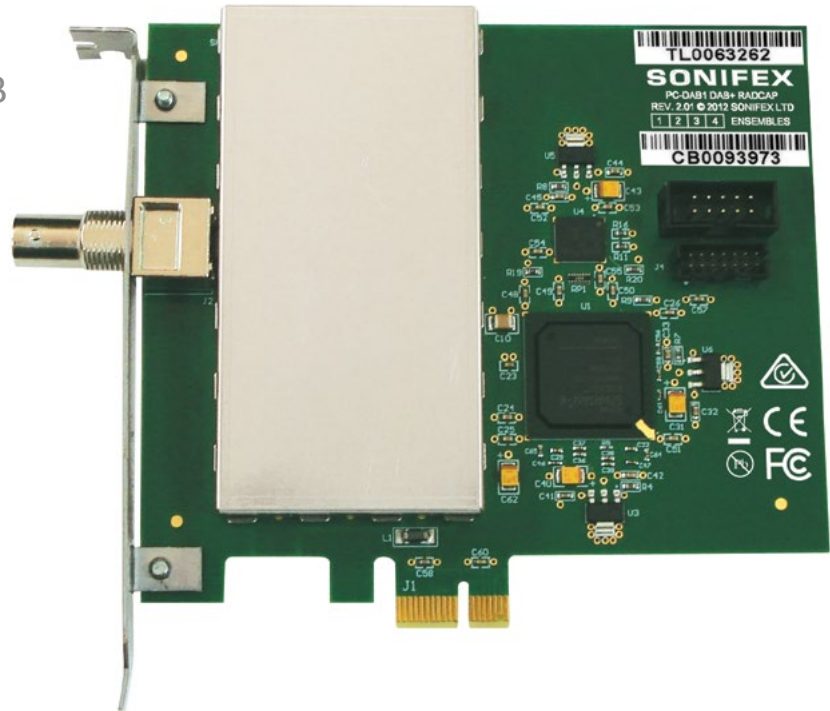


HANDBOOK

## PC-DAB1-4

Multi-Ensemble DAB+/DAB  
Radio Capture PCIe Card



Manufacturers of audio & video  
products for radio & TV broadcasters

**SONIFEX**

This handbook is for use with the following product:  
PC-DAB1-4 Multi-Ensemble DAB+/DAB Radcap PCIe Card  
Stock Code: 30-402

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Sonifex Ltd, 61, Station Road, Irthlingborough,  
Northants, NN9 5QE, England.  
Tel: +44 (0)1933 650 700  
Fax: +44 (0)1933 650 726  
Email: [sales@sonifex.co.uk](mailto:sales@sonifex.co.uk)  
Website: <http://www.sonifex.co.uk>

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# SONIFEX

## Register Online for an Extended 2 Year Warranty

As standard, Sonifex products are supplied with a 1 year back to base warranty.

If you register the product online, you can increase your product warranty to 2 years and we can also keep you informed of any product design improvements or modifications.

Product: \_\_\_\_\_

Serial No: \_\_\_\_\_

To register your product, please go online to [www.sonifex.co.uk/register](http://www.sonifex.co.uk/register)

## Product Warranty - 2 Year Extended

As standard, Sonifex products are supplied with a 1 year back to base warranty. In order to register the date of purchase and so that we can keep you informed of any product design improvements or modifications, it is important to complete the warranty registration online. Additionally, if you register the product on the Sonifex website, you can increase your product warranty to 2 years. Go to the Sonifex website at: [www.sonifex.co.uk/](http://www.sonifex.co.uk/) register to apply for your 2 year warranty.

### Sonifex Warranty & Liability Terms & Conditions

#### 1. Definitions

‘the Company’ means Sonifex Ltd and where relevant includes companies within the same group of companies as Sonifex Limited.

‘the Goods’ means the goods or any part thereof supplied by the Company and where relevant includes: work carried out by the Company on items supplied by the Purchaser; services supplied by the Company; and software supplied by the Company.

‘the Purchaser’ means the person or organisation who buys or has agreed to buy the Goods.

‘the Price’ means the Price of the Goods and any other charges incurred by the Company in the supply of the Goods.

‘the Warranty Term’ is the length of the product warranty which is usually 12 months from the date of despatch; except when the product has been registered at the Sonifex website when the Warranty Term is 24 months from the date of despatch.

‘the Contract’ means the quotation, these Conditions of Sale and any other document incorporated in a contract between the Company and the Purchaser.

This is the entire Contract between the parties relating to the subject matter hereof and may not be changed or terminated except in writing in accordance with the provisions of this Contract. A reference to the consent, acknowledgement, authority or agreement of the Company means in writing and only by a director of the Company.

#### 2. Warranty

- a. The Company agrees to repair or (at its discretion) replace Goods which are found to be defective (fair wear and tear excepted) and which are returned to the Company within the Warranty Term provided that each of the following are satisfied:
  - i. notification of any defect is given to the Company immediately upon its becoming apparent to the Purchaser;
  - ii. the Goods have only been operated under normal operating conditions and have only been subject to normal use (and in particular the Goods must have been correctly connected and must not have been subject to high voltage or to ionising radiation and must not have been used contrary to the Company’s technical recommendations);
  - iii. the Goods are returned to the Company’s premises at the Purchaser’s expense;
  - iv. any Goods or parts of Goods replaced shall become the property of the Company;
  - v. no work whatsoever (other than normal and proper maintenance) has been carried out to the Goods or any part of the Goods without the Company’s prior written consent;
  - vi. the defect has not arisen from a design made, furnished or specified by the Purchaser;

- i. the Goods have been assembled or incorporated into other goods only in accordance with any instructions issued by the Company;
  - ii. the defect has not arisen from a design modified by the Purchaser;
  - iii. the defect has not arisen from an item manufactured by a person other than the Company. In respect of any item manufactured by a person other than the Company, the Purchaser shall only be entitled to the benefit of any warranty or guarantee provided by such manufacturer to the Company.
- b. In respect of computer software supplied by the Company the Company does not warrant that the use of the software will be uninterrupted or error free.
- c. The Company accepts liability:
- (i) for death or personal injury to the extent that it results from the negligence of the Company, its employees (whilst in the course of their employment) or its agents (in the course of the agency);
  - (ii) for any breach by the Company of any statutory undertaking as to title, quiet possession and freedom from encumbrance.
- d. Subject to conditions (a) and (c) from the time of despatch of the Goods from the Company's premises the Purchaser shall be responsible for any defect in the Goods or loss, damage, nuisance or interference whatsoever consequential economic or otherwise or wastage of material resulting from or caused by or to the Goods. In particular the Company shall not be liable for any loss of profits or other economic losses. The Company accordingly excludes all liability for the same.
- e. At the request and expense of the Purchaser the Company will test the Goods to ascertain performance levels and provide a report of the results of that test. The report will be accurate at the time of the test, to the best of the belief and knowledge of the Company, and the Company accepts no liability in respect of its accuracy beyond that set out in Condition (a).
- f. Subject to Condition (e) no representation, condition, warranty or other term, express or implied (by statute or otherwise) is given by the Company that the Goods are of any particular quality or standard or will enable the Purchaser to attain any particular performance or result, or will be suitable for any particular purpose or use under specific conditions or will provide any particular capacity, notwithstanding that the requirement for such performance, result or capacity or that such particular purpose or conditions may have been known (or ought to have been known) to the Company, its employees or agents.
- g. (i) To the extent that the Company is held legally liable to the Purchaser for any single breach of contract, tort, representation or other act or default, the Company's liability for the same shall not exceed the price of the Goods.
- (ii) The restriction of liability in Condition (g)(i) shall not apply to any liability accepted by the Seller in Condition (c).
- h. Where the Goods are sold under a consumer transaction (as defined by the Consumer Transactions (Restrictions on Statements) Order 1976) the statutory rights of the Purchaser are not affected by these Conditions of Sale.

## Unpacking Your Product

Each product is shipped in protective packaging and should be inspected for damage before use. If there is any transit damage take pictures of the product packaging and notify the carrier immediately with all the relevant details of the shipment. Packing materials should be kept for inspection and also for if the product needs to be returned.

The product is shipped with the following equipment so please check to ensure that you have all of the items below. If anything is missing, please contact the supplier of your equipment immediately.

Item	Quantity
Product unit	1
Handbook	1
Driver CD	1

If you require a different power lead, please let us know when ordering the product.

## Repairs & Returns

Please contact Sonifex or your supplier if you have any problems with your Sonifex product. Email [technical.support@sonifex.co.uk](mailto:technical.support@sonifex.co.uk) for the repair/upgrade/returns procedure, or for support & questions regarding the product operation.

## CE Conformity

The products in this manual comply with the essential requirements of the relevant European health, safety and environmental protection legislation.

The technical justification file for this product is available at Sonifex Ltd.

The declaration of conformity can be found at:  
<http://www.sonifex.co.uk/declarations>

## Safety & Installation of Mains Operated Equipment

There are no user serviceable parts inside the equipment. If you should ever need to look inside the unit, always disconnect the mains supply before removing the equipment covers. The cover is connected to earth by means of the fixing screws. It is essential to maintain this earth/ground connection to ensure a safe operating environment and provide electromagnetic shielding.

### Voltage Setting Checks

Ensure that the machine operating voltage is correct for your mains power supply by checking the box in which your product was supplied. The voltage is shown on the box label. The available voltage settings are 115V, or 230V. Please note that all products are either switchable between 115V and 230V, or have a universal power supply.

### Fuse Rating





The product is supplied with a single fuse in the live conducting path of the mains power input. For reasons of safety it is important that the correct rating and type of fuse is used. Incorrectly rated fuses could present a possible fire hazard, under equipment fault conditions. The active fuse is fitted on the outside rear panel of the unit.

### Power Cable & Connection

An IEC power connector is supplied with the product which has a moulded plug attached.

The mains plug or IEC power connector is used as the disconnect device. The mains plug and IEC power connector shall remain readily operable to disconnect the apparatus in case of a fault or emergency.

The mains lead is automatically configured for the country that the product is being sent to, from one of:

Territory	Voltage	IEC Lead Type	Image
UK & Middle East	230V	UK 3 pin to IEC lead	
Europe	230V	European Schuko round 2 pin to IEC lead	
USA, Canada and South America	115V	3 flat pin to IEC lead	
Australia & New Zealand	230V	Australasian 3 flat pin to IEC lead	

Connect the equipment in accordance with the connection details and before applying power to the unit, check that the machine has the correct operating voltage for your mains power supply.

This apparatus is of a class I construction. It must be connected to a mains socket outlet with a protective earthing connection.

**Important note:** If there is an earth/ground terminal on the rear panel of the product then it must be connected to Earth.

## WEEE Directive



The Waste Electrical and Electronic Equipment (WEEE) Directive was agreed on 13 February 2003, along with the related Directive 2002/95/EC on Restrictions of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS). The Waste Electrical and Electronic Equipment Directive (WEEE) aims to minimise the impacts of electrical and electronic equipment on the environment during their life times and when they become waste. All products manufactured by Sonifex Ltd have the WEEE directive label placed on the case. Sonifex Ltd will be happy to give you information about local organisations that can reprocess the product when it reaches its “end of use”, or alternatively all products that have reached “end of use” can be returned to Sonifex and will be reprocessed correctly free of charge.

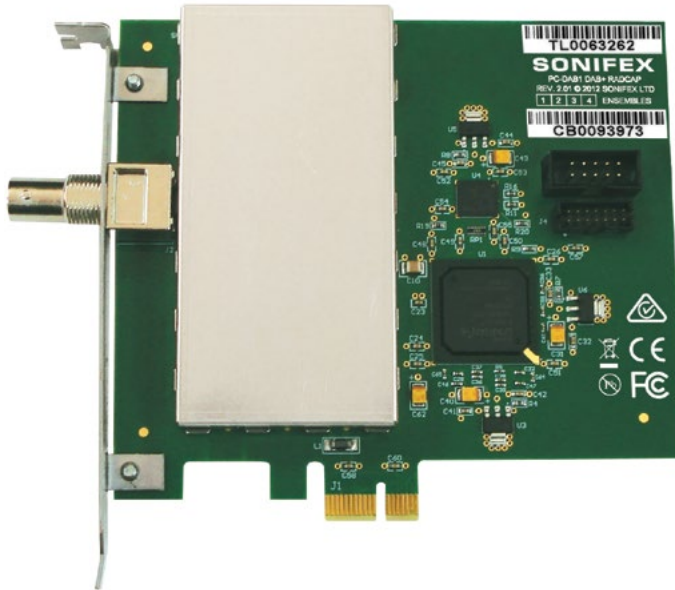
## Atmosphere/Environment

This apparatus should be installed in an area that is not subject to excessive temperature variation (<0°C, >50°C), moisture, dust or vibration.

This apparatus shall not be exposed to dripping or splashing, and no objects filled with water, such as vases shall be placed on the apparatus.



## Introduction



The PCI DAB+/DAB radio capture card receives and decodes the entire contents of up to four DAB+/DAB ensembles, rendering each audio service as a virtual Windows audio capture device for use with multi-channel recording or monitoring software.

Broadcast data services, including DLS text and MOT slideshows, are also available through a simple application programming interface.

The card supports both legacy DAB MP2 audio coding as well as the new HE-AAC v2 encoding used with DAB+ broadcasts.

Any application that records from standard wave input devices can be used to record the audio streams from the DAB+ Radcap. A recording level and mute control are provided for each service through the devices' mixer ports.

A sample monitor application is included which displays a control panel for each card and creates buttons for each audio service. When a button is clicked, it plays the audio through the default output device while displaying information obtained from the service and any DLS text and MOT images being broadcast.

The number of ensembles is factory-set as 1 (PC-DAB1), 2, 3 or 4 (PC-DAB4) but is field-expandable through a purchased expansion key. Multiple cards can be installed, allowing simultaneous monitoring or recording of more than four ensembles.

A sample application is provided with the card, allowing monitoring of DAB+/DAB audio and data as well as providing diagnostic ensemble spectrum displays, signal quality indicators and an uncorrected error counter. Each card panel displays the ensemble name and identifier, along with the phase reference correlator level and signal spectrum.

### System Requirements

Platform:	Windows Vista, Server 2008, Windows 7, Server 2008 R2, Windows 8, Server 2012 (32-bit and 64-bit versions supported) <b>(Note:</b> Windows XP and Server 2003 are not supported)
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Processor:	2GHz quad-core or better
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Memory:	1GB minimum
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Motherboard:	PCIe socket, single lane or greater
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Other:	Sound card or motherboard sound port for monitoring
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## Specifications

Tuning Range:	Band III (174-240MHz)
DAB Format:	Mode 1
RF Input:	BNC connector
Number of Ensembles:	Factory-configured for 1, 2, 3 or 4 (field expandable)
Number of Services:	128 in total across all ensembles
Audio Decoding:	MP2, HE-AAC v2
Audio Sampling Rate:	48kHz 16-bit stereo (other rates supported automatically through the Windows sampling rate converter)

## Installation

The Multi-ensemble DAB+ Radcap card uses static-sensitive components. Observe the usual precautions against static electricity when handling the card and do not touch the PCIe edge connector contacts.

Ensure that Windows Vista / Server 2008 or a later operating system is installed on the PC. The DAB+ Radcap cannot be used on any earlier versions of Windows such as Windows 2000, XP or Server 2003. It is recommended that the latest Service Pack and security updates be installed.

Switch off the PC and unplug the power lead before inserting the card into any vacant PCIe slot.

Restart the PC and allow Windows to boot up.

**Vista, Server 2008** - Windows will report that new hardware has been found and the New Hardware wizard will start. Insert the driver CD supplied with the card and proceed through the wizard. Allow Windows to search for the driver – do NOT specify a driver location or file name.

**Windows 7, 8, Server 2008-R2, Server 2012** – Windows no longer searches removable media for drivers. Open Device Manager, where the Radcap will be listed under Other Devices as a Multimedia Audio Controller. Right-click

on it, select Update Driver Software, then click on Browse my computer for driver software and click on the Browse button to navigate to the driver's location. Click on Next to install the driver.

Windows may warn that the driver being installed has not been certified by Microsoft, which is true. Click on **Continue** to complete the installation. The drivers are digitally signed by Innes Corporation as required by 64-bit Windows Vista and later systems.

Some older processors offer **hyperthreading**, which is a limited form of multiprocessing. However, elements of the processor, such as the floating point unit and memory cache, are shared between the executing threads, and this can cause a high priority thread, such as an audio processing thread, to be blocked by a lower priority thread that's using the shared resource. This can result in skipping during audio recording and gaps during playback. If this problem occurs, we recommend that hyperthreading be disabled in the motherboard BIOS. Note that this problem doesn't occur with true multi-core processors.

**Installing on Windows Server 2012** – For any audio devices to function correctly on this platform, the following steps need to be performed.

- Open the *Add Roles and Features Wizard* and, under *User Interfaces and Infrastructure*, select *Desktop Experience* and install it.
- After rebooting, go to *Control Panel – System and Security – Administrative Tools – Services* and scroll down to *Windows Audio Service*. Right-click on this, select *Properties* and change the *Startup type* to *Automatic*.
- Do the same for the *Windows Audio Endpoint Builder*.
- Close the Service Manager and reboot the system. Check that the speaker symbol in the bottom right hand corner of the screen is enabled.

## Antenna

The DAB+ Radcap requires an external vertically polarised antenna to receive the stations. The type of antenna needed depends on the signal

levels in the area in which it is being used. A splitter may be used to feed a single antenna into multiple cards, but a masthead amplifier may then be needed to compensate for the splitter losses. If using an amplifier, take care not to overdrive the cards as performance will be severely degraded. The minimum gain needed to provide good reception on the weakest ensemble being monitored should be used, and in some applications one or more directional antennas may be required.

**We strongly recommend fitting an external lightning suppressor to minimise the risk of damage to the card.**

Do not use a horizontally polarised TV antenna with the DAB+ Radcap, as the DAB signals are likely to be overloaded by adjacent television services.

## Configuration

To set the card's ensemble channels, open **Control Panel** and double-click on **Sounds and Multimedia**, click on the **Hardware** tab, select **Multi-ensemble DAB+ Radcap** and click on **Properties**. In the Properties window click on the **Configuration** tab and select the required channels from the drop-down lists.

For each ensemble, if a signal is present, the ensemble RF spectrum, RF signal level and phase reference correlator level are shown, with the broadcast ensemble name appearing on the surrounding box.

Each channel must be set to a different ensemble.

Once the ensemble is set and the card is receiving a satisfactory signal, the audio services on the ensemble will appear as Windows audio input devices, using the names broadcast for the services.

The **Device Mapping** setting determines how the driver will behave when services are added or removed from ensembles. If **Dynamic** is selected, the corresponding audio devices will be added or removed, but if **Static** is selected, the audio devices will remain unchanged until the next reboot (although audio will be unavailable on any removed services).

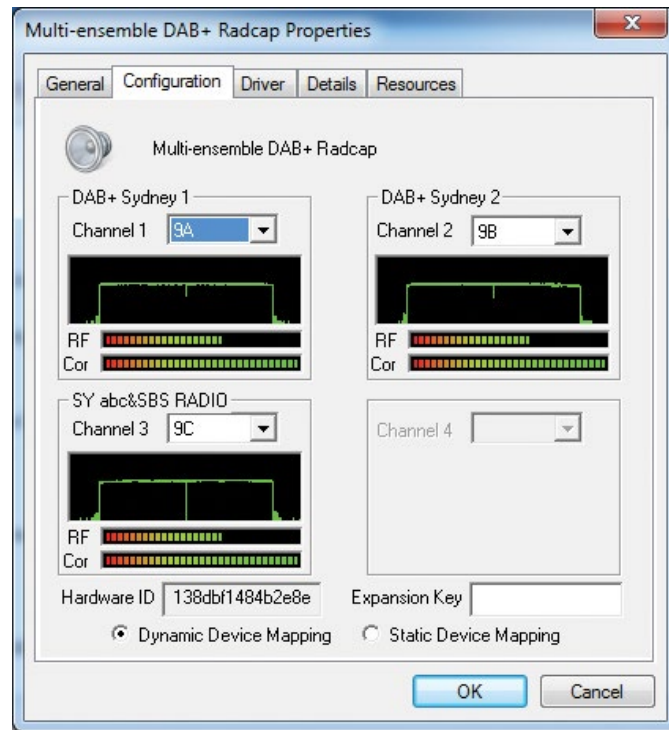


Fig 1-1: Multi-ensemble DAB+ Radcap Properties Screen

The card is factory-configured for 1, 2, 3 or 4 ensembles. For an additional charge, the number of ensembles can be increased in the field by applying the appropriate expansion key. Contact Sonifex Ltd or your distributor and quote the displayed **Hardware ID** number and your required number of ensembles.

## Recording

Any application that records from standard wave input devices can be used to record the audio streams from the Multi-ensemble DAB+ Radcap.

Make sure the recording software you are using allows you to select the audio input devices.

A recording level and mute control are provided for each service through the devices' mixer ports.

If recording a large number of channels using any form of audio compression, be sure to allow sufficient processing power to both capture the audio and compress it. The Performance Monitor in Windows' Task Manager provides a useful guide to CPU loading. Regrettably at this time, the Windows audio subsystem does not support recording directly in the DAB+ / DAB native AAC or MP2 compressed formats.

## Monitor Application

A simple monitor application is included in the distribution package, along with its C++ source code utilising the DAB+ Radcap programming API documented in Appendix A. Two versions are supplied, one based on the WinMM (wave) API and the other on DirectShow.

The application displays a control panel for each ensemble and creates buttons for each audio service. When a button is clicked, it plays the audio through the default output device while displaying information obtained from the service and any DLS text and MOT images being broadcast.

Each ensemble panel displays the ensemble name and identifier, along with the phase reference correlator level and signal spectrum. A drop-down list allows the ensemble channel to be set.

The buttons corresponding to each audio service are sorted by service ID number (Sid). The application periodically scans the list of audio capture devices, adding, removing or renaming buttons as required.

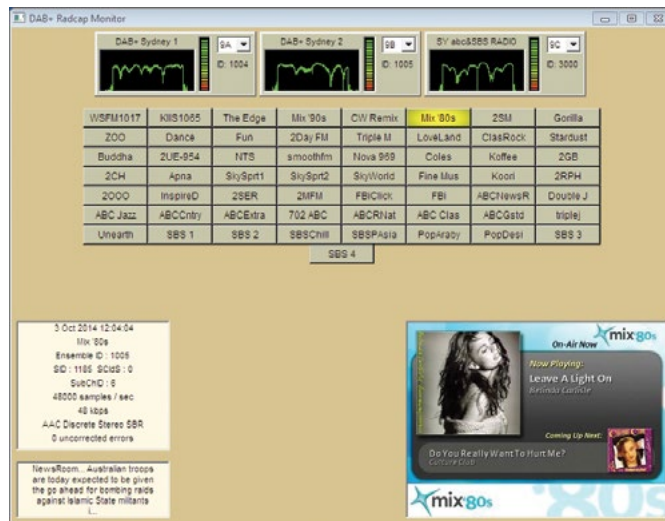


Fig 1-2: DAB+ Radcap Monitor Screen

## Support

For all support matters, go to [www.sonifex.co.uk](http://www.sonifex.co.uk) and click on Technical Support, then Software Downloads. Software and driver updates will be made available from time to time and will be placed on this website.

# Technical Specification For PC-DAB1-4

## Operating Systems Supported

Platform:	Windows Vista, Server 2008, Windows 7, Server 2008 R2, Windows 8, Server 2012 (32-bit and 64-bit versions supported) <b>(Note: Windows XP and Server 2003 are not supported)</b>
Processor:	2GHz quad-core or better
Memory:	1GB minimum
Motherboard:	PCIe socket, single lane or greater
Other:	Sound card or motherboard sound port for monitoring

## Specification

Tuning Range:	Band III (174-240 MHz)
DAB Format:	Mode 1
RF Input:	BNC connector
PCIe Interface:	Single lane PCIe 1.1
Number of Ensembles:	Factory-configured for 1, 2, 3 or 4 ensembles (field-expandable for an additional fee)
Total Number of Services:	128
Error Correction:	Soft-decision Viterbi inner decoder, Reed Solomon outer decoder
Audio Decoding:	MP2 and HE-AAC v2
Audio Format:	48kHz 16-bit stereo (other application sampling rates and bit depths supported through the Windows SRC) (24kHz and 32kHz services are internally up-converted to 48kHz)
Decoding Latency:	3 seconds

## Equipment Type

PC-DAB1	Radcap DAB+PCIe Radio Capture Card - 1 ensemble
PC-DAB2	Radcap DAB+PCIe Radio Capture Card - 2 ensembles
PC-DAB3	Radcap DAB+PCIe Radio Capture Card - 3 ensembles
PC-DAB4	Radcap DAB+PCIe Radio Capture Card - 4 ensembles
PC-DABUP	Radcap DAB+ 1 Ensemble Upgrade

## Physical Specification

Dimensions (Raw):	14cm (L) x 12.5cm (H) x 2cm (D) 5.5" (L) x 4.9" (H) x 0.8" (D)
Dimensions (Boxed):	27cm (L) x 22.5cm (H) x 6cm (D) 10.6" (L) x 8.9" (H) x 2.4" (D)
Weight:	Nett: 0.10kg Gross: 0.20kg Nett: 0.2lbs Gross: 0.4lbs

## Appendix A – Programming the Multi-Ensemble DAB+ Radcap

On the driver CD under **\DAB Radcap\API** you will find `DABRadcap.dll`, `DABRadcap.exp`, `DABRadcap.lib` and `DABRadcap.h`, which can be used with application programs to obtain information about each service while reading the transmitted FPAD and XPAD information. The functions exported by the DLL are grouped into card-centric and service-centric operations.

The card-centric functions require a card identifier number in the range 0 to `CardCount-1`, and, for ensemble-specific functions, an ensemble number in the range 0 to the one less than the number of ensembles on that card. They support operations related to the hardware, including setting and retrieving the tuner channel, monitoring the phase reference symbol correlator and signal spectrum, and retrieving the tuned ensemble identifier and name.

The service-centric functions are accessed using a handle returned by `DabRadcapOpen ()`, which takes a Windows wave capture device ID number, or `DabRadcapOpenFromDirectShow`, which takes an `IBaseFilter` interface pointer. Be aware that wave ID numbers are dynamic, and can change as devices are added or removed, or if the user changes the default capture device. The returned handle will remain associated with a given service regardless of any changes to the wave ID numbers, however once the handle is closed, it must not be assumed that calling this function again with the same wave ID will access the same service as previously obtained.

For applications using `DirectSoundCapture`, the system property `DSPROPERTY_DIRECTSOUNDDEVICE_DESCRIPTION` returns the wave input ID number for a given `DirectSoundCapture` GUID. Refer to System Property Sets in the `DirectSound` documentation for details. Be aware that, like wave input ID numbers, `DirectSoundCapture` GUIDs may change as devices are added or removed and should not be assumed to be static within a session.

Overlapped I/O should be used with the `DabRadcapGetPAD ()` function, as this does not return data immediately but waits until the next block of data is received. Multiple buffers should be used to avoid loss of data. Refer to the `PadThread ()` function in the sample monitor application to see how this is implemented.

The functions `DabRadcapGetCardEnsembleInformation`, `DabRadcapGetEnsembleInformation` and `DabRadcapGetServiceInformation` have been replaced with Unicode versions which take pointers to `EnsembleIdentificationW` or `ServiceInfoW` respectively. Although the older functions are still available in the API, new applications should use the new versions as they fully support the `Charset` information broadcast with the underlying text fields.

### Card-Centric Functions

```
UINT __stdcall DabRadcapGetNumberOfCards ();
```

#### Return value

If the function succeeds, the return value is the number of DAB+ Radcap cards installed in the PC. If the function fails, or if no cards are installed, the return value is 0. To get extended error information, call `GetLastError`.

#### Comments

Subsequent calls to card-centric functions should pass a card number in the range zero to one less than the return value of this function.

**UINT \_\_stdcall DabRadcapGetCardEnsembles (**

UINT CardNum);

**Return value**

If the function succeeds, the return value is the number of ensembles available on the specified card. If the function fails, the return value is 0. To get extended error information, call **GetLastError**.

**Comments**

Subsequent calls to card-centric functions should pass an ensemble number in the range zero to one less than the return value of this function.

**UINT \_\_stdcall DabRadcapGetCardChannel (**

UINT CardNum,  
UINT EnsembleNum);

**Parameters**

*CardNum*

Card identifier in the range zero to one less than the number of DAB+ Radcap cards.

*EnsembleNum*

Ensemble number in the range zero to one less than the number of ensembles on the specified card.

**Return value**

The return value is the channel to which the card is tuned. The channel numbers used in this function correspond to European DAB channel designators and nominal centre frequencies according to the table in Appendix B.

**BOOL \_\_stdcall DabRadcapSetCardChannel (**

UINT CardNum,  
UINT EnsembleNum,  
UINT Channel);

**Parameters**

*CardNum*

Card identifier in the range zero to one less than the number of DAB+ Radcap cards.

*EnsembleNum*

Ensemble number in the range zero to one less than the number of ensembles on the specified card.

*Channel*

Channel number (refer to Appendix B).

**Return value**

If the function succeeds the return value is TRUE.

If the function fails, the return value is FALSE. To get extended error information, call **GetLastError**.

**BOOL \_\_stdcall DabRadcapGetCardEnsembleInformationW (**

UINT CardNum,  
UINT EnsembleNum,  
EnsembleIdentificationW \*pInfo);

**Parameters**

*CardNum*

Card identifier in the range zero to one less than the number of DAB+ Radcap cards.

*EnsembleNum*

Ensemble number in the range zero to one less than the number of ensembles on the specified card.

*pInfo*

Pointer to an EnsembleIdentificationW structure which receives the requested information.

**Return value**

If the function succeeds the return value is TRUE.

If the function fails, the return value is FALSE. To get extended error

information, call `GetLastError`.

#### Comments

This function returns the Ensemble ID, label and label mask that is being broadcast. If this information is unavailable, the Ensemble ID is set to zero.

#### UINT \_\_stdcall DabRadcapGetCardSignalStrength (

UINT CardNum,  
UINT EnsembleNum);

#### Parameters

*CardNum*

Card identifier in the range zero to one less than the number of DAB+ Radcap cards.

*EnsembleNum*

Ensemble number in the range zero to one less than the number of ensembles on the specified card.

#### Return value

The return value is the relative received signal strength in decibels. The 0dB reference level is not well defined due to variations in receiver front-end gain, but is of the order of 3 $\mu$ V RMS.

#### UINT \_\_stdcall DabRadcapGetCardPhaseReferenceCorrelator (

UINT CardNum,  
UINT EnsembleNum);

#### Parameters

*CardNum*

Card identifier in the range zero to one less than the number of DAB+ Radcap cards.

*EnsembleNum*

Ensemble number in the range zero to one less than the number of ensembles on the specified card.

#### Return value

The return value is the phase reference symbol correlator level, in the range 0 to 100 where 100 corresponds to perfect correlation.

#### BOOL \_\_stdcall DabRadcapGetCardSpectrum (

UINT CardNum,  
UINT EnsembleNum  
float \*SpectrumArray,  
SIZE\_T SpectrumArraySize);

#### Parameters

*CardNum*

Card identifier in the range zero to one less than the number of DAB+ Radcap cards.

*EnsembleNum*

Ensemble number in the range zero to one less than the number of ensembles on the specified card.

*SpectrumArray*

Pointer to an array of 2048 floats into which the spectrum data is written.

*SpectrumArraySize*

The size in bytes of the array to which `SpectrumArray` points.

#### Return value

If the function succeeds the return value is TRUE.

If the function fails, the return value is FALSE. To get extended error information, call `GetLastError`.

#### Comments

The values written into `SpectrumArray` represent decibels in the range 0 to 60. The first element in the array represents the lowest frequency in the tuner passband. The frequency spacing is 1kHz, thus the returned data spans a frequency range of 2048kHz.



## Service-Centric Functions

**Note:** DabRadcapOpen should be used in applications based on the WinMM wave API, while DabRadcapOpenFromDirectShow should be used in DirectShow applications.

```
HANDLE __stdcall DabRadcapOpen (
    UINT waveInID );
```

### Parameters

*waveInID*  
waveIn device identifier.

### Return value

If the function succeeds, the return value is a handle for use with other DabRadcap API calls. If the function fails, the return value is INVALID\_HANDLE\_VALUE. To get extended error information, call GetLastError. If the audio capture device isn't a DAB service, the extended error code is ERROR\_SET\_NOT\_FOUND.

### Comments

Use the CloseHandle function to close the object handle that DabRadcapOpen returns.

```
HANDLE __stdcall DabRadcapOpenFromDirectShow (
    IFilterBase *pFilterObject );
```

### Parameters

*pFilterObject*  
The IBaseFilter object representing the audio capture device.

### Return value

If the function succeeds, the return value is a handle for use with other DabRadcap API calls. If the function fails, the return value is INVALID\_HANDLE\_VALUE. To get extended error information, call GetLastError. If the audio capture device isn't a DAB service, the extended error code

is ERROR\_SET\_NOT\_FOUND.

### Comments

Use the **CloseHandle** function to close the object handle that DabRadcapOpenFromDirectShow returns.

**Important:** When enumerating audio capture devices in DirectShow, make sure to use *AM\_KSCATEGORY\_CAPTURE* as the first parameter to CreateClassEnumerator. Using CLSID\_AudioInputDeviceCategory will create a wrapper around the Wave API, making the underlying filter handle inaccessible.

```
BOOL __stdcall DabRadcapGetEnsembleInformationW (
    HANDLE hDev,
    EnsembleIdentificationW *pInfo);
```

### Parameters

*hDev*  
Handle returned by **DabRadcapOpen**.  
*pInfo*  
Pointer to an EnsembleIdentificationW structure which receives the requested information.

### Return value

If the function succeeds the return value is TRUE.

If the function fails, the return value is FALSE. To get extended error information, call GetLastError.

### Comments

This function returns the Ensemble ID, label and label mask that is being broadcast. If this information is unavailable, the Ensemble ID is set to zero.

**BOOL \_\_stdcall DabRadcapGetServiceInformationW (**

HANDLE hDev,  
ServiceInfoW \*pInfo);

**Parameters**

*hDev*

Handle returned by DabRadcapOpen.

*pInfo*

Pointer to a ServiceInfoW structure which receives the requested information.

**Return values**

If the function succeeds the return value is TRUE.

If the function fails, the return value is FALSE. To get extended error information, call GetLastError.

**BOOL \_\_stdcall DabRadcapGetPAD (**

HANDLE hDev,  
PAD \*pPad,  
OVERLAPPED \*pOverlap);

**Parameters**

*hDev*

Handle returned by DabRadcapOpen.

*pPAD*

Pointer to a PAD structure which receives the next broadcast FPAD and XPAD contents.

*pOverlap*

Pointer to an OVERLAPPED structure. For overlapped operations, **DabRadcapGetPAD** returns immediately, and the event object is signalled when the operation has been completed. Otherwise, the function does not return until the operation has been completed or an error occurs.

**Return values**

If the function succeeds the return value is TRUE.

If the operation fails or is pending, the return value is FALSE. To get extended error information, call GetLastError, which returns ERROR\_IO\_PENDING if an overlapped operation is pending.

**Comments**

Refer to Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers (ETSI EN 300 401) for details on how to interpret FPAD and XPAD information. Refer to Digital Radio Broadcasting; Multimedia Object Transfer (MOT) protocol (ETSI EN 301 324) for details on decoding MOT information.

The audio stream must be open and running in order to receive PAD data, otherwise this call will fail and **GetLastError** will return ERROR\_NOT\_READY.

Because PAD information is transmitted frequently (every 24ms for DAB or 120ms for DAB+), the use of multiple buffers and overlapped I/O is strongly recommended to avoid loss of data.

**BOOL \_\_stdcall DabRadcapGetServiceStatus (**

HANDLE hDev,  
ServiceStatus \*pStatus );

**Parameters**

*hDev*

Handle returned by DabRadcapOpen.

*pStatus*

Pointer to a ServiceStatus variable into which the result is to be written.

**Return values**

If the function succeeds the return value is TRUE.

If the operation fails the return value is FALSE. To get extended error information, call `GetLastError ()`.

#### Comments

If this function returns FALSE or if the status is `ServiceStatusLost`, the application should immediately cease any recording operations, close any open waveIn handle on this device and call **CloseHandle** to close `hDev`.

A status value of **ServiceStatusAbsent** typically indicates a momentary loss of signal.

A status value of **ServiceStatusPresent** indicates that the signal is being correctly received.

```
UINT __stdcall DabRadcapGetUncorrectedErrorCount (
    HANDLE hDev );
```

#### Parameters

*hDev*

Handle returned by `DabRadcapOpen`.

#### Return value

The function returns the number of uncorrected errors since the stream was opened.

```
BOOL __stdcall DabRadcapGetDateTime (
    HANDLE hDev,
    DABDateTimeInfo *pDateTime );
```

#### Parameters

*hDev*

Handle returned by `DabRadcapOpen`.

*pDateTime*

Pointer to a `DABDateTimeInfo` structure into which the current UTC and local time is to be written.

#### Return values

If the function succeeds the return value is TRUE.

If the operation fails the return value is FALSE. To get extended error information, call `GetLastError ()`.

```
BOOL __stdcall DabRadcapGetFormat (
    HANDLE hDev,
    DABFormat *pFormat );
```

#### Parameters

*hDev*

Handle returned by `DabRadcapOpen`.

*pFormat*

Pointer to a `DABFormat` structure into which the current audio format parameters are written.

#### Return values

If the function succeeds the return value is TRUE.

If the operation fails the return value is FALSE. To get extended error information, call `GetLastError ()`.

#### Comments

The audio stream must be open and running in order to receive `DABFormat` data, otherwise this call will fail and **GetLastError** will return `ERROR_NOT_READY`.

## Appendix B – DAB Channel Numbers

Channel Number	Channel Designator	Centre Frequency (MHz)
0	5A	174.928
1	5B	176.640
2	5C	178.352
3	5D	180.064
4	6A	181.936
5	6B	183.648
6	6C	185.360
7	6D	187.072
8	7A	188.928
9	7B	190.640
10	7C	192.352
11	7D	194.064
12	8A	195.936
13	8B	197.648
14	8C	199.360
15	8D	201.072
16	9A	202.928
17	9B	204.640
18	9C	206.352
19	9D	208.064
20	10A	209.936

Channel Number	Channel Designator	Centre Frequency (MHz)
21	10N	210.096
22	10B	211.648
23	10C	213.360
24	10D	215.072
25	11A	216.928
26	11N	217.088
27	11B	218.640
28	11C	220.352
29	11D	222.064
30	12A	223.936
31	12N	224.096
32	12B	225.648
33	12C	227.360
34	12D	229.072
35	13A	230.784
36	13B	232.496
37	13C	234.208
38	13D	235.776
39	13E	237.488
40	13F	239.200

## Appendix C – Copyright Notices

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### **MP2 Audio Decoder**

kjmp2 MP2 Decoder Copyright © 2006 Martin J. Fiedler, used with permission.

### **Reed-Solomon Error Correction**

Reed-Solomon decoder Copyright © 2004 Phil Karn, KA9Q, used under the terms of the GNU LESSER GENERAL PUBLIC LICENSE Version 2.1, February 1999. The library source code and licence text is included in the DAB+ Radcap distribution package.

### **aacPlus-v2 Audio Decoder**

FAAD2 aacPlus-v2 Decoder Copyright © 2003-2005 M. Bakker, Nero AG used under commercial licence.





**SONIFEX**

[www.sonifex.co.uk](http://www.sonifex.co.uk)

t:+44 (0)1933 650 700

f:+44 (0)1933 650 726

[sales@sonifex.co.uk](mailto:sales@sonifex.co.uk)