PULSE Vehicle Pass-by

Ground Station Software Type 7788-G
Vehicle Station Software Type 7788-V

PULSE™ Vehicle Pass-by Test helps you measure the operational vehicle exterior noise according to commonly used international standards. Solutions are scalable, ranging from simple set-ups for pass-by testing of two-wheelers, to high-productivity multi-vehicle pass-by testing, where runs for several vehicles tested to different standards are performed in random order.

PULSE Pass-by test systems are built on PULSE LabShop analysis software and LAN-XI data acquisition hardware, which has built-in GPS for data synchronization across ground and vehicle stations during the test. This robust system architecture ensures high-quality test results, even under difficult wireless transmission conditions.

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Uses and Features

Uses

- Pass-by noise testing of accelerating road vehicles according to international standards, including:
  - ISO 362 – 1 for M and N category vehicles (light vehicles and trucks, respectively)
  - ISO 362 – 2 for L category vehicles (two-wheelers)
- Measurement of operational vehicle exterior noise according to standards, including:
  - ISO 13325 (tyres)
  - ISO 5130 (stationary road vehicles)
- Conformance to UN regulations, including:
  - R51.03 (noise emission of M and N category vehicles)
  - R41.02 (noise emission of L category vehicles)
  - R117 (tyre noise)
- Conformance to minimum noise regulations for electric vehicles, including:
  - R138
  - FMVSS 141

Features

- Workflow-driven user interface
- Scalable solution
- Easy configuration of customized procedures, including modifications to international standards
- Meets the requirements of Class 1 instruments described in IEC 61672-1 (inclusive of the recommended windscreen, if used)
- Raw time data storage, including metadata for post-processing
- Export of results in common data formats
- Reporting using Microsoft® Word and Excel®

Brüel & Kjær

Why Do Pass-by Measurements?

Pass-by measurements are mandatory for product certification. For certification in a specific market or class, manufacturers must comply with the standards and regulations in that region and/or for that specific class of vehicle.

Pass-by measurements are also used as a product development and troubleshooting tool. For component suppliers and vehicle manufacturers in particular, it is crucial to identify the contribution of noise sources. Testers can compare spectra and levels from in-vehicle measurements with microphone signals at the ISO-designated positions on the ground. The idea is to identify which components may be main contributors at any given test track position or frequency. For more detailed noise source contribution investigations, Brüel & Kjær offers Moving Source Beamforming and Indoor Pass-by/Contribution Analysis. Brüel & Kjær's Exterior Sound Simulator allows subjective evaluation of exterior noise.

About Pass-by Test Systems

PULSE Vehicle Pass-by Test is a complete solution based on the PULSE LabShop analysis software and LAN-XI data acquisition hardware platforms.

Solution Components
The main components of a solution are the measuring stations: ground and vehicle.

The Ground Station
The ground station measures exterior pass-by noise using two microphones placed at ISO-designated positions on both sides of the test track. Once started, the ground station works continuously, unattended. Ground stations support both single and multiple vehicle tests.

The Vehicle Station
Hardware is installed in the vehicle to monitor parameters such as vehicle speed, engine rpm and/or accelerator pedal position. With the addition of sensors, a LAN-XI front end and Type 7788-V software, vehicle stations also measure in-vehicle noise and vibration during the pass-by test.

Communication Between the Stations
Both ground and vehicle stations time stamp data using GPS satellites which provides very accurate sample-synchronous data between the stations. Depending on the configuration, data is transferred between the ground and vehicle stations using telemetry or a wireless local area network.

Fig. 1
Example of the Measurement Control display
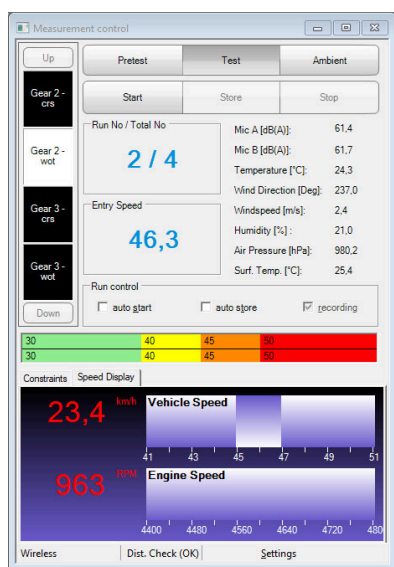
Measurement Control
The Measurement Control provides an optimized control interface with large buttons for easy in-vehicle operation, see Fig. 1.

The interface displays ambient SPL, weather station parameters and vehicle and engine speed information during the test and switches to show a summary of the run results directly after the test.

It supports targets for vehicle and engine speeds that can be set manually or automatically by the pass-by software.

PULSE Pass-by Vehicle Test is scalable and customizable so you can configure a solution to fit your needs.
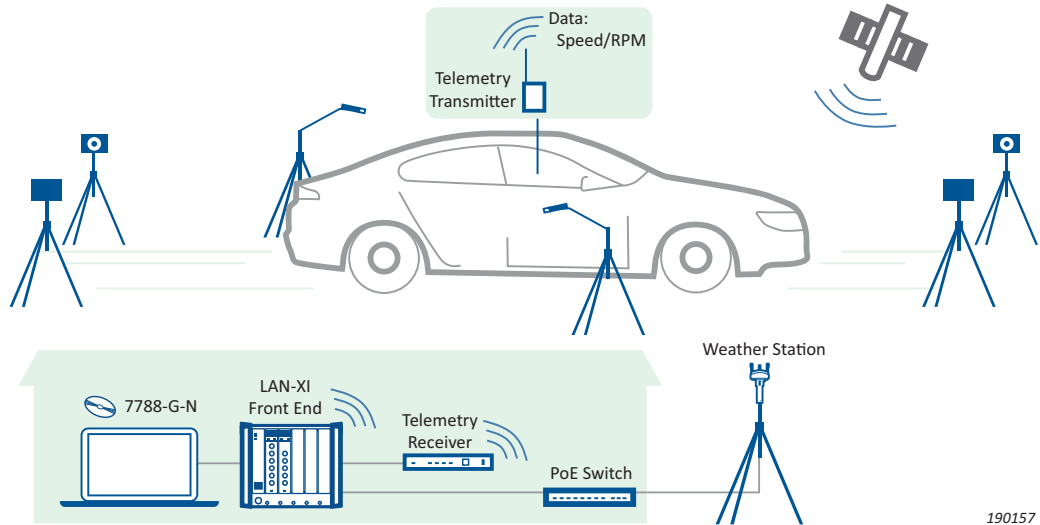
Single Data Acquisition System
These configurations have a single data acquisition system (that is, the LAN-XI data acquisition front end connected to a PC running PULSE Type 7788) and only support testing of one vehicle at a time.

Ground-station-based Configuration
In this configuration, the data acquisition system is part of the ground station which is located at the side of the track. Vehicle speed, engine rpm and accelerator pedal position are measured and transmitted to the ground station using radio telemetry. Measurements are controlled from the ground station.

Fig. 2
*Overview of a pass-by configuration based on a ground station*

Vehicle-station-based Configuration
In this configuration, the data acquisition system is part of the vehicle station. The vehicle station measures vehicle speed, engine rpm and/or accelerator pedal position plus any sound and vibration data from in-vehicle microphones or accelerometers. Measurements are controlled from the vehicle station and SPL data from the pass-by microphones is transmitted to the vehicle station using radio telemetry.

Fig. 3
*Overview of a pass-by configuration based on a vehicle station*

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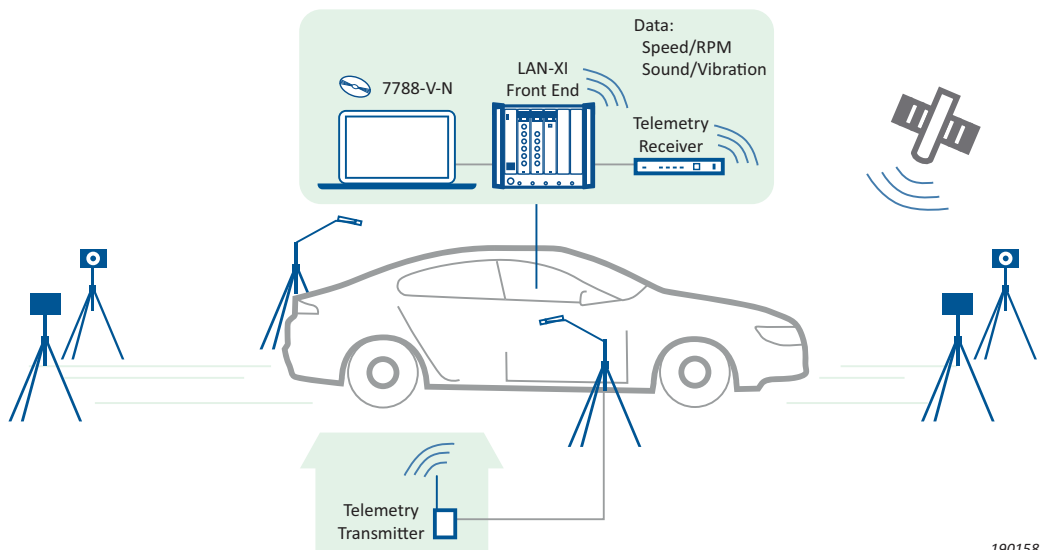
WLAN-based Configuration – Multiple Data Acquisition Systems

In this type of configuration, there is one data acquisition system in the ground station and one in the vehicle, for measuring in-vehicle sound and vibration data. Vehicle speed, engine rpm, and/or the accelerator pedal position is also measured. Transmission of data requires a wireless local area network (WLAN). All data is collected and analyzed on the PC in the vehicle.

Fig. 4
*Pass-by test configuration with multiple data acquisition systems*
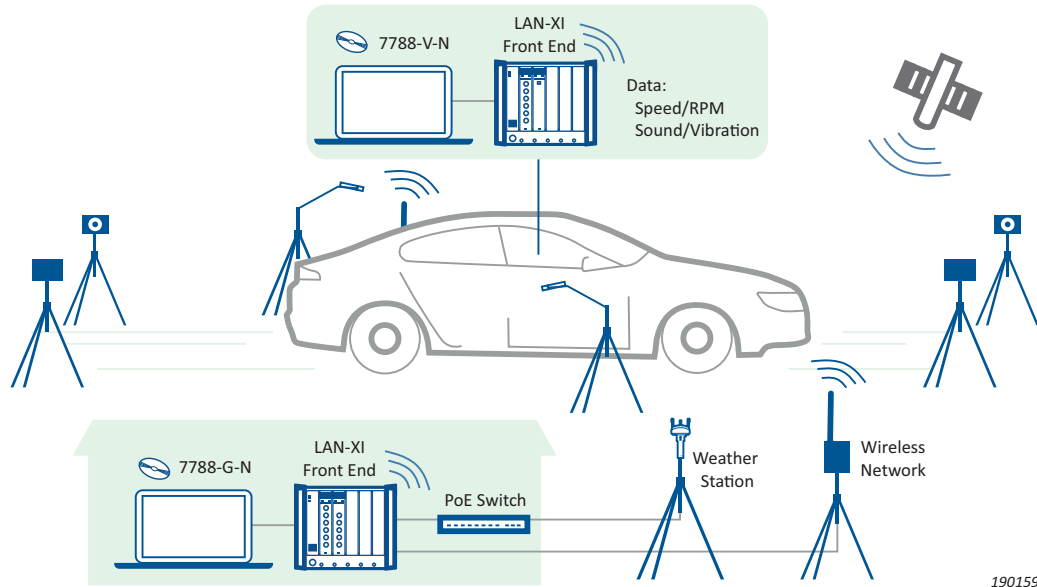
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Multi-vehicle Configuration

Configurations with multiple data acquisition systems support an unlimited number of vehicles, but you can also use it with just one! Each vehicle has its own data acquisition system, and the ground station is shared between the vehicles on the track. Several vehicles can be run at the same time, and vehicles can leave the track to do modifications, while others continue on their test runs. Each vehicle can then be measured based on different standards or regulations, regardless of the other vehicles' measuring schemes.

Fig. 5
Multi-vehicle testing with various vehicle measurement schemes

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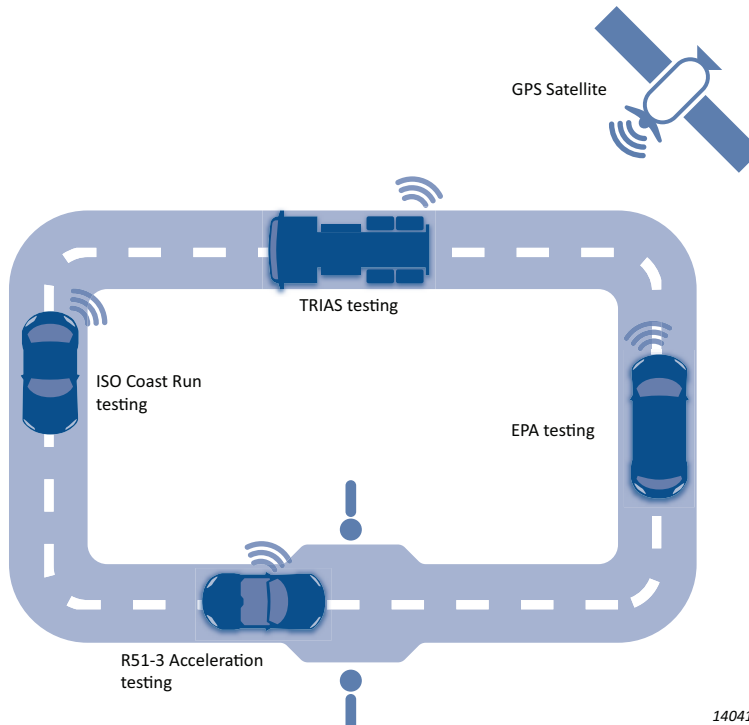
The ground station runs automatically after starting up a pre-defined template and will broadcast SPL levels, weather data and speed, to all vehicles on the track. Status information, including whether the measurement is running; whether other vehicles are using the track; or whether synchronization is working; are all displayed.

Measurements are controlled from the vehicle by the driver. In situations where the driver is not allowed to operate the software, it is possible to switch roles. In that case, an operator on the ground will control the measurements. This will, however, only support one vehicle.

Adding a Wireless Local Area Network
A wireless network enables transfer of data between ground and vehicle data acquisition systems, but it also enables the use of the Driver's Aid application. Therefore, it can be useful to add a wireless network to configurations without a vehicle data acquisition system.

Driver's Aid
The Driver's Aid application gives information on various parameters (for example, actual noise levels, speed, rpm, wind speed, etc.) before and during the measurement. It also displays pass/fail information on the required criteria, like entry speed, speed at Pass-by line P-P' (shown in Fig. 6) and rpm. From the application, measurement runs can be started, stored or deleted.
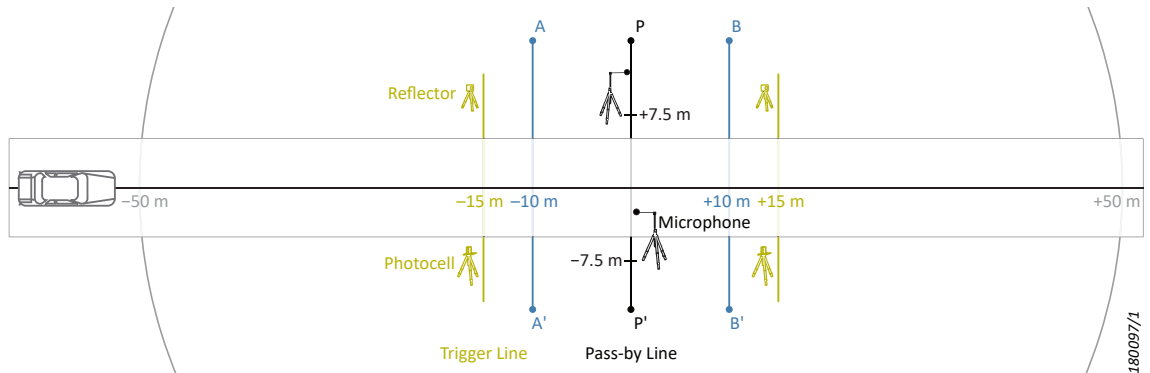
Test Procedure

A typical pass-by test procedure consists of a pre-test, a data recording phase, and then a data merge/ results phase. The procedure is described below with associated figures.

Position 1
The driver/operator checks various signals before starting, such as background noise, wind speed and RPM. He starts driving and presses the Start button. The vehicle station starts recording. (See Fig. 6.)
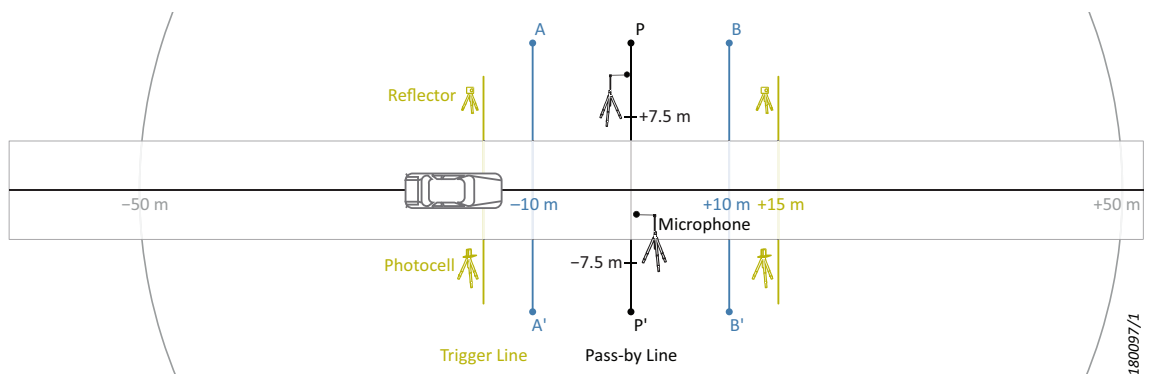
Fig. 6
Test procedure - Position 1

Position 2
The vehicle passes the first photocell (see Fig. 7). This will start the recording on the ground station. This point is used as absolute position to calculate the position of the vehicle on the track.

**Fig. 7**
Test procedure - Position 2

Position 3

The vehicle passes the second photocell (see Fig. 8). This will stop the recording on the ground with a short delay. This delay can be changed by the driver and will guarantee there is enough information after the B-B' line. At the same time a signal is sent to the vehicle that a recording is ready to be downloaded. The vehicle will then automatically download this file, merge it with the recording from the vehicle and analyse and present the data. The time files are synchronized based on the GPS time-stamps.

Fig. 8
Test procedure -
Position 3
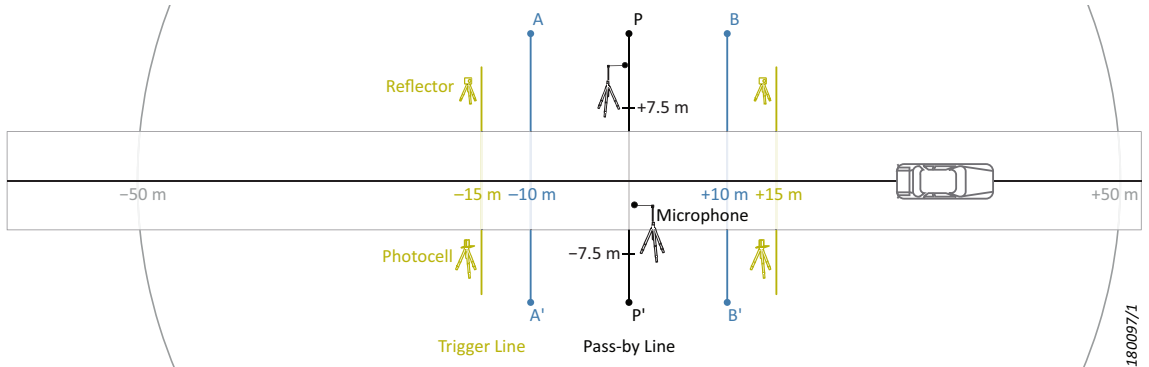
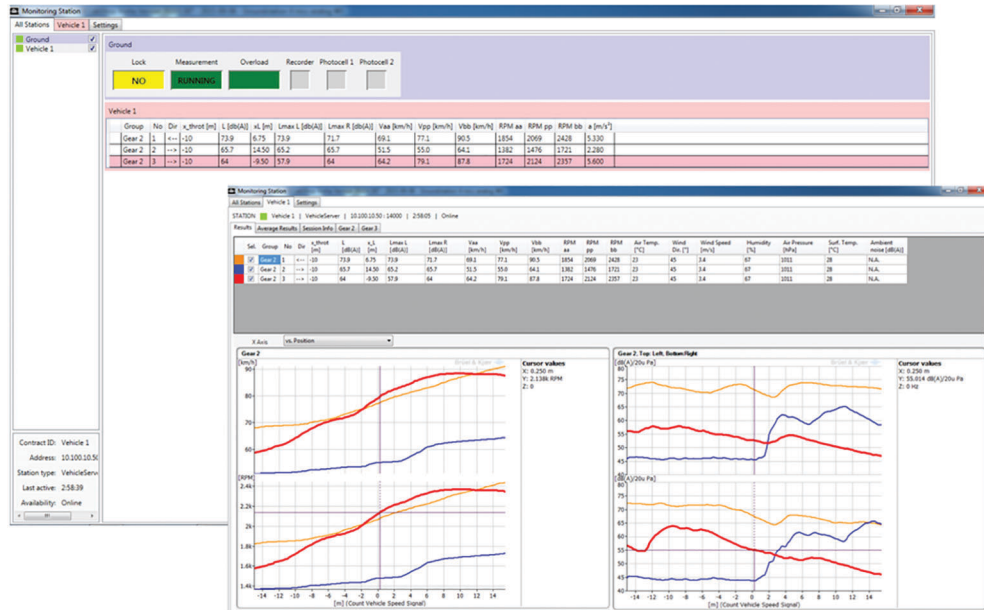The results will be presented to the driver including the pass/fail criteria for the run, see Fig. 9.

Fig. 9
Typical display during
a run
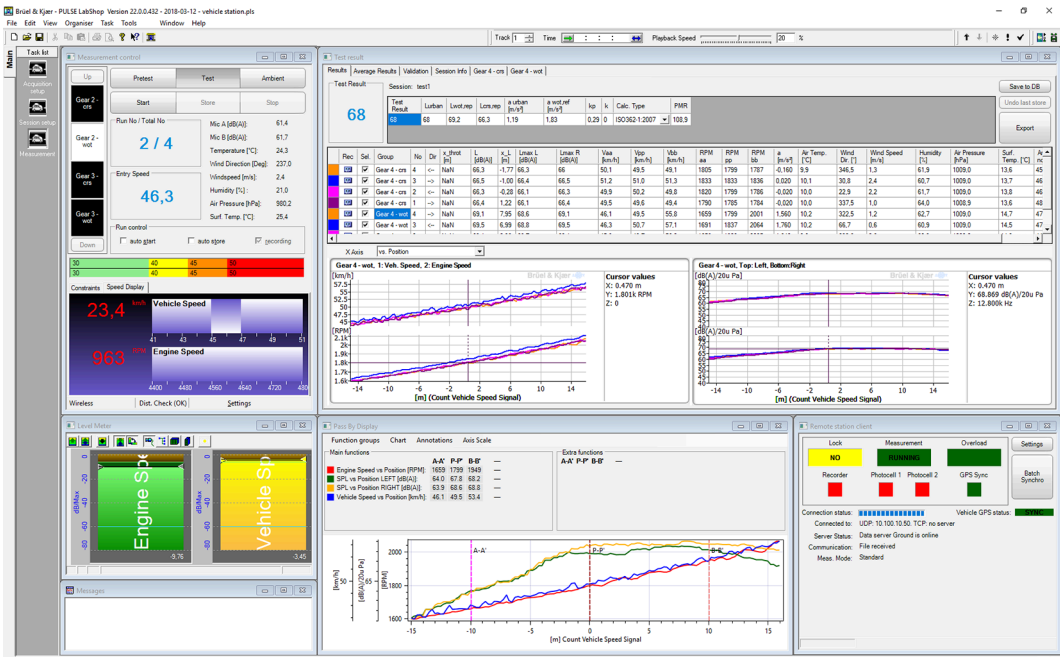
Monitoring Station

In case authorities or guests want to follow the progress a dedicated monitoring station can be installed showing all relevant session data from all vehicles on the track.

Engineering Services

Pass-by regulations are becoming more and more stringent so vehicle OEM and Tier 1 suppliers need to be prepared to efficiently diagnose and solve compliance problems. Brüel & Kjær consultants can apply the latest measurement techniques and algorithms to estimate individual contributions from vehicle sources to the pass-by microphones to identify the one(s) that need to be reduced and by how much. This reduces drastically the amount of trial-and-error and back-and-forth between vehicle OEM and Tier 1 supplier.

The same process can be applied indoors, with the vehicle on a chassis dynamometer in a large hemi-anechoic chamber, leveraging our Indoor Pass-by software and hardware solution. This allows you to assess efficiently the impact on pass-by of different strategies without actually having to conduct the test on the real test track. Finally, we can also support you in designing and evaluating exterior noise strategies for electric vehicles, to ensure compliance to Minimum Noise Requirements, but also to satisfy Sound Quality requirements.

5-MODULE LAN-XI FRONT-END FRAME TYPE 3660-C-100, INPUT MODULE TYPE 3050, PASS-BY CONNECTION MODULE WB-3595 AND BATTERY MODULE TYPE 2831-A

CE / RCM / China RoHS / WEEE marks	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China WEEE mark indicates compliance with the EU WEEE Directive
Safety	EN/IEC 61010−1 and ANSI/UL 61010−1: Safety requirements for electrical equipment for measurement, control and laboratory use
EMC Emission	**Frames** EN/IEC 61000−6−4: Generic emission standard for industrial environments CISPR 22: Radio disturbance characteristics of information technology equipment. Class A Limits
	Modules EN/IEC 61000−6−3: Generic emission standard for residential, commercial, and light-industrial environments CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits
EMC Immunity	EN/IEC 61000−6−1: Generic standards – Immunity for residential, commercial and light industrial environments EN/IEC 61000−6−2: Generic standards – Immunity for industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements **Note:** The frames and modules fulfil the immunity standards, except **Type 3660-C-100** meets EN 61000−4−2 at ±4 kV air discharge and EN 61000−4−5 surge 1.5 kV line-earth **Note:** The above is only guaranteed using accessories listed in this Product Data
Temperature	IEC 60068−2−1 and IEC 60068−2−2: Environmental Testing. Cold and Dry Heat Ambient Operating Temperature: −10 to +55 °C (14 to 131 °F) Storage Temperature: −25 to +70 °C (−13 to +158 °F)
Humidity	IEC 60068−2−78: Damp Heat: 93% RH (non-condensing at 40 °C (104 °F))
Mechanical (non-operating)	**Frames** IEC 60068−2−6: Vibration: 0.3 mm, 2 g, 10 – 500 Hz IEC 60068−2−27: Shock: **3660-C-100:** 100 g IEC 60068−2−29: Bump: **3660-C-100:** 1000 bumps at: 25 g empty, 15 g loaded with modules
	Modules IEC 60068−2−6: Vibration: 0.3 mm, 2 g, 10 – 500 Hz IEC 60068−2−27: Shock: 100 g IEC 60068−2−29: Bump: 1000 bumps at: 25 g
Enclosure	IEC 60529: Protection provided by enclosures: **3660-C-100:** IP 20; **3050, WB-3595 and 2831-A:** IP 31

For environmental specifications and compliance with standards for PCs, see the specifications given by their respective manufacturers

LAN-XI Data Acquisition Hardware

See LAN-XI product data, BP 2215, for full specifications

Typical Ground Station

LAN-XI Frame Type 3660-C-100 with GPS with:
- LAN-XI 6-ch. Input Module Type 3050-A-060
- Pass-by Connection Module WB-3595

Typical Vehicle Station

LAN-XI Frame Type 3660-C-100 with GPS with:
- LAN-XI 6-ch. Input Module Type 3050-A-060
- LAN-XI Battery Module Type 2831-A
- Pass-by Connection Module WB-3595
- Car adapter power cable AO-1489-D-030 (for WB-3595)

POWER REQUIREMENTS

Mains
Wide-range input 90.264 V AC, 47.63 Hz
Connector: Connector type C14 according to IEC/EN 60320.1

DC Input
11 – 32 V DC
Connector: 4-pole XLR plug

Power Consumption
Starts with 19 W if equipped with one LAN-XI module; rises to 70 W if equipped with five LAN-XI modules
Maximum Consumption: 90 W

DC Output
+12 V ±1.0 V; max. 1 A (with current protection)
Connector: EIAJ-05 (pin ∅1.4 mm, outer ∅6.5 mm)

BATTERY MODULE

Li-Ion rechargeable
Typical Operating Time: >7 hours with single module
Output Voltage: 14.8 V (nominal)
Capacity: 91 Wh
Status Indicators: 5 LEDs showing remaining capacity on battery, software access to charging status and remaining capacity in LAN-XI frame

Battery Charging Time
Mains: 3 hours in frame powered from mains
External DC: No charging

LAN

Frames communicate at 1000 Mbits/s
Connectors: Two connectors type RJ45 8/8, optionally Neutrik® etherCON NE8MC1. Left connector for connection to PC. Right connector includes PoE (IEEE 802.3af) power and is for connection to accessories like PoE cameras or wireless access points (WAP). PoE power can be selected on either the first or the second connector
Recommended Cable: Shielded cables of type CAT5e or better should be used. All LAN connectors support MDIX, which means that cables may be crossed or not

Protocol

The following standard protocols are used:
- TCP
- UDP
- DHCP (incl. Auto-IP)
- DNS (on top of UDP)
- IEEE 1588.2008 (on top of UDP)
- IP
- http (on top of TCP; for Web server, etc.)
- Ethernet (IEEE 802.3 with IEEE 802.3X)

GPS

GPS Antenna ZZ-0260 (non-magnetic) is included to allow the use of the time provided by a GPS satellite. GPS time is used:

- To define the absolute time that follows the acquired data
- As an accurate time base that locks the PTP clock on both the master frame and any slaves. Continuous tracking with GPS time allows the acquisition of very long time signals with very high time precision
Connector: SMA
Cable Length: 5 m (16.4 ft)

INPUT MODULE

Number of Channels: 6 input
Connectors: BNC
Input Type: Direct, CCLD transducer, microphone preamplifier (0 or 200 V polarization voltage) or charge[*]
Frequency Range: 0 to 51.2 kHz
Input Voltage: Up to 10 V_{peak}; extended range up to 31.6 V_{peak}
Absolute Maximum Input: 60 V_{peak} without damage

PASS-BY CONNECTION MODULE WB-3595

Can support up to 6 photocells with a 10 second hold-off on triggering
Input Channels: 2 × 6-pole LEMO female, 12 V power, max. current 2.5 A
Output Channel: BNC

ENVIRONMENTAL

Temperature Protection
Temperature sensor limits module's internal temperature to 80 °C (176 °F). If temperature exceeds limit, system will automatically enable fan in frame

Acoustic Noise Emission (at 1 m)
- Fan Off: 5 dB Lw, A-weighted
- Normal (22 °C): 37 dB Lw, A-weighted
- Maximum: 51 dB Lw, A-weighted

Physical Characteristics
Frame:
- Height: 177.8 mm (7.0")
- Depth: 420.4 mm (16.5")
- Width: 224.5 mm (8.8")
- Weight (with mains power supply, etc.): 5.3 kg (11.7 lb)
Modules:
- Height: 132.6 mm (5.22")
- Width: 27.5 mm (1.08")
- Depth: 248 mm (9.76")
- Weight (input and connection modules): 750 g (1.65 lb) each
- Weight (battery module): 1.0 kg (2.2 lb)

Other Hardware

GROUND PARAMETERS

Prepolarized Microphone with Preamplifier Type 4189-A-021
Measures sound pressure level. Two microphones required
Sensitivity: 50 mV/Pa
Frequency: 6.3 Hz – 20 kHz
Dynamic Range: 14.6 – 146 dB
Temperature: −30 to +150 °C (−22 to +302 °F)

Photocells
Photocell and reflector set to provide triggering and an absolute position reference used for distance calculations. Use one set for single-direction measurements; two sets for bidirectional measurements

Driver's Aid (optional)
Windows-based application that gives the driver information on various parameters (for example, actual noise levels, speed, rpm, wind speed, etc.) before and during the measurement. It also displays pass/

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[*] Via CCLD Converter Type 2646 or the range of Charge to CCLD Converters Type 2647

fail information on the required criteria, like entry speed, speed at Pass-by line and rpm. Measurement runs can be started, stored or deleted from here. Requires wireless network

Weather Station (optional)
Measures wind speed, wind direction, temperature, humidity and atmospheric pressure. Includes PoE box for connection to LAN-XI frame and provides power to weather station

Ground Temperature Sensor Unit (optional)
WQ-3755-W-100 or WQ-3755-W-030: Measure asphalt temperature Optional sensor connected directly to the weather station (WQ-3728)

IN-VEHICLE PARAMETERS

Options for Vehicle Speed and/or Engine RPM:
- **WQ-3207**: 100 Hz GPS speed sensor. Measures vehicle speed for either single- or multi-vehicle configurations

- **UL-1052**: Device that reads engine rpm and vehicle speed. Input from the CAN-OBD2 interface and output as analog voltage (0 to 5 V) or digital pulse sequence (TTL)
  Other devices capable of providing TTL pulses (Low: 0 to 0.8, High: 2 to 5) frequency modulated according to speed may also be used
- **MM-0097**: A pressure sensitive on/off sensor mounted on the accelerator pedal that measures the position of the accelerator

DATA TRANSFER AND INTERFACES

Radio Telemetry
For solutions where there is a need for vehicle parameters such as engine rpm, accelerator pedal position or vehicle speed from an on-board precision GPS sensor

Wireless Local Area Network
For solutions where there is a need for vehicle parameters such as engine rpm, accelerator pedal position or vehicle speed from an on-board precision GPS sensor and/or Driver's Aid

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Specifications – PULSE Vehicle Pass-by Types 7788-G/V

PULSE Vehicle Pass-by Ground Station Software Type 7788-G and Vehicle Station Software Type 7788-V are Windows®-based applications for PULSE Pass-by (PBY), a suite of applications for PULSE LabShop. The software is delivered via DVD or USB. Licenses for this solution are node-locked

System

SYSTEM REQUIREMENTS
- Type 8400-N: BK Connect Data Viewer, Node-locked License
- Type 8401-N: BK Connect Hardware Setup, Node-locked License
- Microsoft® Windows® 10 Pro or Enterprise (x64) with either Current Branch (CB) or Current Branch for Business (CBB) servicing model
- Microsoft® Office 2016 (x32 or x64) or Office 2019 (x32 or x64)
- Microsoft® SQL Server® 2017 or SQL Server® 2019
  Note: Microsoft SQL Server 2017 is included in BK Connect installation

RECOMMENDED PC
- Intel® Core™ i7, 3 GHz processor or better
- 32 GB RAM
- 480 GB Solid State Drive (SSD) with 20 GB free space, or better
- 1 Gbit Ethernet network[*]
- Microsoft® Windows® 10 Pro or Enterprise (x64) with CB
- Microsoft® Office 2016 (x32)
- Microsoft® SQL Server® 2017
- Screen resolution of 1920 × 1080 pixels (full HD)

Measurement

Vehicle speed and position measured relative to a reference (photocell), noise measured via two microphones (left and right) and additional parameters

TYPE 7788-G AND 7788-V
- Noise: Overall, FFT, and CPB slices as functions of distance, speed or time, CPB and FFT contours as functions of speed and time
- Auxiliary Parameters: Air temperature, relative humidity, wind speed, wind direction and user-defined parameters, instantaneous, averaged and max. values available as tags on waterfall data (up to 12 channels)

- Supported Standards: ISO 362−1/ECE R51−03, ISO 362−2/ECE R41−02, SAE J1470, SAE J366, QRTV: R138, NHTSA141
- Vehicle engine speed, vehicle accelerator pedal position, user-definable (dependent on hardware and software license) order analysis

Calibration

Calibration of dynamic channels using the PULSE Calibration Master. Calibration histories available from the Global Calibration Database

User Interface
- Standard Windows®-based GUI
- Four-button operation (Activate, Run, Accept and Cancel)
- Automatic display of summarized measurement results including validation criteria with non-compliance notification
- User-configurable test documentation, input window

Available Displays
- Level vs Position
- Spectra vs Position
- Slice vs Position
- 2D Graphics (real-time)
- 3D Graphics (waterfalls)
- Auxiliary data (2D and readout)

Reports
- On-the-fly reporting direct from measurement GUI
- User-defined formats through PULSE Data Manager Type 7767
- Displays of all measured data in Microsoft® Word and Excel®

Data Management
- Configurable data labels and fields
- Automatic storage of all measurement data and validation criteria
- Store items such as pictures or data recordings with measurement data
- Browse stored data
- Drag and drop retrieved data into displays for viewing or comparison
- Edit or delete stored data
- Export as XML or ASCII
- Export to Microsoft® Excel®

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* A dedicated data acquisition network (LAN or WAN) is recommended. A network that only handles data from the front end improves the stability of the data

Example Configurations

		Telemetry-based Configuration	WLAN-based Configuration
		A single data acquisition system in the ground station (see Fig. 2)	Two data acquisition systems: one in the ground station and one in the vehicle station (see Fig. 4)
Ground Station	**Software**	• 1 × Type 7788-G-N: Ground station	• 1 × Type 7788-G-N: Ground station
	LAN-XI Data Acquisition Hardware	• 1 × Type 3660-C-100: 5-module frame with GPS • 1 × Type 3050-A-060: 6-ch. input module • 1 × WB-3595: Pass-by connection module	• 1 × Type 3660-C-100: 5-module frame with GPS • 1 × Type 3050-A-060: 6-ch. input module • 1 × WB-3595: Pass-by connection module
	Pass-by Microphones	• 2 × Type 4966-H-041: Microphone/preamplifier • 2 × UA-0237: Windscreen • 2 × UA-0588: Tripod adapter • 2 × UA-0801: Lightweight tripod • 2 × WL-1391-D-600: Cable on drum	• 2 × Type 4966-H-041: Microphone/preamplifier • 2 × UA-0237: Windscreen • 2 × UA-0588: Tripod adapter • 2 × UA-0801: Lightweight tripod • 2 × WL-1391-D-600: Cable on drum
	Photocell	• 1 × AO-0087-D-002: Cable • 2 × WU-0584-W-004: Laser distance sensor • 2 × SB-1537: Light reflector • 2 × WL-3612-D-600: Cable Roller for photocell • 4 × UA-0801: Lightweight tripod	• 1 × AO-0087-D-002: Cable • 2 × WU-0584-W-004: Laser distance sensor • 2 × SB-1537: Light reflector • 2 × WL-3612-D-600: Cable roller for photocell • 4 × UA-0801: Lightweight tripod
	Telemetry	• 1 × UL-1102: Telemetry system, 2-channels • 1 × WB-3665-W-001: Pass-by conditioning unit • 2 × JJ-0085: Adapter, 3-pin XLC (F) to BNC (F) • 2 × WL-3707: Cable for transmitter • 2 × AO-0087-D-030: Coaxial cable	
	Wireless Network		• 1 × WQ-3530: WLAN base station • 1 × WQ-3529: WLAN antenna • 1 × WQ-2659: Lightweight tripod • 1 × AO-1450-D-800: LAN cable
Vehicle Station	**Software**		• 1 × Type 7788-V-N: Vehicle station
	LAN-XI Data Acquisition Hardware		• 1 × Type 3660-C-100: 5-module frame with GPS • 1 × Type 3050-A-060: 6-ch. input module • 1 × Type 2831-A: Battery module
	Vehicle Speed Sensor	• 1 × WQ-3207: GPS speed sensor	
	RPM / Speed Reader	• 1 × UL-1052: OBD2 Reader • 1 × AO-0087-D-012: Coaxial cable	
	Wireless Network		• 1 × WQ-3528: WLAN radio • 1 × WQ-3561: WLAN antenna, magnetic mount • 1 × WQ-3532: PoE adapter • 1 × AO-1450-D-020: LAN cable
Service	**FAT**	• 1 × BK-0059: Factory acceptance test	• 1 × BK-0059: Factory acceptance test
	Training	• 2 × BK-0060: On-site training	• 2 × BK-0060: On-site training

Ordering Information

Due to the variety of options, solutions are ordered via Project Sales
Note: Licenses are node-locked to PC host ID or dongle

Type 7788-G-N	PULSE Pass-by, Ground Station Software
Type 7788-V-N	PULSE Pass-by, Vehicle Station Software

SOFTWARE MAINTENANCE AND SUPPORT AGREEMENTS

M1-7788-G-N	Agreement for Type 7788-G-N
M1-7788-V-N	Agreement for Type 7788-V-N

Supported Hardware

LAN-XI DATA ACQUISITION HARDWARE

Type 3660-C-100	5-module LAN-XI Front-end Frame with GPS
Type 3050-A-060	6-ch. Input Module LAN-XI 51.2 kHz (Mic, CCLD, V)
WB-3595	Pass-by Connection Module
Type 2831-A	LAN-XI Battery Module

PASS-BY MICROPHONE

Type 4966-H-041	Prepolarized Free-field ½″ Microphone Type 4966 with Preamplifier Type 1706
UA-0237	Windscreen for ½″ microphones, diameter 90 mm (3.5 in)
UA-0588	Tripod adapter for ½″ microphones
UA-0801	Lightweight tripod
WL-1391-D-600	Cable drum with double-screened coaxial cable, BNC connector, 60 m (200 ft)

IN-VEHICLE RPM/SPEED HARDWARE

WQ-3207-W-001	GPS speed sensor, VBOX, 100 Hz
UL-1052	OBD2 reader, KMT RPM-8000-OBD2, 8000 rpm
MM-0097-W-003	Pressure sensor for accelerator pedal
AO-0087-D-012	Cable, single-screened coaxial, BNC (M) to BNC (M), 1.2 m (4 ft), max. 85 °C (185 °F), for UL-1052 and MM-0097-W-003

ADDITIONAL SENSORS

A wide range of Brüel & Kjær accelerometers, microphones and preamplifiers is available for use with LAN-XI systems. Please visit www.bksv.com/transducers for more information.

CALIBRATION CHECK

Type 4231	Sound Calibrator, Class 1 and LS (generates 94 and 114 dB, 1 kHz)

PHOTOCELL

AO-0087-D-002	Cable, single-screened coaxial, BNC (M) to BNC (M), 0.2 m (.7 ft), max. 85 °C (185 °F), photocell output from WB-3595 to input module
WU-0584-W-004	Laser distance sensor with 2 m (6.5 ft) cable, circular-1B 6-pin (M) connector
SB-1537	Light reflector
WL-3612-D-600	Cable roller for photocell, Lemo 1B 6-pin (F) to Lemo 1B 6-pin (M), 60 m (200 ft)
UA-0801	Lightweight tripod

WEATHER STATION

WQ-3728	Digital weather station, based on Viasala WXT536
WQ-3755-W-100	PT1000 ground temperature sensor unit with 10 m (33 ft) cable
WB-3587	PoE supply box for weather station, includes 10 m (33 ft) cable

PC

Type 7201-G	Dell® Latitude® High-end Notebook with Microsoft® Office Pro

TELEMETRY

UL-1102-X-YYY*	Shure Telemetry System, transmits 2-channels
UL-1103-X-YYY*	Shure Telemetry System, transmits 3-channels
WB-3665-W-001	Pass-by Conditioning Unit
JJ-0085	Adapter, 3-pin XLC (F) to BNC (F)
WL-3707	Cable for transmitters, TA4M to BNC, 0.4 m (1.3 ft)
AO-0087-D-030	Cable, single-screened coaxial, BNC (M) to BNC (M), 0.3 m (1 ft), max. 85 °C (185 °F)

WIRELESS NETWORK

WQ-3530	WLAN base station, Ubiquiti airMAX® BaseStation, rocket®M5
WQ-3529	WLAN antenna, Ubiquiti airMAX® Antenna AMO-5G13, 5 GHz
WQ-2659	Lightweight tripod
WQ-3528	WLAN radio
WQ-3561	Magnetic mount antenna, 06 dBi
WQ-3532	PoE adapter
AO-1450-D-020	LAN Cable, Cat.6 S/FTP up to 250 MHz, RJ45 (M) to RJ45 (M), green PVC, 2 m (7 ft), +70 °C (158 °F)
AO-1450-D-800	LAN Cable, Cat.6 S/FTP up to 250 MHz, RJ45 (M) to RJ45 (M), green PVC, 80 m (262 ft), +70 °C (158 °F)

Services

FACTORY ACCEPTANCE TEST AND TRAINING

BK-0059	Factory acceptance test, per day
BK-0060	On-site training, per day (excluding travel and accommodations)

CALIBRATION

CALI-S-CAI	Initial accredited calibration of Type 4231 Sound Calibrator, single
CALI-S-CAF	Accredited calibration of Type 4231 Sound Calibrator, single
WQ-3207-W-CAI	Initial accredited calibration of VBOX Speed Sensor, performed by subcontractor
WQ-3207-W-CAF	Accredited calibration of VBOX Speed Sensor, performed by subcontractor
ANA-LNXI-CAI-SET	Initial accredited calibration of LAN-XI module with microphones and preamplifiers
ANA-LNXI-CAF-SET	Accredited calibration of LAN-XI module with microphones and preamplifiers
MM-0256-CAI	Initial accredited calibration of digital weather station, performed by subcontractor
MM-0256-CAF	Accredited calibration of digital weather station, performed by subcontractor

* Telemetry systems are region specific:
  X = receiver type, YYY = transmitter type

Brüel & Kjær