The effective frequency range is a common characteristic of a loudspeaker and defined by the IEC standard 60268-5 paragraph 21.2 [1]. It describes the range of a requested linearity within the frequency response, where the sound pressure level is not more than 10 dB below an averaged maximum.

This Application Note is a step by step introduction for a fast calculation of the Effective Frequency Range with the appropriate Klippel Template.

## Contents:

1. Definition
2. Requirements
3. Procedure
4. More Information

### 1 Definition

**Effective Frequency Range**

The effective frequency range is the range of frequencies, bounded by stated upper and lower limits (f_up and f_low) for which the transfer function of a loudspeaker does not drop more than 10 dB below the mean value (mSPL according to IEC standard [2]) of the sound pressure level within a determined band. This band is by default one octave or broader (according to the demands of the manufacturer) in the region of the maximum sound pressure level. Notches narrower than 1/9 octave will not be regarded by definition of IEC standard [1].

### 2 Requirements

**Start Up**

To measure and calculate the Effective Frequency Range the following equipment is required:

- Install the RnD Analysis Software on your computer
- Create a new object and select the template *IEC 60268-5 §21.2 Frequency Range* to start the analysis
- Enter the sensitivity of the microphone in property page **Input** of the operation 1 **TRF Measure FUNDAMENTAL** 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 normal to the driver as preferred and select the 1 TRF Measure FUNDAMENTAL operation.
|                 | In Properties → Stimulus set $f_{\text{min}}$ to a lower and $f_{\text{max}}$ to a higher value than the boundary frequencies of the expected effective frequency range and modify the voltage if necessary.
|                 | Run the measurement.
|                 | Select the curve “Fundamental” from the window Fundamental + Harmonic distortion components and copy it to the clipboard.

| DETERMINATION OF THE EFFECTIVE FREQUENCY RANGE | Motivation: The effective frequency range can easily be determined by the operation 2 CAL Effective frequency range, which will automatically find the octave band with the highest sensitivity but can also be modified if required.
|                                               | How to do it: Select SP in Properties → Input of 2 CAL Effective frequency range and paste the Fundamental curve from Clipboard.
|                                               | If you want to use the standard calculation which determines the optimal averaging band (according to IEC standard [1]) select the automatic mode by entering the string ‘auto’ in mod and there is no input required for $f_{\text{min}}$ or $f_{\text{max}}$. Otherwise you may determine your averaging band as you like by defining the frequency bounds $f_{\text{min}}$ and $f_{\text{max}}$ and selecting the ‘user’ mode.

| RESULTS | After running the script the Result Variables window will appear showing following result parameters. If an error occurred it will be displayed in the result variables window as well.
|         | The variables $f_{\text{low}}$ and $f_{\text{up}}$ return the lower and upper boarder of your frequency range according to the definition of IEC standard [1].
|         | In the second table you will find some additional data relevant variables within the calculation. $\text{mSPL}$ is the mean sound pressure level weighted over logarithmic frequency scale within the boarders $f_{\text{min}}$ and $f_{\text{max}}$ which are ½ octave below and above the frequency with the maximum SPL in auto mode. The width is the bandwidth of this averaging band, which must be at least one octave to observe the IEC standard [1].

4 More Information

| APPLICATION NOTE | AN34 – IEC 60268-5: Mean sound-pressure level in a stated frequency band

Find explanations for symbols at:
http://www.klippel.de/know-how/literature.html
Last updated: 12.08.2016