

## APPENDIX D. DEFINITIONS AND FILTER CHARACTERISTICS

### D.1. DEFINITIONS AND FORMULAE

#### Basic symbols and notation

- T** - current time period of the measurement.
- T<sub>b</sub>** - time period after which the results are saved in the buffer (set in the **BUFFER STEP** position of the **MEASURE SETUP** sub-list, the **INPUT** list).
- T<sub>c</sub>** - time period of the measurement (set in the **INT. TIME** position of the **MEASURE SETUP** sub-list, the **INPUT** list).
- τ** - detector time constant (set in the **DETECTOR** position of the **PROFILE x** sub-list of the **PROFILES SETUP** sub-list of the **INPUT** list; equal to **IMPULSE**, **FAST** or **SLOW**).
- a<sub>w</sub>(t)** - the temporary value of the measured sound with the weighting filter **W** (equal to **A**, **C**, **G** or **LIN**) on the input of the RMS detector.
- p<sub>w</sub>(t)** - the temporary value of the measured sound with the weighting filter **W** (equal to **A**, **C**, **G** or **LIN**) on the output of the RMS detector calculated from the equation:
- $$p_w(t) = \left( \frac{1}{\tau} \int_{-\infty}^t a_w^2(t_x) \exp\left(-\frac{t_x - t}{\tau}\right) dt_x \right)^{1/2}$$
- where:
- t<sub>x</sub>** - time (variable of the integration).
- p<sub>0</sub>** - the reference value equal to 20 μPa.

#### The PEAK value

The **PEAK** value (Peak Sound Pressure or Peak Sound Level) is calculated for the given **T** from the formula:

$$\text{PEAK} = 20 \log(\max_T |a_w(t)/p_0|)$$

For the **PEAK** value saved as the main result **T = T<sub>c</sub>** and for the **PEAK** value saved in the files of the buffer (time history) **T = T<sub>b</sub>**.

#### The SPL function

The **SPL** function (Sound Pressure Level) - gives an equivalent of the **Sound Level Meter** according to the **IEC 651 Standard** (meeting the requirements for the **Type "1"** instrument). The value of the functions is calculated from the formula:

$$\text{SPL} = 20 \log(\max_{T_1} (p_w(t)/p_0))$$

where:

- T<sub>1</sub>** - the last second of the measurement.

## The MAX result

The **MAX** result means the maximal value on the detector output for the integration time period. The **MAX** result for the time period of 1 second is equal to the value of the **SPL** function. The **MAX** result is calculated according to the formula:

$$\mathbf{MAX} = 20 \log(\max_T(p_w(t)/p_0))$$

For the **MAX** value saved as the main result  $\mathbf{T} = \mathbf{T}_c$  and for the **MAX** value saved in the files of the buffer (time history)  $\mathbf{T} = \mathbf{T}_b$ .

## The MIN result

The **MIN** result is calculated according to the formula:

$$\mathbf{MIN} = 20 \log(\min_T(p_w(t)/p_0))$$

For the **MIN** value saved as the main result  $\mathbf{T} = \mathbf{T}_c$  and for the **MIN** value saved in the files of the buffer (time history)  $\mathbf{T} = \mathbf{T}_b$ .

## The LEQ function

The **LEQ** function enables the user to calculate the RMS value of sound pressure in the given time period. The instrument operates as the standard **Integrating Sound Level Meter** and conforms to the **IEC 804 Standard** (meeting the requirements for the **Type 1** instrument). The value of the **LEQ** function is calculated, when the **LINEAR** option is selected in the **LEQ INTEGRATION** position of the **SETUP** list, according to the formula:

$$\mathbf{LEQ} = 20 \log \left( \frac{1}{T_c} \int_0^T (a_w(t)/p_0)^2 dt \right)^{1/2}$$

The value of the **LEQ** function is calculated, when the **EXPONENTIAL** option is selected in the **LEQ INTEGRATION** position of the **SETUP** list, according to the formula:

$$\mathbf{LEQ} = 20 \log \left( \frac{1}{T_c} \int_0^T (p_w(t)/p_0)^2 dt \right)^{1/2}$$

For the **LEQ** value saved as the main result  $\mathbf{T} = \mathbf{T}_c$ .

## The RMS result

The **RMS** result, saved in the buffer's file, is calculated according to the formula of the **LEQ** function. The value of the **RMS** result is calculated, when the **LINEAR** option is selected in the **LEQ INTEGRATION** position of the **SETUP** list, according to the formula:

$$\mathbf{RMS} = 20 \log \left( \frac{1}{T} \int_0^T (a_w(t)/p_0)^2 dt \right)^{1/2}$$

The value of the **RMS** result is calculated, when the **EXPONENTIAL** option is selected in the **LEQ INTEGRATION** position of the **SETUP** list, according to the formula:

$$\text{RMS} = 20 \log \left( \frac{1}{T} \int_0^T (p_w(t)/p_0)^2 dt \right)^{1/2}$$

For the **RMS** result saved in the files of the buffer (time history)  $T = T_b$ .

### The SEL result

The **SEL** result (Sound Exposure Level) is essentially the subset of the **LEQ** function. Its value is equal to the **LEQ result referred to the integration time equal to one second** (so, for the **INT. TIME=1 s**, **SEL** is always equal to **LEQ**). The value of the **SEL** function is calculated, when the **LINEAR** option is selected in the **LEQ INTEGRATION** position of the **SETUP** list, according to the formula:

$$\text{SEL} = 20 \log \left( \int_0^T (a_w(t)/p_0)^2 dt \right)^{1/2}$$

The value of the **SEL** function is calculated, when the **EXPONENTIAL** option is selected in the **LEQ INTEGRATION** position of the **SETUP** list, according to the formula:

$$\text{SEL} = 20 \log \left( \int_0^T (p_w(t)/p_0)^2 dt \right)^{1/2}$$

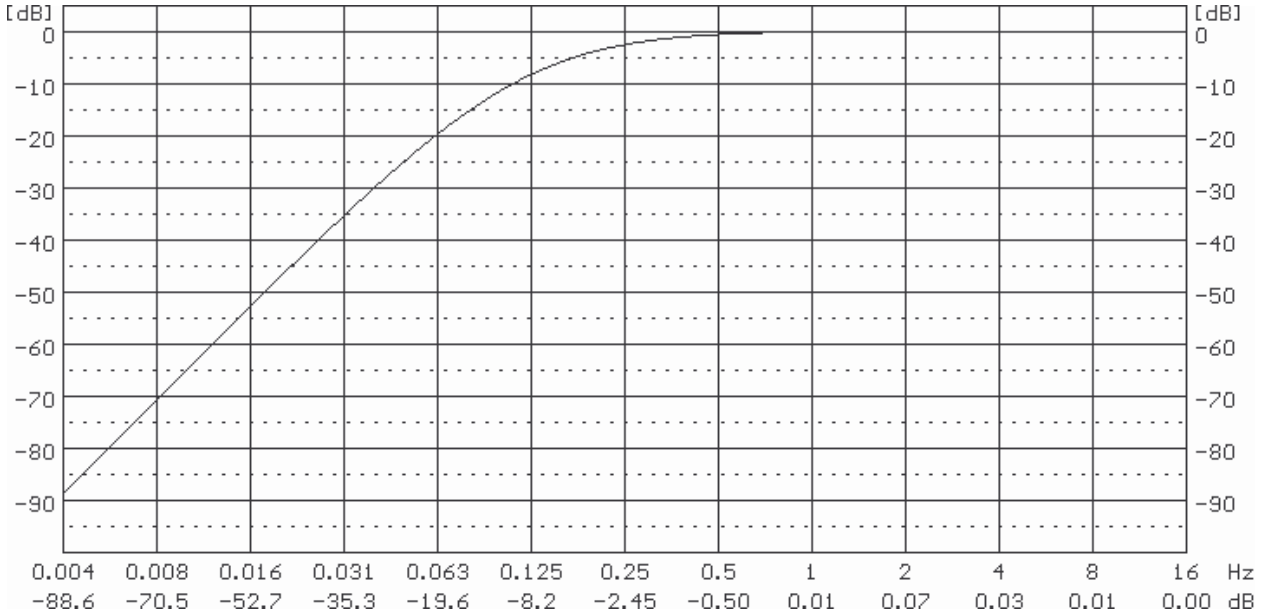
For the **SEL** value saved as the main result  $T = T_c$ .

### The Ltm3 and Ltm5 results

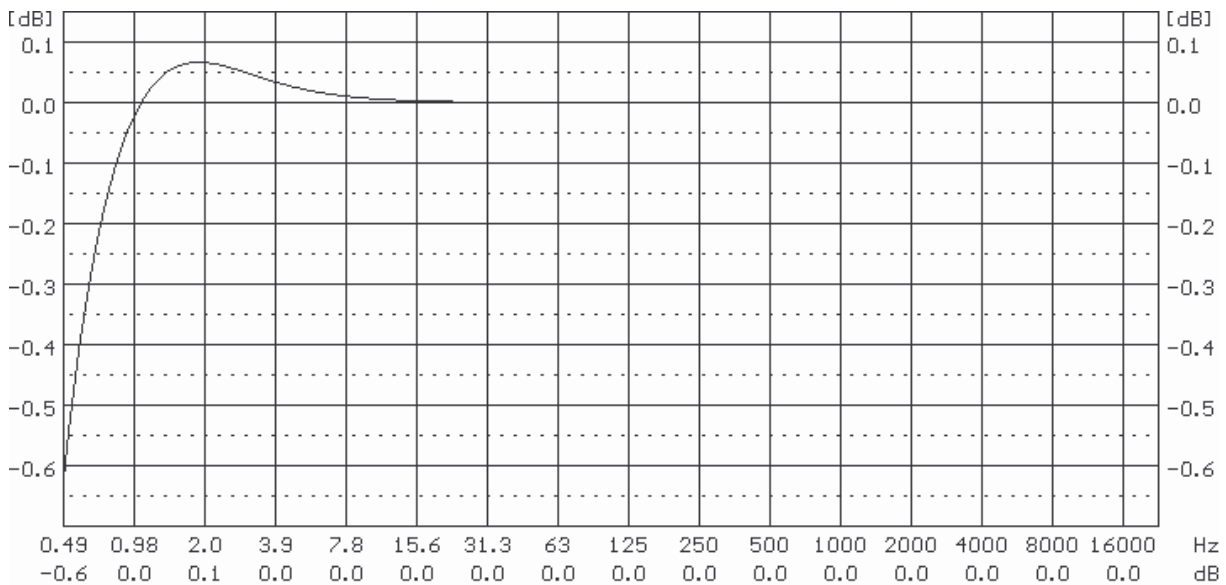
The **Ltm3** and **Ltm5** results (Takt-Maximal Levels) are calculated according to the German standard TA Larm.

## D.2. CHARACTERISTICS OF DIGITAL FILTERS IMPLEMENTED IN SVAN 945A

**HP:** cut-off frequency: 0,770 Hz / -0,1 dB (0,225 Hz / -3,0 dB).

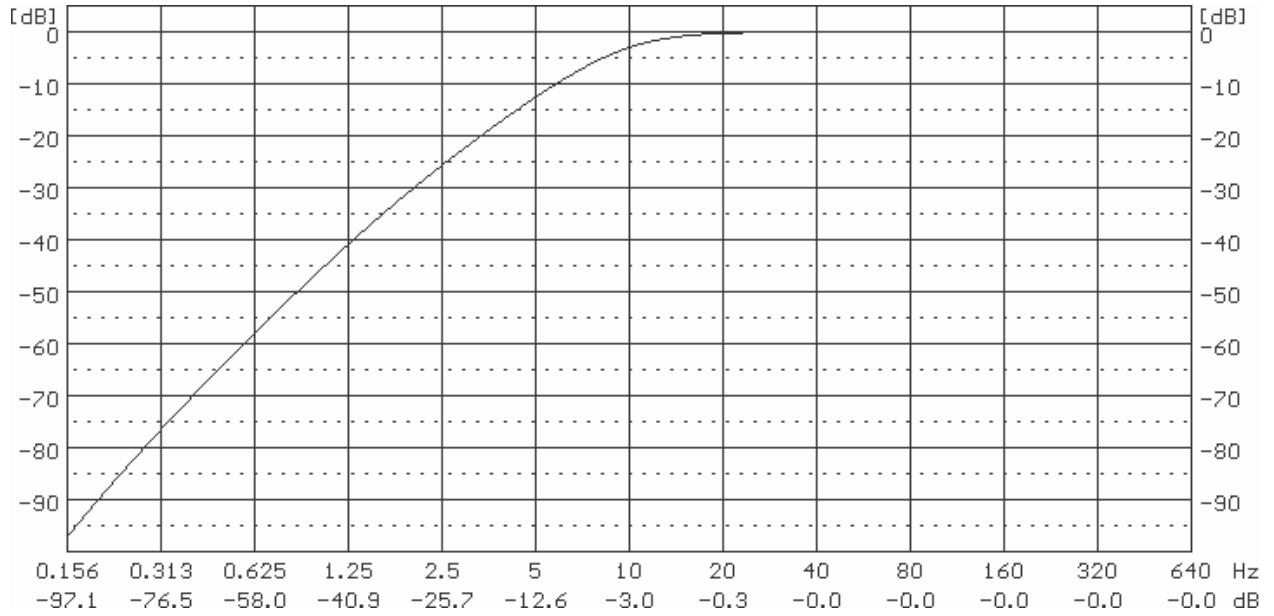


The frequency characteristics of the HP filter implemented in the instrument in the low frequency band with the emphasis on the acquired attenuation

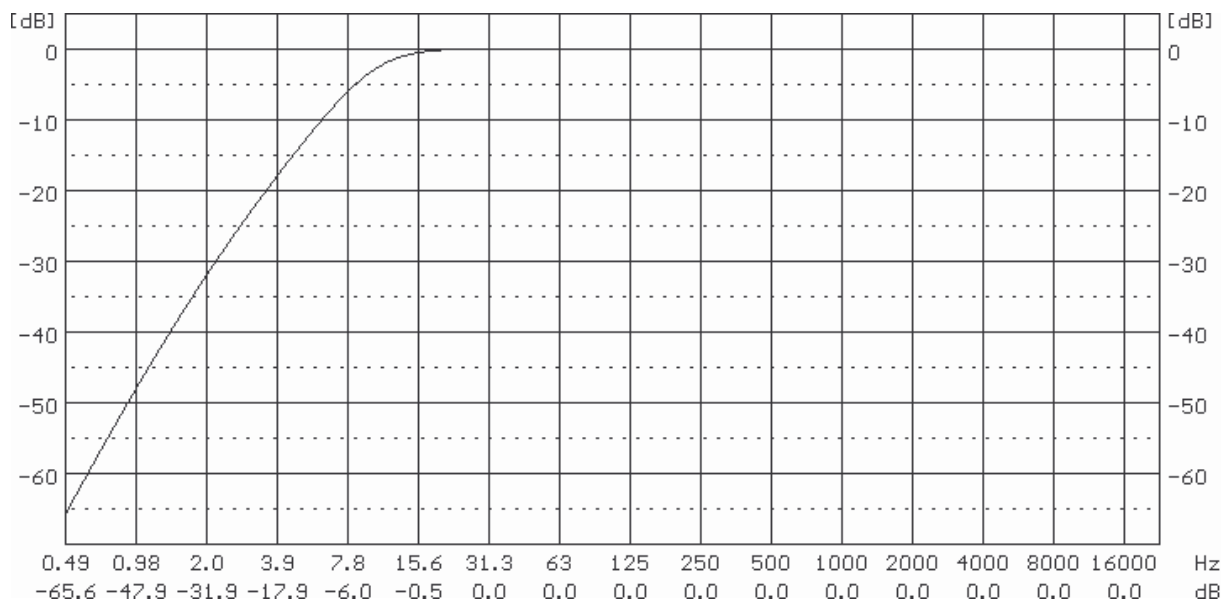


The frequency characteristics of the HP filter in the full band of the SVAN 945A without the emphasis on the acquired attenuation in the low frequency band

**LIN:** cut-off frequency: 27,0 Hz / -0,1 dB (10,0 Hz / -3,0 dB).

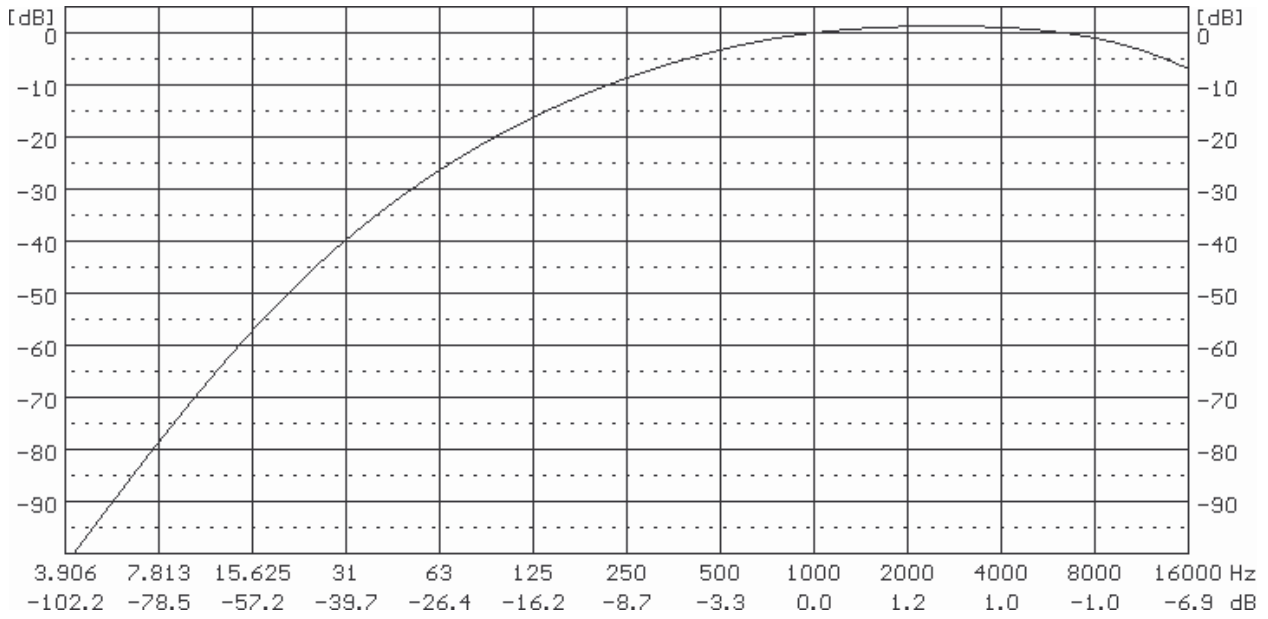


The frequency characteristics of the LIN filter implemented in the instrument in the low frequency band with the emphasis on the acquired attenuation



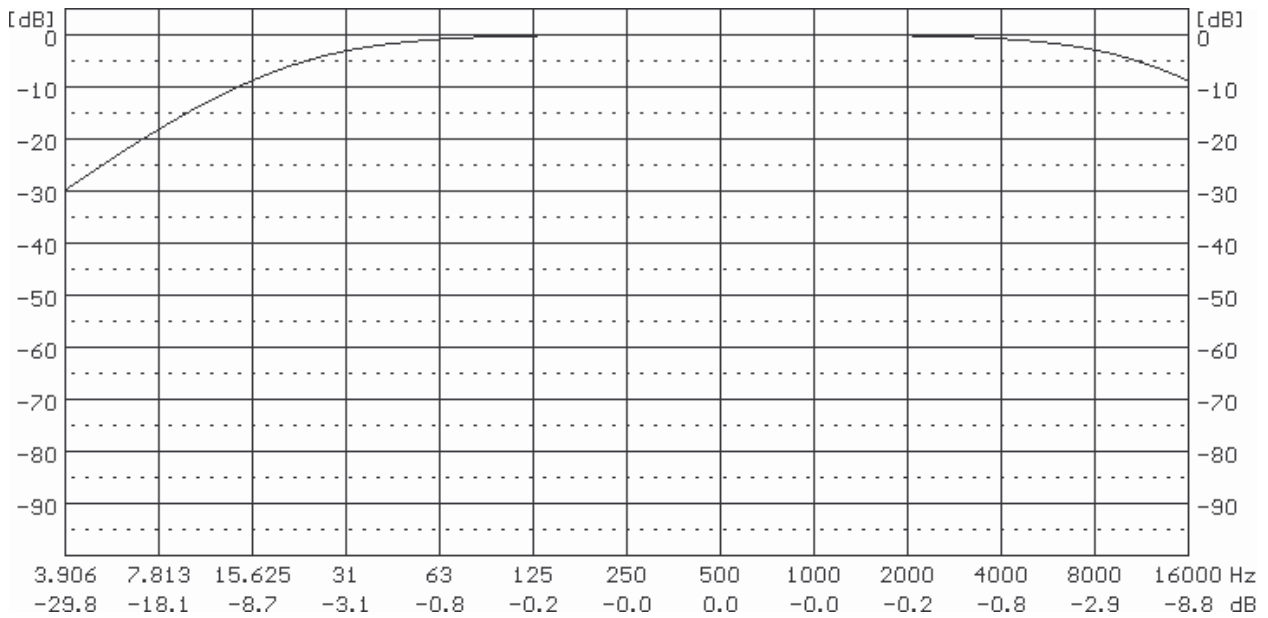
The frequency characteristics of the LIN filter in the full band of the SVAN 945A without the emphasis on the acquired attenuation in the low frequency band

**A** type 1 according to the IEC 651 standard.



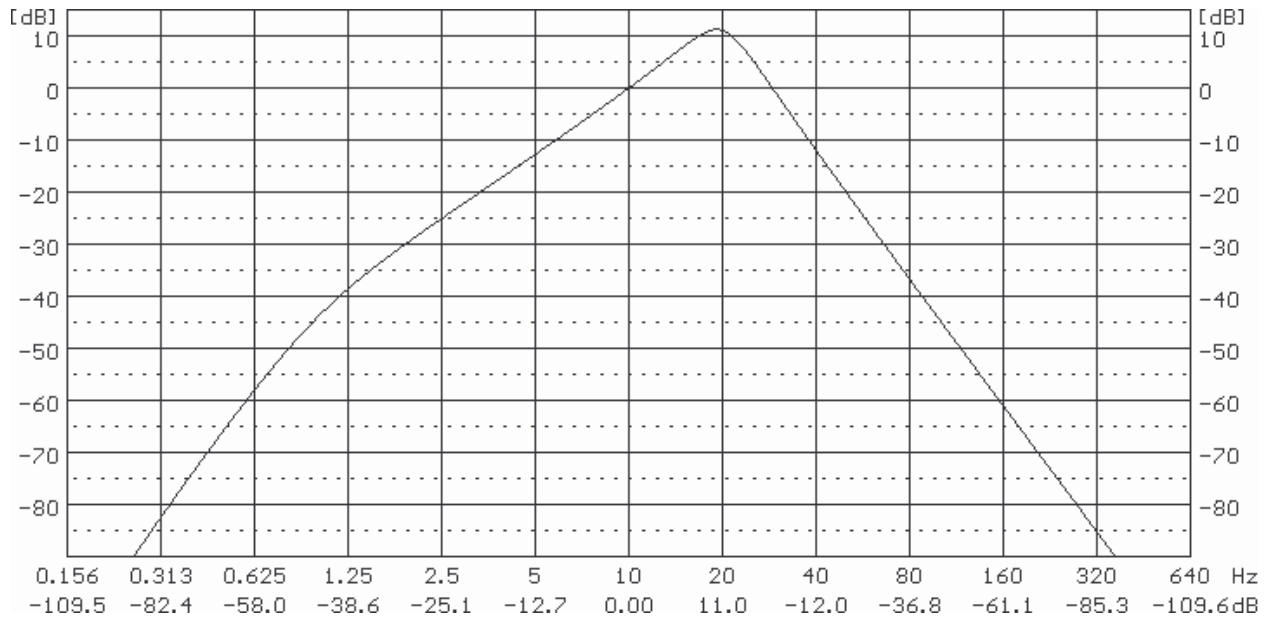
The frequency characteristics of the A filter implemented in the instrument

**C** type 1 according to the IEC 651 standard.

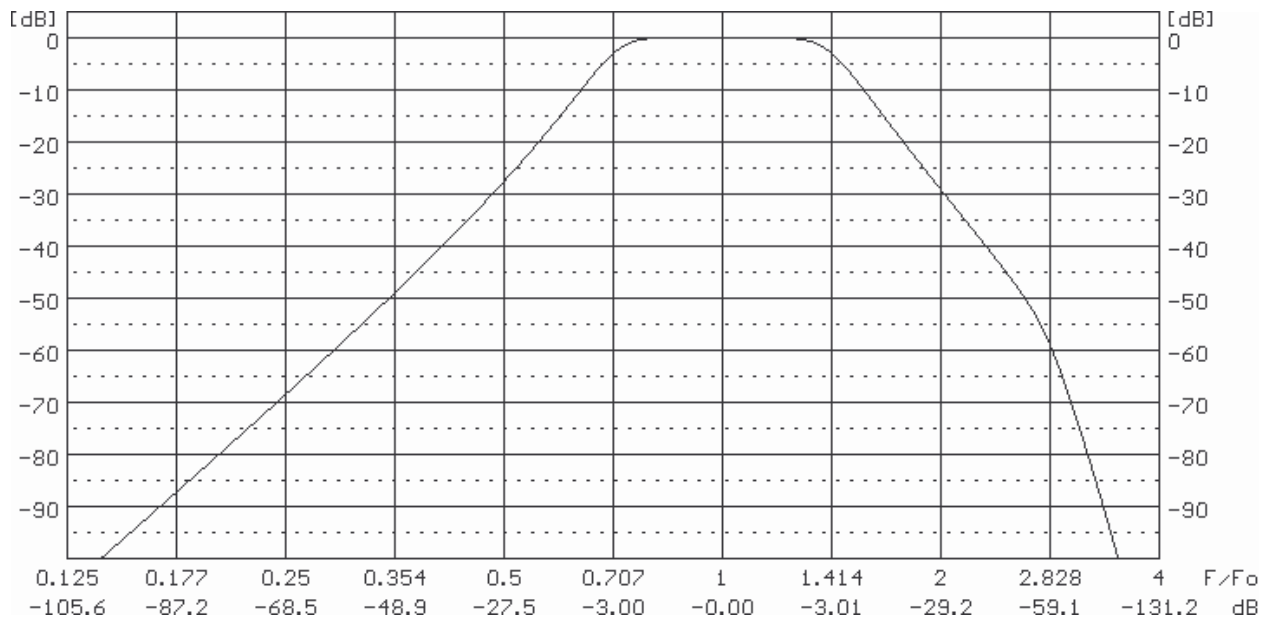


The frequency characteristics of the C filter implemented in the instrument

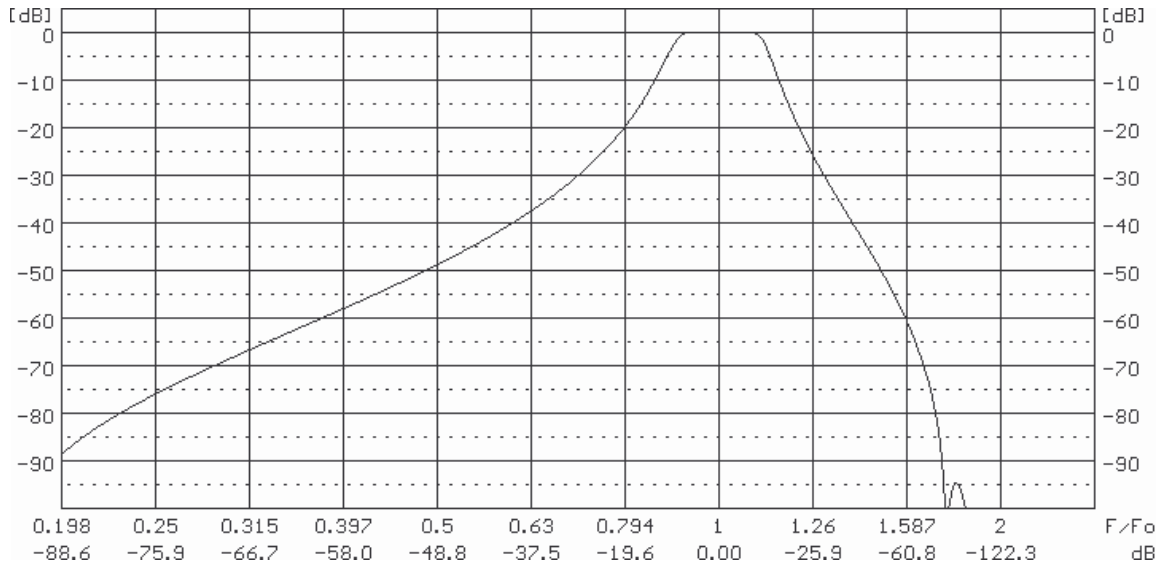
**G** type 1 according to the **ISO 7196** standard.



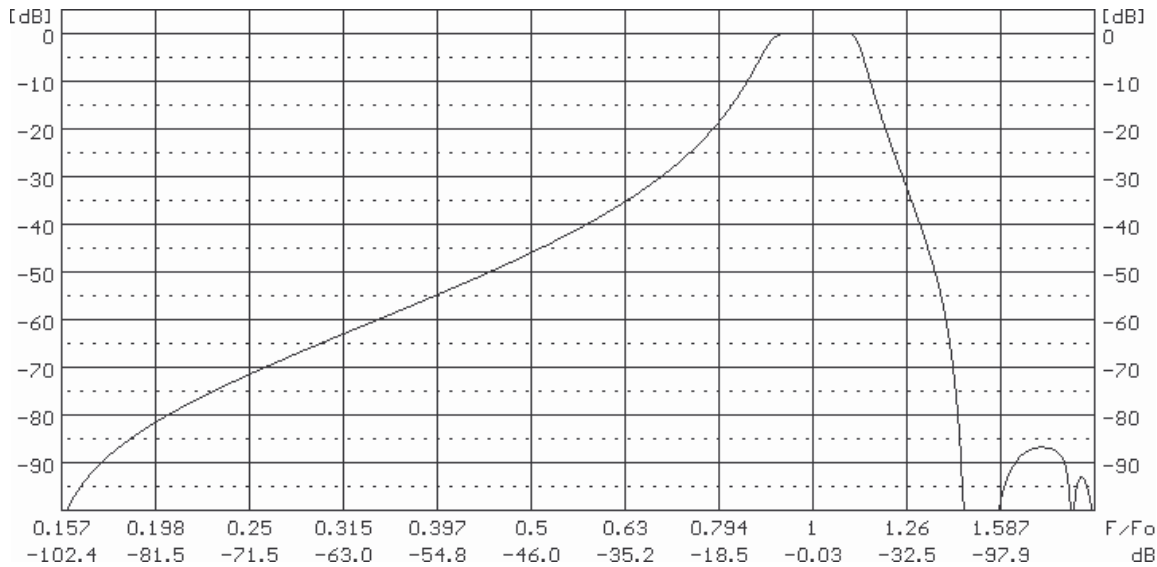
The frequency characteristics of the G filter implemented in the instrument



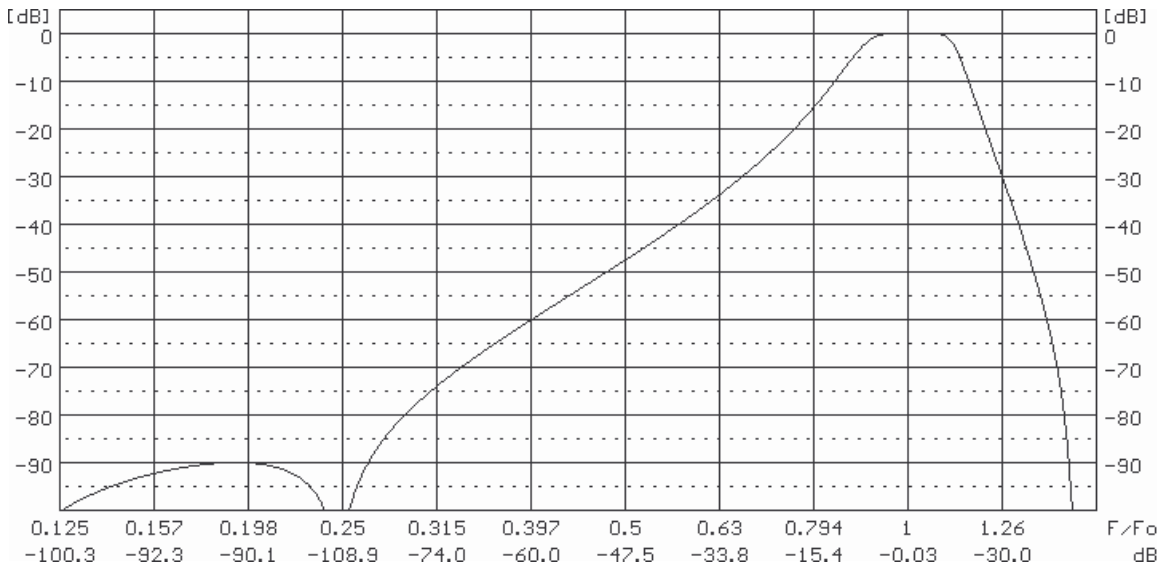
The frequency characteristics of the exemplary 1/1 OCTAVE filter implemented in the instrument



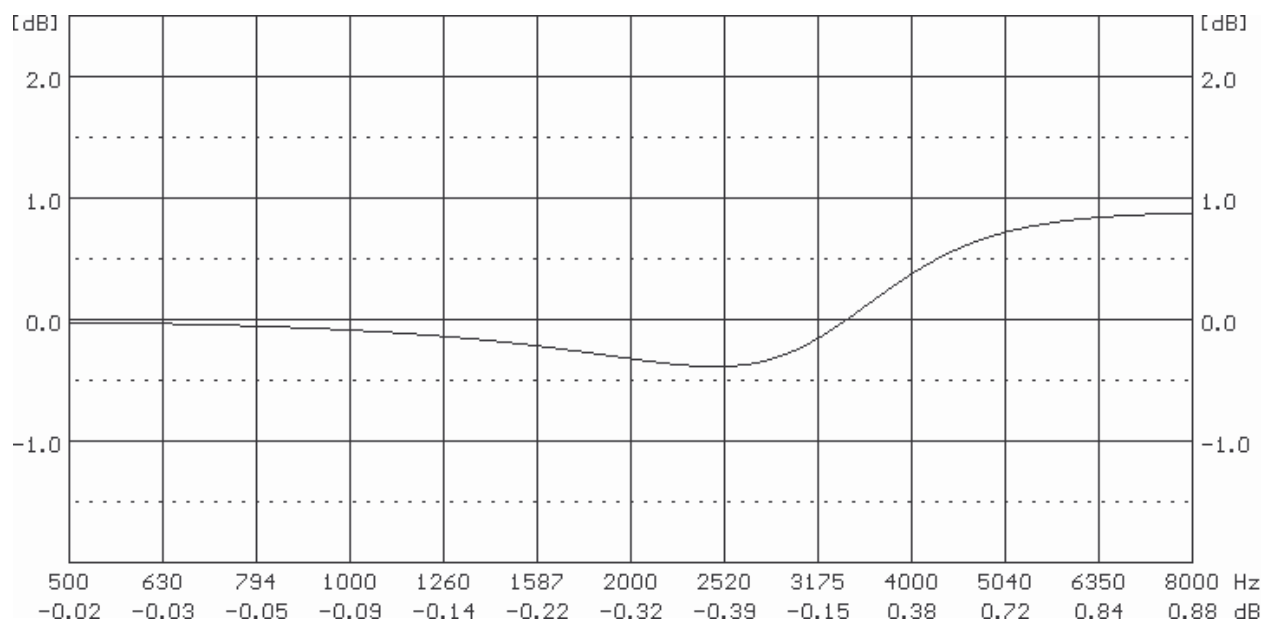
The frequency characteristics of the exemplary lower 1/3 OCTAVE filter implemented in the instrument



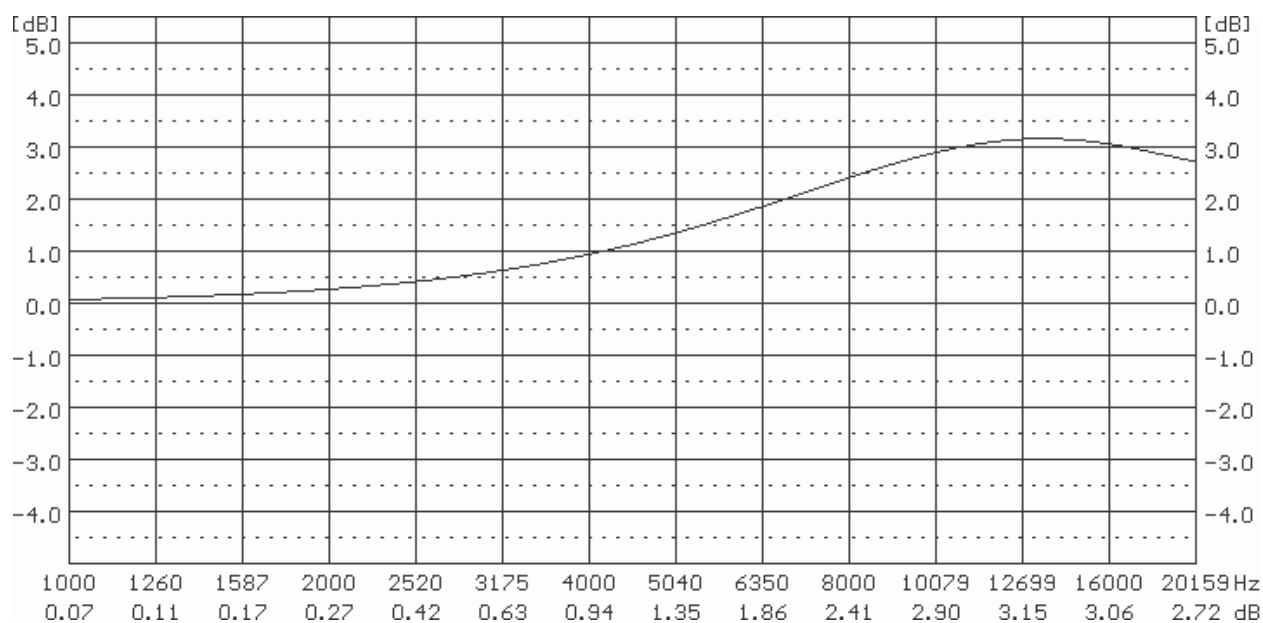
The frequency characteristics of the exemplary middle 1/3 OCTAVE filter implemented in the instrument



The frequency characteristics of the exemplary upper 1/3 OCTAVE filter implemented in the instrument



**The frequency characteristics of the filter implemented in the instrument for the compensation of the frequency characteristics of the microphones supplied by the instrument's manufacture**



**The frequency characteristics of the filter implemented in the instrument for the measurement in the diffuse field conditions**