R&S®SCOPE RIDER RTH – ELECTRIFYING THE AUTOMOTIVE FUTURE

How Rohde&Schwarz helped Politecnico di Torino design vehicles with record-low fuel consumption

AT A GLANCE

- **Customer**: H_2politO team at the Politecnico di Torino
- **Task**: Testing high-efficiency prototypes and urban concept vehicles
- **Challenge**: Monitoring CAN bus and debugging cellular module for a real-time telemetry system
- **Solution/product**: R&S®Scope Rider RTH handheld oscilloscope
- **Key benefits**: Isolated and fully portable oscilloscope, visualization of serial communication like CAN bus, extraordinary remote controllability

Case Study | Version 01.00

ROHDE&SCHWARZ
Make ideas real

The customer

Team H_2politO brings together students from across all the engineering disciplines at Politecnico di Torino in Turin, Italy. Since its inception in 2007, it has been sharing knowledge among the different engineering fields, closing the gap between academia and industry, and training the next generation of engineers for a sustainable future.

Customer situation and requirement

The team's current task is to take on the challenge of the Shell Eco-marathon program to design and build vehicles with extremely high energy efficiency. Building such efficient vehicles requires that everything be tested thoroughly, and the team turned to Rohde&Schwarz for the test and measurement expertise.

The Shell Eco-marathon has been one of the world's leading student engineering competitions for 35 years running. For the competition, the H_2politO team has built five hydrogen-powered prototype vehicles, one ICE urban concept and two hybrid urban concept vehicles.

To help reach the goal of high energy efficiency, the H_2politO team selected the R&S®Scope Rider RTH handheld oscilloscope to monitor the controller area network (CAN) bus and debug the H_2politO telemetry board.

The Rohde&Schwarz solution combines the unique demands on the instrument in this competition: precision measurements achieved with a solution featuring small size and portability, rugged construction and fast operation.

A strong need for on-point debugging

A dedicated part of the testing process before the race focuses on the vehicle communications systems that gather and transmit data to the pilot and the strategy division in charge of simulating and optimizing all aspects of the vehicle. The telemetry system relies on a cellular module that communicates with a specific microcontroller and peripherals via serial communication, while the sensors use a CAN bus in the car.

Standard measurement equipment either lacked the required functionality or portability – or both – to achieve proper timing, clear communications, and the capability to fix problems both on the track and in the laboratory.

The Rohde&Schwarz solution – a perfect match

After consulting with the channel sales engineer at Rohde&Schwarz Italy, the H_2politO team was convinced that the R&S®Scope Rider RTH was the only solution suited to the unique T&M tasks required. The team needed a solution that was both highly portable and powerful enough to perform measurements quickly. In addition to researching the solutions available on the market, the team also considered advice from Würth, an electronics company connected to motor sports that recommended the R&S®Scope Rider RTH. The Rohde&Schwarz solution also offers special analysis functions for automotive applications to provide additional testing features.

R&S®SCOPE RIDER RTH

- Fast and high performance in a portable size
- Bandwidth: 60 MHz to 500 MHz
- Sample rate: up to 5 Gsample/s
- Memory depth: up to 500 ksample, 50 Msample segmented memory

> "The R&S®Scope Rider RTH enabled full monitoring of all communications between our microcontroller and our cellular module, reducing the time for prototyping the telemetry system. In addition, the ability to take snapshots of all measurement data at the press of a button simplified and enriched our documentation for years to come."
>
> Marco Pascarella, Electronic Division Manager, H_2politO

CAN bus and remote control

The Team H_2politO design uses a CAN bus for powertrain communications. Once the messages were displayed on the screen, the component parts of each of them could be clearly seen. With this information, the team was able to adjust the timing of the engine and monitor all of the boards in the car. This helped the team to spot and fix a problem in the packet's structure that was compromising the data stream during the data logging phase. In addition, the remote-control function of the R&S®Scope Rider RTH allowed the team to maximize the efficiency of the whole process, while students worked concurrently on the car and the firmware.

High performance on the track, in the lab and in training

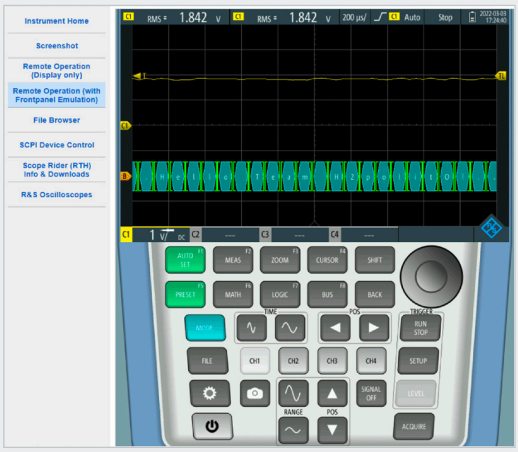
The R&S®Scope Rider RTH enabled the team to implement well-displayed serial decoding and triggering of UART, SPI and CAN protocols in their testing routines. In addition, the solution helped the team reduce the power consumption of their vehicles by enabling them to monitor even the smallest signals. The 10 bit A/D resolution and high-speed acquisition system of the R&S®Scope Rider RTH enabled the H_2politO team to spot the slightest error, even in the middle of the race.

An additional benefit of the R&S®Scope Rider RTH was its K201 web interface remote control option that allowed the team to work simultaneously on the oscilloscope and the computer. The ability to work simultaneously in the laboratory and on the track saved the team a considerable amount of time.

The R&S®Scope Rider RTH has a fully digital trigger and decoding unit with a sampling rate of 1.25 Gsample/s. This made it possible to easily decode serial protocols even when very slow time domain signals were displayed at the same time.

Their experience with the R&S®Scope Rider RTH confirmed for the H_2politO team that the solution was a perfect match for their task. Not only did it add value to measurements taken during the Shell Eco-marathon, but it has also proven to be a useful instrument for training. The team carries out regular training, and the ease of the operation combined with the intuitive UI of the R&S®Scope Rider RTH makes it the ideal instrument for this task as well. Consequently, the solution has become one of the core elements for the education of new team members.

Troubleshooting a CAN in the laboratory.



Telemetry testing with the R&S®Scope Rider RTH.

Service that adds value

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

Rohde&Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems and networks&cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Sustainable product design

- Environmental compatibility and eco-footprint
- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

Rohde&Schwarz training

www.training.rohde-schwarz.com

Rohde&Schwarz customer support

www.rohde-schwarz.com/support

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