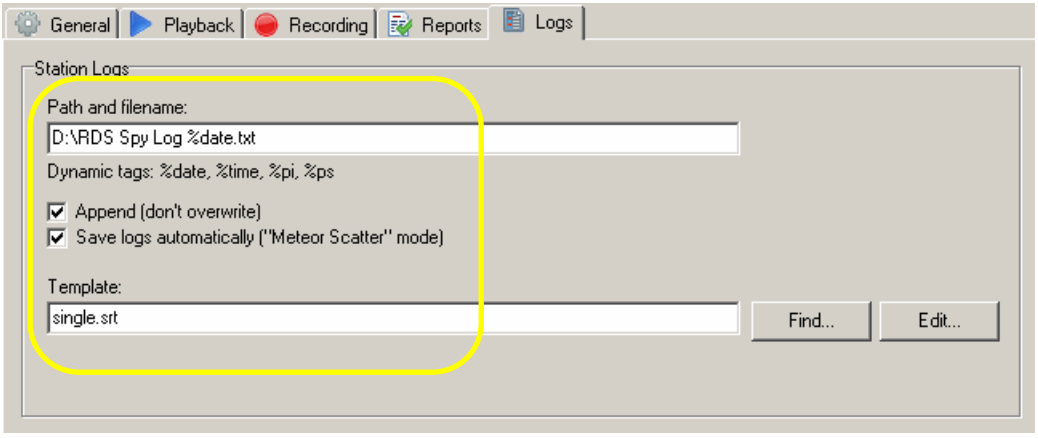
Following instructions describe how to configure the RDS Spy in order to leave a single line in the report file for each station received.

1. Configure highlighted General options:



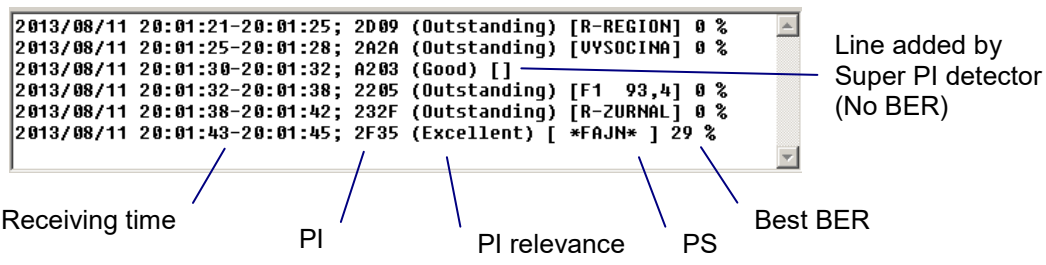
Enable the Reset on PI change.
For DX purposes, enable also the Super PI detector.

2. Configure the Log options:



Fill a file name the logging will occur to. Optionally use the *%date* tag.
Enable saving the logs automatically and appending the log data.
Select appropriate template file. For a single line logging, fill *single.srt*

3. Tune some stations one by another. The log file will look like this:



7.2 Template Files

The user may customize the report content by selecting appropriate template file in the options.

The template file (*.srt) may be edited in any plain text editor such as Notepad. When done, save the template file under another name but keeping the .srt extension. All dynamic tags are delimited by % in the template. These tags are replaced by appropriate value in the final report.

For example a template line
`TA: %TA%`
is replaced by
`TA: 1`
in the report.

To get the list of all dynamic tags, use the menu item View / Decoder Data or open the default template supplied with the application.

Please note that some fields in the report may stay empty if appropriate plugin is not installed.

Note:
The template may be a HTML file as well. If <HTML> and </HTML> tags are found in the template file, all dynamic content is "HTML encoded" as follows:
< changed to <
> changed to >
& changed to &
Other characters pass without change.

8 Plugin Administration

The plugins are located in the folder named ‘plugins’. For example, if the main application is installed to C:\Program Files\RDS Spy\, the plugins are placed in C:\Program Files\RDS Spy\plugins\. Any plugin placed in this folder is automatically active. To deactivate the plugin, delete it from this folder or move it to another folder.

The application searches for installed plugins at stat-up. You can show the plugin using the menu item View. You can configure the plugin using the menu item Configure. For more plugins, visit the website http://www.rdsspy.com.

Tip: If you need to run more instances of the same plugin, copy it to the plugin folder more times using different file names, for example grpconts1.dll, grpconts2.dll etc. Each instance will use own settings.

9 Special Options

9.1 Super PI Detector

The PI is usually unique for each station within a country. Since the PI is transmitted frequently, it can be used for the station identification although the station’s signal is weak and other RDS services like PS are hard to decode.

The Super PI detector extends the possibility of PI reading also under bad reception conditions (DX). Enabling this option the RDS Spy will try to get the PI code using extremely sensitive statistics methods and continuous integration over a few seconds of time. Once the group synchronization is found and the PI is being received by a standard way, the Super PI detector is deactivated. After sync lost, the Super PI detector is activated again.

The Super PI detector is unique in the fact that it can read the PI code although there are no correct blocks in the data being received. It does not require group and block synchronization at all. However it is not a miracle. It gives best results on stable weak signals which start to be noisy on mono listening. Note that it may give a spurious PI occasionally which is usually simple to recognize and it's replaced by the right PI after a moment.

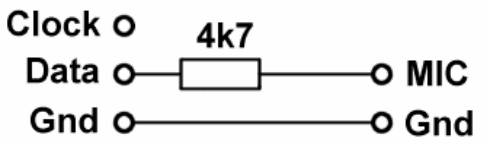
The output from the Super PI detector is also used for PI reset, reports and logging. It is however not possible to record the “super” PI, because the recording works with RDS groups, i.e. only when synchronization is present.

If the Super PI detector is receiving a PI, the signal timeout will not occur although the group counter is not counting.

10 Frequently Asked Questions

Q: I can't find Line-in input on my notebook. There's MIC input only which is mono. Can I decode RDS using this hardware?

A: Yes, you can still decode RDS using the sound card if its sample rate frequency is accurate enough. Due to software defined PLL the application is able to synchronize also using the edges of the Data signal in the Clock channel. Try this connection:



In the sound card configuration switch off all "features" like MIC boost, 20 dB gain, echo cancellation, compressor etc. Some sound cards may require separation capacitor due to high DC voltage on the MIC input (used as the microphone power supply). In this case place a 10 µF capacitor in series with the resistor.

Q: I'm getting PI although the receiver is switched off or the station tuned does not use RDS. How is that possible?

A: Nothing doing. This is a characteristic of the RDS system combined with high PI detection sensitivity. From time to time the PI (valid block 1) can be found repeatedly in almost any signal. The probability is extremely low in random signal (typically noisy reception). However it's more frequent in signals that do not contain any RDS information but also are not really random. It can be noted that specific combinations of equipment and conditions generate repeatedly the same spurious PI codes.

Q: My new radio receiver does not contain any of the RDS demodulator IC. However I have found some clock and data signals inside the receiver. Why RDS decoding does not work with the RDS Spy using these signals?

A: There exist probably tens of different serial buses based on clock and data signals carrying various data. The RDS serial bus based on continuous stream of 1187.5 bit/s is not the only one bus type present in the receivers. Moreover this bus is not accessible on many new receivers as the RDS demodulation and decoding is made internally inside a DSP unit. The RDS Spy cannot read other serial buses, like I^2C or SPI, as these buses often use various data format and they also use a communication speed of up to several MHz which exceeds capabilities of any sound card or serial port. If the MPX output is accessible, an external RDS demodulator or 192kHz-capable sound card can be used to get the RDS clock and data.

Q: Why AF Method B shows the same frequency pair in two different AF lists? Why there are more AF pairs in some lists than indicated?

A: This happens if there can be found two AF lists whose tuning (base) frequencies are equal to the frequencies in the AF pair affected. For example AF pair 95.4, 102.8 will be included in AF list with tuning frequency 95.4 **and** in AF list with tuning frequency 102.8, regardless of which AF list the pair was originally inserted to.

Although this may look like a bug, it is an intention. The software is made to strictly meet some key RDS standard rules, especially the arbitrary group order. There's no memory or anything in the software that makes decisions depending on how the RDS groups are going one after another. So it may occur that some AF B lists contain AF pairs from another AF B lists if one of the frequencies matches to the tuning frequency.

One may say that it is clear from the group order where the list begins and ends and where another list starts so AF pair mixture can be avoided. Yes, that's almost true, but only in case of excellent signal; it does not apply in general! The algorithm implemented in the software is made to give the same result regardless of the signal quality and number of groups lost. In our opinion it's the only one correct algorithm although it is sometimes not visually perfect.

Q: I’m using the RDS Spy with my SDR receiver through a virtual audio cable (VAC) driver. Why the RDS Spy reading is a little bit delayed?

A: Because the VAC driver and subsequent data processing effectively represents an additional buffer for the data. Any buffer inserts a small delay. No information is getting lost, it is only provided with a small latency (typically ~400 ms) to allow smooth playback in the RDS Spy. The latency is user configurable but should not be changed.

11 Support

The software is provided as is, without warranty of any kind. Please send us your suggestions or bug reports, it will help us to improve the software. Your feedback is important. Visit the online forum.

Please note that we are not able to provide individual support and consultancy related to the software use or electronic circuit modifications. Register to the online forum and post your request - create a new topic in appropriate section. You have a chance to get solution from the author or from the community.

Although the RDS Spy is provided as a freeware also for commercial use, please always keep in mind these points:

- You may redistribute the application only with original documentation and a link to the original location (rdsspy.com).
- You may not reverse engineer, decompile, disassemble, rent or lease this application or any part.
- The rdsspy.exe sources are not available anywise.
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Website and the forum: **http://www.rdsspy.com**

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12 Annexes

12.1 RDS Spy Files Specification

The RDS Spy can play any RDS content that meets following minimum specification:

- Input options: file or socket stream (File – Play File; File – Play Stream)
- File name and extension: not limited
- Content type: ASCII text 8-bit
- Content structure: one RDS group per one line
- Line delimiter: CR+LF for files, CR+LF, LF+CR or CR for sockets
- Line order: top line in the file contains the oldest group and it's played first
- Line structure: each line starts with RDS group. Space characters are ignored. If there's any other information in the rest of the line, it is ignored. Exception exists for time information, which - if present - should be the last information on the line.
  Lines that are shorter than 16 characters are ignored.
- RDS group structure:
  AAAABBBBCCCCDDDD, where AAAA is block 1 (PI) in hexadecimal, BBBB is block 2, etc. There may be space characters between any hexadecimal digits. Bad blocks must be replaced by ----.
- Time information structure (optional):
  YYYY?MM?DD?HH:NN:SS?CC
  where '?' can be any character, centiseconds (?CC) are optional.
- For RDS2 streams 1 to 3, each group starts with identifier #S*(1-3)*.

Line examples:

```
2205 0548 A8BB 4631 @2022/05/30 15:30:52.50
#S1 883D 0847 ---- C9B1 @2022/05/30 15:30:52.57
```

12.2 Serial Protocol Specification

This section explains how to feed the RDS Spy directly from a customized external device. For a device equipped with USB or RS232 interface it is better to use this interface also as the RDS data output rather than connecting it to the sound card. The RDS Spy is able to read data that is provided via serial port (implemented in hardware or realized by USB driver, virtual COM port etc.). The software accepts two different protocols via serial port. The first is the one with Clock and Data converter, let's call it Bit protocol. The second is the ASCII G protocol.

Bit protocol

Using this protocol all RDS data bits from RDS demodulator are translated into serial data bytes. These bytes are sent using 19200 Bd, no parity, 1 stop bit.

Bit value	Byte value
0	0xF0
1	0xFE

Thus one bit of the original RDS data occupies one byte in the serial data. The RDS Spy performs all data processing like block and group synchronization or CRC checking.

ASCII G protocol

The device must perform all data processing like block and group synchronization and CRC checking. It sends the groups in ASCII representation, starting with prefix G:, in this form (Pascal):

```
'G:'+#13+#10+'AAAABBBBCCCCDDDD'+#13+#10+#13+#10
```

where AAAA is PI, BBBB is block 2 etc. No CRC or offsets are included. Bad blocks must be recognized in the device and replaced by ----. For example:

```
G:
AAAABBBB----DDDD

G:
AAAA------------
```

etc.

Completely bad groups can be simply omitted. There's no need to send the groups continuously. The data are sent on 19200 Bd, no parity, 1 stop bit or via TCP/IP sockets.

For RDS2, the prefixes are as follows:

Stream 0	G:
Stream 1	H:
Stream 2	I:
Stream 3	J:

Special commands

A special group `RESET-------` will have the same effect as clicking on the Reset button in the application.
A special group `EXIT--------` will have the same effect as clicking on the Close button in the application.
A special group `FREQ=`*(frequency in MHz)*`------` will have the same effect as selecting the tuning frequency in the application.

For example

```
G:
FREQ=102.8------

G:
RESET----------
```

In addition the RDS Spy sends initialization commands on start-up:

For encoders (P132/P232/P332/P164 etc.): `SETSPY=250`<CR>

For decoders (P75/P175/P275 etc.): `*D*R?F`

Especially the command `*R` can be used by the device to activate the RDS group sending. If this is not required, the initialization commands should be ignored.

After clicking on the Tune button, the RDS Spy sends frequency tuning command: *(frequency in kHz)*`*F`

For example (88.4 MHz): `088400*F`

The frequency tuning command can be used for tuning the external device, or can be ignored.

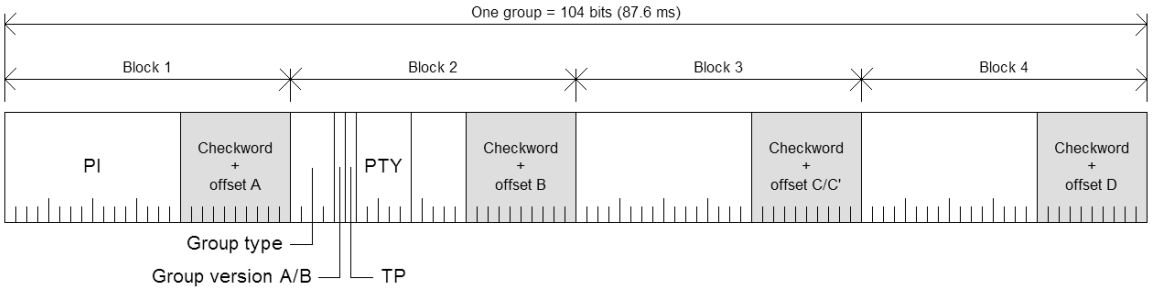
12.3 RDS/RBDS Group Format

Following information is provided for better understanding to the RDS principles and the user defined group coding.

The largest element in the RDS coding structure is called a "group" consisting of 104 bits. The group comprises 4 blocks of 26 bits each. Each block comprises an information word and a checkword. Each information word comprises 16 bits. Each checkword comprises 10 bits.

All information words, checkwords, binary numbers or binary address values have their most significant bit (MSB) transmitted first.

The data transmission is fully synchronous and there are no gaps between the groups or blocks. The basic data-rate of the system is 1187.5 bit/s. Thus transmission of one group takes about 87.6 ms and about 11.4 groups are transmitted per one second.



General RDS group format.

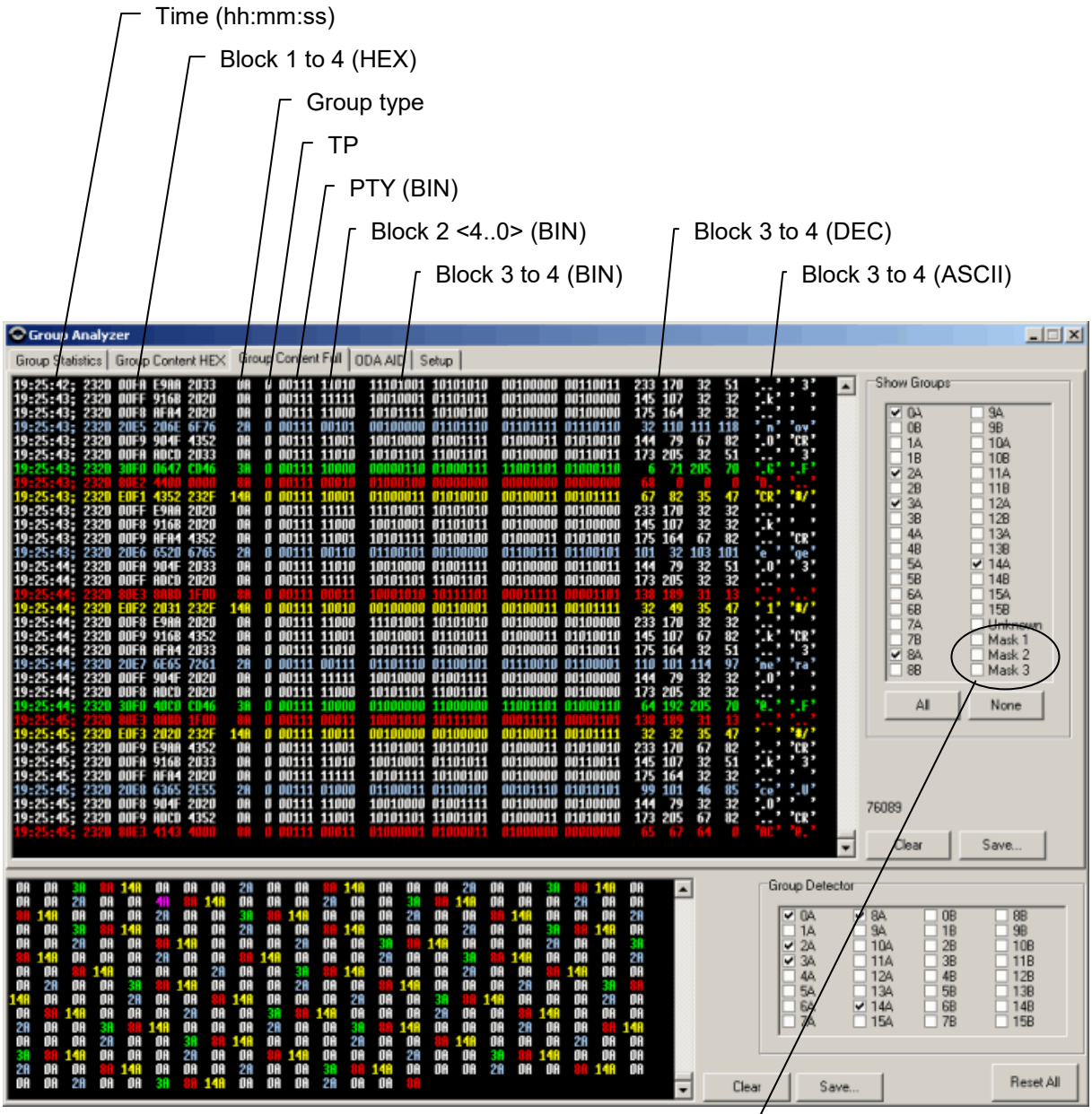
Basic principles and rules

- The services which are to be repeated most frequently, and for which a short acquisition time is required (PI, TP, PTY), in general occupy the same fixed positions within every group.
- **There is no fixed rhythm of repetition of the various types of group**, i.e. there is ample flexibility to interleave the various kinds of message to suit the needs of the users at any given time.
- The first four bits of the second block of every group are allocated to a four-bit code which specifies the application of the group - group type. Groups are referred to as types 0 to 15.
- For each type (0 to 15) two "versions" can be defined. The "version" is specified by the fifth bit of block 2: 0 = version A, 1 = version B.
- For all groups of version B the PI is inserted also in block 3 so this block cannot carry any other information when version B of the group is used.

Group types

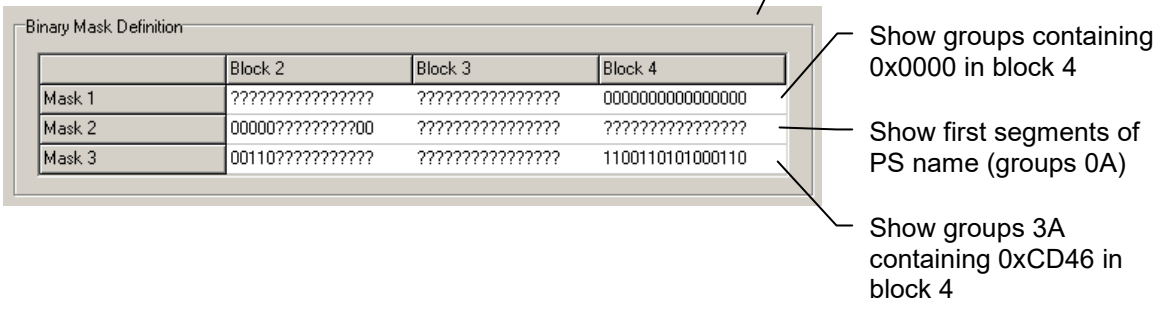
Group type	Binary coding	RDS services
0A	00000	**TA, MS, DI, AF, PS**
0B	00001	**TA, MS, DI, PS**
1A	00010	**ECC, LIC, PIN**
1B	00011	**PIN** (deprecated)
2A	00100	**RT**
2B	00101	**RT**
3A	00110	**AID for ODA**
3B	00111	ODA
4A	01000	**CT**
4B	01001	ODA
5A	01010	**TDC** or ODA
5B	01011	**TDC** or ODA
6A	01100	**IH** or ODA
6B	01101	**IH** or ODA
7A	01110	**RP** or ODA
7B	01111	ODA
8A	10000	**TMC** or ODA
8B	10001	ODA
9A	10010	**EWS** or ODA
9B	10011	ODA
10A	10100	**PTYN**
10B	10101	ODA
11A	10110	ODA
11B	10111	ODA
12A	11000	ODA
12B	11001	ODA
13A	11010	**ERP** or ODA
13B	11011	ODA
14A	11100	**EON**
14B	11101	**EON TA**
15A	11110	**TA, LPS**
15B	11111	**TA, MS, DI**

12.4 Group Analyzer Plugin Description (grpconts.dll)



Note: ---- means corrupted block (CRC mismatch)

Mask examples:



12.5 List of Abbreviations

AF	Alternative Frequencies
ASCII	American Standard Code for Information Interchange
BER	Block Error Rate
BIN	Binary number
CR	Carriage Return character (0x0D)
CRC	Cyclic Redundancy Check
DC	Direct Current
DEC	Decimal number
DSP	Digital Signal Processing
FM	Frequency Modulation
HEX	Hexadecimal number
LF	Line Feed character (0x0A)
LPS	Long Program Service name
MIC	Microphone
MPX	Multiplex stereo+RDS
PC	Personal Computer
PI	Program Identification code
PLL	Phase Locked Loop
PS	Program Service name
PTY	Program Type code
RBDS	Radio Broadcast Data System
RDS	Radio Data System
RF	Radio Frequency
UAC	User Account Control
USB	Universal Serial Bus