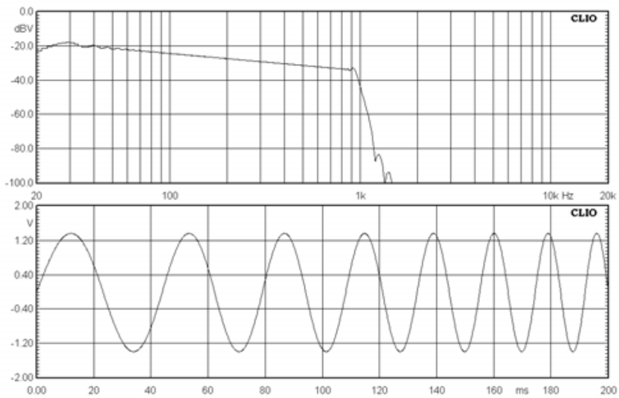
18.9.7 EXAMPLE 7: RUB & BUZZ DETECTION (1)

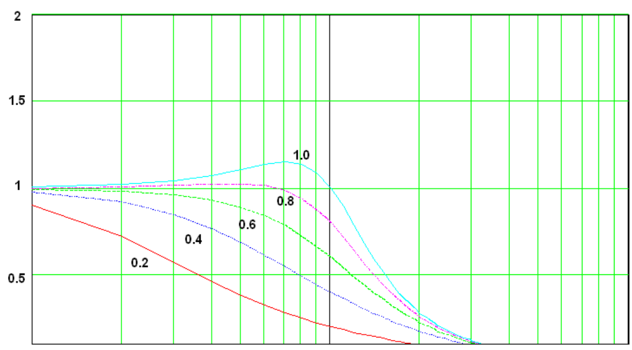
This example describes an effective technique to detect rub&buzz in a production line of loudspeakers. The technique is based on logarithmic chirp stimulus with syncronous FFT detection.

CLIOwin is able to generate (see 7.7) logarithmic chirps of proper length and proper start and stop frequencies.

Given your production of speakers you should program the log chirp following these guidelines:
Frequency Range. The frequency extremes depend on the kind of speaker; the start frequency must be below the resonant frequency (Fs) to achieve excursion while the stop frequency should be high enough to stimulate all possible defects and anomalous mechanical contacts. We suggest start to lie between **20Hz/100Hz** while stop between **500Hz/1500Hz**. Stop should be a compromise between best defect detection and anomalous resonances excitation.



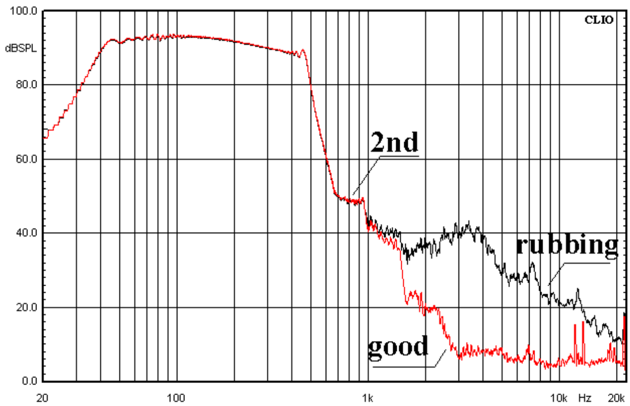
Amplitude. Perhaps this is the most critical parameter to set. Its choiche must take into consideration T&S parameters of the device and tend to exploit the maximum excursion possible (XMax). On the other side a too high stimulus amplitude will tend to give false positives to R&B. The graph below shows excursion normalized versus Qt and Fs; it tells us that, in free air (as it is usually the case of production lines), maximum excursion is reached well below Fs (around 0.1*Fs).



This leads us also to consider the technique described after (18.9.9) to apply DC and relax other parameters while augmenting R&B detection.
Duration. It is directly related to the chirp length; at 48 kHz sampling you get the following: a 16k chirp lasts around 0.35s, a 32k chirp lasts around 0.7s, a 64k chirp lasts around 1.4s and so on.
The choiche should be coinsistent with your production test needs provided a longer test should be preferable as some kind of R&B phenomena appear with time as device thermal constants are reached. For the same reason if R&B is one among other QC tests, it should be done **at the end**.

Once the stimulus has been defined you must define a proper FFT QC test; be sure to use the same size of the stimulus, i.e. **FFT Size = Chirp Size**. Another important FFT parameter to set is smoothing which will present an easier to detect analysis; we suggest 1/48 or 1/24th of octave smoothing.

The analysis leads to the following situation:



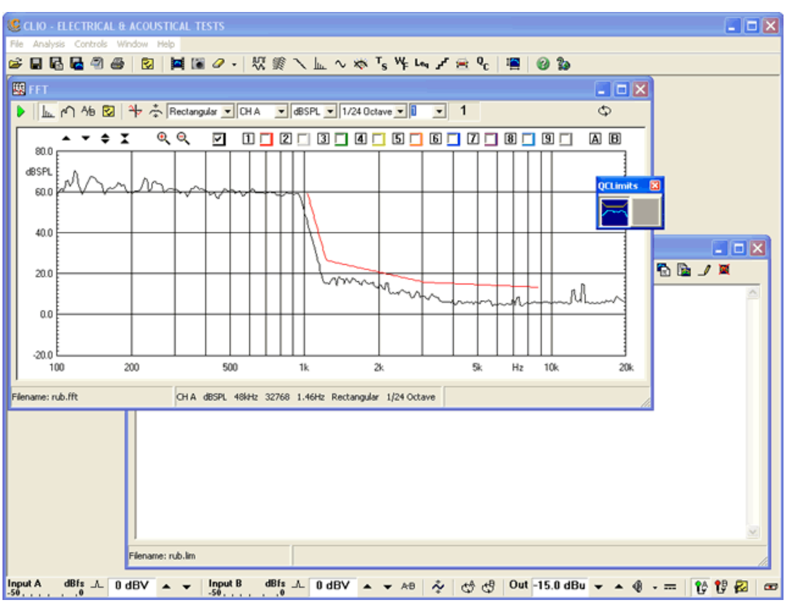
You can see the response of a good and a rubbing device which will lead you to correct mask definition; it is also shown how this measurement detects the harmonic signature of the device; the plateau marked with 2nd directly refers to second harmonic response.

This QC test is as simple as the following definition:

```
[FFT]
COMMENT=RUB&BUZZ
OUTQCBOX=2.83
IN=0
REFERENCE=RUB.FFT
LIMITS=RUB.LIM
```

We set 2.83V at the QCbox output (given a former OUTUNITS=V definition) and input at 0dBV. **Extreme care must be put in order to optimize input sensitivity** as this measurement is very sensitive to noise.

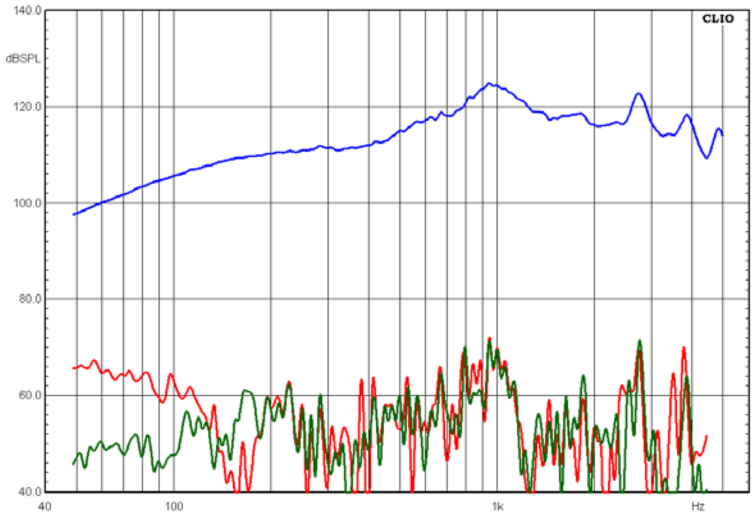
Limits mask should be placed in the decaying part of the acquisition and extendend to cover the highest frequencies; only upper limit is necessary in this case.



18.9.8 EXAMPLE 8: RUB & BUZZ DETECTION (2)

This example describes a second technique to detect rub&buzz in a production line of loudspeakers. The technique is based on a sinusoidal test with fifth harmonic detection which has proven to be sensitive to R&B.

The following figure shows the fifth harmonic sinusoidal response of a good and rubbing speaker:



See 18.6.6 for setting up this kind of QC test. A QC test will be as simple as:

```
[SIN]
REFERENCE=RESPONSE.SIN
LIMITS=RESPONSE.LIM
```

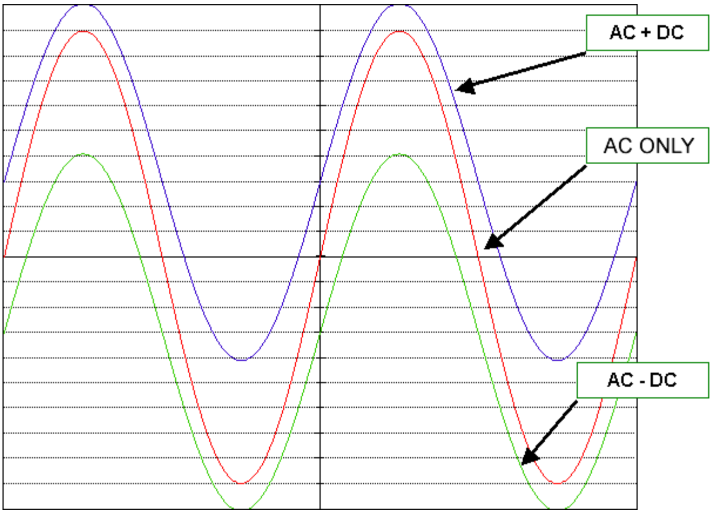
Where the limit file will contain also a test mask for the fifth harmonic:

```
[UPPER LIMIT DATA]
.....
.....

[LOWER LIMIT DATA]
.....
.....

[5 UPPER LIMIT DATA]
.....
.....
```

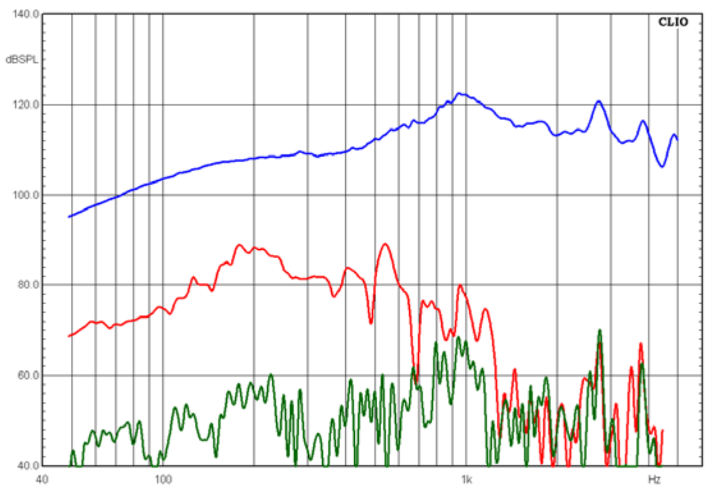
18.9.9 EXAMPLE 9: RUB & BUZZ DETECTION (3)

This example describes a simple method to enhance rub&buzz detection. This method is based on the possibility of applying a DC voltage superimposed to the generated stimulus. This technique applies to any test possible with CLIO and augments its sensitivity.

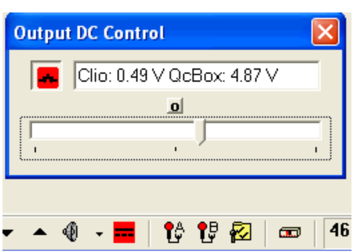
As it is evident also from the figures in 18.9.7 the maximum excursion is obtained at DC and this is an effective way to bring the speaker to its limits. As it is evident from the following figure when a DC is applied the corresponding AC signal amplitude must be lowered to obtain similar excursion.



Applying a DC to the same QC test as described before in 18.9.8 it is possible to obtain the following measurement where it is evident the much better detection of the defect which is possible.



As described in 4.5.3 it is possible to manually set the DC voltage using the relative control panel.



Under a QC script it is possible to apply DC with the following synthax:

```
[PERFORM]
DCON=1
[SIN]
```

```
DCVQCBOX=1.2
REFERENCE=RESPONSE.SIN
LIMITS=RESPONSE.LIM
[SIN]
DCVQCBOX=-1.2
REFERENCE=RESPONSE.SIN
LIMITS=RESPONSE.LIM
[PERFORM]
DCON=0
```

In this example it has been applied a 1.2V DC voltage to a sinusoidal test; the same could have been applied to a FFT with log chirp or any other test; **to be noted that the same test must be executed twice** as we don't know a priori which direction stimulates the defect to arise.

In this case also lower harmonics could be checked as, when DC is present, they become sensitive to R&B too.