IEC 60268-5: Effective Frequency Range **AN 35**

Application Note to the KLIPPEL R&D SYSTEM

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.

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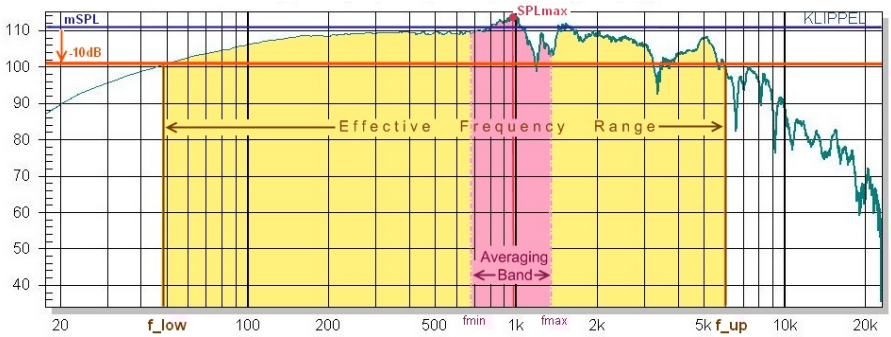
Definition

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].

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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 *IEC 21.2 Frequency Range* to start the analysis
- Enter the sensitivity of the microphone in property page *Input* for the *TRF Measure FUNDAMENTAL* or use a pistonphone to calibrate the microphone.

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 *TRF Measure FUNDAMENTAL* operation.

In *Properties* → *Stimulus* set F_{min} to a lower and F_{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 *CAL Frequency Range* operation, 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 *CAL 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 *fmin* or *fmax*. Otherwise you may determine your averaging band as you like by defining the frequency bounds *fmin* and *fmax* 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_low** and **f_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. **mSPL** is the mean sound pressure level weighted over logarithmic frequency scale within the boarders **fmin** and **fmax** 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].

More Information

Standards	[1] IEC standard 60268-5 Sound System Equipment – Part 5 Loudspeakers, 21.2 Effective frequency range [2] IEC standard 60268-5 Sound System Equipment – Part 5 Loudspeakers, 20.6 Mean sound-pressure level in a stated frequency band
Application Note	AN34 – IEC 60268-5: Mean sound-pressure level in a stated frequency band

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