

CASE STUDY

Spain

SEAT S.A. Automotive NVH Testing

Automotive

PULSE™, Transducers, Calibrators

SEAT was established in Spain in 1950, and is today active in over 70 countries. A part of the Volkswagen Group, it is one of Europe's youngest automotive manufacturers, and renowned for the innovative design and production of cars with sporty character.

The mission of SEAT's Complete Vehicle Auditing Section is to verify that all new models fulfil specified NVH parameters. Exclusively using PULSE™ data acquisition systems, testing times have been reduced by 75 percent.

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Advanced Facilities



Opened by His Majesty King Juan Carlos I in 1993, SEAT's production plant at Martorell, some 30 km north-west of Barcelona, Spain, is one of Europe's most advanced automotive production plants using state-of-the-art technology.

In 2003, a total of more than 14000 employees produced 436 933 vehicles. Extensive R&D is a vital part of creating new models that embody the SEAT spirit.

Complete Vehicle Auditing

Fig. 1
Dionisio Garrote Peraira evaluates a vehicle's sound and vibration characteristics in SEAT's Acoustics and Vibration Laboratory.

Dionisio Garrote Peraira, responsible for the Acoustics and Vibration laboratory, has worked at SEAT for more than 35 years, and is an expert in sound quality. He explains, "I am very critical, like the most fussy customer. The mission of SEAT's Complete Vehicle Auditing Section is to verify that all new models and variations fulfil specified parameters. My task is to evaluate the sound and vibration characteristics of a vehicle and a new model cannot be released for production unless its target noise parameters fully conform. We also test vehicles from the production line – complete vehicle auditing is like a gauge of production quality".

Dionisio continues, "The NVH requirements are tightened every year. Our customers expect improved vehicle comfort and the sound and vibration characteristics of our cars are a key product differentiator".



NVH Testing

Fig. 2
A new 'Altea' in SEAT's Acoustics and Vibration Laboratory

Several different NVH tests are made:

Interior Noise

Using PULSE, the signals from four Microphones Type 4192 are measured. Initially without the engine running, the noise generated by vehicle's various functions – electric windows, wipers, sun roof, etc. – are measured.

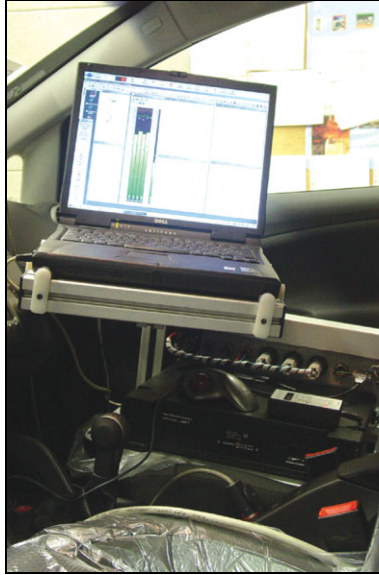
Next, together with one tacho signal, the engine noise is recorded during acceleration and deceleration. Order analysis is performed in real-time so the results are seen immediately.

Simultaneously, all the signals are stored on the PC's hard disk using Data Recorder Type 7701. Later, in the office, PULSE Sound Quality Software Type 7698 and Order Analysis option BZ5277 are used to make further subjective analyses of the signals.

Dionisio says. "It's very easy as I make the measurements while I drive the car, and it's safe too because I use PULSE WorkFlow Manager Type 7756 and its Remote Control ZH0630. Workflow Manager automates the complete sequence of testing. PULSE runs in the background and all I have to do is to start, stop and save a measurement. Workflow Manager then automatically progresses to the next test".



Fig. 3
The laptop PC is held in a specially constructed fixture – the driver can easily see the screen while driving on the test track. Remote Control ZH0630 enables the recording of data to be started, stopped and saved



Vibration

Vibration measurements are made on two axes, radially and axially, on the steering wheel and seats. The PULSE data acquisition system collects the data and does the post-processing. Brüel & Kjær single axis Type 4384 and triaxial Type 4326A accelerometers are used.

Exterior Noise

A Brüel & Kjær two-channel analyzer and Microphones Type 4190 are used to make these measurements.

Calibration

The transducers are calibrated before the start of each series of tests – a Brüel & Kjær Calibration Exciter Type 4294 is used to calibrate the accelerometers and a Sound Level Calibrator Type 4231 calibrates the microphones.

PULSE

Fig. 4
Alberto Pardina Magdalena is responsible for SEAT's Complete Vehicle Auditing Section



Alberto Pardina Magdalena is responsible for the Complete Vehicle Auditing Section. Alberto explains, “We started investing in PULSE in 2001 and added more systems test capability last year. Our experience in using PULSE with WorkFlow Manager to automate the NVH testing function cannot be better. The combination of simultaneous real-time analysis and recording is a great advantage of PULSE – we can validate the measurements in-situ and perform further analysis if required”.

The test data is saved on a central server and our colleagues in SEAT's Technical Center have access to the results.

A key factor in choosing PULSE was the quality of the support and service provided by the local Brüel & Kjær office.

“Every time we have a question, Brüel & Kjær is always there – we get answers and everything we need. We wanted the highest level of accuracy and reliability, and Brüel & Kjær's reputation as the world-market leader was another strong argument to choose PULSE”, says Alberto.

Reduced Testing Time

Alberto continues, “As we can now measure all required channels simultaneously, and, including the setting up and final reporting, we have reduced the total measurement time per car from four hours down to one hour – a saving of 75 percent. Of course using transducers with built-in TEDS has reduced the setup time, and there are less

errors. In the near future, the tests currently made with our Type 2145 analyzer will be transferred to PULSE and this will result in a further saving of testing time”.

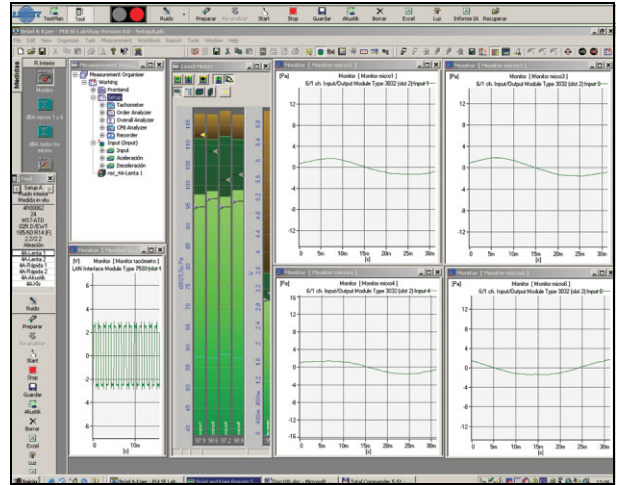
Confidence

Fig. 5

A typical display showing data from a test run. The green bars are the level indicator. The tachometer signal is shown on the lower left while the graphs display sound pressure level vs. time measured on four microphone channels

“The final consequence of our NVH tests is to decide if a car can or cannot be manufactured and therefore this means that we must be very sure of our conclusions. Using these new tools gives us complete confidence in our decisions”, says Alberto.

He concludes by saying, “PULSE has helped SEAT to fulfil the ever increasing quality demands of our brand, especially in the NVH area. In the near future we would like to go deeper into the evaluation of the acoustics and vibration comfort inside the car”.



Key Facts

Fig. 6

Typical test plan from PULSE WorkFlow Manager Type 7756 showing the setup for a number of tests. Clicking on a specific cell starts the predefined test procedure. If required, a picture of the test object can be inserted in the field at the top right. Metadata fields enable the parameters for the test to be added to the test plan

- A part of the Volkswagen Group, SEAT was established in Spain in 1950, and is today active in over 70 countries
- The mission of SEAT's Complete Vehicle Auditing Section is to verify that all new models and variations fulfil specified parameters
- “The NVH requirements are tightened every year – our customers expect improved vehicle comfort”
- “The sound and vibration characteristics of our cars are a key product differentiator”
- PULSE™ data acquisition systems are used exclusively
- A key factor in choosing PULSE was the quality of the support and service provided by the local Brüel & Kjær office
- “Our experience in using PULSE with WorkFlow Manager to automate the NVH testing function cannot be better”
- All test setup parameters and metadata are defined in the lab prior to test making the actual test almost automatic
- “We have reduced the total measurement time per car from four hours down to one hour – a saving of 75 percent”
- “PULSE has helped SEAT to fulfil the ever-increasing quality demands of our brand”

