



UNIVERSITY OF NIŠ  
FACULTY OF OCCUPATIONAL SAFETY



# NOISE AND VIBRATION LABORATORY



Niš, july 2021.

# Laboratory staff



**Momir Praščević, PhD**



**Darko Mihajlov, PhD**



**Marko Ličanin, MSc**

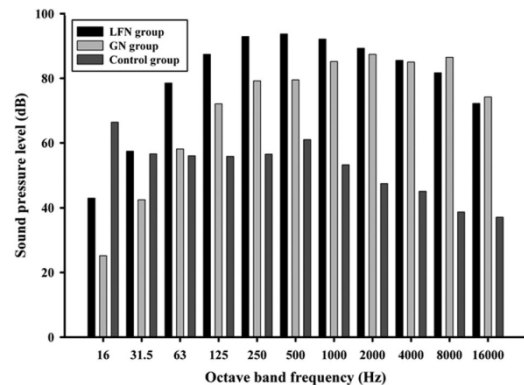


# BASIC ACTIVITIES

1. ENVIRONMENTAL NOISE & OCCUPATIONAL NOISE – MEASUREMENT AND ANALYSIS
2. ENVIRONMENTAL NOISE MONITORING
3. ENVIRONMENTAL NOISE MAPPING
4. ROOM ACOUSTICS
5. SOUND POWER OF NOISE SOURCES
6. PREDICTIVE / PREVENTIVE MAINTENANCE OF MACHINE
7. DESIGN OF NOISE AND VIBRATION CONTROL SYSTEMS
8. HUMAN VIBRATION
9. EDUCATION & CONFERENCE
10. PROJECTS
11. LAB EXERCISE



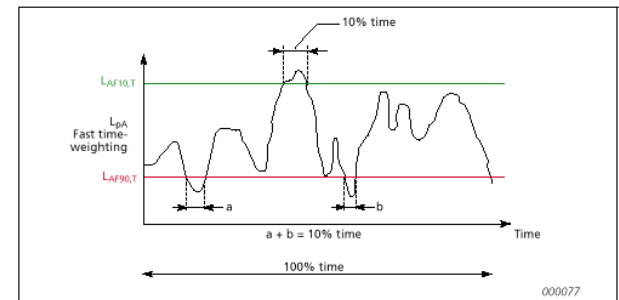
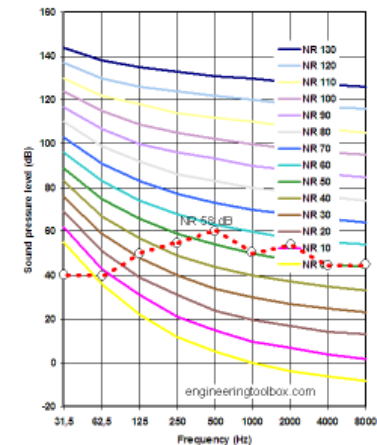
## ENVIRONMENTAL NOISE & OCCUPATIONAL NOISE – MEASUREMENT AND ANALYSIS



Rating  
noise level

Frequency  
analysis

Statistical  
analysis



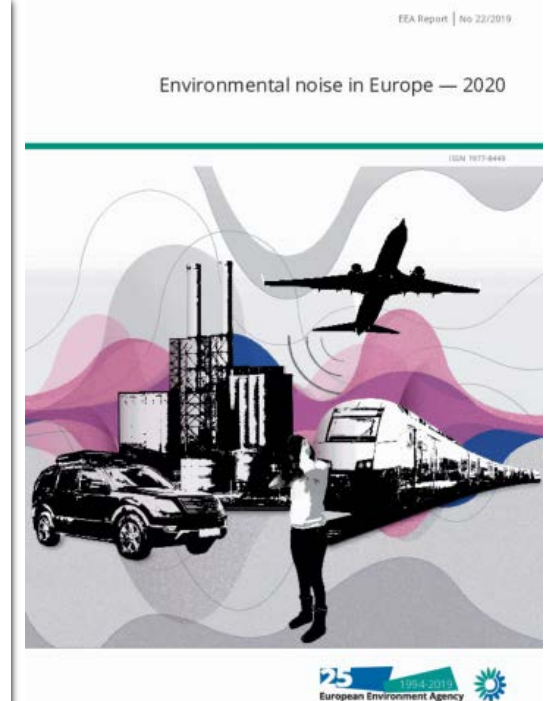
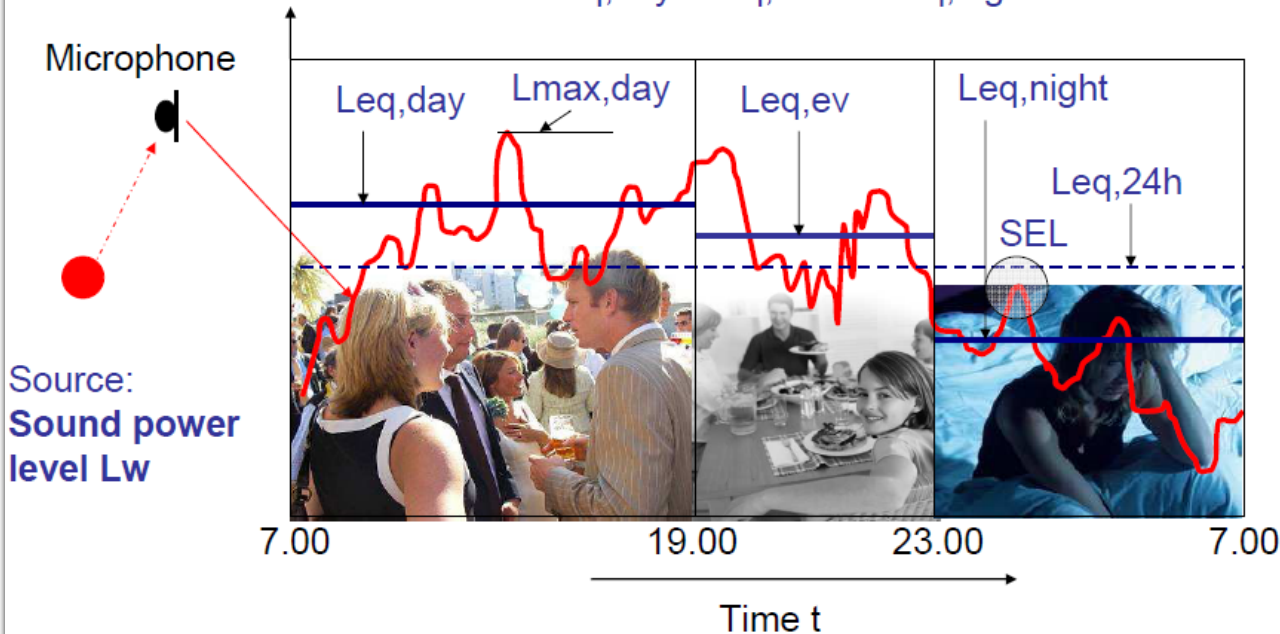
## ENVIRONMENTAL NOISE MONITORING

Short-term

Long-term

Sound pressure level  $L_p(t)$

$L_{den}$  weighted year average  
 $L_{eq,day} / L_{eq,ev} + 5 / L_{eq,night} + 10 \text{ dB}$



$L_{day}$

$L_{evening}$

$L_{night}$

$L_{den}$





## ENVIRONMENTAL NOISE MAPPING

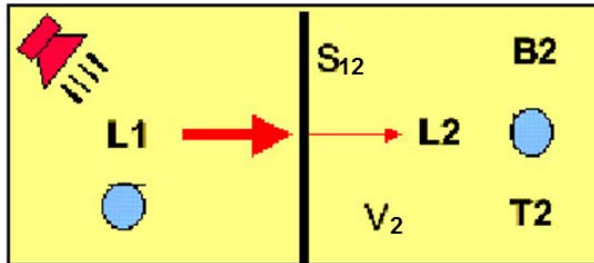
### Noise maps



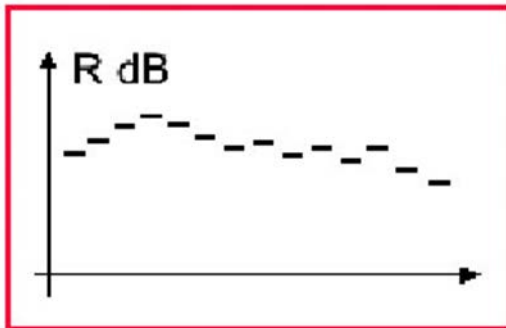
**SoftNoise**  
DEVELOPERS PREDICTOR & LIMA

### Strategic noise maps

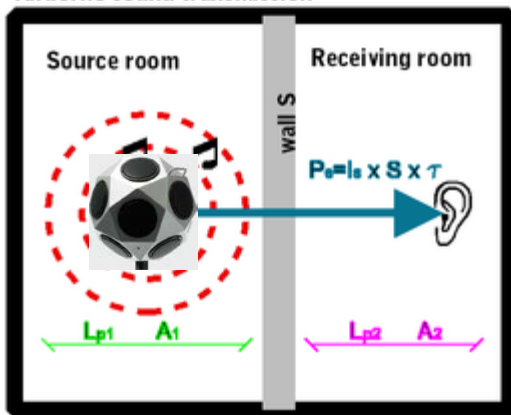




## ROOM ACOUSTICS

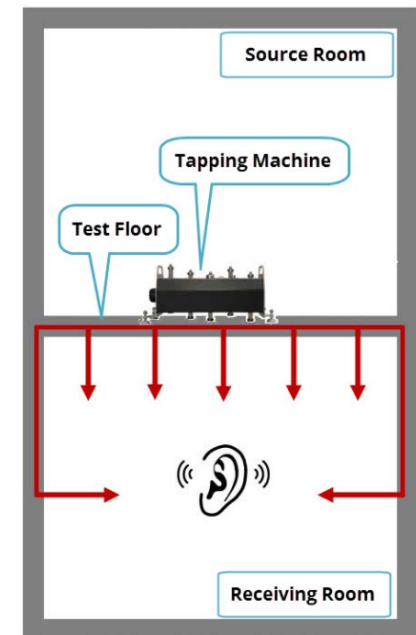
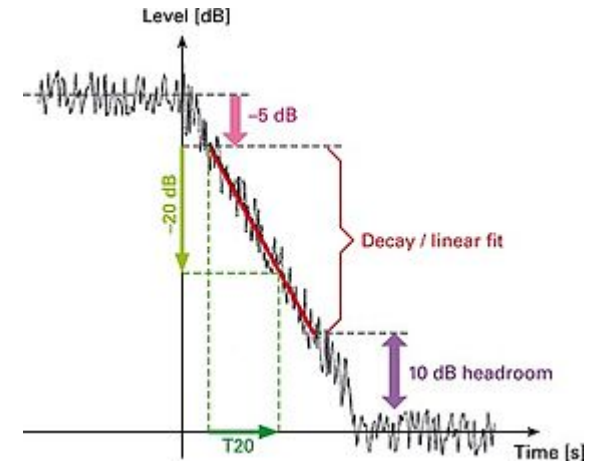


## Time reverberation

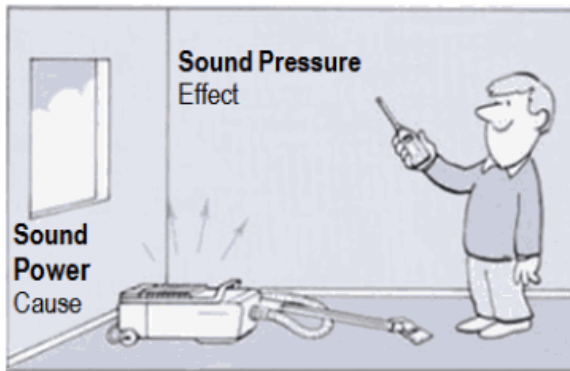


## Airborne sound reduction index

## Impact sound reduction index

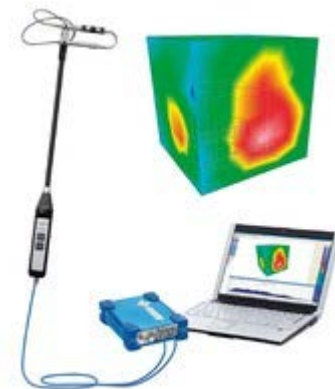
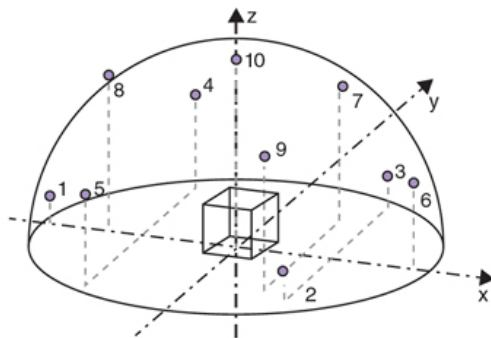


## SOUND POWER OF NOISE SOURCES



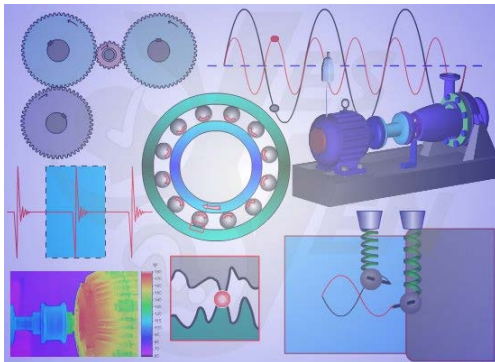
Sound pressure method

Sound intensity method





## PREDICTIVE / PREVENTIVE MAINTENANCE OF MACHINE



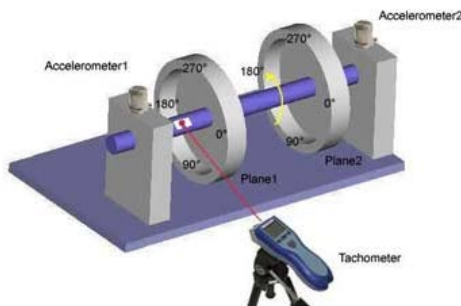
**Vibration condition  
monitoring**



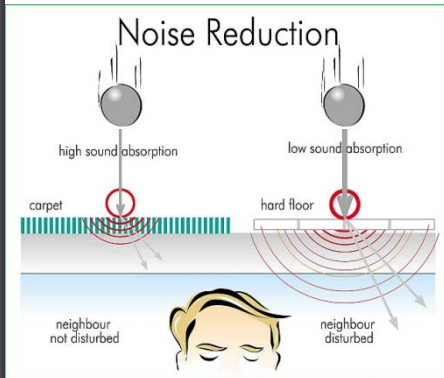
**Vibrodiagnostics**

*SAVE PRODUCTION DOWNTIME & MAINTENANCE COSTS*

**Balancing of rotating  
machine**



## DESIGN OF NOISE AND VIBRATION CONTROL SYSTEMS



**Design of noise insulation and absorption systems**



**Design of vibration insulation and absorption systems**



**Design of room acoustics**

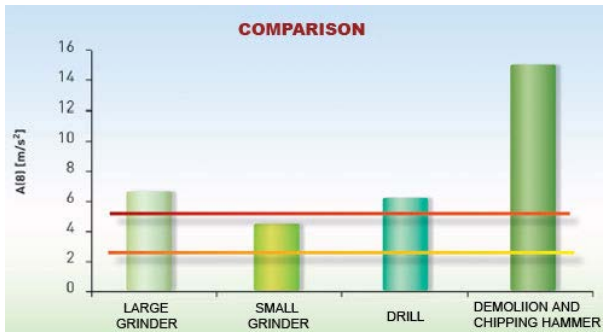




**HUMAN  
VIBRATION**

**Hand-arm  
vibration**

**Whole body  
vibration**



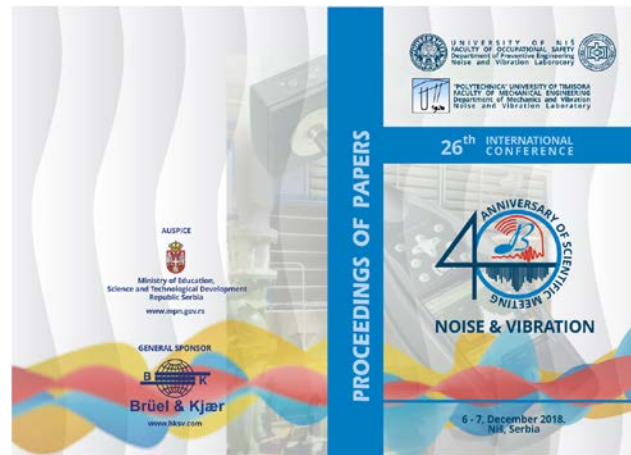


## EDUCATION


## Workshops


## Courses

## Conferences





## PROJECTS



WE PARTICIPATE  
IN 

'Strengthening Educational Capacities  
by Building Competences and Cooperation  
in the Field of Noise and Vibration Engineering'

  ERASMUS+ KA2 CBHE PROJECT

urbaNoise

<https://servibe.uns.ac.rs/>



## LAB EXERCISES

**Time reverberation**

**Airborne sound  
reduction index**

**Impact sound  
reduction index**

**Sound power**

**Human vibration**

**Environmental noise &  
Occupational noise**



## SOUND LEVEL METER Type 2250 D

## USES

- ➡ Environmental noise assessment and monitoring;
- ➡ Occupational noise evaluation;
- ➡ Selection of hearing protection;
- ➡ Noise reduction;
- ➡ Product quality control;
- ➡ Class 1 sound measurements to the latest international standards;
- ➡ Real-time analysis of sound in 1/1- and 1/3-octave bands;
- ➡ FFT sound analysis;
- ➡ Tone assessment;
- ➡ Analysis of time histories for broadband parameters and spectra (Logging);
- ➡ Documentation of measurements using text and voice annotations;
- ➡ Documentation of measurements through recording of measured sound;

This equipment was financially supported by the Regional Programme on Environment Western Balkans of the Netherlands Ministry of Foreign Affairs



## SOUND LEVEL METER Type 2250 D

## FEATURES

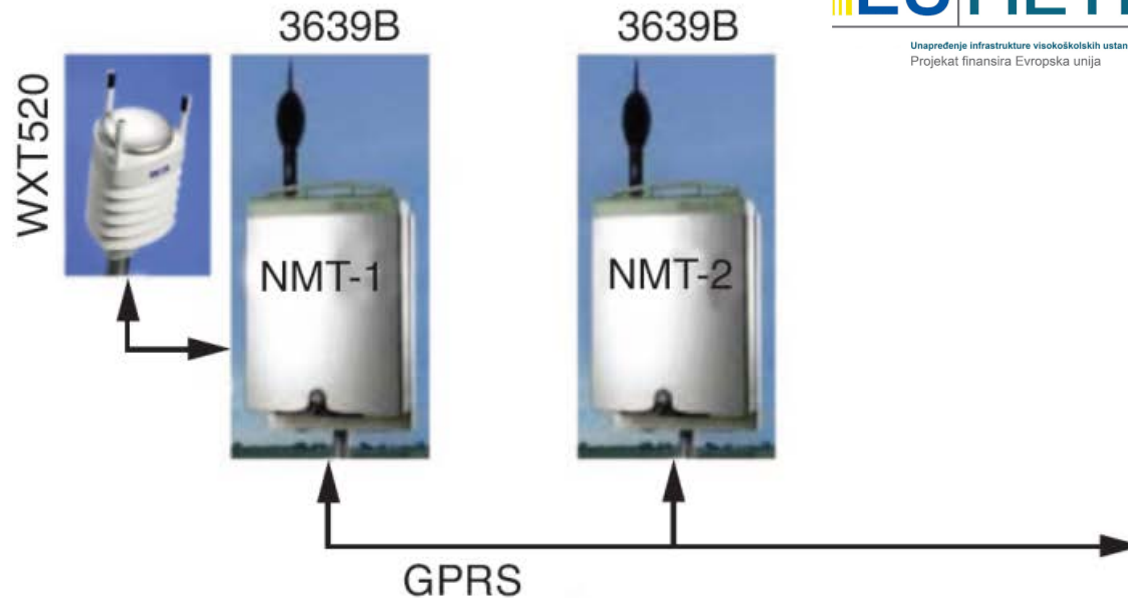
- ➡ Large, high-resolution, touch-sensitive colour screen;
- ➡ Dynamic range in excess of 120 dB;
- ➡ 3 Hz ÷ 20 kHz broadband linear frequency range;
- ➡ Broadband and spectral data can be logged to obtain a time history for later analysis;
- ➡ Sound recording of measured signal during all or parts of a measurement;
- ➡ Personal measurement, display and job setup;
- ➡ PC software included for setup, archiving, export and reporting;
- ➡ Automatic detection of, and correction for, windscreen;
- ➡ Robust and environmentally protected (IP44);

*new*



## ENVIRONMENTAL NOISE MANAGEMENT SYSTEM

- ➡ Environmental Noise Management System Software, Type 7843;
- ➡ Two Noise Monitoring Terminals (NMT), Type 3639-B;
- ➡ One Weather Station, Type WXT520.



**EU HETIP**  
Unapređenje infrastrukture visokoškolskih ustanova u Srbiji  
Projekat finansira Evropska unija



## ENVIRONMENTAL NOISE MANAGEMENT SYSTEM

### USES

➡ Long-term permanent noise monitoring;

➡ **Lday** **Levening** **Lnight** **Lden**

➡ Four default periodical reports based on the noise data:

- Hourly;
- Daily;
- Monthly;
- Annual.

 **EU HETIP**

Unapređenje infrastrukture visokoškolskih ustanova u Srbiji  
Projekat finansira Evropska unija

➡ ENMS enable definition of 12 additional periodical reports.





## PULSE Type 3560-B

COMPACT DATA ACQUISITION UNIT, UP TO FIVE INPUT CHANNELS

### USES

- ➡ 5 input and 1 output channel;
- ➡ Signal and system analysis using all PULSE application packages for, or example:
  - ✓ Time data acquisition,
  - ✓ General noise and vibration measurements:
    - Real-time analysis in 1/1- and 1/3-octave bands;
    - FFT analysis.

w u s a u s t r i a  
*right to education*



## DATA COLLECTOR Type 2526-MK2

### USES

- ➡ Collection and analysis of vibration and process data of rotating machines in a safe and hazardous environment for reliable prediction of machine failure.

### INTERNAL SOFTWARE:

- ➡ Balancing Software 7111;
- ➡ Vibration monitoring Software 7107-L;

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right to education



## DATA COLLECTOR Type 2526-MK2

### FEATURES

- ➡ Light weight - 1.2 kg;
- ➡ IP 54 conformity for industrial applications;
- ➡ Illuminated LED display;
- ➡ Simple operation using two keys;
- ➡ Severity of event display for evaluating machine condition at a glance; . . .

### SENSORS



Piezoelectric charge  
accelerometer Type 4391



Photoelectric probe  
Type MM-0024

## DATA COLLECTOR Type 2526-MK2

### FEATURES

- ➡ Options for balancing and in-situ analysis;
- ➡ Complete spectrum display with cursors;
- ➡ Quick evaluation of machines and alarms:
  - Pre-defined notes may be added;
  - Absolute bearing vibrations;
  - Process parameters (DC signals), rotational speed;
- ➡ Modem connection.



## HUMAN VIBRATION ANALYZER Type 4447

### USES

- Hand-arm vibration measurements;
- Whole-body vibration measurements;
- Assessment of vibration exposure;

### FEATURES

- Compact, rugged, battery-powered instrument;
- Four-button operation: Easy to use, ideal for field work, and can be operated using gloves;
- RMS, MTVV, VDV (Whole-body) and Peak with 1 s interval logging;
- Triaxial, single-axis and 3+1 measurements;
- EU Directive parameters measured and displayed;
- In-field assessment of vibration exposure - all necessary data are displayed;





## HUMAN VIBRATION ANALYZER Type 4447

4447 with accessories



## SOUND CALIBRATOR Type 4231

### USES

- Calibration of sound level meters;
- Calibration of microphones;
- Calibration of general sound measurement instrumentation.



SenVibe

## SOUND CALIBRATOR Type 4231

### FEATURES

- Robust, pocket-sized design with highly stable level and frequency;
- Calibration accuracy  $\pm 0.2$  dB;
- 94 dB SPL or 114 dB SPL for calibration in noisy environments;
- Extremely small influence of static pressure and temperature;
- Sound pressure independent of microphone equivalent volume;
- 1 kHz calibration frequency for correct calibration level independent of weighting network;
- Fits Brüel & Kjær 1" microphones (1/2", 1/4" and 1/8" microphones with a microphone adaptor);
- Switches off automatically when removed from the microphone.



## ENHANCED PORTABLE NOISE MONITORING UNIT 3655-B

### USES

- Weather-protected sound measurements;
- Unattended noise measurements;
- Unattended sound monitoring using calibrated equipment for short- and medium-term applications;
- Environmental impact assessment and planning;
- Controlling noise on construction sites;
- Monitoring concert and sports events;
- Assessment of road, railway and aircraft noise;
- Noise monitoring at industrial sites;
- Noise map validation;



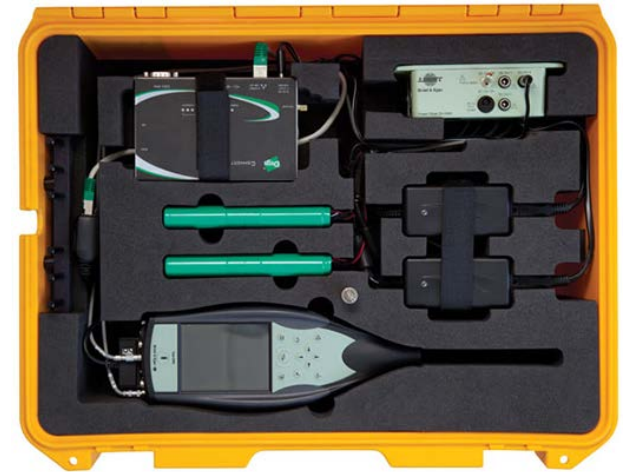
SeNVibe

## ENHANCED PORTABLE NOISE MONITORING UNIT 3655-B

### FEATURES

➡ Type 3655-B includes:

- ✓ Hand-held Analyzer Type 2250-S with
    - Sound Level Meter Software BZ-7222,
    - Frequency Analysis Software BZ-7223,
    - Enhanced Logging Software BZ-7225,
    - Sound Recording Option BZ-7226,
    - Tone Assessment Option BZ-7231,
    - Noise Monitoring Software BZ-7232;
  - ✓ Internal Li-Ion batteries;
  - ✓ Outdoor Microphone Type 4952-A;
- ➡ Operating time 80 hours / weight < 7 kg;
- ➡ Optional internal 3G or GPRS modem;



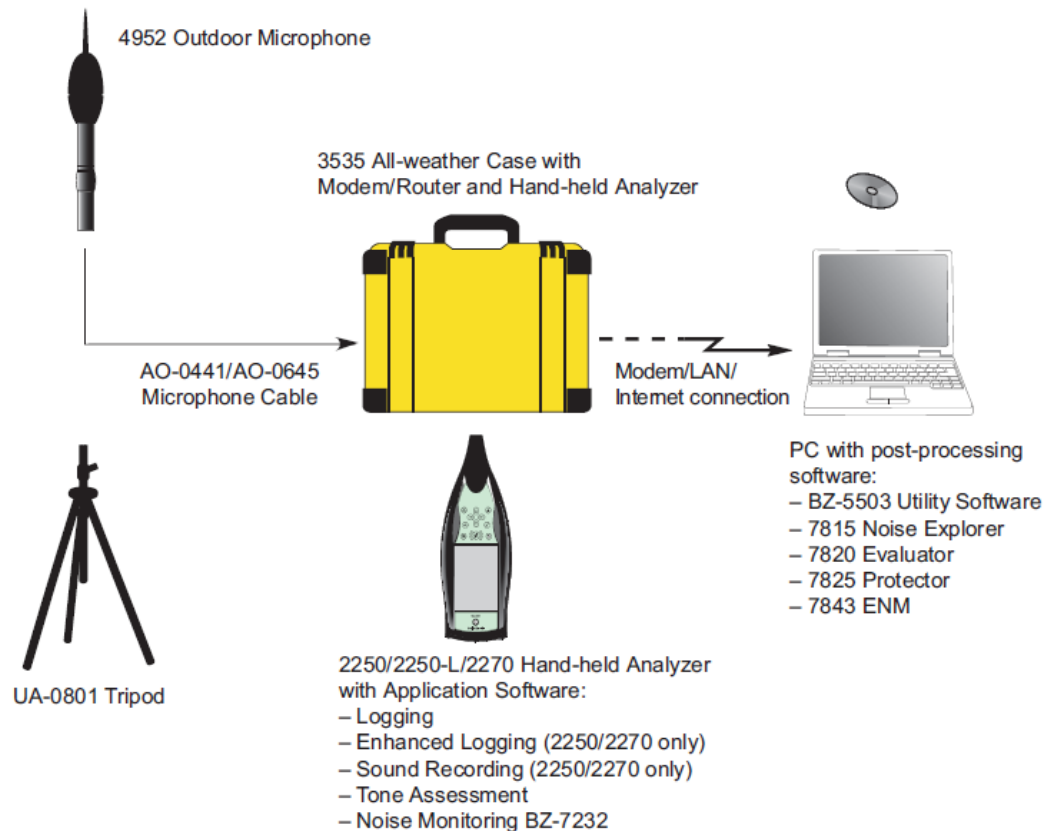
All-weather Case Type 3535-A houses a noise measurement system based on Hand-held Analyzer Type 2250

SenVibe



## ENHANCED PORTABLE NOISE MONITORING UNIT 3655-B

Noise Measurement System with All-weather Case Type 3535-A



## PORTABLE SYSTEM FOR TWO-CHANNEL MEASUREMENTS FOR BUILDING ACOUSTICS

### USES

- ➡ Two-Channel measurement for architectural and building acoustics;
- ➡ Measurement of:
  - Airborne sound insulation,
  - Reverberation time,
  - Impact sound level.

SenMiBe



## PORTABLE SYSTEM FOR BUILDING ACOUSTICS

Building acoustics system featuring:

1. Brüel & Kjær's Hand-held Analyzer Type 2270-S;
2. An omnidirectional noise source that gives reproducible and reliable results for airborne noise transmission measurements;
3. A tapping machine for impact sound level measurements;

### FEATURES

- ➡ Remote operation via cable and wireless audio system;
- ➡ Satisfies national and international standards;
- ➡ Robust;
- ➡ Easily portable.



SenVibe

## PORTABLE SYSTEM FOR BUILDING ACOUSTICS

### TWO-CHANNEL SOUND LEVEL METER / ANALYZER TYPE 2270-S

#### USES

- ➡ General-purpose class 1 sound measurements to the latest international standards;
- ➡ Multi-point measurements;
- ➡ Occupational Health and Safety (OHS) noise assessments;
- ➡ Environmental noise assessment;
- ➡ Product development and quality control;
- ➡ Building acoustics;
- ➡ Tone assessment using 1/3-octave methods;
- ➡ Infrasound (G-weighting) measurements according to ISO 7196:1995 and ANSI S1.42–2001 (R2011).

SenVibe



## PORTABLE SYSTEM FOR BUILDING ACOUSTICS

### TWO-CHANNEL SOUND LEVEL METER / ANALYZER TYPE 2270-S

#### FEATURES

The applications package includes:

- ➡ Sound Level Meter Software BZ-7222,
- ➡ Frequency Analysis Software BZ-7223,
- ➡ Reverberation Time Software BZ-7227,
- ➡ Building Acoustics Option BZ-7228,
- ➡ Two-Channel Measurement Option BZ-7229,
- ➡ Tone Assessment Option BZ-7231,
- ➡ Noise Monitoring Software BZ-7232;

SenMiBe 





## PORTABLE SYSTEM FOR BUILDING ACOUSTICS

### OMNIPOWER SOUND SOURCE TYPE 4292-L

- Type 4292-L uses 12 loudspeakers in a dodecahedral configuration to radiate sound evenly with a spherical distribution.
- All speakers are connected in a series-parallel network to ensure both in-phase operation and an impedance that matches the power amplifier

### USES

- Room and building acoustics,
- Measuring airborne sound insulation,
- Measuring reverberation time.

SenVibe



## PORTABLE SYSTEM FOR BUILDING ACOUSTICS

### OMNIPower SOUND SOURCE TYPE 4292-L

#### FEATURES

- ➡ Part of a complete, robust building acoustics system featuring sound level meter Type 2270-S;
- ➡ Satisfies national and international standards;
- ➡ Lightweight, making it easy to transport to the measurement location;
- ➡ Powerful, 122 dB re 1 pW, ideal for measurements in large spaces or for assessing the sound insulation of high performing walls and floors.

SenVibe



## PORTABLE SYSTEM FOR BUILDING ACOUSTICS

### TAPPING MACHINE / IMPACT SOUND SOURCE TYPE 3207

- The generator uses five hammers each weighing 500 g and operating at 2 Hz dropping from a height of 40 mm, giving an operating frequency of 10 Hz;

#### USES

- Impact sound measurements.



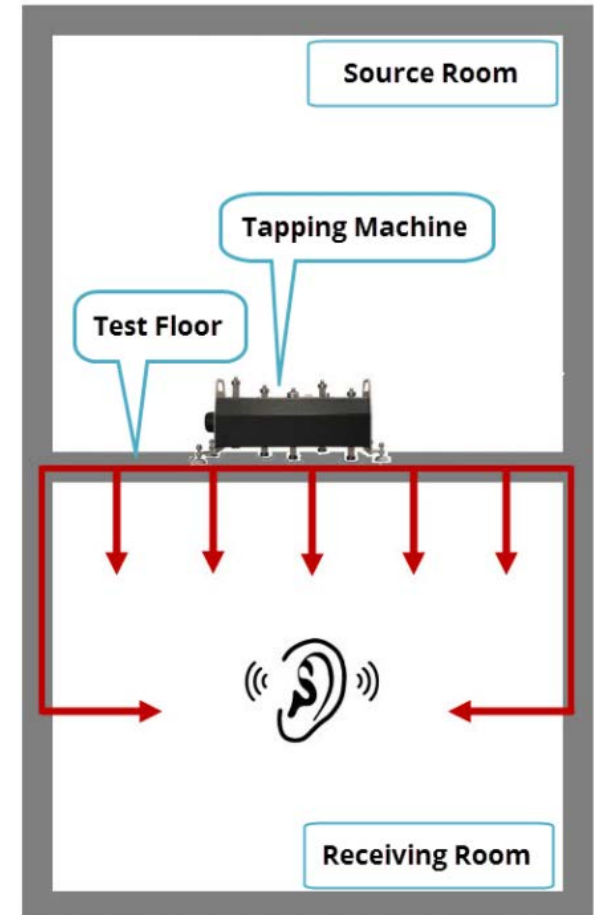
SenVibe

## PORTABLE SYSTEM FOR BUILDING ACOUSTICS

### TAPPING MACHINE / IMPACT SOUND SOURCE TYPE 3207

#### FEATURES

- Complies with international standards;
- Optional wireless remote control, to reduce operating time and annoyance;
- Optional Battery power for use, e.g., on building sites;
- Easy portable and lightweight;
- Low inherent noise for precise impact noise measurement.



## PORTABLE SYSTEM FOR BUILDING ACOUSTICS

### POWER AMPLIFIER TYPE 2734-B

#### USES

- A power amplifier designed to power sound sources in building and room acoustic field measurements.
- Compact, lightweight and built into a robust flight case, the power amplifier is easy and safe to carry to the measurement location.
- All connectors and controls are on the front for easy access, and the amplifier can stand horizontally or vertically as required for convenient operation;





## PORTABLE SYSTEM FOR BUILDING ACOUSTICS

### POWER AMPLIFIER TYPE 2734-B

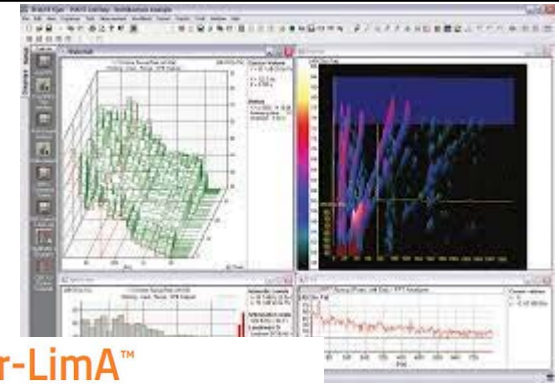
#### FEATURES

- A sensitivity selector in 10 dB steps adapts the amplifier to a variety of source-signal levels and sound sources;
- Maximum output power is 500 W into 4 Ohm output with a frequency response of 20 Hz – 20 000 Hz within  $\pm 1$  dB;
- Quiet, no fan cooling required;
- Remote operation via cable or wireless remote control;
- Satisfies national and international standards;
- Robust, light and easily portable.

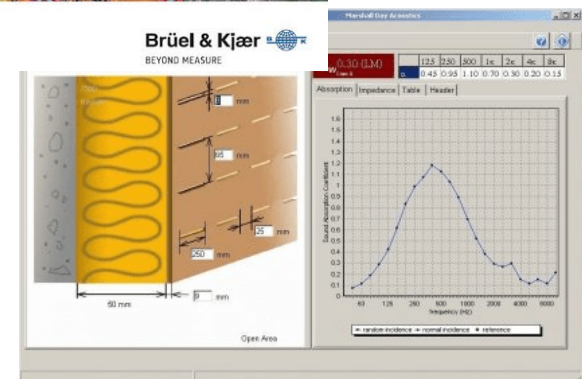
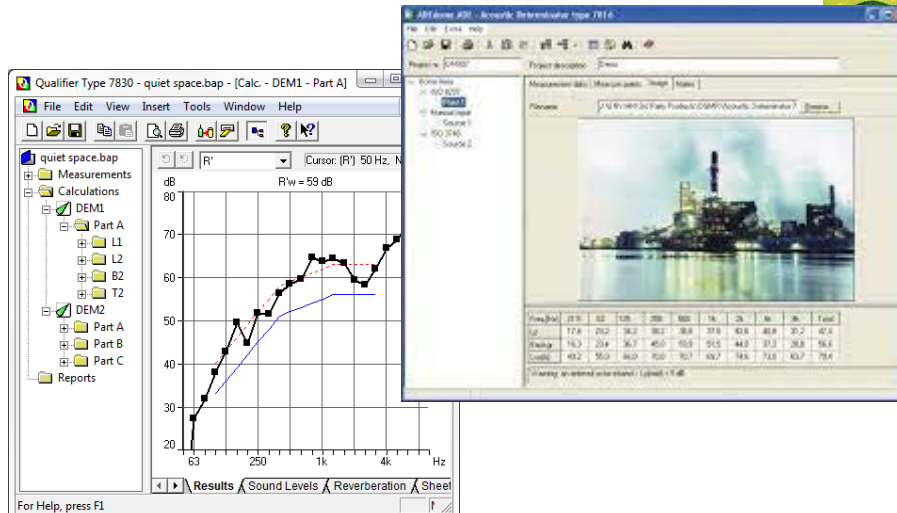
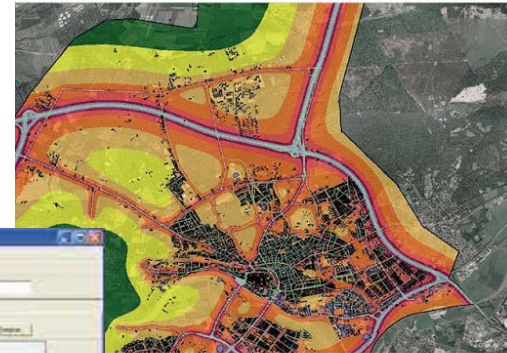
SenVibe



- ➡ PULSE LabShop FFT&CPB analysis, type 7700;
- ➡ Sentinel;
- ➡ Predictor-Lima, type 7810;
- ➡ Acoustic Determination, type 7816;
- ➡ Measurement partner, type BZ 5503;
- ➡ Acoustic Qualifier, type 7830 
- ➡ Insul.



Predictor-Lima™



# Accreditation Certificate



**АТС**

АКРЕДИТАЦИОНО ТЕЛО СРБИЈЕ  
ACCREDITATION BODY OF SERBIA



**АТС**

01-393

ЛАБОРАТОРИЈА  
ЗА ИСПИТИВАЊЕ  
ISO/IEC 17025



Акредитационо тело Србије

Accreditation Body of Serbia

Београд

Belgrade

додељује

awards

01965

## СЕРТИФИКАТ О АКРЕДИТАЦИЈИ

Accreditation Certificate

којим се потврђује да тело за оцењивање усаглашености  
confirming that Conformity Assessment Body

Универзитет у Нишу  
Факултет заштите на раду у Нишу  
Центар за техничка испитивања  
Ниш

акредитациони број

accreditation number

01-393

задовољава захтеве стандарда  
fulfils the requirements of

SRPS ISO/IEC 17025:2017

(ISO/IEC 17025:2017)

те је компетентно за обављање послова испитивања  
and is competent to perform testing activities

који су специфицирани у важећем издању Обима акредитације  
as specified in the valid Scope of Accreditation

Важеће издање Обима акредитације доступно је на интернет адреси: [www.ats.rs](http://www.ats.rs)  
Valid Scope of Accreditation can be found at: [www.ats.rs](http://www.ats.rs)

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Date of issue

21.05.2021.

Акредитација важи до  
Date of expiry

20.05.2025.



**АТС**



**ILAC MRA**

ВД ДИРЕКТОРА  
проф. др Ацо Јанићјевић

Acting Director  
prof. Aco Janicjevic, PhD

Акредитационо тело Србије је потписник Мултилатералног споразума о признавању еквивалентности система акредитације Европске организације за акредитацију (EA MLA) и ILAC MRA споразума у овој области. / ATS is a signatory of the EA MLA and ILAC MRA in this field.



**NOISE AND VIBRATION LABORATORY**



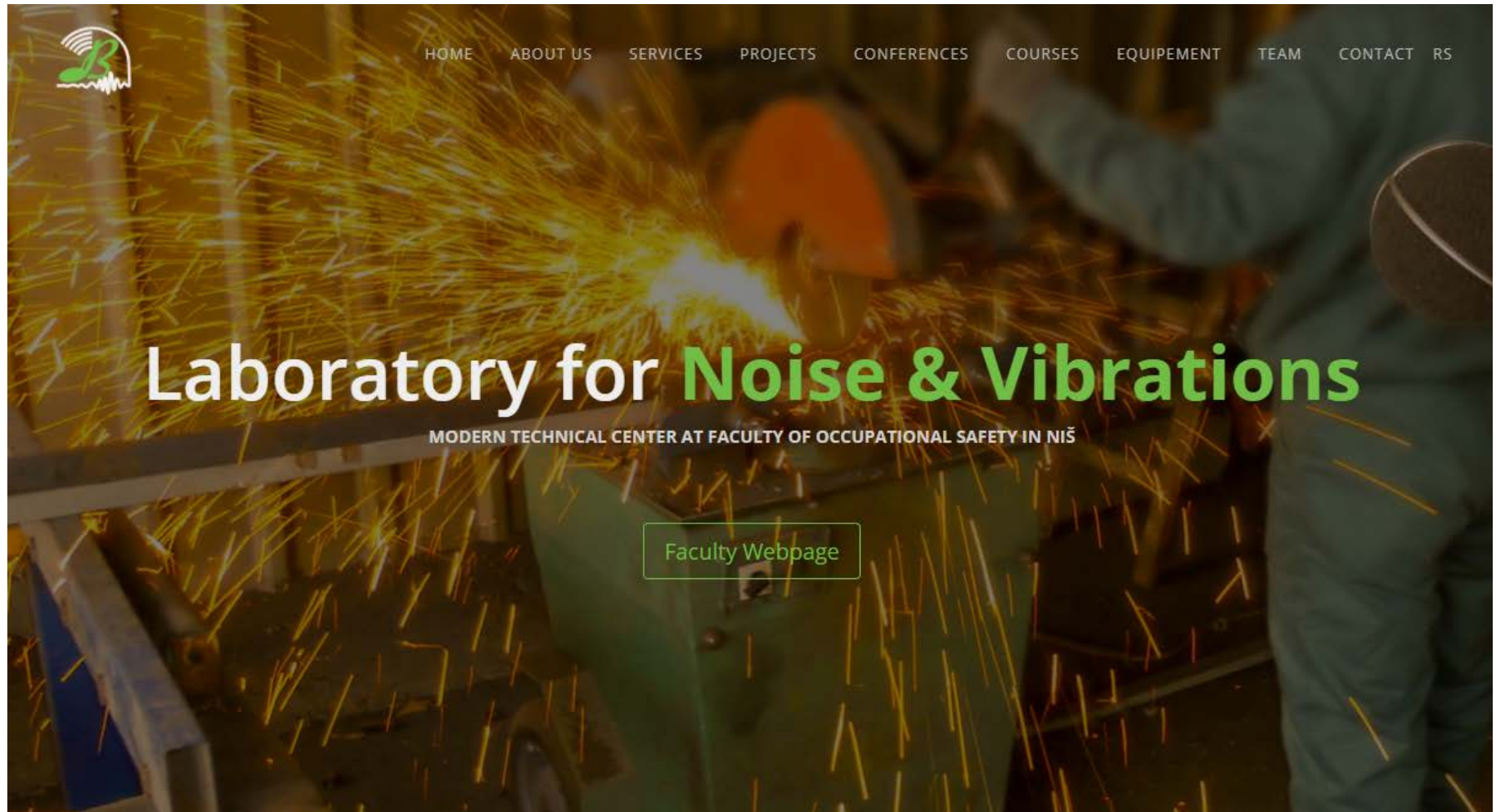


# LAB PHOTO



NOISE AND VIBRATION LABORATORY





<https://www.znrfak.ni.ac.rs/BVLab-KMB/BVLABSITE/Index.html>

