PC-AM6-32

AM Radio Capture PCIe Card
(6 to 32 Channels)

Manufacturers of audio & video
products for radio & TV broadcasters

SONIFEX

This handbook is for use with the following product:
PC-AM6-32 AM Radcap PCIe Card (6 to 32 Channels)
Stock Code: 30-404

Made in the UK by **SONIFEX**

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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.

To register your product, please go online to 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 within 30 days of purchase, you can increase your product warranty to 2 years. Go to the Sonifex website at: http://www.sonifex.co.uk/technical/register/index.asp to apply for your 2 year warranty.

Note: For your own records the product serial number is recorded on the CE certification page of this handbook.

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;

vii.   the Goods have been assembled or incorporated into other goods only in accordance with any instructions issued by the Company;

viii.   the defect has not arisen from a design modified by the Purchaser;

ix.   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.

c.   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 for the repair/upgrade/returns procedure, or for support & questions regarding the product operation.

CE Declaration of Conformity and Approval Information

SONIFEX

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This document certifies that the Sonifex product that you have purchased is compliant with CE specifications. If you would like further information on compliance of all Sonifex products, please check the website at the address above where full information is available.

Sonifex Limited hereby certify that the following product with serial number shown has been designed and manufactured in accordance with the following specifications:

Product: _____

_____

Serial No: _____

EMC:	EN 55103-1: 1997 Electromagnetic Compatibility. Limits of disturbance for audio apparatus for professional use For use in environments 1 to 4.
	EN 55103-2: 1997 Electromagnetic Compatibility. Limits of disturbance for audio apparatus for professional use For use in environments 1 to 4.
Safety:	EN 60950: 1992 Safety of Information Technology Equipment Including Electrical Business Equipment.
Hybrid Approvals:	BS6301, BS7002, BS415, CTR21, R&TTE directive (1999/5/EC)

The Reference Technical Justification File for this product is available at Sonifex Ltd.

Authorised By:

Name: Chris Stills

Position: Technical Director

Date of Issue: 01 October 2014

Signature:

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.

RoHS Directive

The RoHS directive limits the use of certain hazardous substances currently used in EEE manufacture, including lead, mercury, cadmium, hexavalent chromium, and halide-containing compounds PBB (polybrominated biphenyl) and PBDE (polybrominated diphenyl ether). Elimination of these substances will result in more environmentally friendly recycling of electronic equipment.

Sonifex Ltd practices lead-free (LF) manufacturing processes and does not use any of the hazardous substances identified in the European Union's Restriction of Hazardous Substances (RoHS) directive. The manufacturing processes include the assembly of purchased components from various sources. Product is offered as RoHS compliant, or LF, only after sufficient evidence is received from the component manufacturers that their components are RoHS compliant. Sonifex Ltd relies solely on the distributor, or manufacturer, of the components for identification of RoHS compliance. Thus whilst every effort is made to ensure compliance, Sonifex Ltd makes no warranty, or certification, or declaration of compliance concerning said components.

Atmosphere

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

Electromagnetic Compatibility

Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

This product complies with the relevant tested clauses of AS/NZS CISPR 22:2009 +A1:2010 and AS/NZS CISPR 13:2012.

This product complies with the relevant tested clauses of EN55022:2010, EN55013:2013, EN55024:2010, EN61000-3-2:2009 and EN61000-3-3:2013.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Introduction
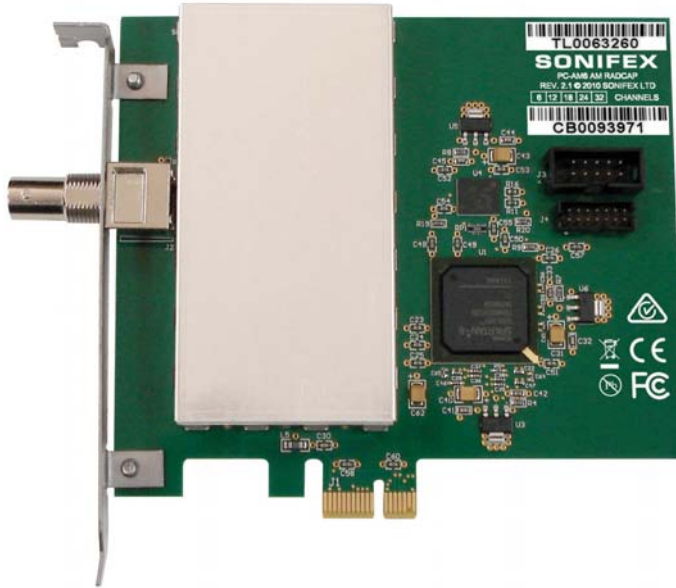
The AM Radcap PCIe card is a radio capture card designed for simultaneous recording of up to 32 radio stations. The frequency of each individual station may be set in software and its audio appears as a standard Windows audio input device.

The AM Radcap uses a high speed analogue-to-digital converter to digitise the entire AM band, with advanced digital signal processing on a Spartan 6 FPGA used to tune and extract the audio for each individual station. It can be configured to either create a separate audio stream for each station or to pair stations together as 2-channel streams.

A WDM driver for Windows XP, Windows 7/8 and other versions is supplied as well software for setting the tuner frequencies and monitoring the received audio.

A recording level control, mute control and peak meter are provided for each station (or pair of stations) through the devices' mixer ports. The default level setting is 50%, and at this setting 100% modulation will produce a peak audio level 6dB below clipping.

A utility called AmSpectrum is supplied. This displays the RF spectrum from 500kHz to 1700kHz and may be useful in selecting the best location for the antenna or resolving interference problems. The receiver bandwidth can be set to wide (default) or narrow. The narrow setting restricts the audio response to about 3kHz, which may be useful in noisy environments.

A utility program called Tuner is also supplied which can be used to set the frequency of each station and to monitor each station through the PC's standard sound card or motherboard sound port. The Tuner program also provides relative signal strength indicator bars which may be useful in adjusting antenna placement.

The card is factory-configured for 6 (PC-AM6), 12, 18, 24 or 32 (PC-AM32) stations, but needs licensing on your PC hardware. It may be expanded in the field for an additional charge.

System Requirements

Platform:	Windows XP, Server 2003, Vista, Server 2008, 7, Server2008-R2, 8, Server 2012 (32- or 64-bit versions)
Processor:	500MHz Pentium II or better
Memory:	128MB minimum
Motherboard:	PCI Express version 1.0 or later
Other:	Sound card or motherboard sound port for monitoring

Specifications

Tuning range:	500kHz to 1710kHz in 1kHz steps
Sensitivity:	50uV for 40dB S/N
Maximum input level:	200mVp-p
RF input impedance:	50Ω
Filter attenuation:	82dB at 15kHz or more from centre frequency
Audio bandwidth:	5kHz (wide) or 3kHz (narrow)
Audio distortion:	< 0.1%
Audio sampling rate:	22.05 kHz (other rates supported via Windows SRC)
Number of stations:	6, 12, 18, 24 or 32 (factory configured but user-expandable)

Installation

The AM 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 XP (SP2 or later), Server 2003, Server 2008, Vista, 7, Server 2008-2, 8 or Server 2012 is installed on the PC. The AM Radcap card cannot be used under Windows 9x or Windows ME, 2000 and versions of XP prior to SP2. The latest Service Pack should be installed.

Switch off the PC and unplug the power lead. Insert the card into any vacant PCIe slot. Although the card is single-lane, it can be used in multi-lane slots as the PCIe protocol automatically negotiates lane width.

Restart the PC and allow Windows to boot up.

Windows XP, Server 2003, 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 8, 7, Server 2012, Server 2008-R2 – Windows no longer searches removable media for drivers. Open Device Manager, where the Radcap will be shown 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 that it is installing has not been certified by Microsoft, which is true. The driver is however digitally signed by Innes Corporation to meet the requirements of 64-bit Windows Vista and later systems. Click on Continue to complete the installation.

Antenna

The AM Radcap requires an external antenna to receive the stations. The type of antenna needed depends on the signal levels in the area in which it is being used. The card has a low input impedance (50Ω) and is better suited to a loop antenna than a whip antenna, although the latter can be used. An amplified antenna may be needed in some situations.

As a guide, a whip antenna one metre in length at a distance of 10km from a 5kW transmitter at 1MHz will produce a signal level of about 100uV into the card's 50 ohm input. A shielded loop antenna enclosing a one square metre area under the same conditions will produce about 600uV and will offer better immunity to local electrical noise.

A suitable shielded loop antenna is the Belar model LP-1.

While the card is fitted with an input protection diode, we strongly recommend fitting an external lightning suppressor to minimise the risk of damage to the card. If using an amplified antenna, ensure the maximum input level (200mVp-p) is not exceeded.

A utility called AmSpectrum is supplied on the driver CD. This displays the RF spectrum from 500kHz to 1700kHz and may be useful in selecting the best location for the antenna or resolving interference problems.
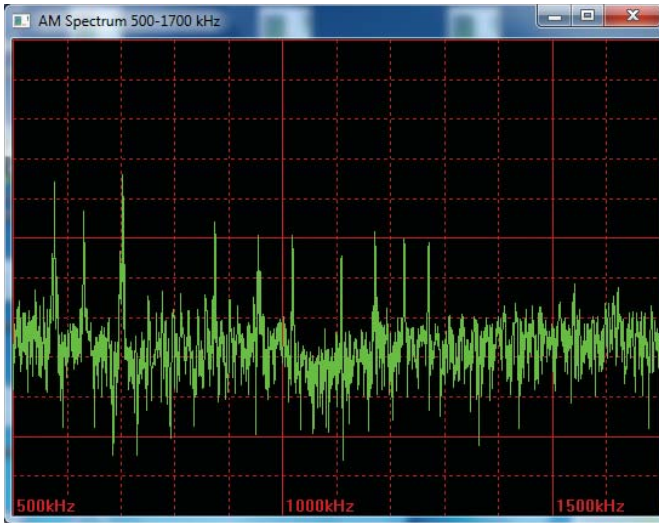

Fig 1-1: AM Spectrum 500-1700 kHz Screen

To run the program, insert the driver CD, click on Start – Run and type in d:\ AM & FM Radcap AmSpectrum.exe where d: is the drive letter for the CDROM drive.

While every effort has been made to shield the Radcap input from internal PC noise, in some situations such interference may be experienced. Trying different PCIe slots may help to minimise such interference. The use of PCIe extender cards is not recommended because of the increased potential for interference. Avoid placing the card in PCs fitted with high-performance video cards as these can be very noisy.

Configuration

To change the configuration, open **Device Manager**, expand the **Sound, video and game controllers** section, right-click on **AM Radcap PCIe** and select **Properties**. The available options are under the **Configuration** tab.

Note that, due to a limitation in the current driver, the Hardware ID will not display if any applications are using the Radcap API. Please close any Radcap-related programs before changing the settings.
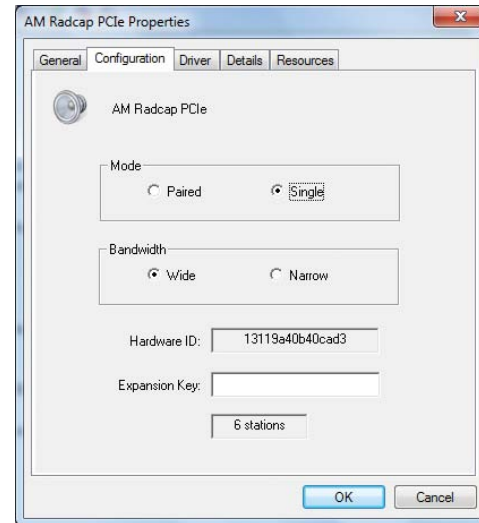
Fig 1-2: AM Radcap PCIe Properties

The AM Radcap PCIe is factory-configured for 6, 12, 18, 24 or 32 stations, but needs licensing on your PC hardware. For an additional charge, the number of stations can be increased in the field by entering the appropriate expansion key on this page. Contact Sonifex Ltd to obtain an expansion key, quoting the card's Hardware ID and the number of stations you require. Windows XP and Server 2003 limit the total number of audio input devices

to 32. Please be aware of this limit, particularly if there are other audio input devices present in the PC. There is no device limit in Vista, Windows 7, 8, Server 2008, Server 2008-R2 or Server 2012.

The AM Radcap card can be configured to produce a separate audio stream for each station (single mode), or alternatively to pair stations together as the left and right sides of a 2-channel audio stream (paired mode). Which mode is best will depend on the application software being used.

The receiver bandwidth can be set to wide (default) or narrow. The narrow setting restricts the audio response to about 3kHz, which may be useful in noisy environments.

Once the configuration has changed it may take up to a minute for Windows to reconfigure itself – be patient, it hasn't crashed!

Setting Station Frequencies

A utility program called Tuner is supplied on the driver disc (this replaces the earlier AmTune utility). This can be used to set the frequency of each station and also to monitor each station through the PC's standard sound card or motherboard sound port.

To run the program, insert the driver CD, click on Start – Run and type in d:\AM & FM Radcap\Tuner.exe where d: is the drive letter for the CDROM drive. To set the frequency of a station, click on the Set button for that station, type in the frequency (in kHz) and click on OK. To monitor a station, click on the Monitor button for that station. Note that there is a delay of about one second in the audio heard via this monitor, due to the amount of audio buffering used.

Fig 1-3: Radcap Monitor Screen

The frequencies set are stored in the Windows Registry by the driver and are automatically restored whenever the PC is started. It is not necessary to re-run Tuner or to leave it running once the frequencies are set.

Alternatively, if you write your own software, there is a DLL supplied on the driver disc that can be used for setting and retrieving the station frequencies. Refer to Appendix A for details.

The Tuner program also provides relative signal strength indicator bars which may be useful in adjusting antenna placement. These indicators don't take into account the action of the card's front-end AGC, and so should not be used as an absolute signal strength reference. The signal strength indicator has an approximately logarithmic response.

Note also that the AM Radcap does not support AM Stereo, as the use of this mode has largely gone out of favour, and so the Stereo indicators in the Tuner program don't operate on AM stations.

Recording

Any application that records from standard wave input devices can be used to record the audio streams from the AM Radcap. The native sampling rate of the card is 22.05kHz with 16 bit resolution and, all other things being equal, this rate should be used. Other rates can be used as Windows automatically provides a sampling rate converter, but this converter will consume some CPU time.

Make sure that the recording software you are using allows you to select the audio input devices. The Radcap virtual devices have names like "AM Radcap Ch. 1" (or "AM Radcap Ch. 1/2" if stations are paired).

A recording level control, mute control and peak meter are provided for each station (or pair of stations) through the devices' mixer ports (peak meters in Windows Vista and later can only be accessed through the mixer API if the application is running in XP-SP2 compatibility mode, or by using the new Core Audio API). The default level setting is 50%, and at this setting 100% modulation will produce a peak audio level 6dB below clipping.

Support

For all support matters, go to 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-AM6-32

Operating Systems Supported	
Platform:	Windows XP, Server 2003, Vista, Server 2008, Windows 7, Server 2008 R2, Windows 8, Server 2012 (32-bit and 64-bit versions)
Processor:	1GHz Pentium II or better
Memory:	128MB minimum (1GB for Vista and later systems)
Bus:	Single lane PCI Express v1.1
Other:	Sound card or motherboard sound port for monitoring

Specification	
Tuning Range:	500kHz to 1710kHz in 1kHz steps
Sensitivity:	50uV for 40dB S/N
RF Input Impedance:	50Ω
Filter Attenuation:	82dB at 15kHz or more from centre frequency
Audio Bandwidth:	5kHz
Audio Distortion:	<0.1%
Audio Sampling Rate:	22.05kHz (other rates supported via Windows SRC)
Number of Stations:	6, 12, 18, 24 or 32

Equipment Type	
PC-AM6	Radcap AM 6 - 6 channel AM PCIe Radio Capture Card
PC-AM12	Radcap AM 12 - 12 channel AM PCIe Radio Capture Card
PC-AM18	Radcap AM 18 - 18 channel AM PCIe Radio Capture Card
PC-AM24	Radcap AM 24 - 24 channel AM PCIe Radio Capture Card
PC-AM32	Radcap AM 32 - 32 channel AM PCIe Radio Capture Card
PC-AMUP6	Radcap AM 6 Channel Upgrade
PC-AMUP8	Radcap AM 8 Channel 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 PC-AM6-32

On the driver CD you will find Radcap.dll, Radcap.exp, Radcap.lib and Radcap.h, which can be used to read and set the frequency of each station or read the received signal strength indicator. The DLL exports the following functions:

enum RadcapTunerType { RadcapAM, RadcapFM };

UINT __stdcall RadcapStationCount (
    enum RadcapTunerType Mode);

Parameters
    Mode
        Specifies AM or FM tuners.

Return value
    The return value is the number of stations available.

Comments
    This function will fail if the monitor program (Tuner.exe) or the AM spectral display program (AmSpectrum.exe) is running.

BOOL __stdcall RadcapGetID (
    UINT DeviceID,
    enum RadcapTunerType *pType,
    int *pTunerID, BOOL *pPaired);

Parameters
    DeviceID
        waveIn device ID
    pType
        Pointer to RadcapTunerType variable to receive the returned device type
    pTunerID
        Pointer to int variable to receive the returned Tuner ID number
    pPaired
        Pointer to BOOL variable to receive the returned tuner configuration

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 takes the Device ID number of a waveIn audio stream and returns the tuner type, identifier and configuration information for the corresponding tuner. If the audio stream does not correspond to a Radcap tuner the function returns FALSE.

UINT __stdcall RadcapGetFrequency (
enum RadcapTunerType Mode,
int TunerID);

Parameters

Mode

Specifies AM or FM tuner.

TunerID

Index of the station to be read, beginning at zero for the first station.

Return values

If the function succeeds the return value is the frequency in kilohertz.

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

Comments

This function will fail if the monitor program (Tuner.exe) or the spectral display program (AmSpectrum.exe) is running.

UINT __stdcall RadcapSetFrequency (
enum RadcapTunerType Mode,
int TunerID,
UINT Kilohertz);

Parameters

Mode

Specifies AM or FM tuner.

TunerID

Index of the station to be set, beginning at zero for the first station.

Kilohertz

The frequency (in kilohertz) that the station is to be set to. For AM, this must lie between 500 and 1700, and for FM this must lie between 87500 and 108500.

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 will fail if the monitor program (Tuner.exe) or the spectral display program (AmSpectrum.exe) is running.

UINT __stdcall RadcapGetRSSI (
    enum RadcapTunerType Mode,
    int TunerID);

Parameters

    Mode

        Specifies AM or FM tuner.

    TunerID

        Index of the station to be read, beginning at zero for the first station.

Return value

    If the function succeeds the return value is the received signal strength indicator.

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

Comments

    The received signal strength indicator is not available on the original 2-channel FM Radcap cards. This function will succeed with those cards but will always return 0.

    The received signal strength indicator is a relative indication only and should not be taken as an absolute measurement of signal strength.

    This function will fail if the monitor program (Tuner.exe) or spectrum display program (AmSpectrum.exe) is running.

BOOL __stdcall RadcapGetStereo (
    enum RadcapTunerType Mode,
    int TunerID);

Parameters

    Mode

        Specifies AM or FM tuner.

    TunerID

        Index of the station to be read, beginning at zero for the first station.

Return value

    The return value is TRUE if the station is being received in stereo.

Comments

    The stereo indicator is only available on the FM Radcap cards, and then only if the card is configured for stereo reception. This function will fail if the monitor program (Tuner.exe) or spectrum display program (AmSpectrum.exe) is running.

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