NoiseTools Reverberation Time Module
For NoiseTools

Cirrus Research plc

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Updates

In the interests of continuous product improvement, Cirrus Research plc reserves the right to make changes to product specifications without notice.

To understand the latest updates that have been implemented into this product and to download the most current version of this user manual, visit our web site at www.cirrusresearch.co.uk

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Overview

The Reverberation Time module allows the NoiseTools software to calculate RT20, RT30 and RT60 values from either interrupted or impulse noise source data.

The calculations are made in accordance with EN ISO 3382-2:2008[1]

The data is taken from a measurement, or measurements, within the NoiseTools software. The calculated values are displayed both in graphical and numerical form and a report can be produced. The graphical and numerical data can be exported for use in other programs or applications as required.

The module will determine if the data is of sufficient quality to accurately calculate the RT20 and RT30 values according to EN ISO 3382-2:2008[1]. To calculate the reliability of the data source, the module uses BT>4 for impulse noise sources and BT>16 for interrupted noise sources as defined in EN ISO 3382-2:2008[1].

NoiseTools uses a licencing system that requires an Optimus Cloud to be created. The module will be connected to that Optimus Cloud account using the email address provided.

An example measurement data file can be downloaded from www.cirrusresearch.co.uk/library/software and this can be used within the Reverberation Time Module.

[1] EN ISO 3382-2 Acoustics - Measurement of room acoustic parameters - Part 2: Reverberation time in ordinary rooms (ISO 3382-2:2008)

Installation & Activation for NoiseTools 1.7 or later

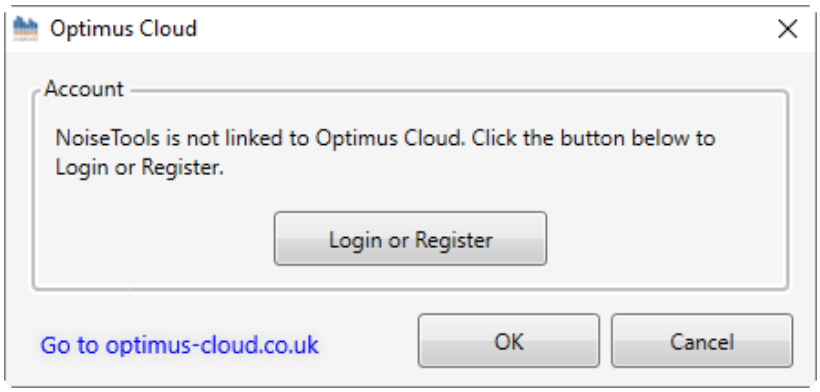
Ensure that NoiseTools 1.7 is installed (click Help, About to confirm the version of NoiseTools).

The files required for the Reverberation module are installed automatically with the NoiseTools 1.7 installation.

Create an Optimus Cloud Account

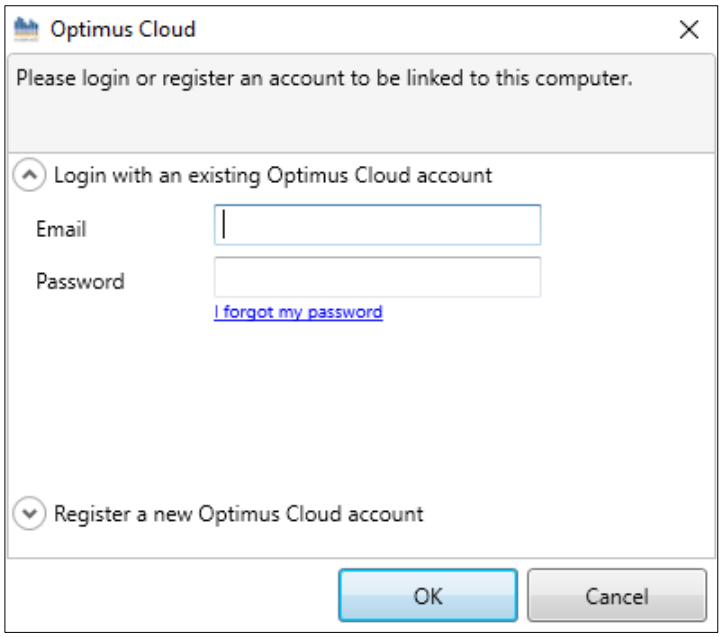
1. Open the NoiseTools software
2. Click Tools -> Optimus Cloud

   If NoiseTools is not currently associated with an Optimus Cloud account, the following message will be shown:

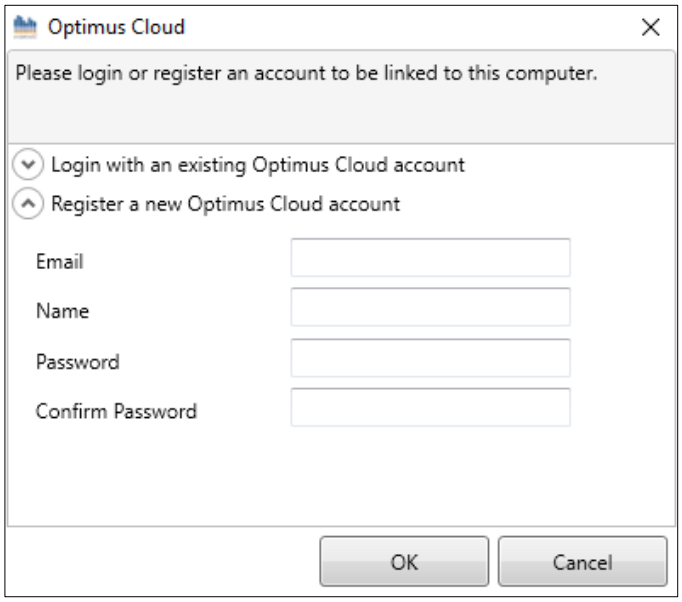


3. Click Login or Register

If you already have an Optimus Cloud account, click Login with an Existing Optimus Cloud account and enter the details. Click OK.



For a new account, click register for a new Optimus Cloud Account and enter the details. Click OK to register.



You will receive an email with a confirmation link.

Click the link to confirm the email address.

Once the email address has been confirmed, login to the Optimus Cloud using the Tools -> Optimus Cloud option in NoiseTools.

The email address given will be linked to NoiseTools.

Activating the Reverberation module

To activate the module, please send an email to support@cirrusresearch.com

Please include the following information:

Name

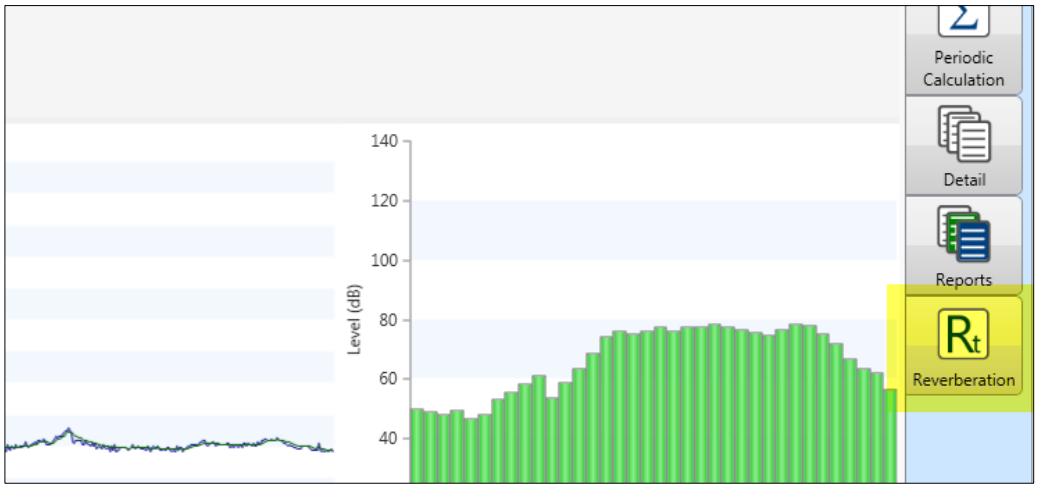
Email address – this must be the email address used for the Optimus Cloud account

Module name – This is NoiseTools Reverberation Time Module

Once the module has been activated, you will receive a confirmation email and the module will be activated.

Open the NoiseTools program and the Reverberation module will appear as a new tab on the right-hand side when a measurement is opened (as shown below):

If the module does not appear, please check that NoiseTools is connected to an Optimus Cloud account (Tools -> Optimus Cloud) and confirm that the module has been activated.



Installation & Activation for NoiseTools 1.6.4

Ensure that NoiseTools is installed. The Reverberation Time module must be installed separately from the main NoiseTools program.

System Requirements

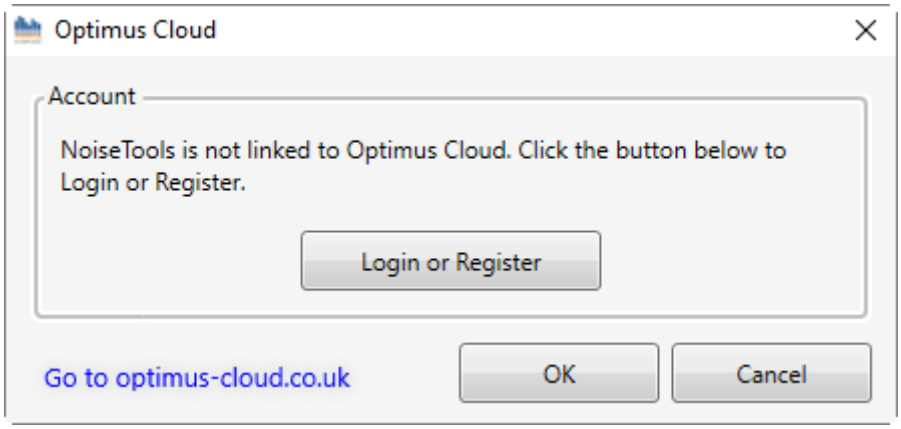
The Reverberation Time module requires NoiseTools v1.6 or later.

The computer used to run NoiseTools should meet the minimum requirements specified on page 19.

Create an Optimus Cloud Account

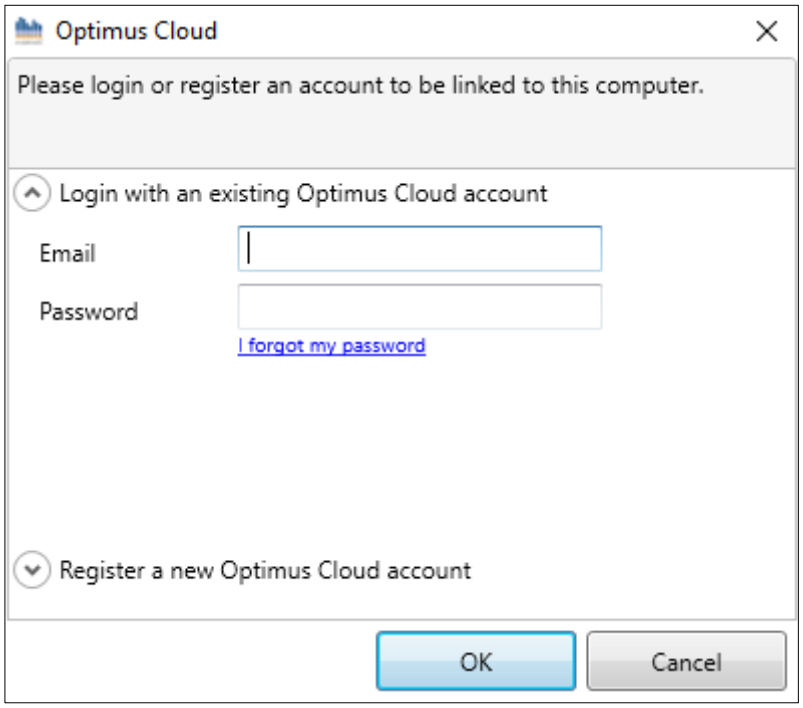
4. Open the NoiseTools software
5. Confirm that the version of NoiseTools is 1.6.4 (Click Help -> About to confirm the version number)
6. Click Tools -> Optimus Cloud

   If NoiseTools is not currently associated with an Optimus Cloud account, the following message will be shown:

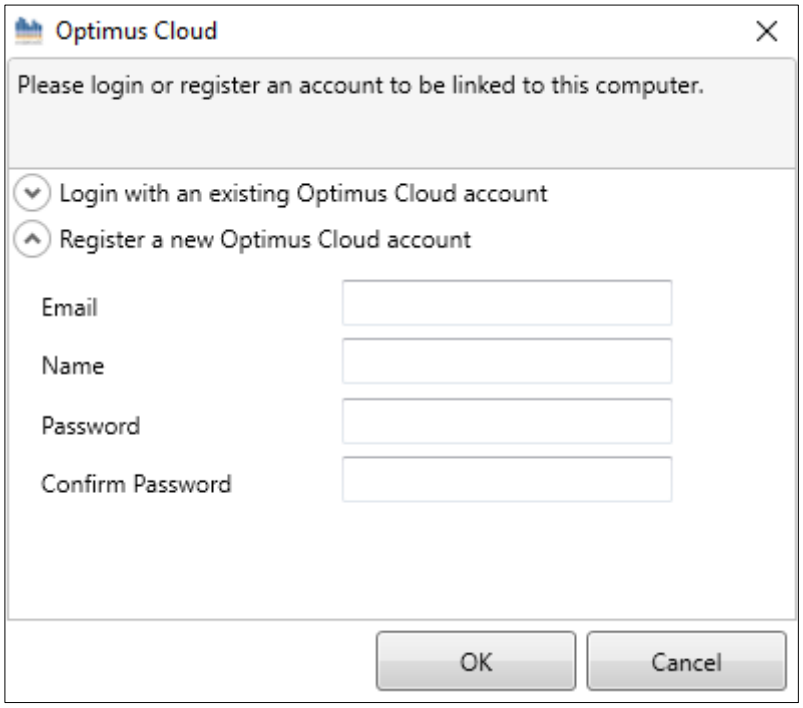


7. Click Login or Register

If you already have an Optimus Cloud account, click Login with an Existing Optimus Cloud account and enter the details. Click OK.



For a new account, click register for a new Optimus Cloud Account and enter the details. Click OK to register.



You will receive an email with a confirmation link.

Click the link to confirm the email address.

Once the email address has been confirmed, login to the Optimus Cloud using the Tools -> Optimus Cloud option in NoiseTools.

The email address given will be linked to NoiseTools.

Activating the Reverberation module

To activate the module, please confirm the email address used for the Optimus Cloud account to support@cirrusresearch.com

Please include the following information:

Name

Email address – this must be the email address used for the Optimus Cloud account

Module name – This is NoiseTools Reverberation Time Module

Installing the Reverberation Time module

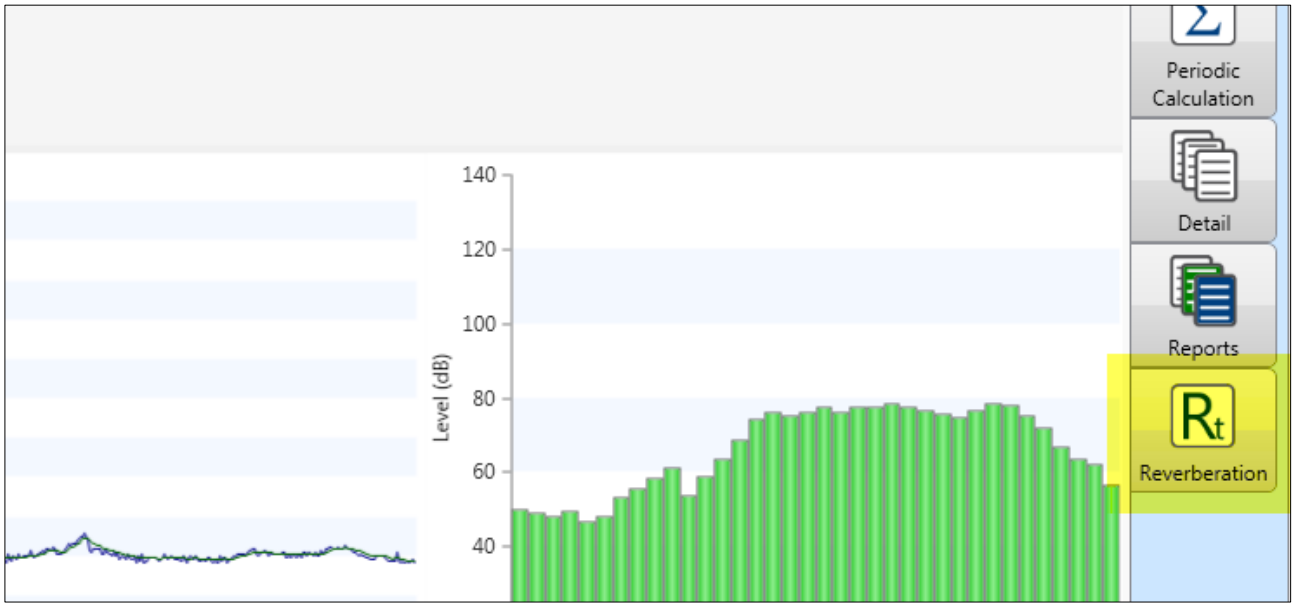
To install the module, close the NoiseTools program. If NoiseTools is running, the module will not install.

Run the NoiseTools_Reverberation_Setup.exe program. This will install the required files into the relevant location in the NoiseTools application.

Please note that this will require Administrator rights. Please contact your IT support if you do not have sufficient access rights.

Open the NoiseTools program and the Reverberation module will appear as a new tab on the right hand side when a measurement is opened (as shown below):

If the module does not appear, please check that NoiseTools is connected to an Optimus Cloud account (Tools -> Optimus Cloud) and confirm that the module has been activated.



Measurement requirements

Data rates

The module requires that the Time History data rate in any measurements to be used is set to 1/16 second (62.5ms). If the data rate is not set to 1/16 second, the module will report that the data is not suitable.

Setting the time history data rate in the instrument

To check or set the time history data on the Optimus instrument, go to the Time History Rate option in the Storage Options as follows:

Menu > Storage Options > Time History Rate

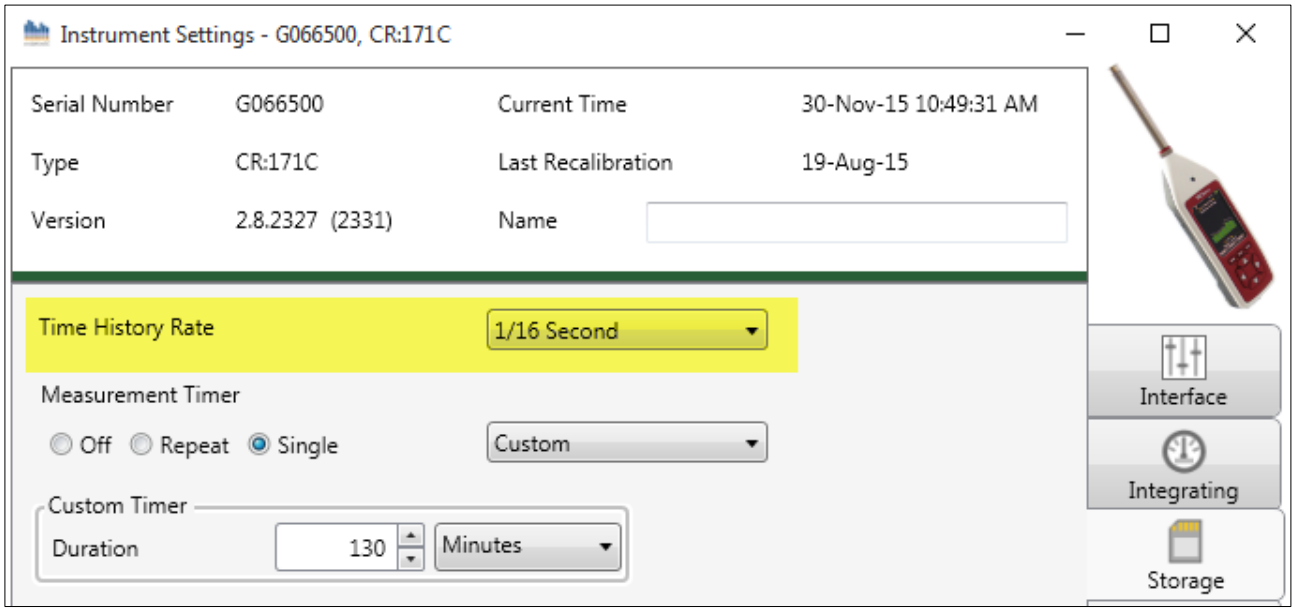
Select the 1/16 second option and press OK.

Setting the time history data rate in the NoiseTools software

The time history data rate can be changed in the NoiseTools software.

Connect the instrument to the NoiseTools software and from the Configure menu, select the Storage tab.

Adjust the Time History Rate option to 1/16 second and select **Save to Instrument**.



Measurement types

The module supports the calculation of RT values (20, 30 and 60) from both 1:1 and 1:3 octave bands as well as from broadband data sources.

The module will determine if the available data meets the requirements to calculate the RT20 and RT30 according to EN ISO 3382-2:2008[1].

Where the data meets the requirements, the module will calculate the appropriate values.

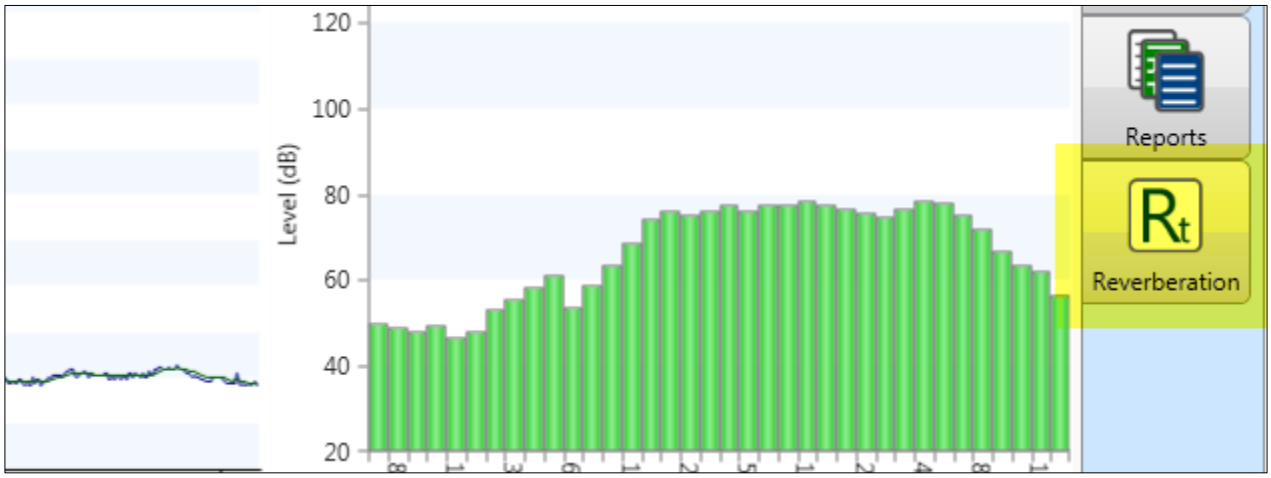
If the data is does not been the requirements, or where no suitable data can be found, the module will not allow that specific band to be selected.

Using the Reverberation Time module

Using a single measurement

For a single measurement, the RT module is accessed through the Reverberation tab

Open the measurement to be used for the data source and click the Reverberation module tab on the right hand side of the main screen:



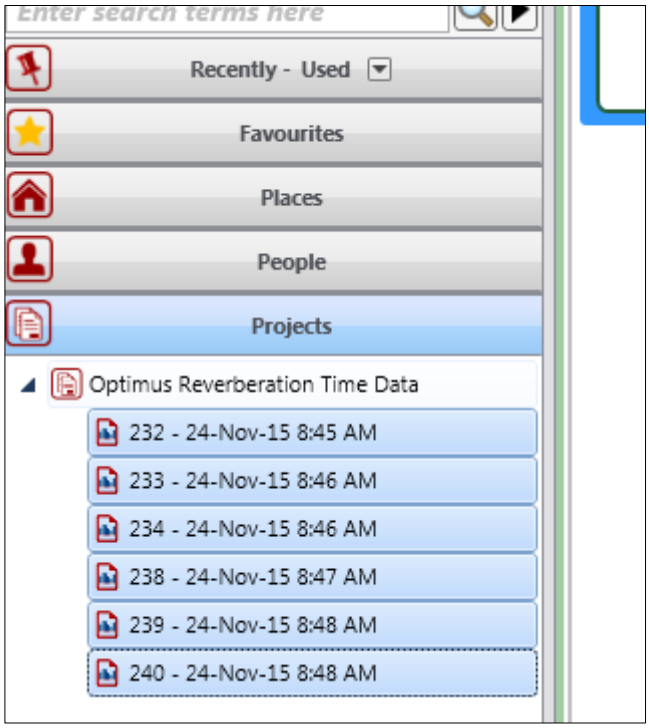
Using multiple measurements

Where multiple measurements are available, the module will average the slope values and calculate the results using this data.

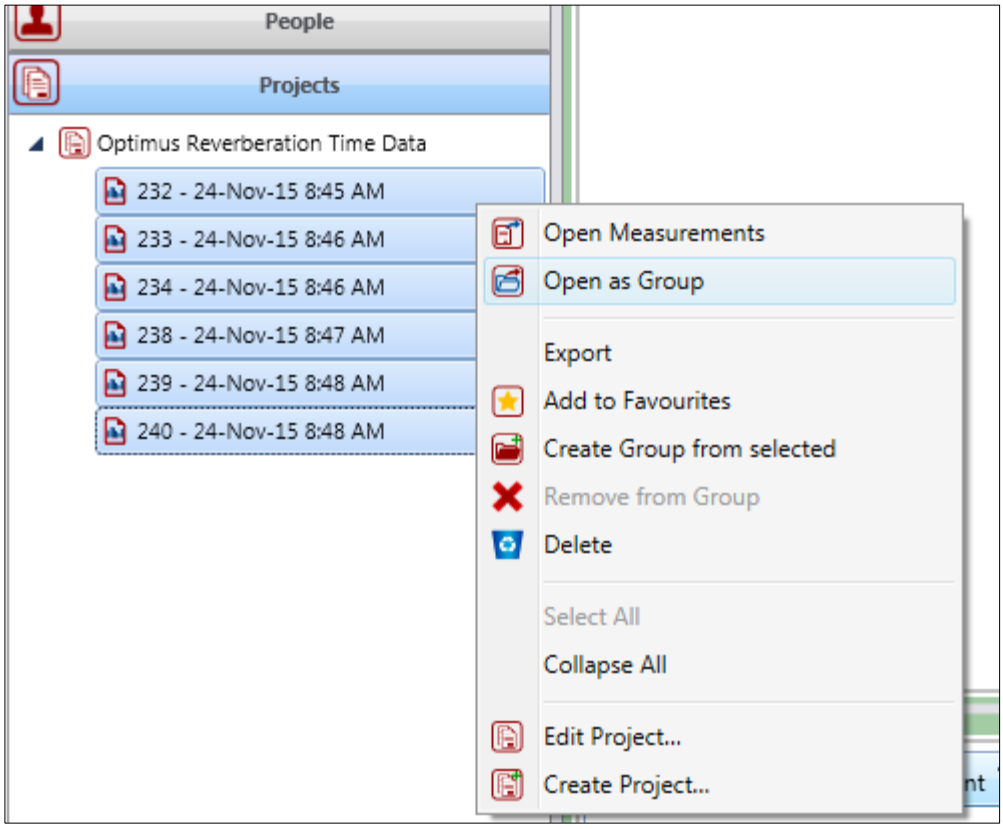
The method used for the calculation of RT values from multiple measurements is as per the preferred method in EN ISO 3382-2:2008[1].

To use multiple measurements, the data must be first added to a group.

To add a number of measurements to a group, open the database tree and select the measurements required as shown below:

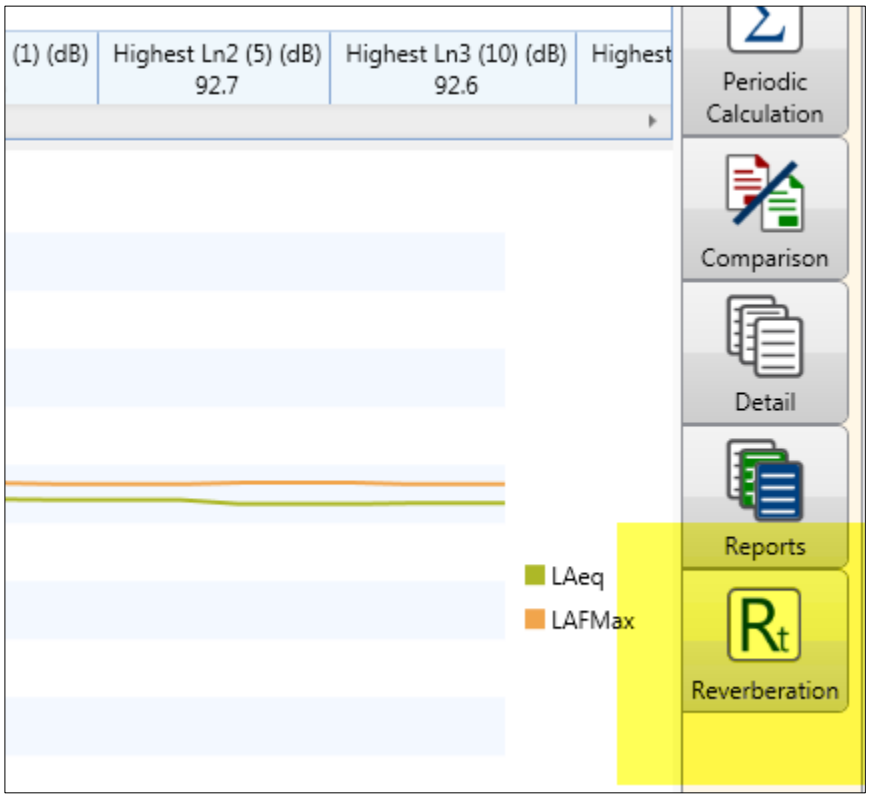


Right click over the measurements and select Open as Group:



The selected measurements will be opened into a temporary group.

Click the Reverberation module icon to access the RT calculator:



Selecting the data sources to be used in the calculations

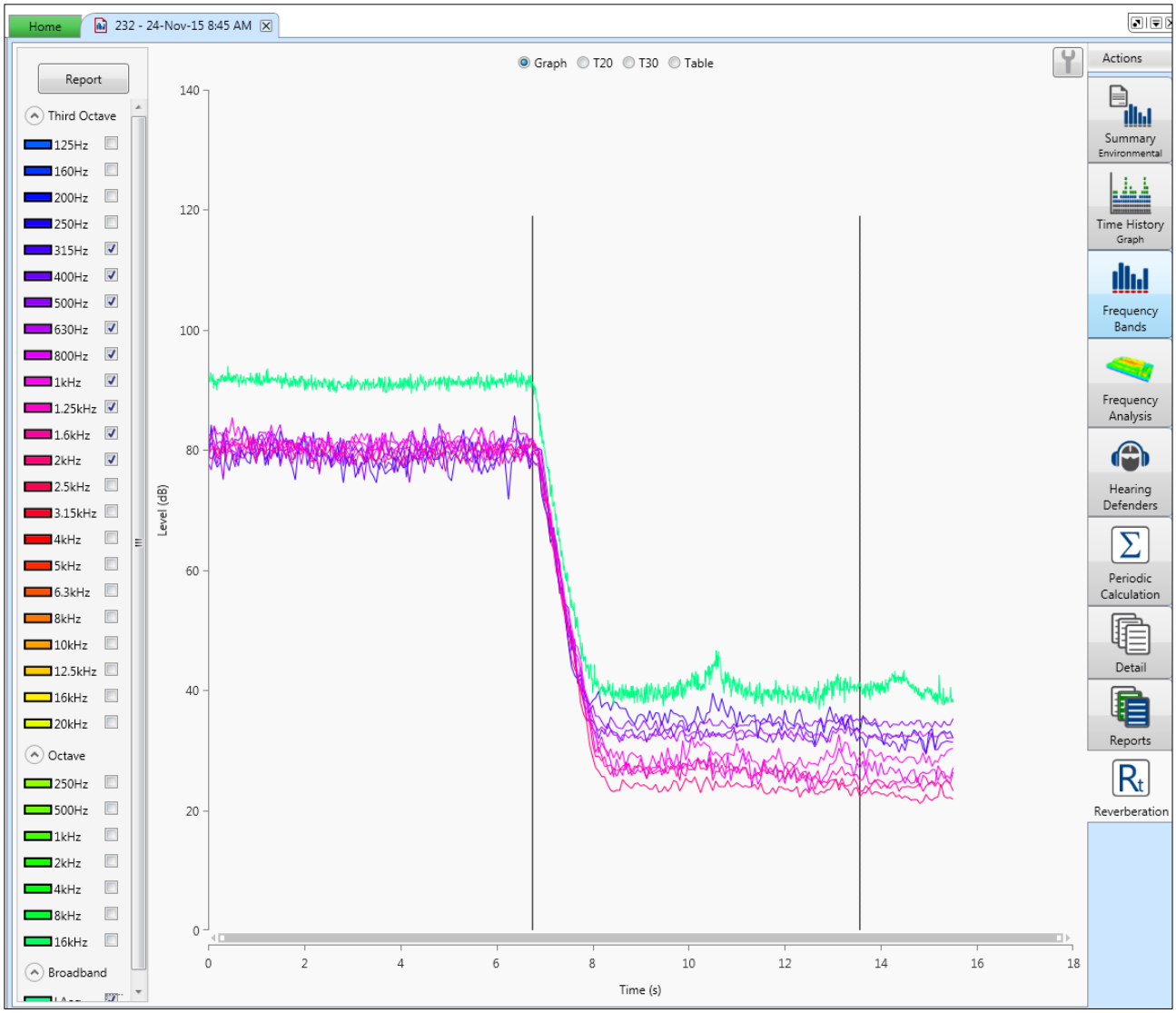
The module will determine, from the available data, which bands meet the criteria to provide an accurate calculation of the RT values according to EN ISO 3382-2:2008.

The data types that meet the criteria are displayed on the left side of the window.

To select the data to be used for the calculations, select the check box next to the data source. The module will display on the graph the section of the data that will be used for the calculations.

The mouse wheel can be used to zoom in and out of the graph. The graph can be exported as an image by right clicking and selecting Export.

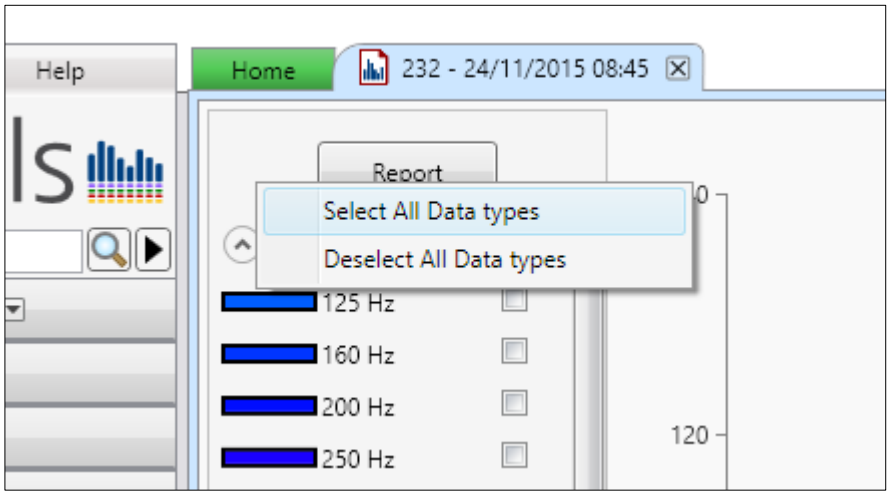
In the example below, the 1:3 octave bands from 315Hz to 2kHz along with the dB(A) data have been selected.



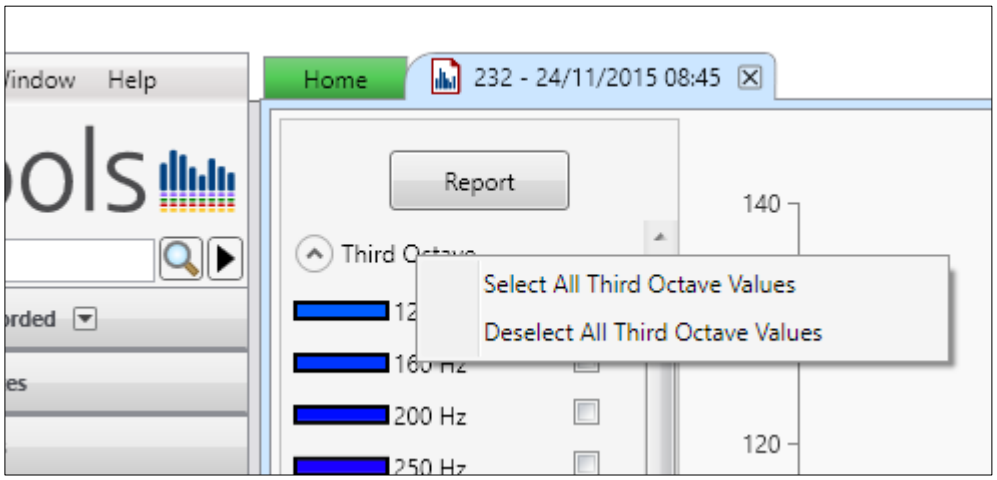
Selecting multiple data sources at the same time

It is possible to select, or deselect, all of the available data sources for a measurement using the right click options.

To select or deselect the all available data sources, right click next to the Report button and choose either Select All Data Types or Deselect All Data Types as needed as shown below.



To select all data types within a section, for example all Third Octave Band Values, right click on the Third Octave heading and choose the option required as shown below.

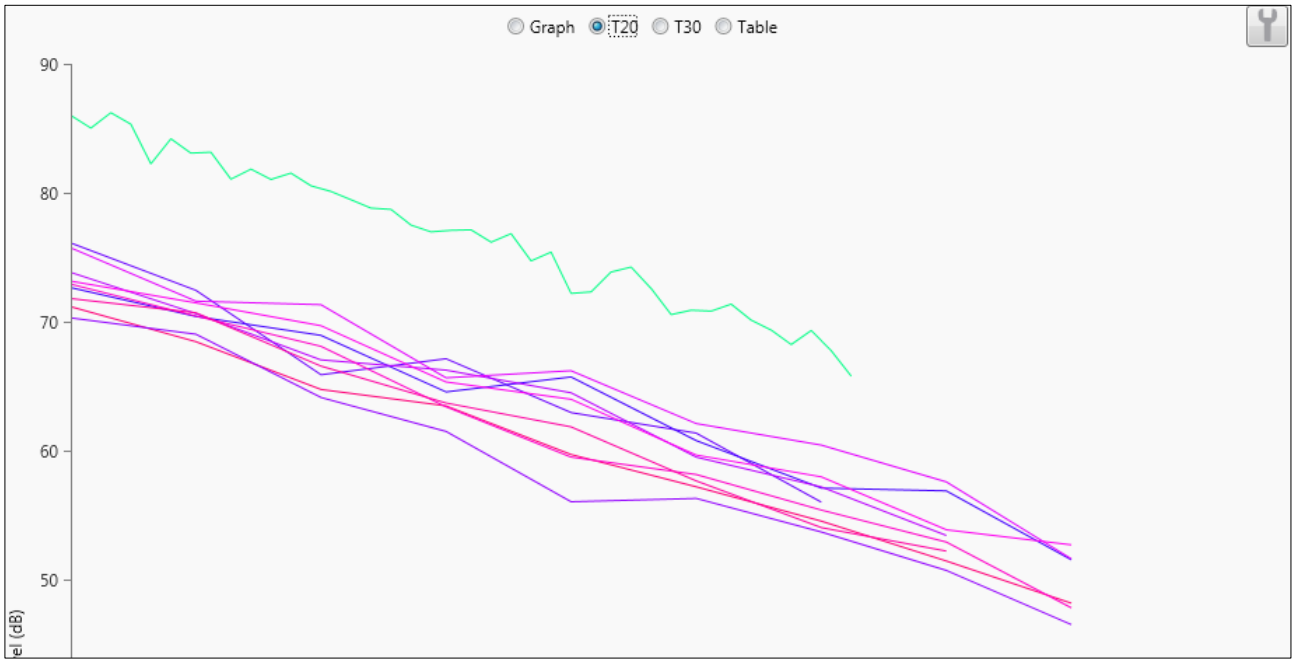


This option is available for all data sections.

Viewing the T20 and T30 decay curves

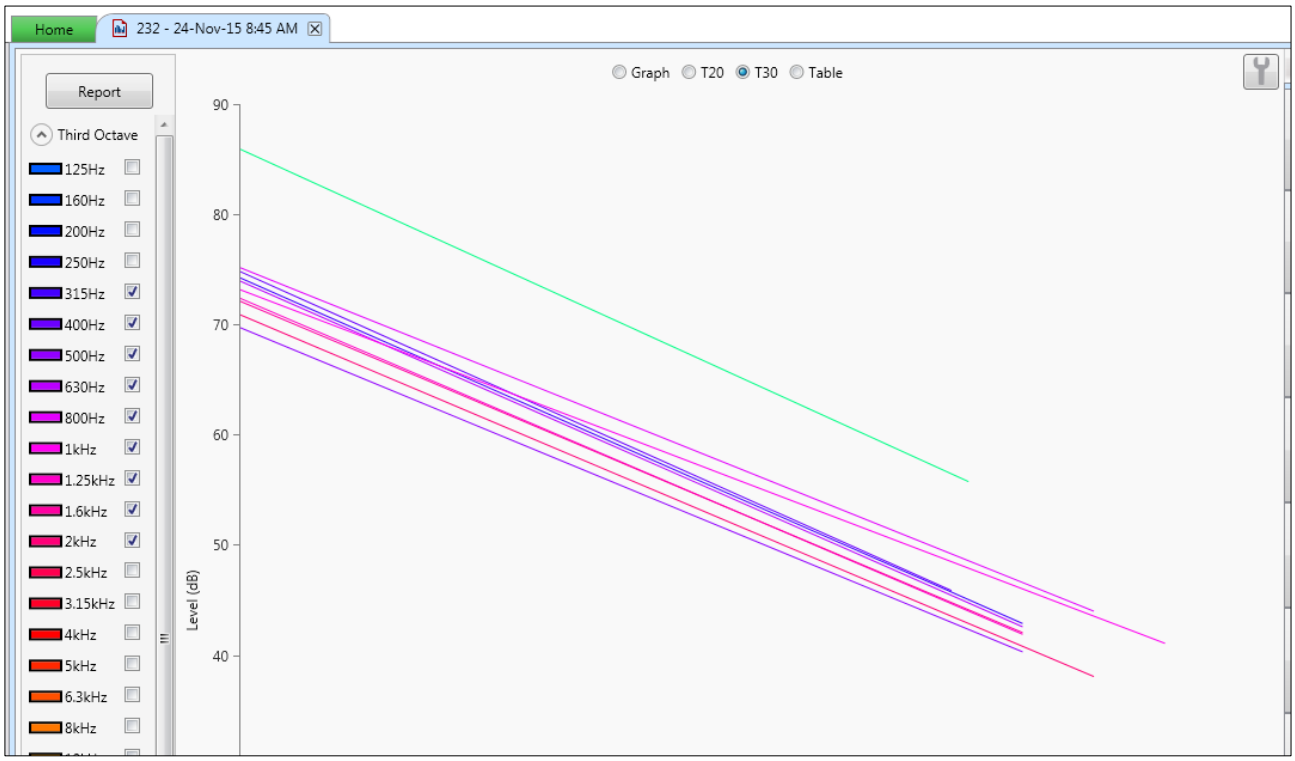
At the top of the main window are the T20, T30 and Table options.

Selecting the T20 or T30 options will display the decay curves that have been calculated using the chosen data sources. The example below shows the T20 decay curves:



If sufficient data is available, the T30 calculations can also be displayed.

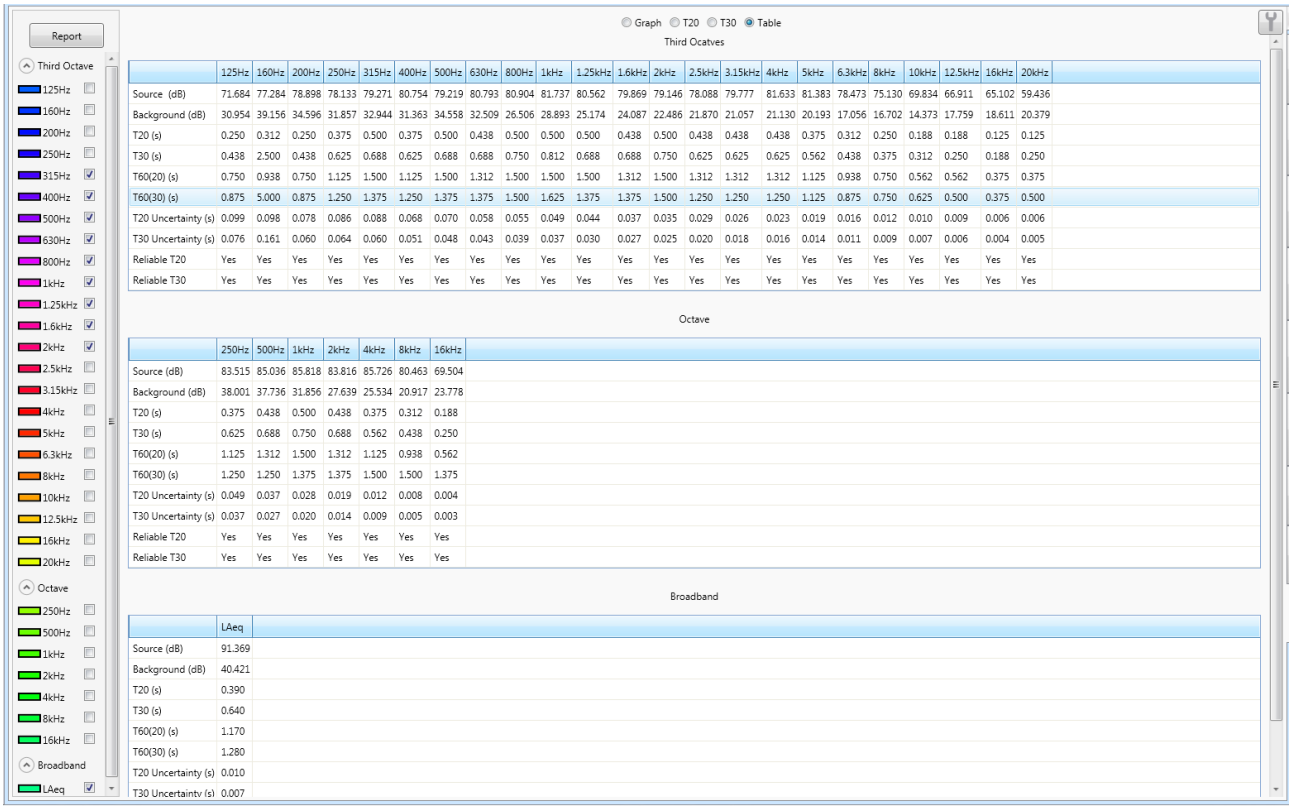
The example below shows the T30 calculations where the settings have been changed to Line of Best Fit. See section 0 for details of the available configuration settings.



Viewing the tabular data

Selecting the Table option will display the complete data set in a tabular form.

An example of this is shown below:



	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
Source (dB)	71.684	77.284	78.898	78.133	79.271	80.754	79.219	80.793	80.904	81.737	80.562	79.869	79.146	78.088	79.777	81.633	81.383	78.473	75.130	69.834	66.911	65.102	59.436
Background (dB)	30.954	39.156	34.596	31.857	32.944	31.363	34.558	32.509	26.506	28.893	25.174	24.087	22.486	21.870	21.057	21.130	20.193	17.056	16.702	14.373	17.759	18.611	20.379
T20 (s)	0.250	0.312	0.250	0.375	0.500	0.375	0.500	0.438	0.500	0.500	0.500	0.438	0.500	0.438	0.438	0.438	0.375	0.312	0.250	0.188	0.188	0.125	0.125
T30 (s)	0.438	2.500	0.438	0.625	0.688	0.625	0.688	0.688	0.750	0.812	0.688	0.688	0.750	0.625	0.625	0.625	0.562	0.438	0.375	0.312	0.250	0.188	0.250
T60(20) (s)	0.750	0.938	0.750	1.125	1.500	1.125	1.500	1.312	1.500	1.500	1.500	1.312	1.500	1.312	1.312	1.312	1.125	0.938	0.750	0.562	0.562	0.375	0.375
T60(30) (s)	0.875	5.000	0.875	1.250	1.375	1.250	1.375	1.375	1.500	1.625	1.375	1.375	1.500	1.250	1.250	1.250	1.125	0.875	0.750	0.625	0.500	0.375	0.500
T20 Uncertainty (s)	0.099	0.098	0.078	0.086	0.088	0.068	0.070	0.058	0.055	0.049	0.044	0.037	0.035	0.029	0.026	0.023	0.019	0.016	0.012	0.010	0.009	0.006	0.006
T30 Uncertainty (s)	0.076	0.161	0.060	0.064	0.060	0.051	0.048	0.043	0.039	0.037	0.030	0.027	0.025	0.020	0.018	0.016	0.014	0.011	0.009	0.007	0.006	0.004	0.005
Reliable T20	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reliable T30	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Octave

	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz
Source (dB)	83.515	85.036	85.818	83.816	85.726	80.463	69.504
Background (dB)	38.001	37.736	31.856	27.639	25.534	20.917	23.778
T20 (s)	0.375	0.438	0.500	0.438	0.375	0.312	0.188
T30 (s)	0.625	0.688	0.750	0.688	0.562	0.438	0.250
T60(20) (s)	1.125	1.312	1.500	1.312	1.125	0.938	0.562
T60(30) (s)	1.250	1.250	1.375	1.375	1.500	1.500	1.375
T20 Uncertainty (s)	0.049	0.037	0.028	0.019	0.012	0.008	0.004
T30 Uncertainty (s)	0.037	0.027	0.020	0.014	0.009	0.005	0.003
Reliable T20	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reliable T30	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Broadband

	LAeq
Source (dB)	91.369
Background (dB)	40.421
T20 (s)	0.390
T30 (s)	0.640
T60(20) (s)	1.170
T60(30) (s)	1.280
T20 Uncertainty (s)	0.010
T30 Uncertainty (s)	0.007

The table displays the values for every available data source.

Where available, the 1:3 octave, 1:1 octave and broadband values are shown.

For each band, the following information is provided:

- Source (dB) — This shows the level, in dB, of the specific band at the start of the decay
- Background (dB) — This shows the level, in dB, of the background in the specific band
- T20 (s) — The calculated T20 value in seconds
- T30 (s) — The calculated T30 value in seconds
- T60(20) (s) — The calculated T60 from the T20 value, in seconds
- T60(30) (s) — The calculated T60 from the T30 value, in seconds
- T20 Uncertainty (s) — The calculated uncertainty of the calculated T20 value
- T30 Uncertainty (s) — The calculated uncertainty of the calculated T30 value
- Reliable T20 — A Yes/No indication of reliability of the calculated T20 value
- Reliable T30 — A Yes/No indication of reliability of the calculated T30 value

The uncertainty values are calculated in accordance with ISO 3382-2:2008[1]

The data is considered to be reliable if BT>16 for interrupted noise sources or if BT>4 for impulse noise sources.

The data shown in the tables can be exported, as a CSV file, by right clicking and selecting Export.

It is possible for the data to be suitable to calculate the RT20 values but not the RT30. In this case, the module will indicate where it has not been possible to calculate accurate values by placing --- in the table of data.

Creating the measurement report

The module has a simple measurement report function that takes all of the available data and incorporates it into a document.

To generate the report, click the Report button above the data selection options. The report will be created as a PDF document which can be saved and printed as required.

An example of the first page of the report is shown below:

Interrupted Reverberation Report

Number of source points	1
Number of receiver points	1
Number of decays in each position	1

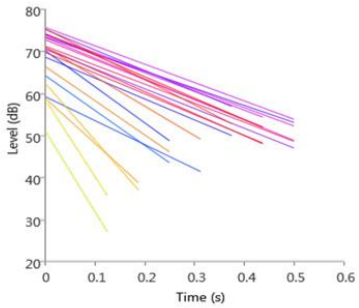
Measurements

Name	Start Time	End Time
232	Tuesday, November 24, 2015 8:45:40 AM	Tuesday, November 24, 2015 8:45:56 AM

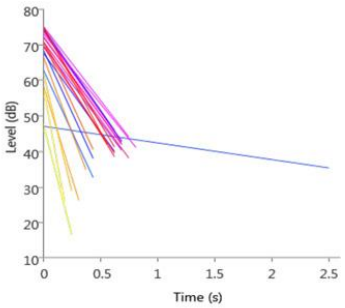
Results

1:3 Octave

T20 Graph



T30 Graph



	S (dB)	B (dB)	T20 (s)	T30 (s)	T60* (s)	T60** (s)	Uc T20 (s)	Uc T30 (s)	Reliable T20	Reliable T30
125Hz	71.7	31.0	0.250	0.438	0.750	0.875	0.099	0.076	Yes	Yes
160Hz	77.3	39.2	0.313	2.500	0.938	5.000	0.098	0.161	Yes	Yes
200Hz	78.9	34.6	0.250	0.438	0.750	0.875	0.078	0.060	Yes	Yes
250Hz	78.1	31.9	0.375	0.625	1.125	1.250	0.086	0.064	Yes	Yes

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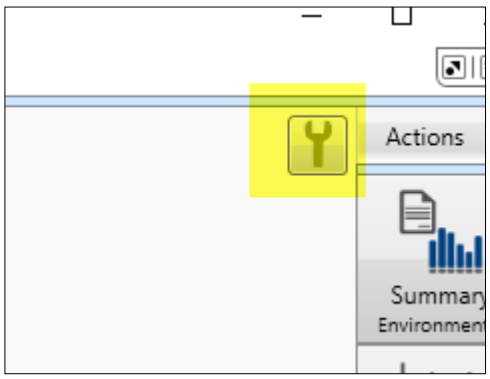
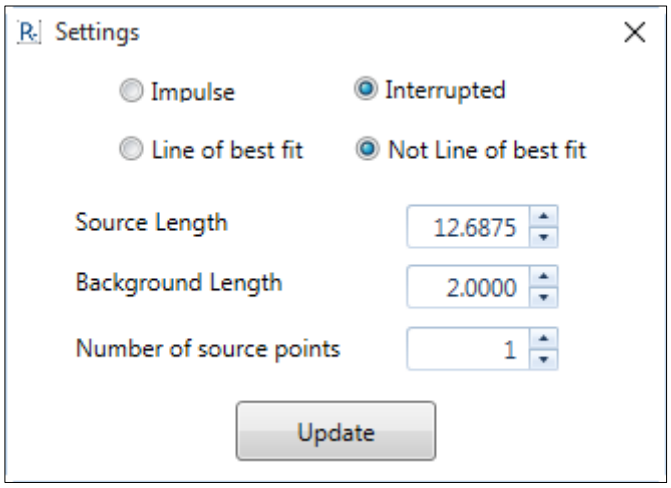
Changing the calculation type

The Setting button in the top right corner of the screen allows the configuration of the calculations to be adjusted.



Clicking on this icon will open the Settings box:



The available options are:

Interrupted or impulse source data

The option determines the type of noise source used to generate the data files. The default setting is to use an Interrupted noise source. Where an Impulse noise source is used, select the Impulse option.

Line of best fit or Not Line of best Fit

The module can use either Line of best fit or Not Line of best fit according to ISO 3382-2:2008[1] when calculating the decay curves. **This option is only available for Interrupted noise sources.**

Source Length

The module will automatically detect and determine the length of data to be used for the calculation. This can be adjusted if needed to alter the time over which the calculations are made.

Background Length

The module will automatically detect and determine the section of data to be used for the background noise assessment. This can be adjusted if needed to alter the time over which the calculations are made.

Number of Source Points

The number of source points can be changed, if required, in accordance with ISO 3382-2:2008[1].

NoiseTools System Requirements

The NoiseTools software (supplied with the optimus sound level meters, doseBadge Noise Dosimeter, Trojan Noise Nuisance Recorder, CR:800C and CR:260A sound level meters) can be run on most modern PCs. To get the best from the software the PC should meet the minimum specifications below and where possible meet the recommended specifications.

If you are using functions such as the FFT analysis or 3D playback of audio recordings, having a faster PC with a dedicated NVIDIA graphics card will be beneficial.

Please note that NoiseTools is not compatible with the Apple Mac Operating system.

Operating System

Version 1.5 of NoiseTools will currently run on Windows XP SP3. However this is no longer supported by Microsoft, as of April 2014, and will not be supported in future versions of NoiseTools.

Minimum System Requirements

- Windows 7 SP1 *
- CPU: 2GHz Dual Core
- Memory: 2GB
- Storage: 10GB free space
- Display: 1280x800

Recommended System Specification

- Windows 7 SP1 Professional/Enterprise (x64)
- CPU: 3GHz Dual Core
- Memory: 4GB
- Storage: 50GB free space
- Display: 1280x1024

Ideal System Specification

- Windows 8.1 Pro/Enterprise (x64)
- CPU: 3GHz Quad Core
- Memory: 8GB
- Storage: 100GB free space
- Display: 2x 1920x1080
- Dedicated NVIDIA graphics card with CUDA support
- Dedicated sound card and external speakers

Storage requirements for NoiseTools installation & measurement data

- Approximately 1GB for installing NoiseTools and dependencies
- Up to 512MB for temporary files during measurement download
- 1GB per instrument per year for measurements and time history data, assuming typical usage

Where an instrument is storing and downloading audio recordings, additional storage space will be required. The amount of storage will depend upon the length of recordings and the audio quality chosen. Audio recordings require the following amounts of space:

Standard Quality	120MB/hr
Studio Quality	1.4GB/hr

Sound card for audio playback

NoiseTools can work with on-board sound cards and internal laptop speakers.

However for best results a dedicated card and external speakers are required.

Some on-board sound cards will not be capable of playing the studio quality 96kHz audio. In these cases an external sound card will be required that is capable of playing back this type of file.

In some cases internal speakers are sufficient, however to playback at realistic levels, such as when using the speaker calibration feature, good quality external speakers are required.

Audio files created by the Cirrus instruments and downloaded to the NoiseTools software are stored as WAV files.

Graphics Card

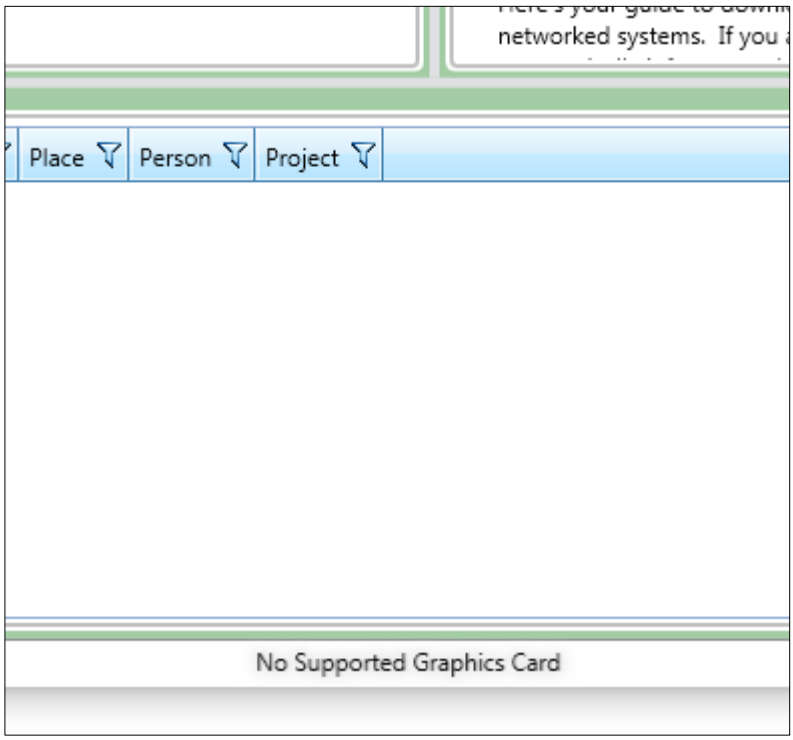
NoiseTools uses the latest technologies to draw the user interface directly using the graphics card. This gives a much better looking more responsive experience and allows us to easily provide certain advanced features, such as the 3D frequency analysis view.

Most on-board graphics chips can provide more than enough power to display the basic user interface but the more advanced screens will be noticeably smoother on more powerful hardware.

NoiseTools is also able to use the latest CUDA graphics cards, from NVIDIA, to do FFT and other complex calculations. This can be many times faster than running these calculations on the main processor.

This feature requires a CUDA capable card and 64bit version of Windows.

If a suitable graphics card is not detected, NoiseTools will display a message at the bottom of the main screen as shown below:



NoiseTools will operate as normal without a CUDA capable graphics card.

References

EN ISO 3382-2 Acoustics - Measurement of room acoustic parameters - Part 2: Reverberation time in ordinary rooms (ISO 3382-2:2008)

Example measurement data

An example measurement file is included on the DVD with the module.

This measurement data can be loaded into the NoiseTools program as follows:

1. Open the NoiseTools program
2. Create a new, empty database
    a. Click Tools, Databases, Create New
    b. Give the new database a name such as RT Example Data
    c. Click Save
3. Click File, Switch Database and choose the new, empty database
4. Open the Reverberation Time Noise Source Data.MTP file supplied on the DVD
5. Import the measurements into NoiseTools following the steps given on screen

This file contains interrupted and impulse noise source measurements.

Warranty Information.

1. This document is a summary of the full warranty document and explains the Cirrus Research plc warranty in ordinary English; not in legal or complex terms.
2. The warranty covers any acoustic instrument such as a sound level meter, acoustic calibrator, real time acoustic analyser or personal sound exposure meter (dosimeter) manufactured by Cirrus Research plc after September 1st 2011.
3. The warranty covers all faults on, and minor accidental damage to, the instrument except the microphone capsule for the period defined in para (5) below.
4. Minor accidental damage does not include blatant miss-use, damage caused by the use of any accessories or components not specified or recommended by Cirrus, damage caused through non-Cirrus modification, continued use outside of Cirrus' recommended procedure or conditions or use contrary to the any advice provided by Cirrus.
5. The initial period of the warranty is 2 (two) years or 104 weeks from the date of purchase as a new instrument from Cirrus Research plc or their formally approved distributors OR 130 weeks from the date the instrument passed its final manufacturing inspection at Cirrus Research plc - whichever is the shorter.
6. A shorter 1 (one) year or 52 week warranty is offered for used, ex-demo or ex-rental equipment unless a special arrangement is made and a written confirmation of the special warranty is given by Cirrus Research plc.
7. Any rechargeable battery only has the battery manufacturer's one year warranty, however there will be a reduced charge for their replacement during the annual "Traceable Calibration."
8. On completion of the annual "Traceable Calibration" by Cirrus Research plc, or an official Cirrus Calibration Centre, the instrument will automatically be given an additional free one year warranty.
9. It follows that should the instrument be calibrated by Cirrus Research plc, or an official Cirrus Calibration Centre every year, the warranty is effectively continuous to a maximum of 15 (fifteen) years from the date of purchase.
10. There will be a charge for this "Traceable Calibration" and the price is published in the Calibration Price List. The customer is responsible for all shipping, duty and other charges relating to the annual "Traceable Calibration".
11. Where a repair service is conducted under warranty, Cirrus Research plc will cover the shipping, duty and other costs relating to the repair of the instrument.
12. Cirrus Research endeavours to ensure stocks of instrument components for the full fifteen year period but do not guarantee to do so as certain components do become obsolete or discontinued.
13. If a sub-component becomes obsolete and stocks are depleted then Cirrus Research will endeavour to facilitate a repair but will not offer the same length warranty.
14. In the event of any dispute on the terms of the warranty Cirrus Research plc will accept pendulum arbitration by the United Kingdom Institute of Acoustics Ltd.
15. The warranty does not in any way reduce any legal right of the buyer or user of the sound level meter; it is in addition to all legal rights determined by the European Union.
16. Cirrus Research plc reserves the right to amend or update these terms and conditions without prior notice.

Warranty Terms 2.5 May 2012

Cirrus Research Offices

The addresses given below are the Cirrus Research plc offices. Cirrus Research plc also have approved distributors and agents is many countries worldwide. For details of your local representative, please contact Cirrus Research plc at the address below. Contact details for Cirrus Research authorised distributors and agents are also available from the Internet Web site at the address shown below.

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