

Sound Power Measurement with imc WAVE

Evaluate Sound Emission and Immission According to Standard



Today, sound power measurement is a central component in mechanical engineering. This is because the product noise level, which is defined by existing DIN ISO standards on noise emission, is becoming increasingly important as a product characteristic. This whitepaper describes how to adapt the evaluation functions of the imc WAVE Spectral Analyzer in a few steps using a FAMOS sequence for sound power analysis according to the standard.

Sound power

Various DIN ISO standards describe the permissible noise level when operating machines. This is necessary in order to reduce noise pollution. In the development of machines, for example, sound emissions are measured using objective measuring methods. One of these methods is the sound power measurement using the sound pressure method. The sound power is a mechanical power and generally describes the strength of a sound source. It provides information about the sound pollution of the environment. The measured frequencies, which are expressed as spectra, can be analyzed with the imc WAVE Spectrum Analyzer and evaluated according to standards.

Sound emission and immission

Sound emission indicates how much sound a sound source, i.e. a machine, emits. The quantity to be measured associated with sound emission is the sound power level L_w . The Machine Noise Directive stipulates that manufacturers of machines must clearly indicate the sound emission on the product.

In contrast, **sound immission** describes the effect of sound on a place or person. The corresponding measured variable is the averaged A-weighted sound pressure level $L_{eq}(A)$. This is determined by measurements at the workplace.

Evaluation of sound emission and immission

In order to reduce noise and vibration stress on man and machine, it is necessary to reduce disturbing or damaging frequency components. For this purpose, the imc WAVE Spectrum Analyzer has professional tools for frequency analysis, whereby the acoustic data can be correlated with other measured parameters. The frequencies can be displayed as third-octave, octave and FFT spectra and sound level evaluations can be carried out in accordance with EN 61672.

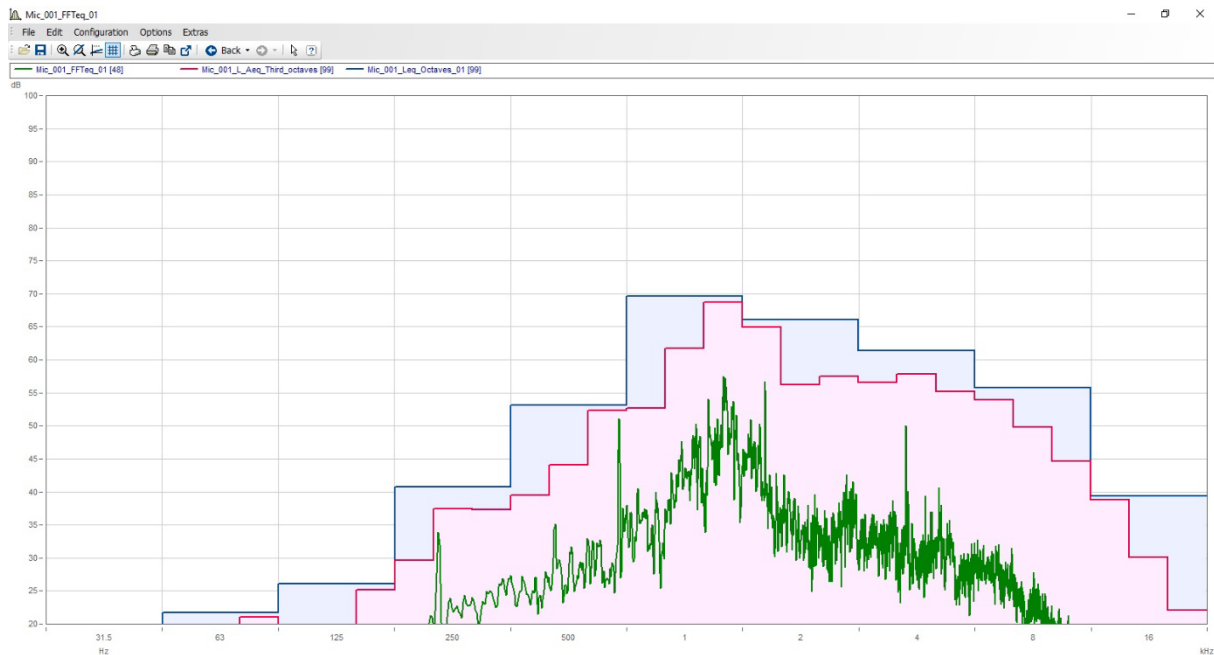


Fig. 2: Third octave and octave spectrum and FFT spectrum (green) in imc WAVE

The imc WAVE Spectrum Analyzer as sound power meter

With the imc WAVE Spectrum Analyzer the sound power can be measured using the sound pressure method. This method takes into account the sound energy radiated in all directions and is described in DIN ISO standards. To measure the radiated sound in all directions, an imaginary enveloping surface is placed around the test object (red cube). Microphones are positioned on the enveloping surface to record the average sound pressure levels L_{eqs} over the measuring surface. The number of microphones depends on the size of the measurement object and the size of the enveloping surface.

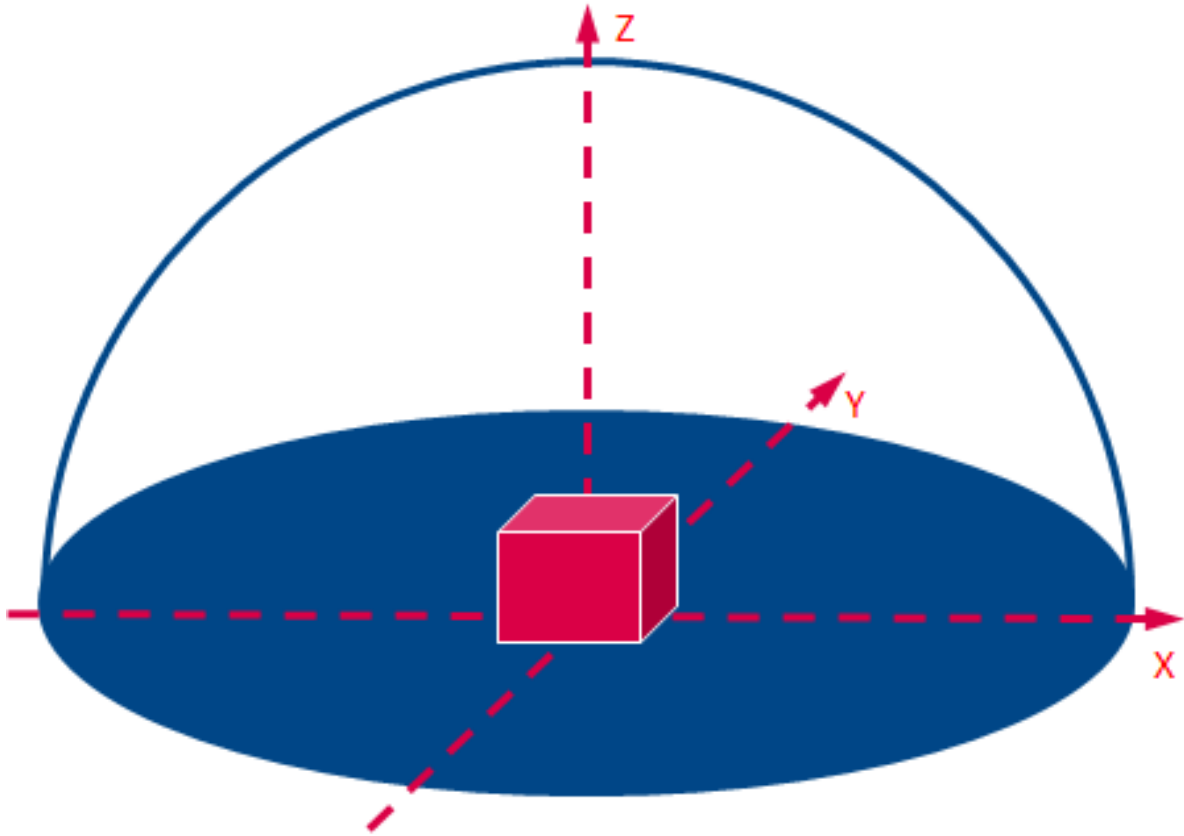


Fig. 3: Measuring object (red) with hemispherical enveloping body

When measuring with the sound pressure method, the imc WAVE Spectrum analyzer can be extended in a few steps to a sound power analyzer. The "Command Batches" page allows to add user defined evaluations by starting an imc FAMOS sequence as a batch after loading the experiment.

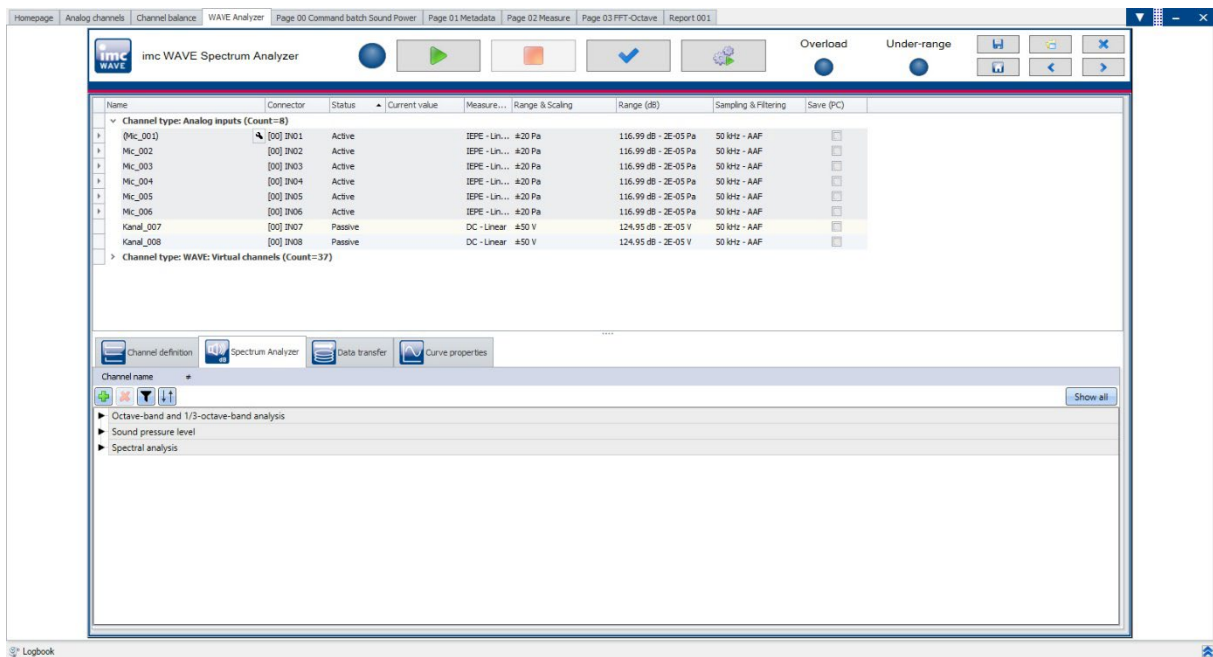


Fig. 4: Result parameters of the imc WAVE Spectrum analyzer:

- L_AF = A weighted sound level
- L_Aeq = averaged A weighted sound level
- L_Aeq_Third_octaves = averaged A weighted Third octave level
- L_Aeq_Octaves = averaged A weighted Octave level
- FFT_Aeq = averaged A weighted Sound FFT level

Step by step to sound power measurement

Step 1: Opening the experiment template for the sound power measurement in imc WAVE

Step 2: Adjusting the experiment template: Setting the number of microphones, the envelope area, and the desired result curves

Step 3: Loading the customizable start page with the metadata of the measurement

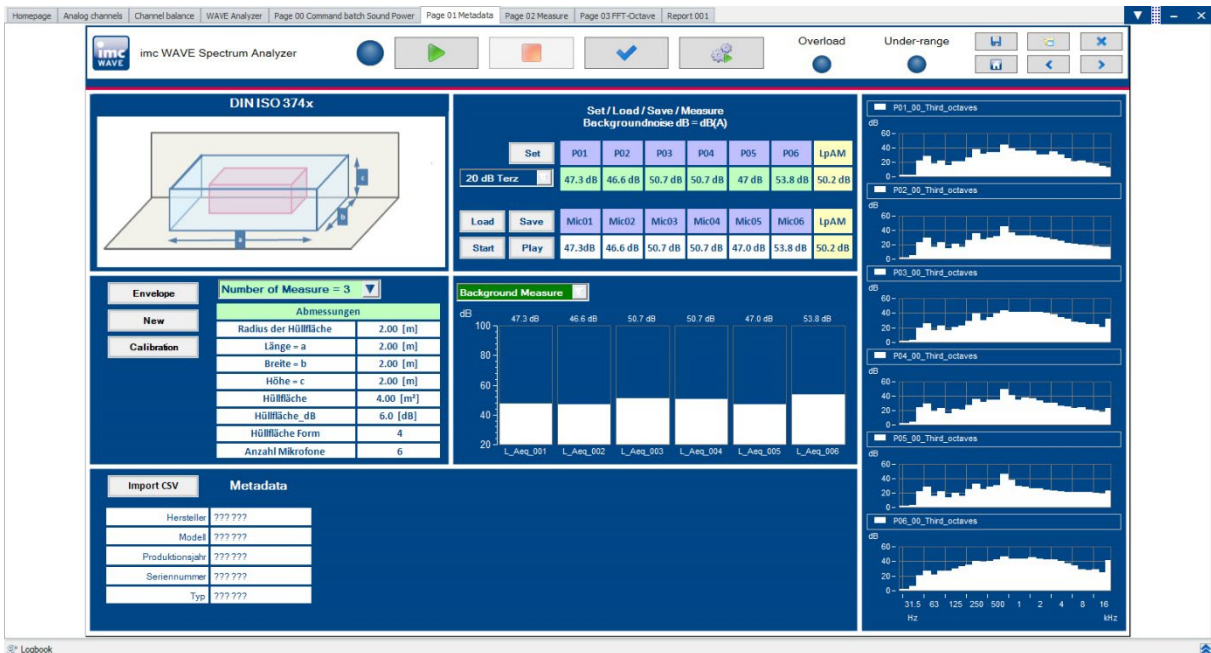


Fig. 5: Startpage with metadata

Step 4: Creation of the measurement page: All relevant information can be displayed here, which one you determine yourself. In the example below, the measurement page contains the measured values in tabular form, the sound pressure and sound power level as third octave/octave spectrum, and other spectra (e.g. FFT spectrum, Hertz spectrum) can also be displayed. At the end of the measurement, an automatic correction of the results with regard to extraneous noise and the measurement environment is performed.

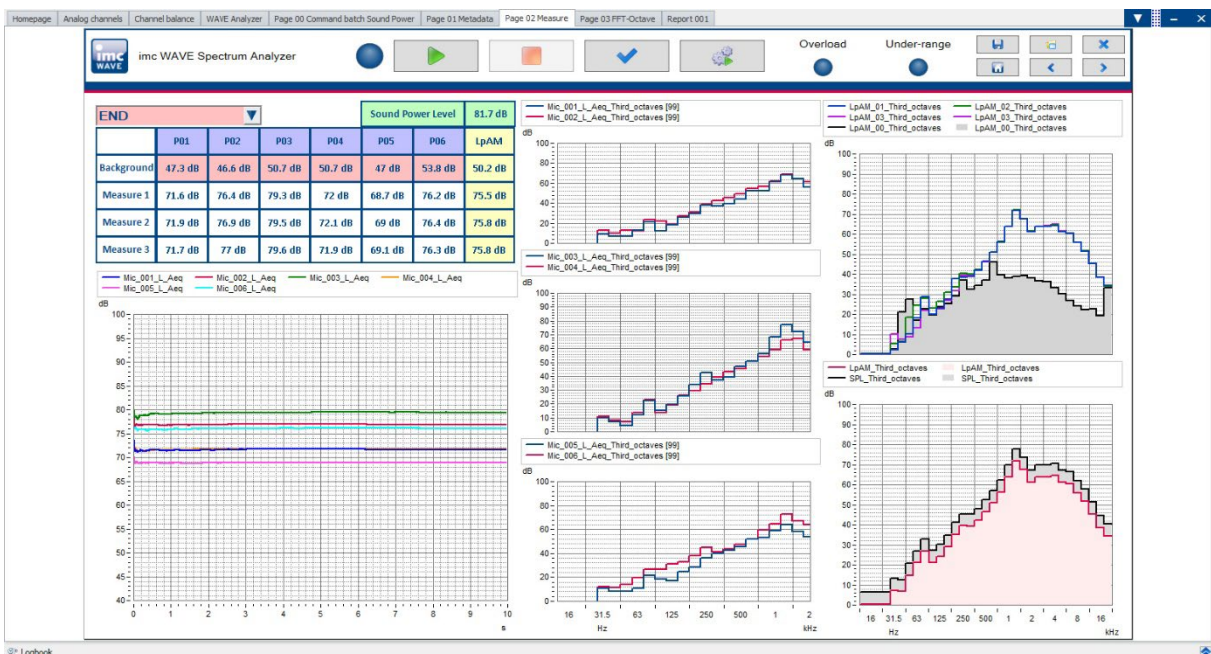


Fig. 6: Individual start page of the measurement

Step 5: Observation of the measurement: The results are calculated in real time according to the standard and displayed directly at the end of the measurement. The different measurements are performed one after the other and can be repeated at any time using the selection list.

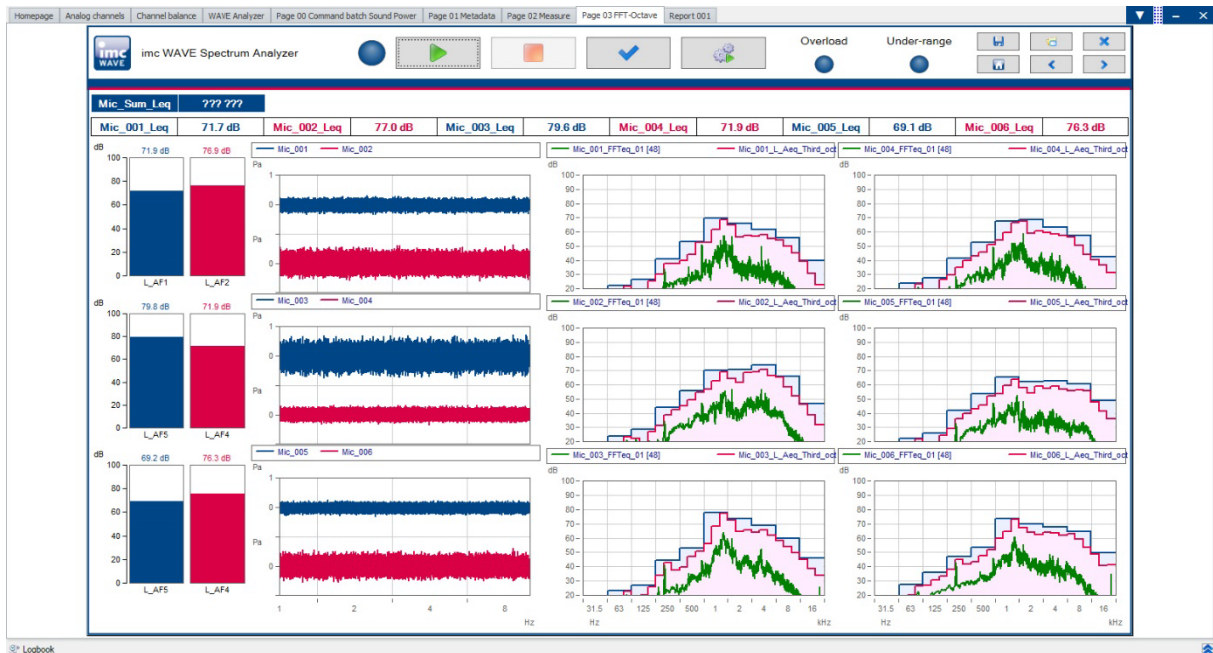


Fig. 7: Sound pressure measurement

Step 6: Creation of the individually designed report: The report can contain measurement curves, measurement results, measurement data, comparisons to limit curves, a description of the measurement object or the metadata of the measurement, as desired. These data are presented in an accurate and clear report.

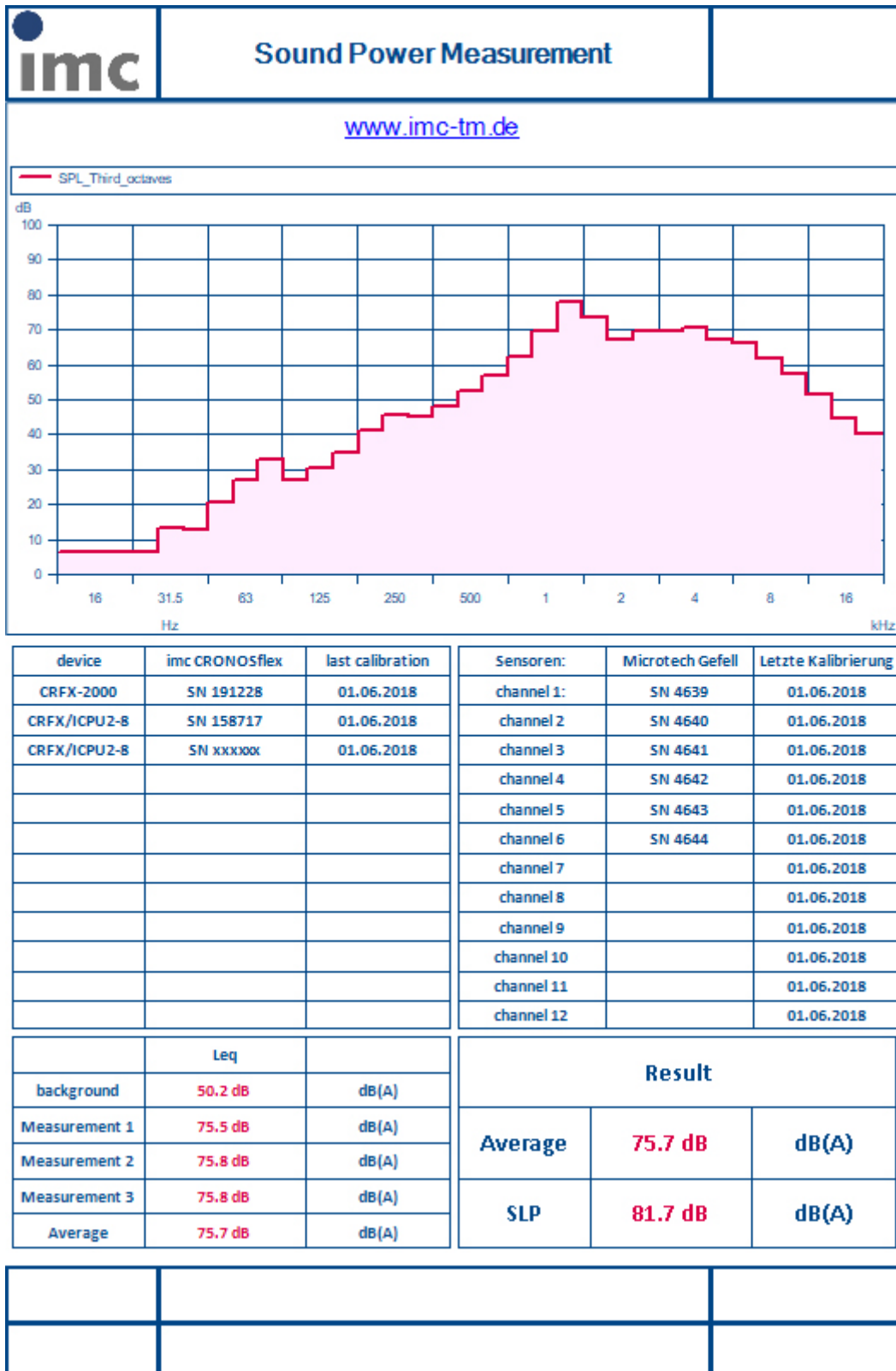


Fig. 8: Individually configurable report

Conclusion

The imc WAVE spectrum analyzer is an efficient tool for measuring and evaluating sound emissions. In just a few steps, machines and systems are measured and the measurement result is returned in accordance with DIN ISO standards.

For a first introduction to the evaluation of sound power measurements in the imc WAVE Spectrum Analyzer, the imc WAVE demo software, including demo test data, is available on the imc website.

The software is available for download at

<https://www.imc-tm.com/products/measurement-software/imc-wave-nvh-analysis/>

About imc

imc Test & Measurement GmbH is a manufacturer and solution provider of productive test and measurement systems. Together with its customers from the fields of automotive engineering, mechanical engineering, railway, aerospace, and energy, imc implements test and measurement solutions for research, development, service and production. Every day, customers use imc data acquisition (DAQ) systems, software solutions and test stands to validate prototypes, optimize products, monitor processes and gain insights from measurement data. imc consistently pursues its claim of providing services for “productive testing”. The company offers its customers top technological performance throughout the entire measurement chain.

The core of the product portfolio consists of imc’s modular data acquisition and control systems, which are supplemented by tailor-made sensor and telemetry systems.

As a solution provider, imc offers its customers an attractive range of services. The service includes project consulting, contract measurements, data evaluation, outsourcing of specialists and customer-specific software development through to system integration and test bench automation. Our team of engineers and natural scientists has extensive project experience and a high level of competence in solving test and measurement tasks.

The imc global partner network enables imc customers to find direct contacts in more than 30 countries.



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