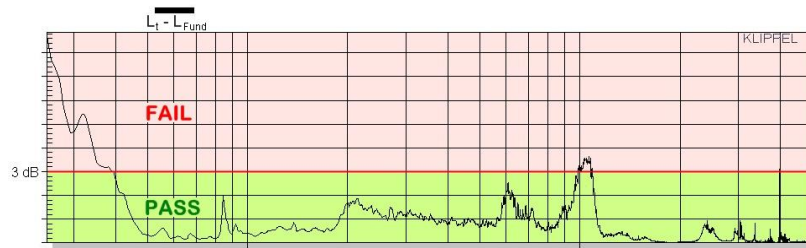# EIA-426-B 7.4 Section B: Distortion Check   AN 33

Application Note to the KLIPPEL ANALYZER SYSTEM (Document Revision 1.1)

Every electro acoustical driver produces harmonic distortion component, but they vary in order to the quality of the loudspeaker. The Electronic Industries Alliance (EIA) provides a definition for the maximum distortion level in the total sound pressure output. Using the KLIPPEL *EIA 426-B 7.4 Distortion* template you might easily check if your loudspeaker will meet this demand.

This Application Note is a step by step introduction for a fast test of your loudspeaker according to the EIA-426-B standard.

CONTENTS:

1   Definitions

TOTAL HARMONIC DISTORTION (THD)	$p_{THD}(f) = \sqrt{\sum_{i=1}^{n} p_{if}{}^2(f)}$	A very important characteristic of amplitude nonlinearity is the Total Harmonic Distortion which is defined by the pressures of all harmonic components (p_{if}) in the frequency response of a loudspeaker.
MAXIMUM DISTORTION	$L_t - L_{Fund} < 3\,\mathrm{dB}$ $20\log\dfrac{p_{THD}+p_{Fund}}{p_{Fund}}\,\mathrm{dB} < 3\,\mathrm{dB}$	According to the EIA standard the RMS of speaker generated harmonics (p_{THD}) shall be less than that of the fundamental (p_{Fund}). It is necessary to define the desired working range of the loudspeaker. Within this specified bandwidth the total sound pressure level (L_t), which contains the fundamental and all harmonic content, shall not be greater than the amplitude of the fundamental (L_{Fund}) by more than 3 dB to pass the test.

2   Requirements

START UP	To measure and calculate the Characteristic Harmonic Distortion the following equipment is required: • Install the RnD Analysis Software on your computer • Create a new object and select the *EIA 426-B 7.4 Distortion* template to start the analysis • Enter the sensitivity of the microphone in property page Input for the *1 TRF Measure FUND+THD* or use a pistonphone to calibrate the microphone.

3   Procedure

TRF MEASUREMENT	**Motivation:** We start with a simple sinusoidal sweep measurement to gain the Transfer Function of the Loudspeaker. **How to do it:** Adjust the measurement microphone in the nearfield normal to the driver (just one or two centimeters from the dustcap) and select the *1 TRF Measure FUND+THD* operation. In *Properties → Stimulus* set F$_{min}$ to a lower and F$_{max}$ to a higher value than the boundary frequencies of your required bandwidth and modify the voltage if necessary. Run the measurement.
DISTORTION CHECK	**Motivation:** With an easy calculation you may Check if your loudspeaker conforms to the EIA standard. You may also see in which frequency band you have the highest distortion ratio. **How to do it:** Select the curve "*Fundamental*" from the window *Fundamental + Harmonic distortion components* and copy it to the clipboard. In *Properties → Input* of the *2 CAL Distortion Check* operation select *Fund* in and paste the Fundamental curve from Clipboard. Repeat this Step for the *THD* curve. Determine your frequency band for your check by defining the upper and lower bounds f_{max} and f_{min} as required. We recommend selecting a band

	which is marginally wider than your desired working range. If your bounds are beyond the band of the measured distortion, you might increase your resolution of your stimulus in the TRF property page to earn a wider bandwidth of the THD curve.
RESULTS	After running the script the result variables window will return a PASS if your speaker meets the standard or a FAIL if not. If an error occurred it will be displayed in the result variables window as well. The window "Result Curve 1" shows the level in which the Total Harmonic Distortion influences the Fundamental Curve. Here you may locate the frequencies, where your loudspeaker might exceed the 3dB border, if it failed. The "Result Variables" window also displays the actual bounds f_{min} and f_{max}. These bounds usually resemble your entered parameters, but might deviate if they exceeded the bounds of the THD curve.

4   More Information

STANDARDS	EIA-426-B 7.4 Section B – Distortion IEC 60268 Sound System Equipment – Part 5 Loudspeakers, 24.2 Total harmonic distortion

Find explanations for symbols at:

http://www.klippel.de/know-how/literature.html

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