NOTE ON TERMINOLOGY

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TUNE computes four output quantities, all within a specified time interval (snapshot):

- Broadband SPL (Sound Pressure Level)
- Decidecade SPL (“”)
- Zero-to-peak SPL (“”)
- Broadband PSD (Power Spectral Density)

A description for each quantity is given below, including references, symbols, and units.

Broadband SPL

This quantity is obtained by taking the sum of all power spectrum components, expressed as a single broadband value in dB. It is equivalent to taking waveform mean-square in time domain, that is the square of its rms value.

TUNE presents broadband SPL in a plot or tabular form as a series of dB values as a function of time.

Definition is given in ISO 18405:2017 standard as follows:

> **3.2.1.1**
> **mean-square sound pressure level**
> **root-mean-square sound pressure level**
> **sound pressure level**
> **SPL**
> $L_{p,\mathrm{rms}}$
> L_p
> DEPRECATED: mean-square SPL
> ten times the logarithm to the base 10 of the ratio of the *mean-square sound pressure* (3.1.3.1) to the specified reference value, p_0^2, in decibels

which in turn derives from:

> **3.1.3.1**
> **mean-square sound pressure**
> $\overline{p^2}$
> integral over a specified time interval of squared *sound pressure* (3.1.2.1), divided by the duration of the time interval, for a specified frequency range

Symbol and unit for **Broadband SPL** are: $\boldsymbol{L_{p,rms}}$, **dB re 1 µPa²**

Note: reference is to 1 µPa² since it is based on mean-square sound pressure which is quadratic.

Decidecade SPL

This quantity is obtained by first taking waveform power spectrum, then selecting frequency components that lie inside each decidecade band and adding them together. It is equivalent to filtering in time domain (ideally with infinite frequency rolloff, that is zero transition band), then computing SPL in a similar way as described above for broadband case.

TUNE computes SPL values in a series of decidecade bands and presents them in a plot or tabular form arranged on decidecade center frequency.

Definition is given in ISO 18405:2017 standard as follows, where 'weighted' is meant to be 'decidecade filtered':

> **3.7.1.3**
> **mean-square weighted sound pressure level**
> **weighted sound pressure level**
> **SPL_w**
> $L_{p,w}$
> ten times the logarithm to the base 10 of the ratio of the mean-square *weighted sound pressure* (3.7.1.1) to the specified reference value, p_0^2, in decibels

which in turn derives from:

> **3.7.1.1**
> **weighted sound pressure**
> p_w
> output of a specified linear filter when the input is the *sound pressure* (3.1.2.1), $p(t)$

Symbol and unit for **Decidecade SPL** are: $L_{p,dd}$, **dB re 1 µPa²**

where 'dd' is used as a subscript to refer to a decidecade band.

Zero-to-peak SPL

This quantity is obtained by taking the maximum peak value (either positive or negative) within each snapshot, which is then multiplied by an 'effective' calibration value. The latter is the scale factor value corresponding to the highest frequency component of the snapshot spectrum, which for typical pressure pulses is of the order of one hundred hertz. Spectrum components below a given limit (hard-coded to 10 Hz) are excluded, since they are usually much higher than those in the frequency band of interest.

Definition is given in ISO 18405:2017 standard as follows:

> **3.2.2.1**
> **zero-to-peak sound pressure level**
> **peak sound pressure level**
> $L_{p,0\text{-pk}}$
> $L_{p,pk}$
> DEPRECATED: peak SPL
> twenty times the logarithm to the base 10 of the ratio of the *zero-to-peak sound pressure* (3.1.2.3), p_{pk}, to the specified reference value, p_0, in decibels

which in turn derives from:

> **3.1.2.3**
> **zero-to-peak sound pressure**
> **peak sound pressure**
> $p_{0\text{-pk}}$
> p_{pk}
> greatest magnitude of the *sound pressure* (3.1.2.1) during a specified time interval, for a specified frequency range

Symbol and unit for **Zero-to-peak SPL** are: $L_{p,pk}$, **dB re 1 µPa**

Broadband PSD

This quantity is directly obtained from FFT power spectrum as a series of frequency components starting from zero up to half sampling frequency (Nyqvist limit), thus it is named ‘Broadband’.

TUNE presents broadband PSD as a series of dB values for each frequency bin: each bin has a fixed width which depends on sampling frequency and number of FFT points.

Definition is given in ISO 18405:2017 standard as follows:

> **3.2.1.10**
> **mean-square sound pressure spectral density level**
> $L_{p,f}$
> ten times the logarithm to the base 10 of the ratio of the *mean-square sound pressure spectral density* (3.1.3.13), $\left(\overline{p^2}\right)_f$, to the specified reference value, $\left(\overline{p^2}\right)_{f,0}$, in decibels

which in turn derives from:

> **3.1.3.13**
> **mean-square sound pressure spectral density**
> $\left(\overline{p^2}\right)_f$
> distribution as a function of non-negative frequency of the *mean-square sound pressure* (3.1.3.1) per unit bandwidth of a sound having a continuous spectrum

Symbol and unit for **Broadband PSD** are: $L_{p,f}$, **dB re 1 µPa² / Hz**