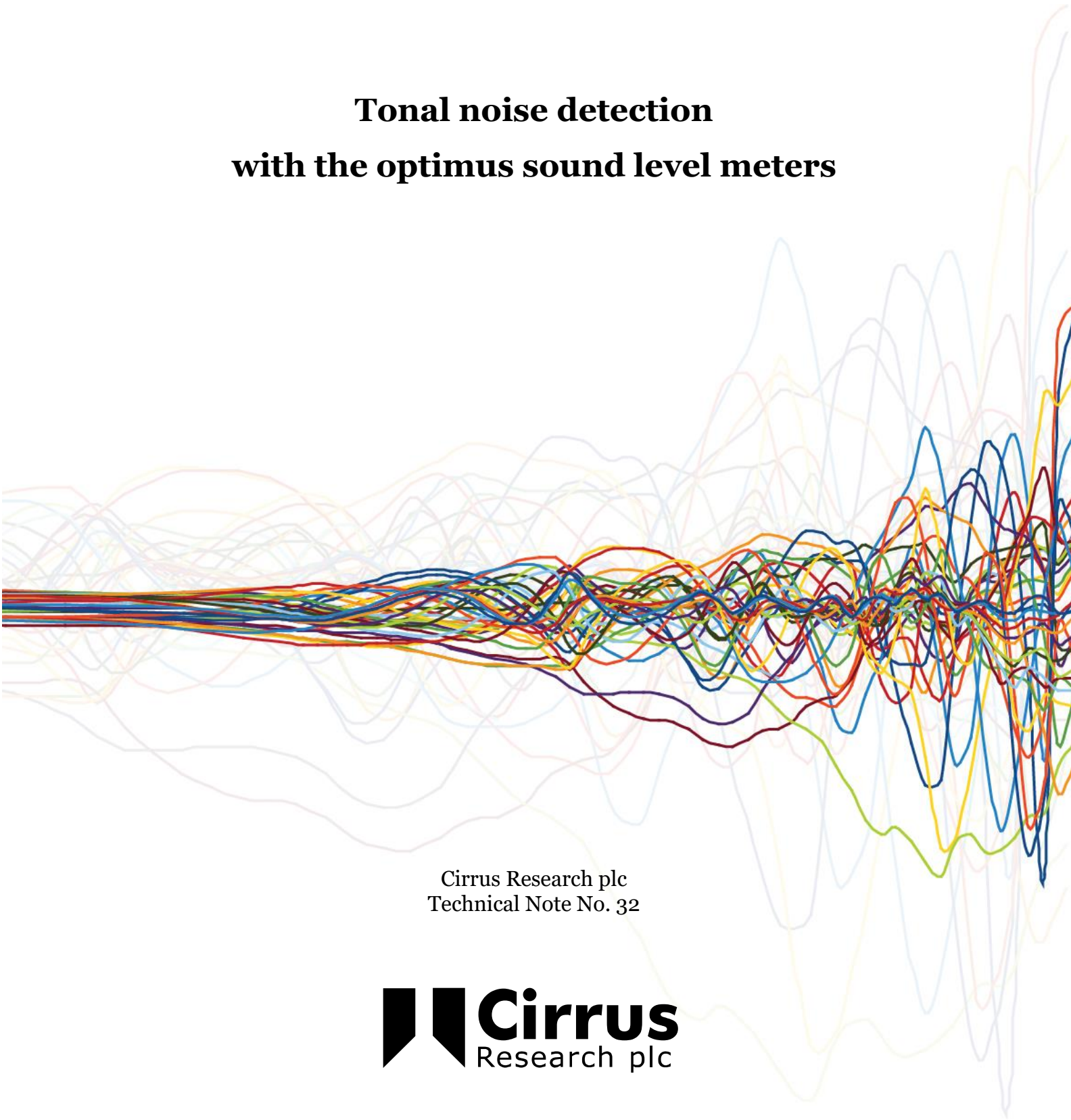
Tonal noise detection
with the optimus sound level meters



Cirrus Research plc
Technical Note No. 32

Cirrus Research plc

Acoustic House

Bridlington Road

Hunmanby

North Yorkshire

YO14 0PH

United Kingdom

Tel: 0845 230 2434 (UK)

Tel: +44 1723 891655 (International)

Fax: +44 1723 891742

Email: sales@cirrusresearch.co.uk

Web: www.cirrusresearch.co.uk

Twitter: @cirrusresearch

Version 1.2
24th November 2014

Default method information added

Version 1.3
18th December 2015

Added information relating to BS 4142:2014 Annex C – Objective method for assessing the audibility of tones in sound: One-third octave method

Version 1.4
20th September 2017
Formatting updated. References to ISO 1996-2 Annex K added.

1 Introduction 4
2 Tonal noise detection methods 4
2.1 Method 1 - ISO 1996-2:2007 Annex D 4
2.2 Method 2 – Cirrus improved method 5
2.2.1 Detection of tones between bands 5
2.2.2 User defined thresholds 5
2.3 Displaying the detected tones 6
3 Triggering audio recording from tonal noise 6
4 References 7
5 Cirrus Research Offices 8

1 Introduction

Tonal noise detection is a useful function for environmental noise measurements and can aid in the location and identification of problematic noise sources.

Noise sources that are tonal in nature or that have tonal content can often be more annoying or disturbing and so having the ability to detect and record tones can be very useful.

The CR:171C and CR:172C optimus sound level meters, which are Class 1 and Class 2 respectively, can use one of two different methods to detect and identify noise tones and these are outlined below.

The default method for the Tonal Noise Detection is the Cirrus Improved Method.

2 Tonal noise detection methods

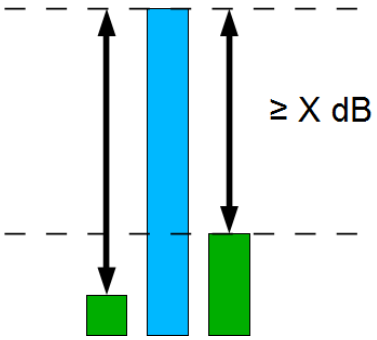
2.1 Method 1 - ISO 1996-2:2007 Annex D/ ISO 1996-2:2017 Annex K

In the ISO standard, the definition of a tone is that if a band is higher than its direct neighbours by an amount that is dependent upon frequency, it is highlighted.

The ISO method uses A-weighted bands.

The standard defines different levels of threshold depending upon the frequency of the 1:3 octave band and these are:

25Hz to 125Hz:	15dB
160Hz to 400Hz:	8dB
500Hz to 10kHz:	5dB



When a tone is detected using the ISO 1996-2:2007 Annex D/ ISO 1996-2:2017 Annex K method, it is highlighted in blue on the A weighted graphical screen and also the A weighted numeric screen.

The method is referred to in BS4142:2014 “Methods for rating and assessing industrial and commercial sound”. Annex C “Objective method for assessing the audibility of tones in sound: One-third octave method” refers to the use of 1:3 octave bands with the threshold levels defined above:

25Hz to 125Hz:	15dB
160Hz to 400Hz:	8dB
500Hz to 10kHz:	5dB

2.2 Method 2 – Cirrus improved method

There are several limitations with the Simplified Method described in ISO 1996-2:2007 Annex D/ ISO 1996-2:2017 Annex K.

These are:

1. The frequency bands used are limited to 25Hz to 10kHz
2. Only A-weighted data is used
3. Tones between bands may not be detected accurately

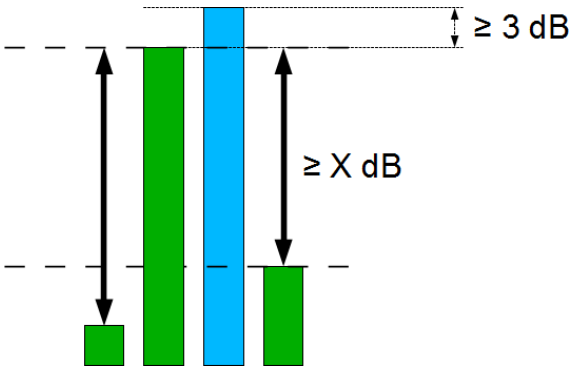
The Cirrus improved method takes the ISO method and expands upon it by:

1. Using all of the frequency bands available in the instrument (6.3Hz to 20kHz)
2. Detecting tones between bands
3. Using both A and Z weighted spectra
4. Allowing the thresholds for detection to be adjusted within the NoiseTools software

2.2.1 Detection of tones between bands

One of the problems with the ISO method is that in theory, a pure tone at the exact frequency between 2 bands will have its energy equally spread across them, making their value 3dB lower than the value a band would have had if the tone was at its centre frequency.

The Cirrus improved methods checks if 2 bands are within 3 dB, and if they are both higher than their neighbours by the defined thresholds. The highest of those 2 bands is defined as the tone.



When a tone is detected using the Cirrus improved method, the appropriate band is highlighted on both the A and Z weighted screens.

2.2.2 User defined thresholds

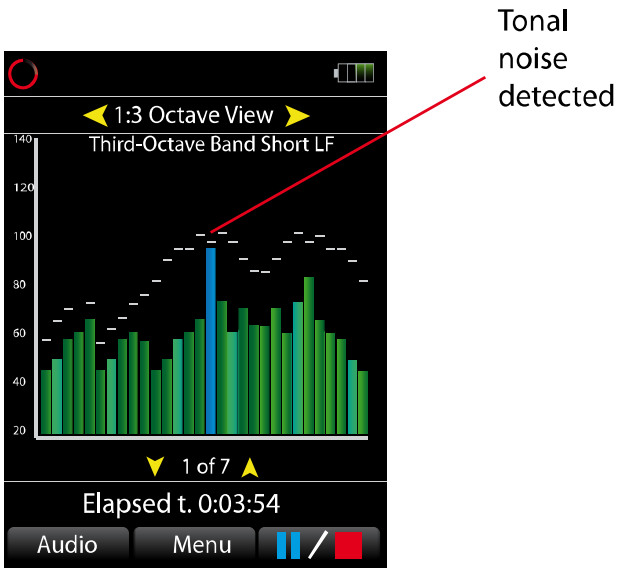
The threshold levels used for the Cirrus improved method can be adjusted within the NoiseTools software. The defaults values are :

6.3Hz to 20Hz :	18dB
25Hz to 125Hz :	15dB
160Hz to 400Hz :	8dB
500Hz to 10kHz :	6dB
12.5kHz to 20kHz :	6dB

2.3 Displaying the detected tones

When a tone is detected according to either the method 1 or 2 above, the optimus will display this in the 1:3 octave band screens.

In the graphical screens, the 1:3 band or bands are highlighted in blue. On the numeric screens, the value of the band or bands is highlighted in blue.



If the ISO method is used, the tonal noise detection will only be shown on the A-weighted screens (graphical and numeric). If the Cirrus improved method is used, the tonal noise detection is shown on both the Z and A weighted screens (graphical and numeric).

The method used can be changed within the NoiseTools software.

This can be set to use the ISO 1996-2:2007 Annex D/ ISO 1996-2:2017 Annex K Simplified Method by connecting the instrument to the

3 Triggering audio recording from tonal noise

The optimus green sound level meters feature an advanced audio recording system known as Acoustic Fingerprint.

This system allows audio recordings and alerts to be triggered from a combination of level and rate of change templates. In addition to these, the CR:171C and CR:172C instruments allow the tonal noise detection to be used as part of the Acoustic Fingerprint system.

This allows audio recordings and alerts to be triggered when a tonal noise is detected using either the ISO 1996-2:2007 method or the Cirrus improved method.

4 **References**

ISO 1996-2:2007 - Acoustics – Description, measurement and assessment of environmental noise
Part 2 : Determination of environmental noise levels
Annex D Objective method for assessing the audibility of tones in noise – Simplified method

ISO 1996-2:2017 – Description, measurement and assessment of environmental noise
Part 2 : Determination of sound pressure levels
Annex K Objective method for assessing the audibility of tones in noise — Survey method

Technical Note 28 - Recording Audio with the optimus green (CR:170) sound level meters

5 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.

Main Office

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
United Kingdom
YO14 0PH

Telephone: +44 (0)1723 891655
Fax: +44 (0)1723 891742
E-mail: sales@cirrusresearch.co.uk
Web Site: www.cirrusresearch.co.uk

Germany

Cirrus Research plc Deutschland
Arabella Center
Lyoner Strasse 44 – 48
D-60528 Frankfurt
Germany
Tel: +49 (0)69 95932047
Fax: +49 (0)69 95932049
E-mail: vertrieb@cirrusresearch.de
Website: www.cirrusresearch.de

Cirrus Environmental

Unit 2 Bridlington Road Industrial Estate
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Tel: +44 (0) 1723 891722
Email: sales@cirrus-environmental.com
Web: www.cirrus-environmental.com