TECHNOLOGY, TEST PROCESSES
& ENGINEERING SERVICES

MB Dynamics

# BSR SUITE

## *Designed to Optimize Squeak & Rattle Testing*

### Designed for

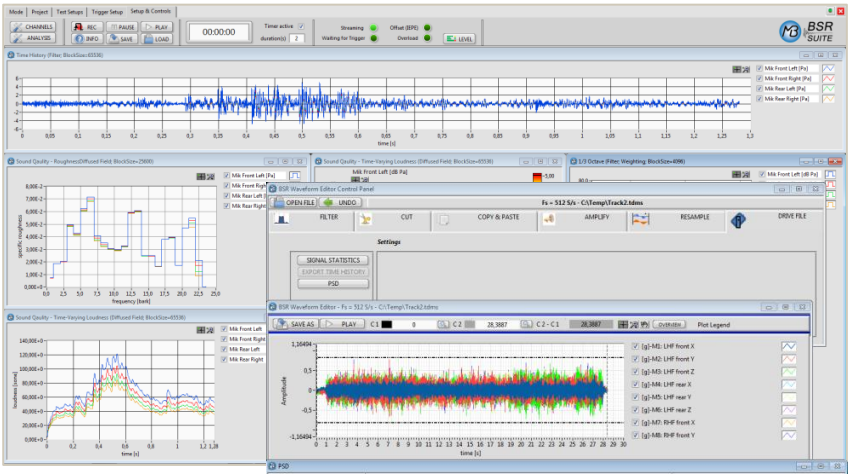
- Road load data acquisition
- Drive-File generation for single- and muti-axis shaker test systems
- Objective Squeak & Rattle testing
- Sound & Vibration measurements
- Measurement of relative motions
- In-line Sound Quality testing

### Features

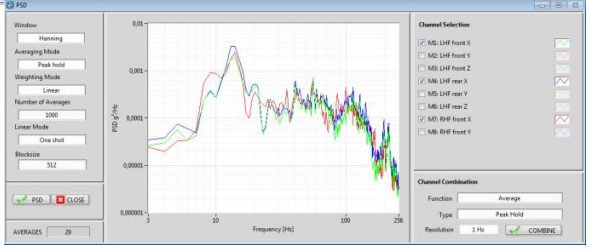
- 4-16 dynamic input channels
- Simultaneous 24-bit A/D converters
- Flexible sample rates up to 105.4 kHz
- 4mA IEPE-supply, software switchable
- Predefined setups for typical S&R tasks and test specification
- Project oriented management of measurement data & test setups
- Signal statistics
- Real-time testing against user selectable thresholds
- Offline data processing and playback

### Key Differentiators

- Minimized set-up times & ease of use
- Real-Time Sound Quality testing signal recording and monitoring in one shot
- Independend optimized resolution for each analysis
- Powerfull and flexible signal processing and analysis features for BSR analysis and testing



**Real-Time Sound Quality Test in *BSR ANALYZER***



**Signal Processing of Recorded Road Load Data and Drive-File Generation in *BSR EDITOR***

## Designed to Improve S&R Testing

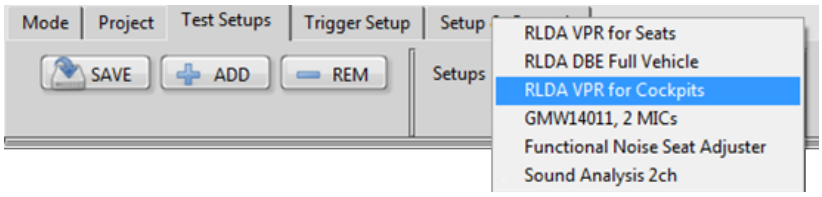
Years of practical experience in the fields of Squeak & Rattle (S&R) and Sound Quality testing are behind the design of this powerful and user-friendly, multi-channel test system for different typical tasks such as road-load data acquisition, drive-file generation or objective S&R testing.

Predefined test setups including channel and analysis configuration, testing thresholds and graph settings turn the ***BSR ANALYZER*** into an application specific tool. Drive-file generation for full vehicles and component test systems based on proven algorithms is easy. Simulation quality and the resulting correlation of test results to road testing is improved.

Objective S&R testing according to different test specifications becomes fast, simple and repeatable. Sound and vibration quality is measureable and comparable.

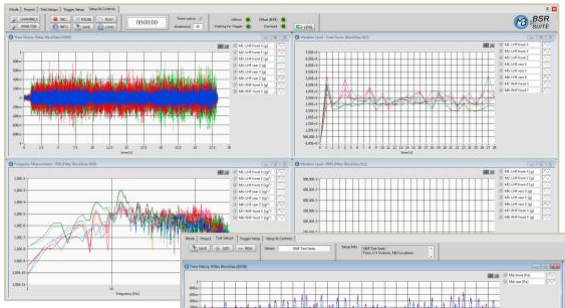
The compact USB-powered 4-channel frontends can be combined for up to 16 simultaneous sampled measurement channels. Flexible sample rates up to 104 kHz (combined with the MB 4104-I USB-Frontend) per channel, independent block length for each analysis and the definition of virtual input channels enable the use of ***BSR SUITE*** for many different S&V applications.

# *BSR ANALYZER* – Recording and Real-Time Testing



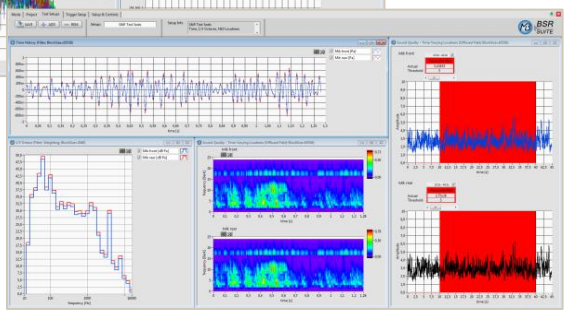

***Predefined test configurations*** for Road Load Data Acquisition (RLDA), Drive-File Generation, objective Squeak & Rattle testing and general Sound & Vibration measurements help get measurements done – easy and *repeatable!*

Each test setup defines the input channel configuration, signal processing, analysis settings and graph properties. By loading a predefined test configuration, ***BSR ANALYZER*** is transformed into an application-specific tool. Test setups and associated measurement data can be managed in different projects. Raw data, analysis settings and test limits are always available for offline analysis, playback or export into standard formats like WAV, CSV, TXT or RCPIII.

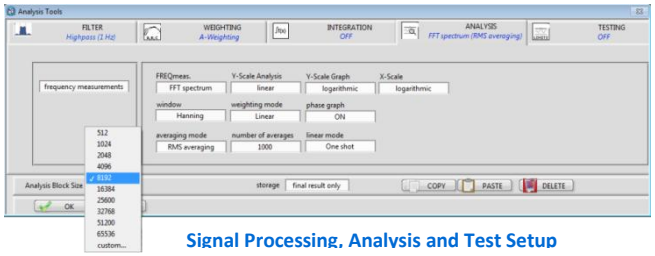


**2ch S&R Testing against Definable Thresholds**

***Multi-Core processing enables Real-time analysis and simultaneous recording to hard disc*** up to 16 dynamic input channels using user definable sample rates up to 105.4 kHz. Recorded time history data is available for further offline analyses in ***BSR ANALYZER*** or data processing, playback and export to various data formats in ***BSR EDITOR.***



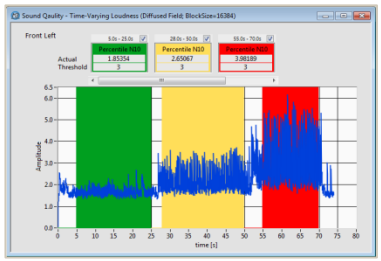
**8ch RLDA, PSD, CREST and Vibration Level**



**Signal Processing, Analysis and Test Setup**

***Comprehensive signal processing and analysis features that different filters, weighting***, integration and various analyses such as Running RMS, Leq, Lpeak, FFT, PSD, 1/n Octave Band Spectra and Time-Varying Loudness turn ***BSR SUITE*** into a powerful and flexible tool for S&R testing and Sound & Vibration analysis.

**Objective S&R Test based on N10 Loudness for 3 Different Test Tracks**

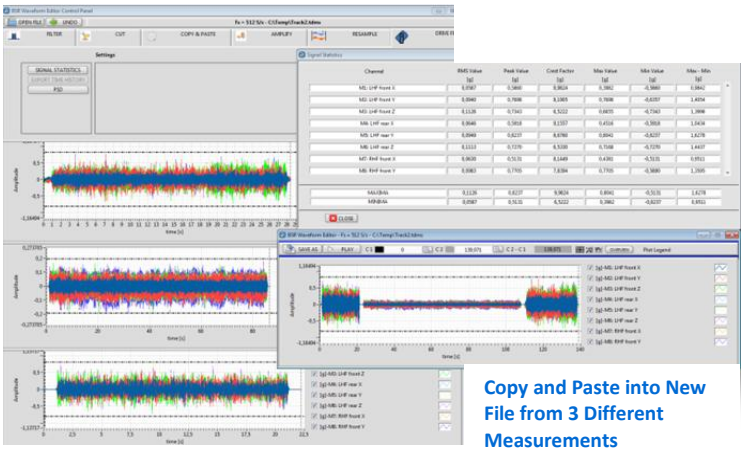


***Independent analysis block length up to 65536 Samples for each analysis*** allow for maximum resolution in time and frequency domain without having to compromise. Define ***virtual input channels*** through an arithmetic combination of multiple physical input signals enables the measurement of relative motions for effective Squeak & Itch testing.

***Signal statistics and testing against user definable thresholds*** enables objective Squeak & Rattle and Sound Quality testing according to different test specifications in real-time. Statistical values and test results (Green/Yellow/Red) over freely definable time periods are displayed directly in the associated graph.

**Analysis Configuration including 4 Physical and 2 Virtual Input Channels**

# *BSR EDITOR* – Signal Processing, Playback and Export



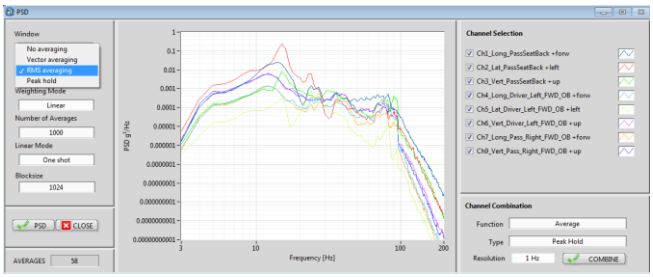
Copy and Paste into New File from 3 Different Measurements

***Editing multiple records in parallel*** enables very easy and effective ways to compare and combine different recordings. Cut, Copy and Paste of relevant time signal sections from different recordings into a new file is intuitive and easy. Fading signals in and out, inserting pauses of user selectable durations or mixing and combining test track data is done within a few minutes.

***Signal statistics*** provide overview of main statistical values such as RMS, PEAK, MAX, MIN and CREST-factor for each channel with just one mouse click.

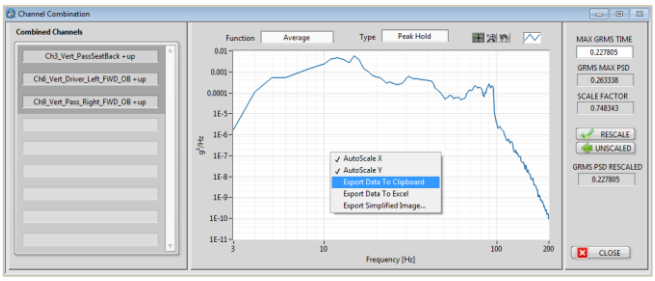
***Integrated know-how and procedures to transfer vibration conditions from the road to the lab*** improve the simulation quality and correlation to road testing. Calculation of equivalent PSD-spectra over user selectable time sections, averaging of multiple sensor locations, rescaling of the resulting vibration level and smoothing of the PSD shape is done by only a few clicks.

For RANDOM tests data can be copied directly into the Win2k5 Vibration Controller. For multi-axis vibration testing data can be exported to the MB MIMO Drive File Processor for further processing. ***BSR SUITE*** will help you to improve your vibration testing.

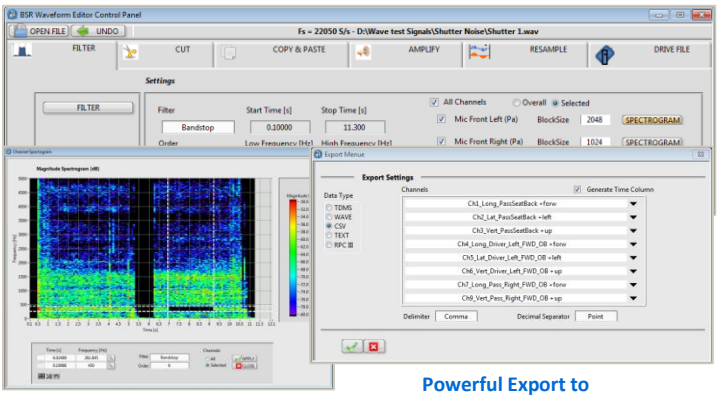


Calculate PSD Spectra based on User-Selectable Averaging Methods
Combine Multiple Sensor Locations to MAX-PSD

***Filter definition in time and frequency domain by drag and drop*** allows the modification of recorded sounds. Interfering noise can be identified and filtered out by selecting the desired time and frequency band in the 3D-Spectrogram. Recorded and filtered sound signals can be compared by offline analysis or playback in various ways.



Rescaling of GRMS Level and Smoothing of PSD Shape
Copy and Paste to WIN2k5 Vibration Controller



Filter Definition in 3-D Spectrogram

Powerful Export to Various Data Formats

***Amplifying, Resampling and Export to various data formats*** allows the ideal adaption of recorded data for direct transfer to MB vibration control systems or exchange with other sound and vibration analyzers. Data exchange with colleagues and customers becomes quick and easy.

# Hardware and Technical Data

## USB Powered Front-end Modules MB 452-1 and MB 4104-1

| Technical Specifications | |
|---|---|
| Analog Inputs | 4, simultaneous sampled, 24-bit resolution |
| Max. Sampling Rate | 52.7 kHz (MB 452-I), 105.4 kHz (MB 4104-I) |
| IEPE-Supply | 4mA, software switchable |
| Input Ranges | ±10V, ±1V |
| AC/DC Coupling | Yes, 0.1Hz AC-cutoff frequency (MB 452-I)<br>Yes, 0.5Hz AC-cutoff frequency (MB 4104-I) |
| Trigger | External digital or analog threshold |
| Tachometer-Input | Input Range ±30V |
| Cascade-able | Synchronization of up to 4 modules (max. 16 channels) |
| Power Supply | USB |

## Technical Data

| Virtual Arithmetic Channels | |
|---|---|
| Functionality | Definition of virtual channels by arithmetic combination of physical input signals |
| Channel arithmetic | Difference, Average |

| Signal Conditioning | |
|---|---|
| Filter Functions | Low-Pass, High-Pass, Band-Pass & Band-Stop |
| Integration | Single & double integration in time domain |
| Weighting-Filters | Linear, A-,B- and C-Weighting |

| Vibration Level | |
|---|---|
| RMS | User selectable block size / time resolution |
| Peak | User selectable block size / time resolution |
| Exp. Avg. Level | Time constants: FAST, SLOW, IMPULSE, CUSTOM |
| Crest Factor | User definable block size/time resolution |

| Sound Level | |
|---|---|
| Leq | User selectable block size / time resolution |
| Lpeak | User selectable block size / time resolution |
| Exp. Avg. Sound Level | Time constants: FAST, SLOW, IMPULSE, CUSTOM |

| Frequency Analysis | |
|---|---|
| Narrowband FFT | Amplitude & Phase |
| Power Spectral Density | Amplitude |
| FFT-Block size | 512-65536 Samples |
| Window functions | Rectangle, Hanning, Flat Top, Gaussian, Blackman |
| Averaging | Linear, Exponential, Peak-Hold |

| 1/n Octave Analysis | |
|---|---|
| Fractional Octaves | 1/1-, 1/3-, 1/6-, 1/12 & 1/24-Octave bands |
| Averaging | Linear, Exponential, Peak-Hold |
| Time constants | FAST, SLOW, IMPULSE, CUSTOM |

| Loudness | |
|---|---|
| Stationary Loudness | Loudness Level in [Sone] or [Phon]<br>Specific Loudness spectra<br>In compliance with ISO 532B, DIN45631 and ISO/R131 |
| Time-Varying Loudness | Time-Varying Loudness [Sone]<br>Specific Loudness Spectra<br>In compliance with DIN45631/A1 |

| Sound Quality (Option) | |
|---|---|
| Sharpness | Specific Sharpness spectra & Sharpness [acum] |
| Roughness | Specific Roughness spectra & Roughness [asper] |
| Tonality | 1/3 octave spectra & Tonality [tu] |
| Fluctuation Strength | Specific Fluctuation Strength spectra & Fluctuation Strength [vacil] |

| Signal Statistics | |
|---|---|
| Statistical Value | Max, Min, Max-Min, Average |
| Percentile Levels | N1-N99 (user selectable) |

| Waveform Recording | |
|---|---|
| Sampling rates | Up to 52700 S/s on 16 channels (MB-452I)<br>Up to 105400 S/s on 8 channels (MB-4104I) |

| Input Monitoring and Playback | |
|---|---|
| Real-time | Monitoring user selectable input channels (max. 2 channels) over internal sound card |
| Offline | Playback of recorded time history data over internal sound card |

| Graphs | |
|---|---|
| 2-D Plots | Overlay of multiple curves in one graph or separate graphs grouped in one window |
| 3-D Plots | Real-Time colored Sonogram |

| Data Export and Import | |
|---|---|
| Graphs & Data | Direct export of graphs and to clipboard or Office programs |
| Export THD | WAV, TXT/CSV, RPCIII |
| Import THD | WAV, TXT/CSV, RPCIII |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