Fraunhofer Institut Integrierte Schaltungen

DRM Software Radio

PC based software for DRM reception

User Manual
Version 1.0

Content

1. Document Info

Document DRM Software Radio User Manual

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Version 1.0

FhG takes no responsibility for wrong or missing information in this document.
As the DRMSoftwareRadio is under development all information given in this document, especially the graphical outfit and the available functions, are subject to change without notice.

Revision Index

Revision	Changes
0.1	Draft, Initial Version
0.2	revised by Alexander Zink, added chapter user registration
0.3	revised document info
0.5	revision by VT Merlin Communications
0.6	Updated screenshots for version 0.0.16 and GUI description
1.0	Revision for software general release. Sound card info update. HVXC support. Information on service buttons added. Screenshots updated. Multimedia section revised.

2. Copyright information

3. Contact, information and Updates of software

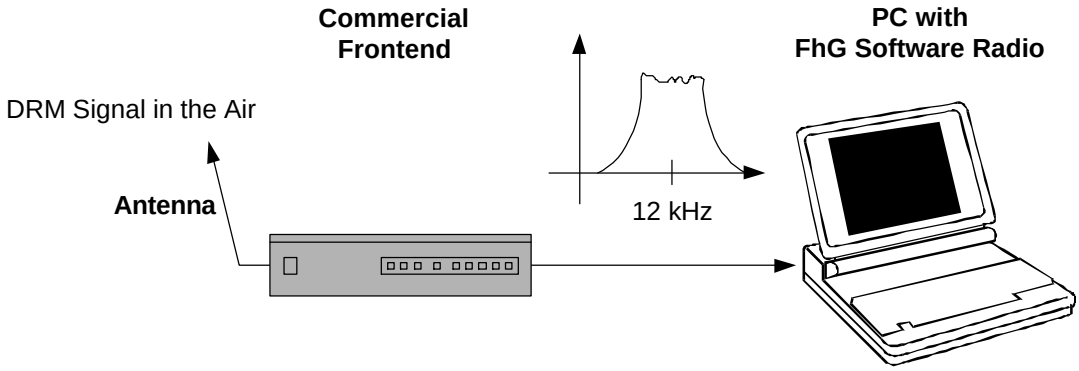
Via Website at
http://www.DRMrx.org/
http://www.DRMswr.com

This web site will be supported and maintained for a 2 year period from December 2002 to January 2005. Updates and new versions of the software will be downloadable for registered users from this web site. After initial purchase of the software, future upgrades will be provided free of charge to registered users.

4. Overview

4.1 Receiving path

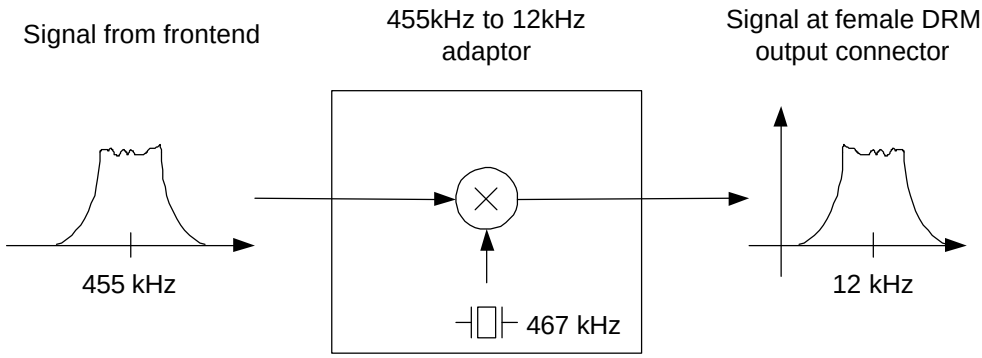
The following picture shows the DRM Software Radio system for reception of DRM signals.



The DRM Signal is received by an commercial long, medium, shortwave (SW, MW, LW) front-end. Any front-end should be usable which can provide an IF of 12 kHz direct or with a adapter circuit. The bandwidth must be greater 10 kHz for normal transmissions and greater 20 kHz for transmissions with channel bundling.
This signal is then fed into a standard soundcard. The soundcard must offer a sampling rate of 48 kHz. For output of the audio signal also a soundcard with a sampling rate of 48 kHz is required. If one sound card is used for sampling the signal and output of the music the soundcard must provide full duplex operation. Most of all newer soundcards provide all these features (e.g. SoundBlaster Live! from Creative Labs). Attention must be taken not to use an input with AGC (Automatic Gain Control) as this disturbs the DRM signal. Please pay attention that most of the internal soundcards of newer notebooks have the AGC enabled and offer no way to disable it. They also have very often low pass filters which can not be disabled. In order to get the system working on such notebooks (or also on other PCs with no or no suitable soundcard) we suggest the use of an external USB soundcard (e.g. „USB One“ USB Audio Interface).

4.2 Modifications of existing frontends

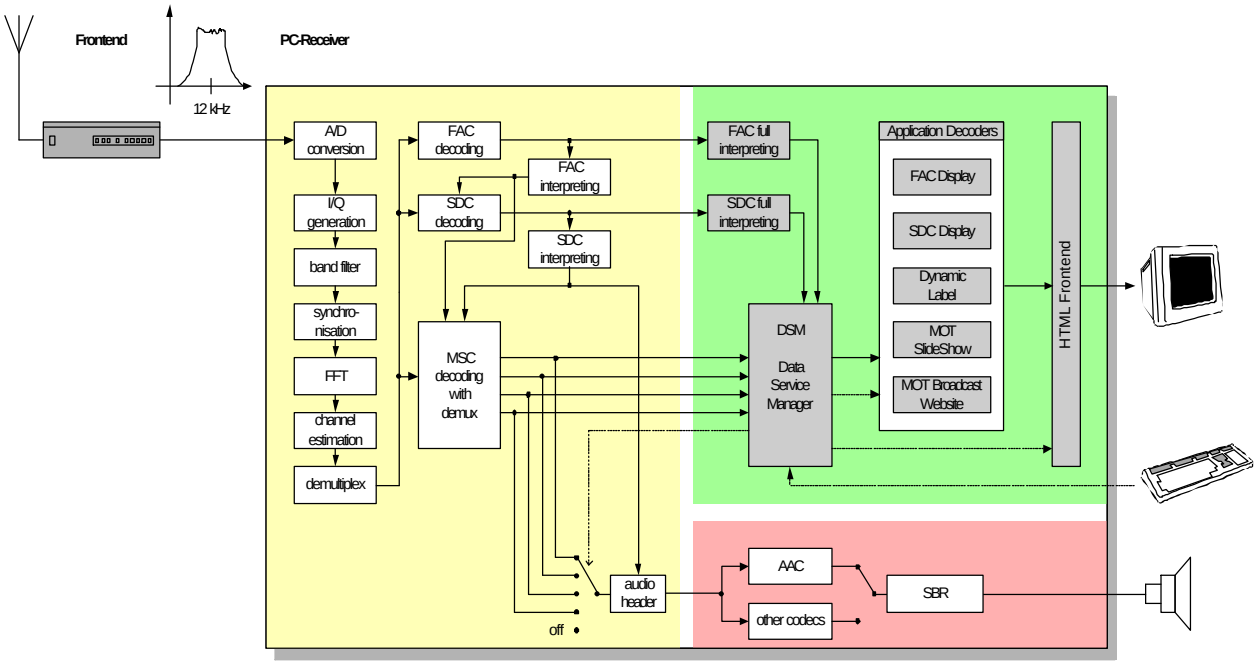
If a frontend provides an IF of 455 kHz it can be used for the DRM Software Radio by adding an 455 kHz to 12 kHz adaptor.



Worked examples of frontend modifications, are posted (by the general public) at http://www.drmrx.org/receiver_mods.html

4.3 Block diagram of the Software

The following picture gives an overview about the software modules of the DRM Software Radio.



4.4 Minimum System Requirements

- Windows 2000 or Windows XP or Windows 98
- AT-compatible PC
  - 500 MHz Intel Pentium processor (or equivalent)
  - 64 MB RAM
  - 50 MB free disk space
  - 16-bit SoundBlaster (or compatible) soundcard that supports full duplex at 48 kHz sampling rate for input and output; the input must be without AGC (Automatic Gain Control); recommended: Creative SoundBlaster Live! or „USB One“ USB Audio Interface
- LAN network driver or dial-up network installed
- Suitable frontend with 12 kHz IF output, output level suitable for soundcard

4.5 Tested soundcards

The following soundcards have been reported as suitable to work in full duplex mode:
The internal soundcards have been tested and work in the following PC's.
Dell Inspiron 4100
Dell Inspiron 8000
Dell Inspiron 8100
Dell Inspiron 8200 is now also checked and works 4 Dec 2003
Dell Latitude 800
Dell Latitude 810
Dell Latitude 840

Sony VAIO PCG-C1MHP, 860Mhz/128MB with Yamaha AC-XG soundcard
Dell Dimension (desktop) 4100, 800Mhz/512MB with Creative SB Audio PCI 64V

Dell 2 GHz Pentium 4 machine with a 'SoundBlaster live' card

Fujitsu Siemens T-bird Desktop PC with a 933 MHz PIII & Soundblaster Live Player 5.1 Soundcard.

Unbranded Pentium 1.8 GHz with a "low cost" sound Blaster PCI 128

1200MHz AMD Duron on Elitegroup Corp.(ECS) K7VVM main board with intergrated sound card

Laptop Gericom Webengine Force 2440 XL (2,4 GHz, 512 MB RAM)SIS 7012 Wave (built-in)

Unbranded PC with AMD Athlon 1.7 GHZ & Soundblaster Live 5.1

MEDION 2,5GHz from ALDI (HOFER in Austria)

Sometimes you need to disable the AGC or "sound boost" via the settings for the

soundcard. This depends on the driver you have loaded for the soundcard.

An external soundcard had to be used with the following PC as the internal one was not suitable:

Compaq Armada E500
Unspecified mainboard with integrated C-media sound

Sometimes soundcards can seem to work, but do not have full duplex ability. In this case audio dropouts will occur. The following procedure can give an indication of the location of the problem.

Use the record function to generate a file:
Here is a file recorded and posted by tido1322 in the forum (www.drmrx.org/forum)
MINUTE SNR SYNC AUDIO TYPE
0000 26 150 1492/10 0
0001 26 150 1474/10 0
0002 25 150 1399/10 0
0003 24 150 1409/10 0
0004 25 150 1348/10 0
0005 24 149 1242/10 0
0006 24 150 1380/10 0
0007 25 150 1429/10 0
0008 25 150 1422/10 0
0009 25 150 1472/10 0
0010 24 150 1342/10 0
0011 25 150 1346/10 0
0012 26 150 1348/10 0
0013 26 150 1401/10 0
0014 24 150 1086/10 0
0015 22 150 908/10 0
0016 21 150 790/10 0
0017 19 150 500/10 0
0018 21 149 805/10 0

Here is a guide for the meaning of the figures:
MINUTE: minute of recording
SNR: average SNR of this minute
SYNC: number of frames in this minute where FAC CRC was OK
AUDIO: number of error free audio frames in this minute and (separated by '/') number of audio frames per transmission frame
TYPE: 0 = AAC, ..etc (audio coding type)

If we take a look at the AUDIO column, we can see how many audio frames are decoded correctly. Each audio transmission frame is 400 mS long, and Tidos1322 file (the /10 part) indicates there are 10 audio frames per transmission frame. So this means, for this transmission, there are 150 transmission frames and 1500 audio frames per minute.
For minute 0, the average SNR is 26, 150 (i.e. maximum) FAC frames were received

correctly, and 1492 audio frames were received correctly.
This means 8 audio frames were received with errors.
I am a little surprised that all 1500 frames were not received correctly, as a SNR of 26 is very good: perhaps there was some transient noise.
8 corrupted audio frames would not cause any dropout, in practice the audio is still OK if 50-60% of audio frames are received OK.

If we look at minute 17 in the file, then we can see there were only 500 correctly received audio frames, so for this minute, we certainly would expect to hear audio drop outs as only 33% of the frames were correctly received.

So, if the file indicates few audio drop outs, but you are hearing many, then most likely there is a problem with the soundcard

Features

⇨ **Channel decoder**

- ☑ 4.5 and 5.0 kHz
- ☑ 9.0 and 10.0 kHz

- ☑ Mode A, B, C, D
- ☑ 4 and 16 QAM for SDC
- ☑ 16 and 64 QAM for MSC
- ☑ MLC with two iterations
- ☑ All code rates
- ☑ EEP and UEP

- ☑ spectral inversion of input signal

- ☑ Complete FAC and SDC decoding
- ☑ Display of Service Label and Service Information
- ☑ Display of Text messages

- ☑ All implemented features ETSI TS 100 980 V1.1.1 compliant

⇨ **Multimedia**

- ☑ Program associated and stand-alone data application support
- ☑ Text messages
- ☑ Slideshow service
- ☑ Broadcast Website

⇨ **Audio decoder**

- ☑ AAC
- ☑ SBR
- ☑ HVXC

5. Features of the DRM Software Radio

The DRM Software Radio enables you to receive and to listen to DRM transmissions by using a suitable PC (see chapter System Requirements) and a suitable frontend.

DRMSoftwareRadio.exe includes

Channel Decoder
The Channel Decoder is the Software inside the DRMSoftwareRadio which does the decoding of the DRM signals. The Channel Decoder is part of the DRMSoftwareRadio.exe program. Using the Monitoring and Recording or the Signal Analysis option the user can have a look at various stages of the channel decoder.

MPEG4 AAC + SBR Decoder
The Audio Decoder decodes the binary data transmitted in a DRM signal and produces audio output. It is part of the DRMSoftwareRadio.exe program. The decoding libraries were provided by Coding Technologies (www.codingtechnologies.de).

Graphical user interface

Includes user localization based on Airport locations.
Includes recording of status files.
Description please see following chapters.

Multimedia
Description see following chapters.

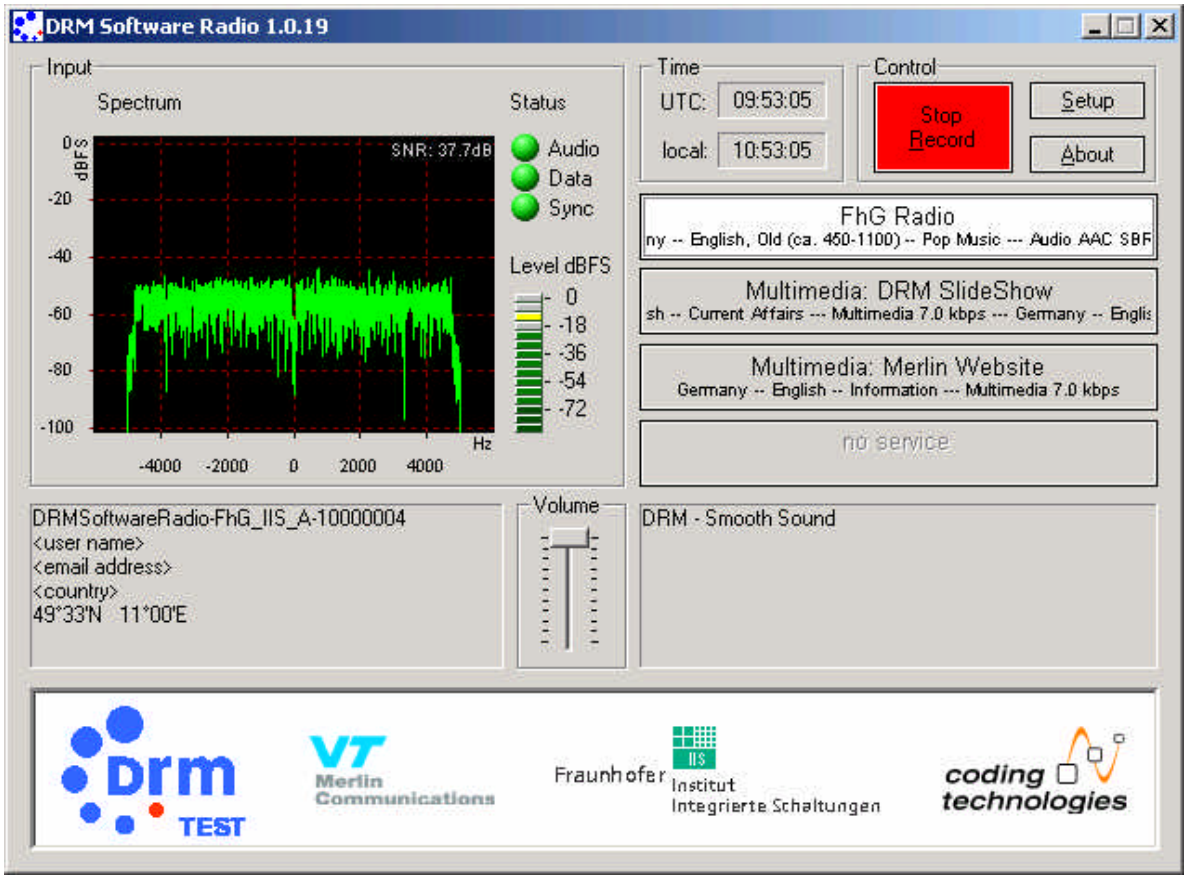
6. Operation of the DRM Software Radio

6.1 User registration

To enable the functionality of the DRMSoftwareRadio the user needs a personalized key file. This file is provided after the purchase of the software. The file has to be copied into the installation directory. The user is not allowed to distribute this key file.

6.2 Graphical user Interface

The picture below shows a running DRMSoftwareRadio. On the right side you can see the four buttons to select the DRM Service. Up to four services may be available in a DRM transmission.



The DRMSoftwareRadio window displays:

- Input Level as an 'LED' level meter
- FFT of the Input Signal as an plot
- SNR of the Input Signal
- status of the decoder (sync, data , audio decoding state) as an green/red 'LED'
- Service buttons with service labels, service information (e.g. language, country,...) audio type (with/without SBR, mono/stereo) and bitrate of the service content
- DRM text message

- Local / UTC time display

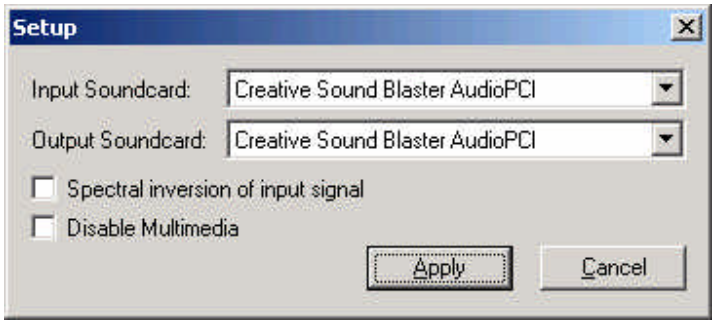
The user can:

- Select one of the 4 possible services (with the 4 buttons on the right)
- Start the Multimedia Player for streams with multimedia content by pressing the according stream button
- Adjust the output volume (slider in the lower middle of the screen)
- Record status data to file (‘Record’ button)

- 4 services can be transmitted
- the services can contain audio and/or multimedia/data content
- the button with the audio service that is played by the soundcard is displayed in white (light grey), buttons for possible other audio services are grey with back labels
- buttons for services with multimedia content are also grey with black labels
- when clicking on an button with multimedia, the multimedia viewer will be opened, or if the multimedia viewer is already running, the display will be switched to this content. If an audio service is also containing multimedia/data clicking on this button will also open the multimedia viewer.
- buttons for unused services are grey with a grey label 'no service'
- the text on the buttons have on the first line the name of the service and on the second line information on the content of this service: country, Language, type (audio/multimedia/data) and bitrate

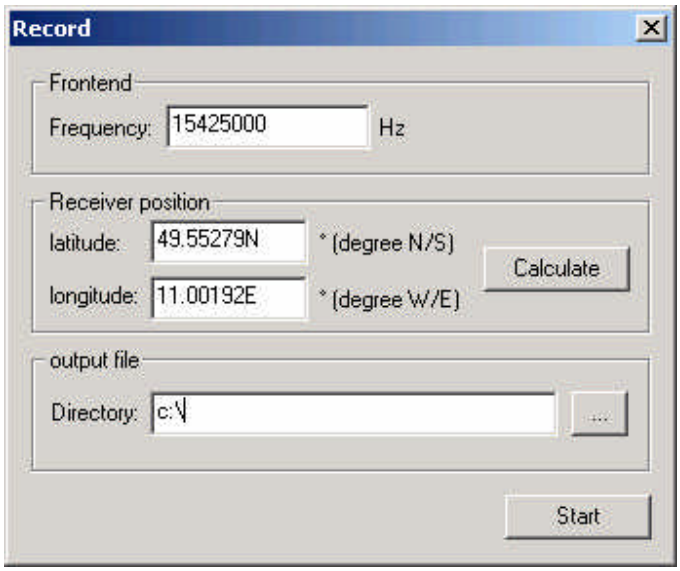
Setup dialog:
This dialog is used to:

- Select the input soundcard for the DRM IF input
- Select the output soundcard used for the playback of the decoded audio signal
- Switch the spectral inversion of the input signal on/off
- Disable the Multimedia support

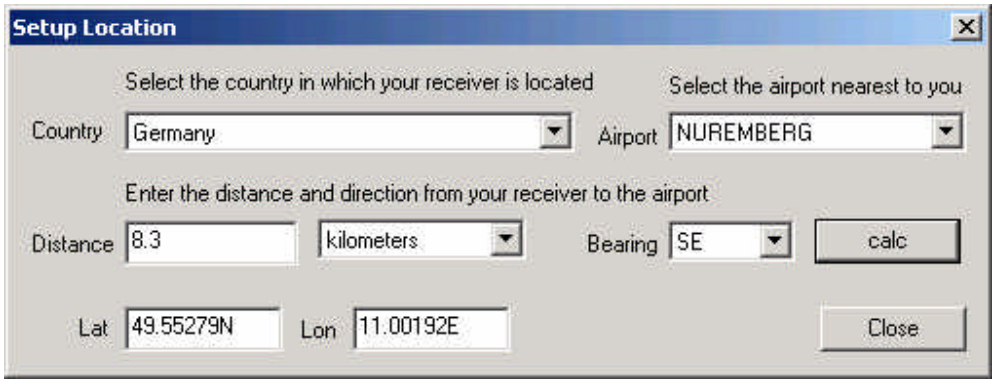


Recording:

After pressing the ‘Record’ button on the main window, a new dialog is displayed, where specific information on the reception can be entered (e.g. the frequency the frontend is tuned to, the receiver location). Also the output directory for the recording can be selected in this dialog. If you do not know your exact position (e.g. from a GPS device) you can press the ‘Calculate’ button to open a further dialog box, where your position can be determinated by using an airport nearby as an reference point.

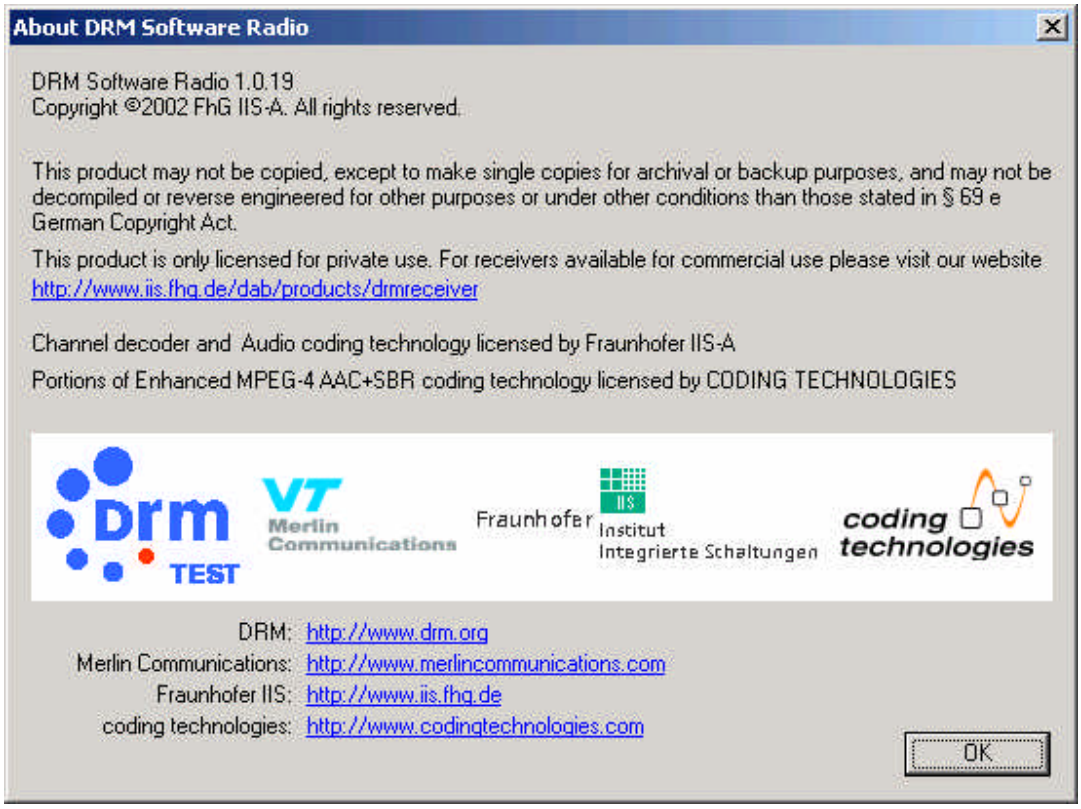


Below is the dialog for estimating the current receiver position by using an nearby airport as a reference.



About Box:

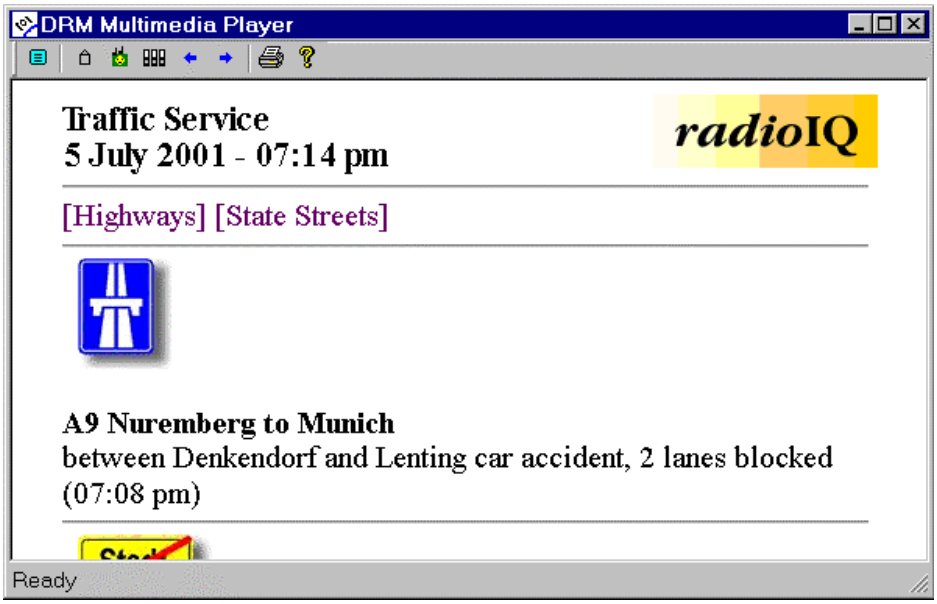
The about box provides Version number(s), copyright information and Web addresses of the evolved project partners.



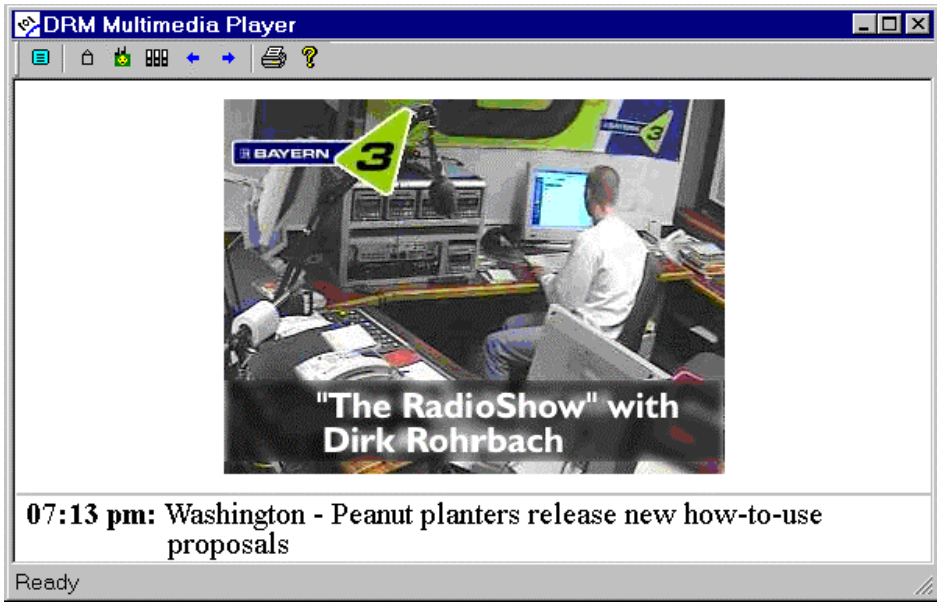
6.3 Multimedia

The Fraunhofer DRM Multimedia Player permits the reception and presentation of multimedia content which is sent—besides regular audio services—together with the DRM signal. It comprises currently the following types of multimedia services:

- **MOT Broadcast Website**
  This multimedia service allows the broadcast of complete web sites including HTML pages and images.
  The individual capabilities of a receiver are defined as receiver profiles. In contrast to restricted (mostly integrated) receivers, the "DRMSoftwareRadio" Multimedia Extension supports the full unrestricted profile. This means easy access to all current and future features of the HTML and other internet standards.
  The user can navigate through the received HTML pages as if they were loaded from the internet.



- **MOT Slideshow**
  The MOT Slideshow is a very convenient service especially when combined with an audio main program. In this case, the user receives automatically updated visual information while listening to the audio service.
  A good example is the weather forecast. While the radio speaker explains the weather during the next days, the user of the "DRMSoftwareRadio" can even see the information as he is used to it from TV!
  Or the user gets informed of traffic problems with a visually prepared street map, which states exactly and easily to comprehend all the affected locations.



- **Dynamic Label Service**
  This service is also known as "DRM text messages".
  While the user listens to an audio main program, he receives the latest news and updates immediately on the screen when they are broadcast.
  This information may comprise traffic news, stock information, weather updates or other individual messages from the broadcast station to its listeners.

The application interface allows the user to switch between the program associated data of the audio program which he currently listens to and the stand-alone data services which are broadcast on the same frequency.
If the user wants to access the stand-alone data services, he receives an overview in form of a list of all currently broadcast data services to choose from.

Using the Multimedia Player

The Multimedia Player is started by pressing one of the DRM Service selection buttons of the DRMSoftwareRadio (see chapter 6). If the selected DRM Service carries data applications (stand-alone or as audio program associated data), the Fraunhofer DRM Multimedia Player window will be shown.

It automatically shows the multimedia services which are signaled as belonging to the currently selected audio service. If there are no such multimedia services a message will be displayed.

The multimedia services can be classified into two groups:

- multimedia services associated to an audio program: **PAD** ("Program Associated Data")
- independent multimedia services: **DATA-ONLY**

The following features can be accessed by pressing the corresponding buttons:

button	description	shortcut key
	Toggles between full screen and regular view	F11
	Switches to the DATA-ONLY selection page. All independent multimedia services which are broadcast within the current DRM program will be listed.	CTRL+ALT+H
	Switches to the PAD page. The multimedia services marked as belonging to the currently selected audio program will be displayed.	CTRL+ALT+P
	Navigates back in browsing history.	ALT+LEFT ARROW
	Navigates forward in browsing history.	ALT+RIGHT ARROW
	Prints the content of the currently displayed page.	CTRL+P
	Shows the About dialog (indicating the version of the multimedia player)	

An example for the DATA-ONLY selection page (accessed by clicking on the button ) is shown below. The actual content of this page depends on the DRM multimedia services which are currently received.

Each of the listed multimedia services can be selected by clicking on the corresponding hyperlink. From there it is possible to navigate further (depending on the kind of service selected).

7. Software Setup

7.1 Software Installation

1. Insert CD.
2. Run Setup_DRMSoftwareRadio_x.x.x.exe and follow the instructions. (x.x.x is a placeholder for the actual revision of the software)
3. Copy the license key file into the installation directory.
4. Run DRMSoftwareRadio.exe (link is placed on desktop).

*** End of Document ***