Uncertainty in data processing in R51.03 Annex 10

A basic comparison of the four proposals

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Sources of uncertainty investigated

- Measurements
- Calculation
- Limit curve

Uncertainty in noise measurements

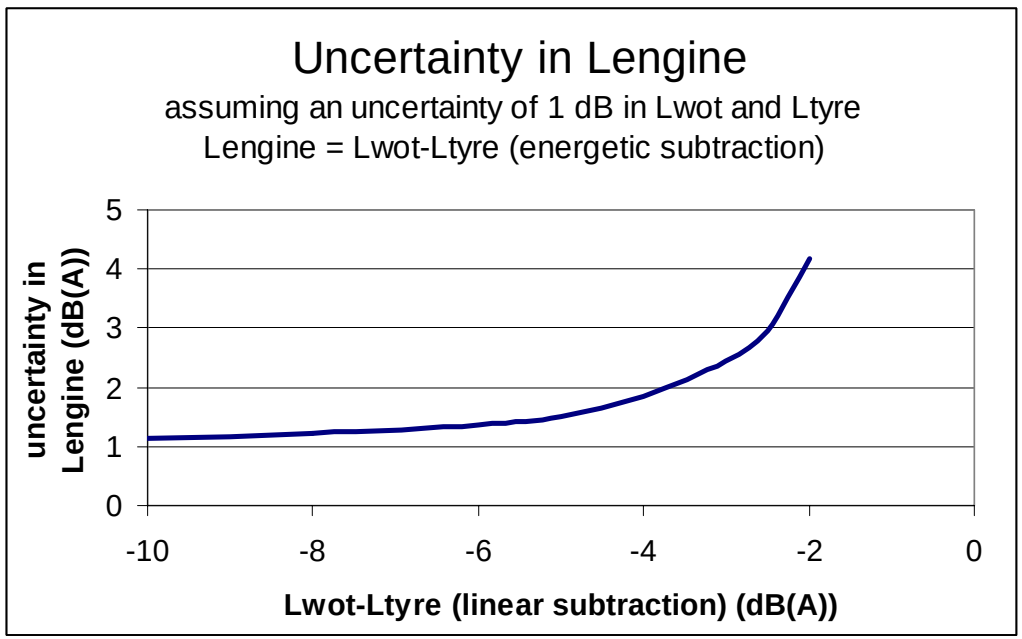
- Uncertainty in Annex 3 measurements:
  - Run-run: 0,5 dB(A)
  - Day-day: 0,9 dB(A)
  - Site-site: 1,4 dB(A)
  - (ref: ISO 362)

- Uncertainty in Annex 10 measurements are 2 a 4 times higher.
  - Mainly due to the lack of averaging of measurement results.
  - Uncertainty :: 1/sqrt(n) (n=number of measurements)
  - Annex 3 is the result of 8 to 16 noise measurements.
  - In Annex 10 every single noise measurement is evaluated
  - In 3 of 4 Annex 10 proposals no uncertainty due to acceleration measurements. Therefore decrease of uncertainty compared to Annex 3

- Conclusion: Uncertainty in Annex 10 measurements
  - Run-run 1,5 dB(A)

Uncertainty due to calculation with noise values

- In case of subtracting noise values, the uncertainty increases
- D/F proposal uses subtraction of noise values. (up to Lwot,i - Ltyre = 3 dB)
- Lwot,i an Ltyre are assumed to be based on the average of four measurements and to have an uncertainty of each 1 dB(A)
- Uncertainty of Lengine is up to 2,5 dB(A)



- Conclusion: D/F proposal uncertainty of reference point = 2,5 dB(A)
- Other options have an uncertainty of the reference point of 1 dB(A)

Uncertainty due to limit curve proposals

- D/F proposal and DeGraaff option have separate limit curves for all gears.
- Japan and Gerhard option are assumed to have a single limit which has to cover the noise variation of 3 different gears
- The extra variation in noise between the 3 gears is assumed to be on average ± 2 dB(A).
- Conclusion: extra uncertainty of single limit proposals: 2 dB(A)

Uncertainty in final noise values

proposal	uncertainty (dB(A))			
	measurements	calculation reference value	limit curve	total
D/F	1,5	2,5	0,0	2,9
Japan	1,5	1,0	2,0	2,7
Graaff	1,5	1,0	0,0	1,8
Gerhard	1,5	1,0	2,0	2,7

Options to decrease uncertainty

- Use averaging of measurement results. E.g by using regression analysis
- Avoid subtraction of measured (noise) values or set demands to the minimum difference between them
- Match the amount of gears to be judged with the amount of limit curves