



Application Note

RT-Speaker - Rub & Buzz Test

How to set the tolerance limits for accurate PASSED/FAILED decision ?

This application note describes the setting of tolerance limits for fast and accurate Rub&Buzz testing, using the NTI RT-Speaker production test software. The PureSound Rub&Buzz measurement is tailored for automated PASSED/FAILED decision with a 100% correlation to the human ear.

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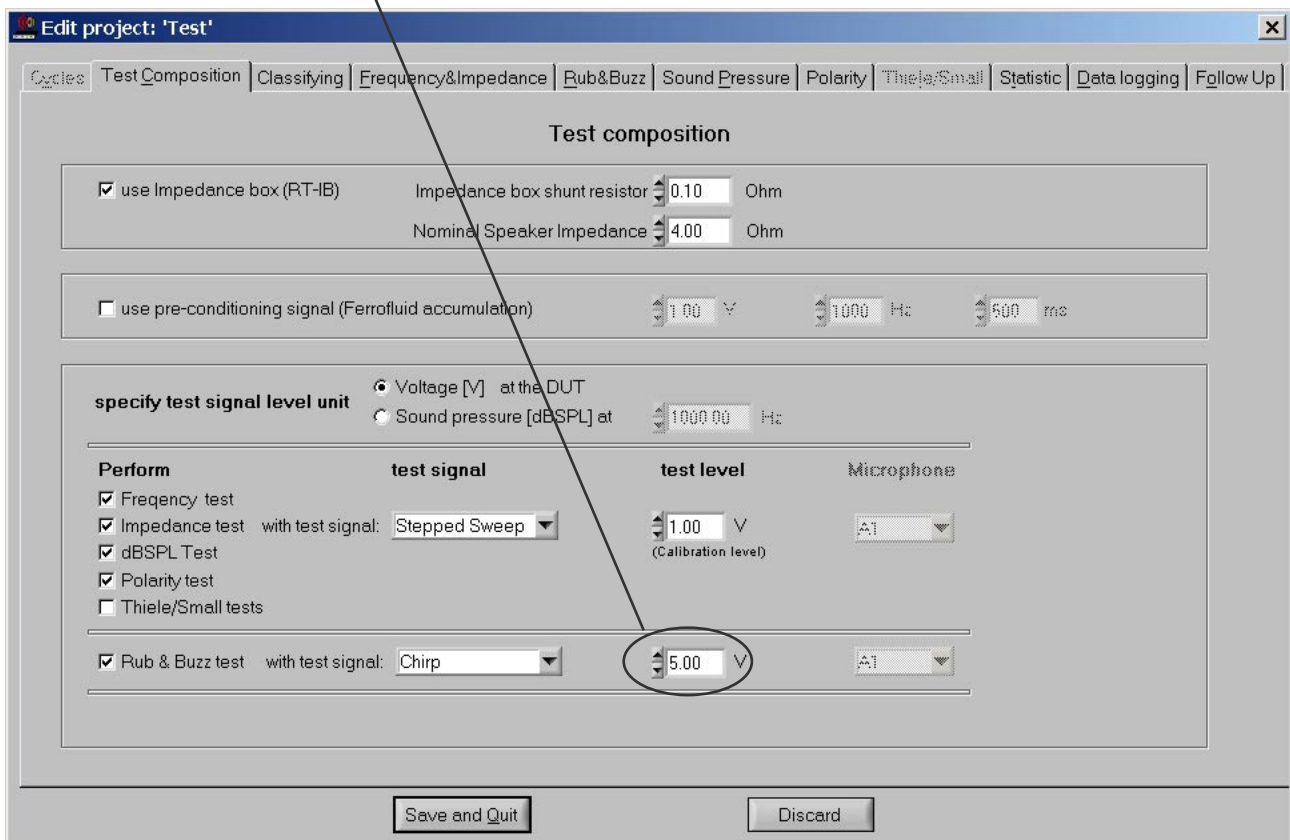
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1. Introduction

The Rub&Buzz test of speakers in the production line with RAPID-TEST and PureSound™ uses a very short chirp as test signal. This fast continuous sweep ensures an accurate Rub & Buzz analysis with 100% correlation to the human ear. This chirp signal is defined as follows:

- a. The chirp level should be equal to the maximum allowed driver voltage.

a. Rub&Buzz Chirp Level



Setup Panel Rub&Buzz Test Level



- b. Adjust the start- & stop-frequency of the chirp (default setting is 20Hz - 1,5kHz, the max. available range: 5 Hz - 6 kHz). Select the start/stop frequency in compliance with the frequency range, where the DUT typically shows Rub & Buzz defects (e.g. from 20 Hz to 800 Hz).
- c. Determine the minimum required chirp duration by evaluating bad samples. The default setting is 1500ms at a test chirp from 20Hz - 1.5kHz and can be reduced down to 700ms for speed optimization. You may set this test time according the selected frequency range so all possible Rub&Buzz effects are detected.

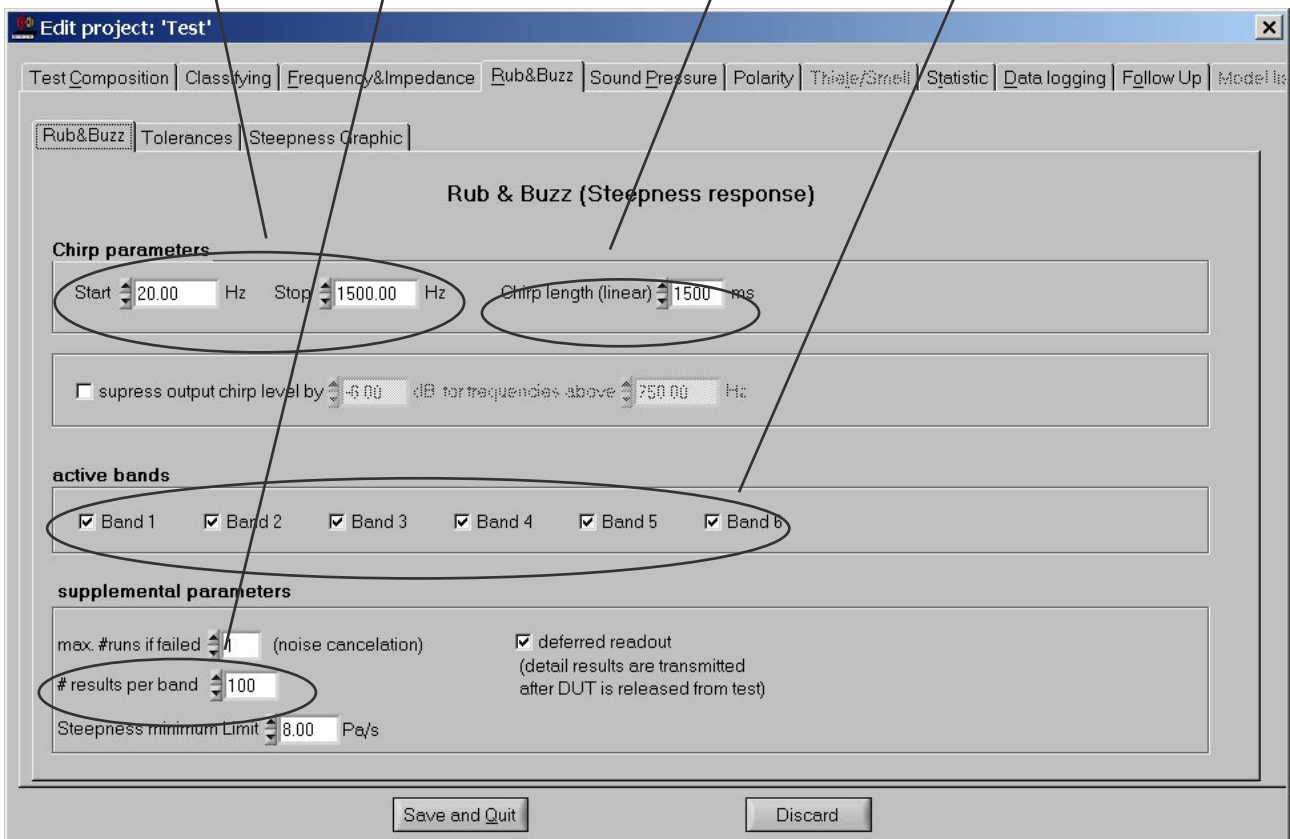
Note: The longer the test cycle time the more sensitive the Rub&Buzz measurement !

- d. All six steepness bands should be enabled to allow characterizing possible Rub & Buzz defects.
- e. The number of steepness results can be high for evaluation but should be reduced for production. Thereby, it is important to know that a low number of results has no effect on the

resolution of the internal Rub & Buzz analysis of RAPID-TEST.

- f. The steepness limits (=Edit Project Tab "Rub&Buzz - Tolerance") represent individual acceptance criteria for the six bands. The best way to define them is by measuring several good reference drivers ("golden samples") and adding a user-defined offset to the results.

b. Start / Stop Frequency e. Steepness Results c. Chirp Duration d. Six Steepness Bands



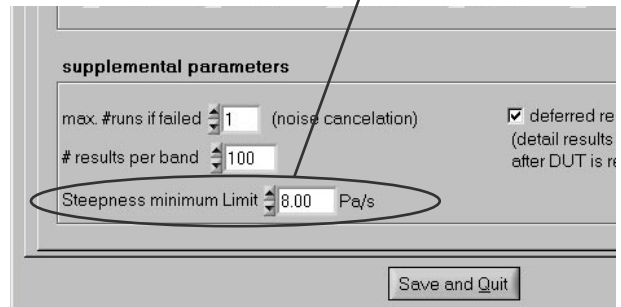
Rub&Buzz test setup panel



2. Measure environmental noise floor

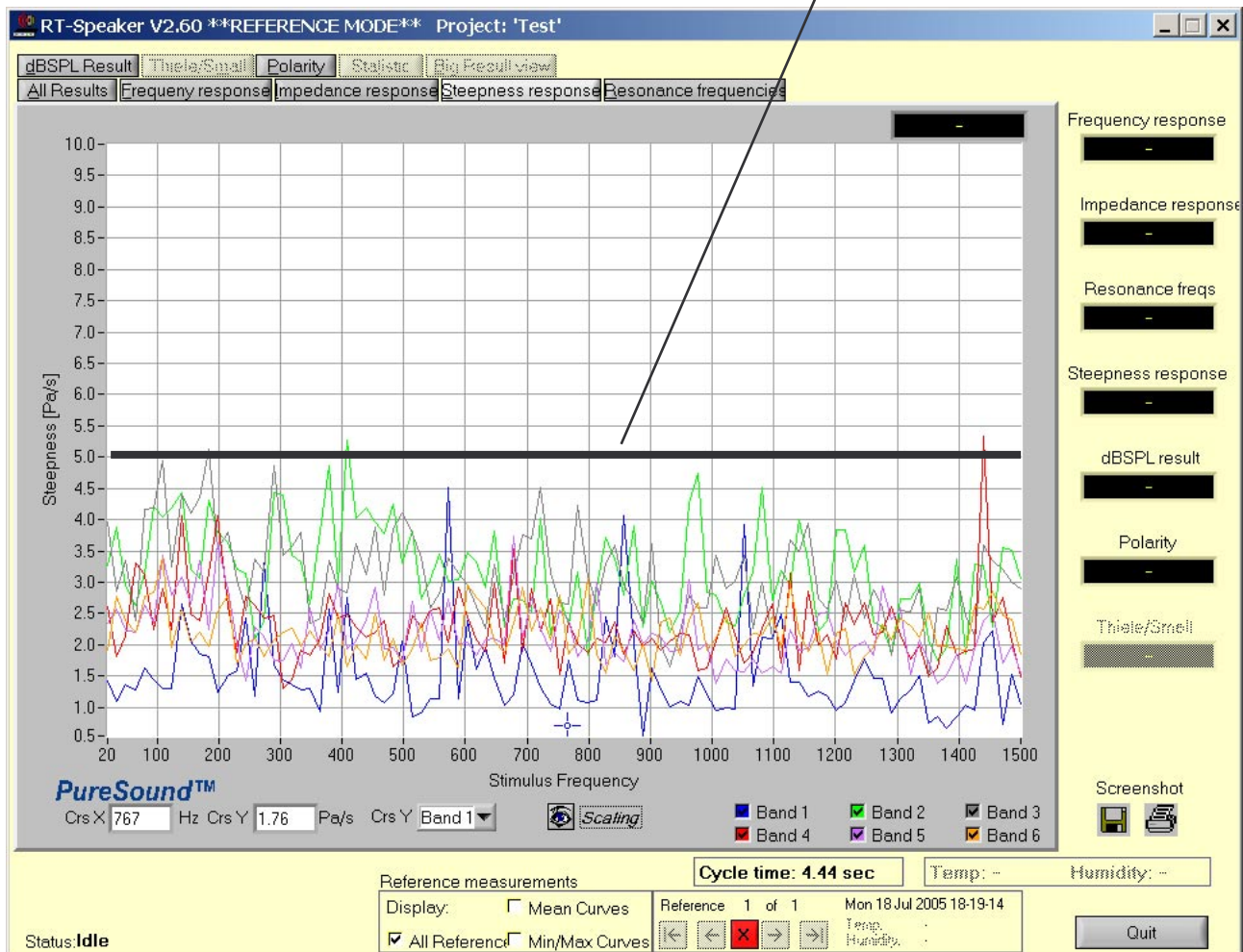
- a. Upon completing the Rub&Buzz test parameters the automatic calibration of the system has to be carried out to compensate non-linearity's in the used amplifier frequency response.
- b. Select Reference Measurement and connect the reference speaker to the PureSound speaker test system. Complete a reference measurement to verify the basic functionality of the speaker test system.
- c. Disconnect the speaker electrically and press the "F1" function key on your keyboard to carry out a measurement of the surrounding. Now the microphone measures the acoustical noise floor in the production environment. Typical test result: e.g. max. 5 Pa/s.
- d. Note down this result as it is required later to set the minimum steepness limit (any test result below the minimum steepness limit is always considered as passed).

Minimum Steepness Limit



- e. Enter the EDIT Project mode and select the Rub&Buzz -> Rub&Buzz panel.
- f. Set "Steepness minimum Limit" according to the measured max. noise floor and save the data.

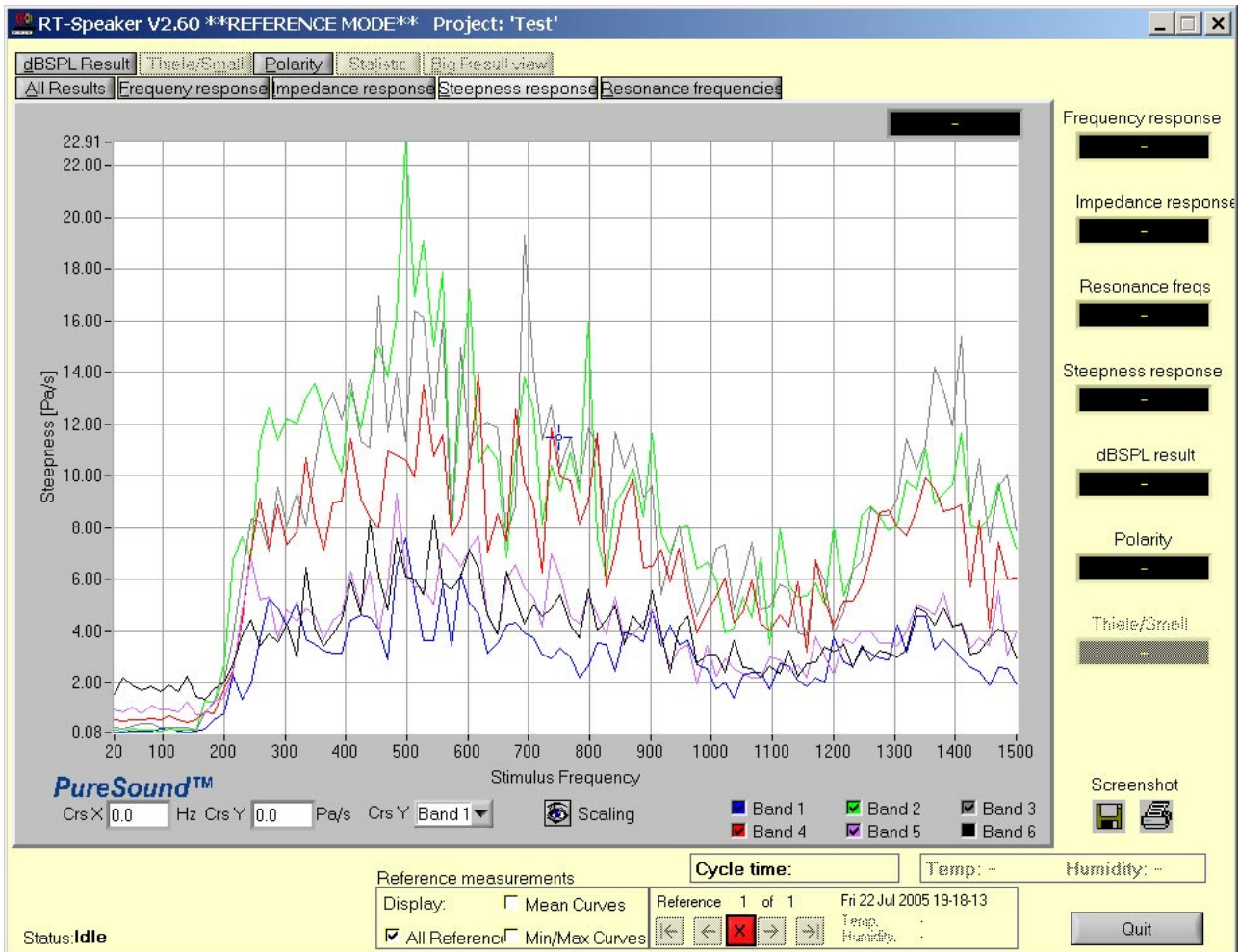
Upper Limit of Noise Floor



Rub&Buzz Reference Measurement of noise floor, max. Steepness is approx. 5 Pa/sec



3. Reference Measurement



Rub&Buzz Reference Measurement with connected DUT, max. noise floor is approx. 8 Pa/sec

- Connect the reference speaker and carry out the reference measurement.
- In case of more than one available reference speaker continue with the reference recording of the remaining speakers and select "Display Min/Max Curves", so highlighting the max. of all test results only.
- This test result has to be higher than the earlier measured environmental noise limit within the complete frequency measurement range.
- In case the test result is (partly) within the noise floor, the acoustical shielding against excessive environmental noise has to be improved and the measurements in pos. 2 & 3 repeated.
- Alternatively you may disregard this frequency ranges and verify if all detected Rub&Buzz problems are within frequency ranges exceeding the environmental noise limit.
- In case you wish to adjust that any test result below a certain steepness value shall always be passed, you may increase the earlier setting of the minimum steepness limit.
- Exit the reference mode and save the test results.



4. Rub&Buzz Tolerances

The Rub&Buzz tolerances depend on the test result of the reference ("golden") sample. The tolerances are created by adding a user-defined margin in % or dB to the max. steepness test result of the reference speaker(s).

The RT-Speaker production test software enables three (3) different setting of the Rub&Buzz tolerances:

Sigma Tolerances

Applicable for a bigger number of reference speakers, such as 20 or higher. This mode calculates the tolerance mask statistically as follows:

$$\text{Upper/Lower limit} = \text{reference data} \pm x \text{ Sigma}$$

(*x* = offset; *Sigma* = deviation of ref. data)

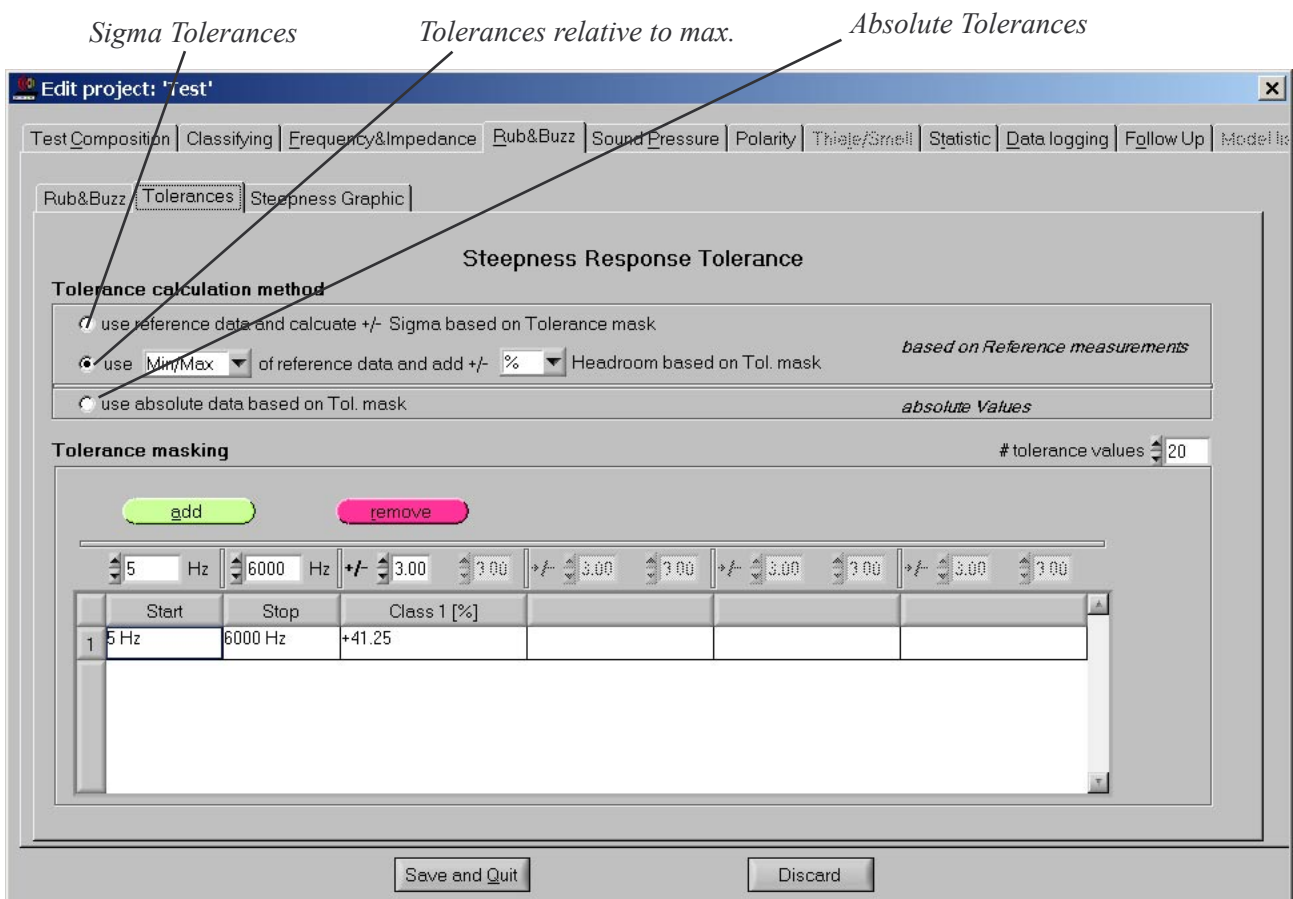
Adding linear tolerance margin to max. of reference data

Default setting, applicable for standard "golden sample" reference speaker(s).

Using an absolute tolerance mask

Enter a fixed, absolute tolerance mask not depending on the reference sample test results

- a. We recommend using the default setting at the initial stage.
- b. Press "Save & Quit" to store the settings.
- c. Press the button "Calculate Tolerances" and enter the production mode.
- d. On the detailed Rub&Buzz screen you may see grayed lines displaying the tolerances for the production measurement.
- e. Re-measure the reference speaker(s). All reference speaker tests have to pass, as these results have been the base for the tolerance calculation.



Rub&Buzz, Tolerance Setting possibilities



f. In case the reference speakers do not pass this production measurement the following may cause such instabilities:

- noisy or unstable environment
- speaker test box not stable, e.g. has some resonance vibrations
- bad noisy amplifier used in the setup configuration
- not enough reference samples have been taken

Proceed with resolving any possible matters as e.g. listed above and test the reference speakers again, so all measurements are passed.

g. Measure various bad speakers with typical Rub&Buzz errors of the same speaker type. All test results have to be "FAILED". In case some bad speakers are "PASSED" the tolerance settings shall be adjusted accordingly to pos. 5.

h. Measure further good speakers to ensure all good samples are "PASSED".

i. In case the above is in good order the basic Rub&Buzz tolerances are in good order. Start the production testing and monitor the Rub&Buzz test results of the first batch closely. Any tolerance fine adjustment might be necessary.

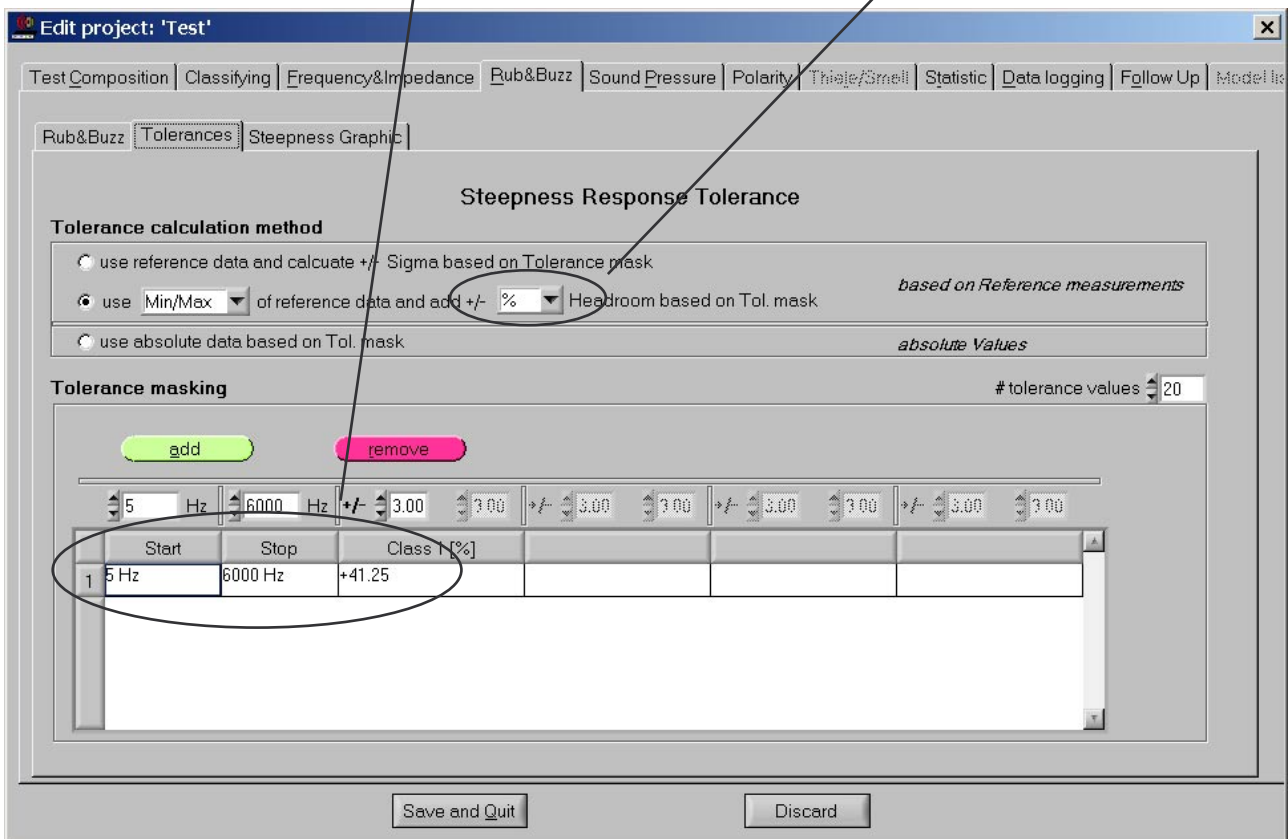
5. Modification of Tolerances

If the production measurement results are not according to the speaker quality, such as good speakers fail or bad speakers pass the following actions have to be carried out:

- Enter the reference recording menu and press "Append measurements", in order not to delete the reference records. Verify all measurement records are in good order and no bad, FAILED speaker is used as reference speaker. Any reference records of bad speakers shall be deleted and thereafter the production test measurements repeated.
- Enter the Rub&Buzz Tolerance menu, the

Tolerance Setting, default value = 3 dB = 41.25%

Set % or dB for tolerance setting



Rub&Buzz Tolerance Setting



- tolerance value can be set to % or dB.
- c. If some good speakers produce a FAILED test result increase the Rub&Buzz tolerance.
 - d. If some bad speakers produce a PASSED test result decrease the Rub&Buzz tolerance.
 - e. The tolerance setting can be selective for different frequency ranges, e.g. certain ranges shall have lower and others higher tolerances.
 - f. The tolerance setting can be compared to the learning curve. The amount of increase/decrease is based on error/trial method and depends very much on the individual speaker characteristics.
 - g. Repeat the production measurement of various PASSED/FAILED speakers to verify the new tolerance setting.

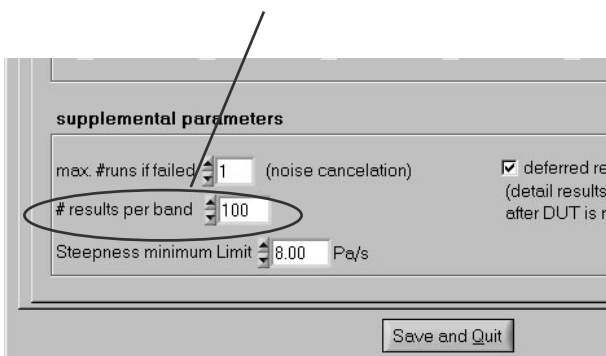
6. Test Result Resolution

The Rub&Buzz test result is carried out anytime in highest resolution (500 points from the adjusted start frequency to the end frequency). The steepness result screen displays 100 Rub&Buzz measurement points by default setting, so saving time at the data transfers, as well speeding up the measurement cycle time.

Note: The production software RT-Speaker displays the max. Rub&Buzz values at anytime, so no measurement data of non-displayed measurement points is getting lost.

A higher test result resolution allows a more detailed Rub&Buzz failure feedback.

Test Result Resolution





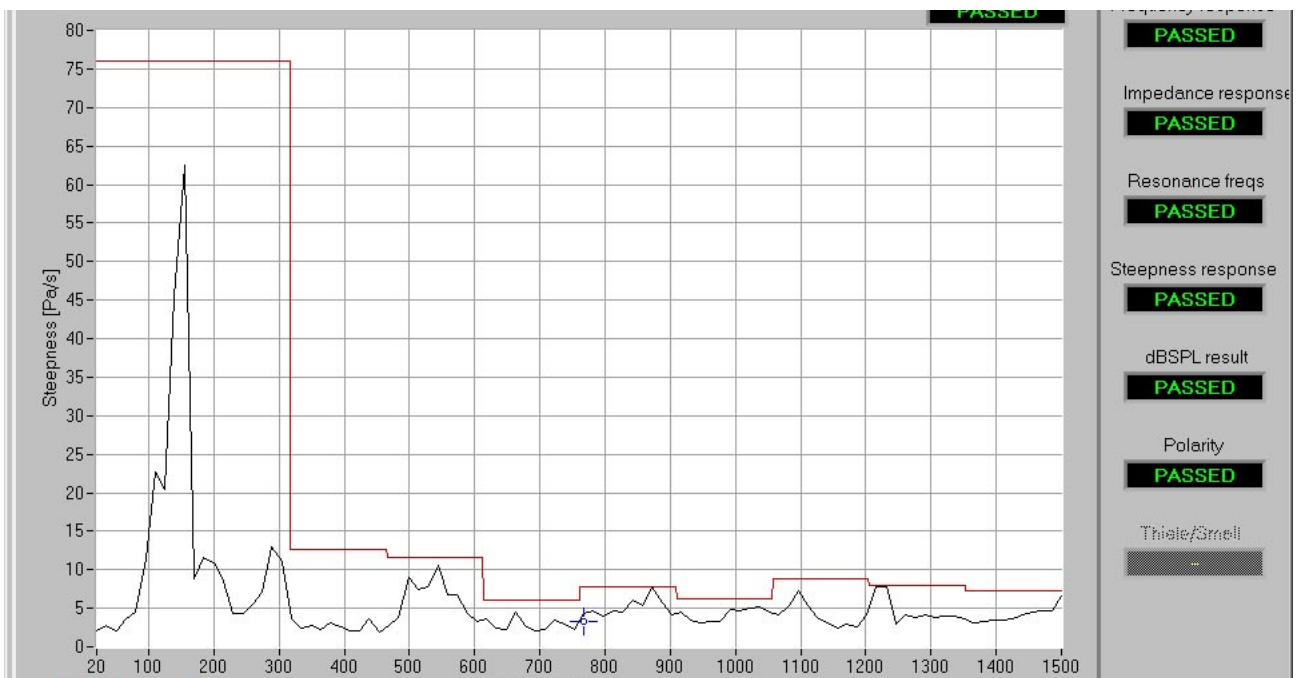
7. Tolerance Resolution

The tolerance resolution set by default is 20 points from the adjusted start frequency to the end frequency. This setting parts the measurement frequency range in e.g. 20 frequency ranges of equal size with the bandwidth of (fstop - fstart)/20.

e.g. fstart = 20 Hz, fstop = 1500 Hz
-> 20x tolerance bands of 74 Hz bandwidth

When do I have to use a higher tolerance resolution?

Set the tolerance resolution at the Rub&Buzz Tolerance Setup Panel to the individual required higher value to achieve a higher correlation of the speaker under test to the reference speaker, e.g. preventing frequency shifts of Rub&Buzz peaks (= test result = FAILED).



Default setting of tolerance resolution = 20



Increased setting of tolerance resolution = 40

Quick Guide

Setup of PureSound Rub&Buzz Test

(for further details see the indicated positions in brackets of the application note)

