

Averna builds Record & Playback System for Car Radio and GPS System Testing based on PXI Technology

by

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The Challenge:

IAV Automotive Engineering Inc., a Michigan-based company that tests and validates car radios and GPS receivers for the world's top automakers, needed a way to gain reproducibility and repeatability for RF signal testing, a solution that would help them curb time-consuming and costly field testing as well as further improve device quality.

The Solution:

Averna created a turnkey system that records real-world RF signals, impairments and environmental data for convenient playback in the lab at any time, and that is built using high-bandwidth PXI products. Averna is helping IAV to build a custom reference library for long-term test efficiency.

Delivering Quality to Automakers with the Highest Standards

IAV, with its international headquarters in Germany, is one of the leading engineering and design providers to the automotive industry. One of the company's recent projects involves testing and validating in-vehicle radio and navigation systems for one of Germany's leading car manufacturers.

IAV must perform thorough RF signal testing on these devices for all common analog and digital broadcast standards in Europe, including AM/FM, RDS, TMC, DAB/DMB, GPS, and HD Radio™ (IBOC). They must test these signals on a number of device models with a wide variety of functions and for diverse types of radio programming — rock, jazz, classical, talk radio, etc. Further complicating the matter, these devices must be tested in a panoply of environmental and driving conditions throughout Europe, from a sunny day in downtown London to a snowy night on winding roads in the French Alps.

To meet the rigorous specifications of their customers, IAV must ensure top-notch quality in the face of these thousands of possible test cases.

The Search for Reproducible and Repeatable Methods

As part of this evaluation, IAV first performs static test and validation in the lab using a typical signal generator to measure metrics such as threshold, sensitivity, and signal-to-noise. However, many problematic RF signal behaviors can only be experienced in a dynamic environment — in a moving vehicle. These impairments include, for example, multipath interference that occurs when a signal bounces off city skyscrapers, or weather-related fading and distortion due to fog and rain. Mathematical models and test file libraries fall short in emulating these degradations.

As a result, IAV has been sending dozens of “expert listeners” on the road every year to detect signal glitches for every possible test case. However, because this method offers no reproducibility — test engineers were required to travel every time, for every radio model and every signal — this was becoming time-consuming and costly.

IAV needed to assemble a library of comparison points to help them evaluate different devices 1) under the same signal with different conditions, and 2) under different signals with the same conditions, as well as other permutations. In short, they needed repeatability in order to make their test and validation operations as efficient as possible.

Gaining Record & Playback Capability with NI PXI

IAV turned to Avera to help them meet these challenges. They purchased the RF Signal Record & Playback System, a turnkey solution for recording real-world signals and playing them back at will for laboratory analysis, part of Avera’s URT™ (Universal Receiver Tester) platform (see Figure 1).



Figure 1 – Record and Playback of RF Signals with High-Bandwidth NI PXI Products

The Record & Playback System is built on the strength of PXI and PXI Express products (NI PXIe-1065 Chassis, NI PXIe-8106, NI PXIe-5672, NI PXI-5661). These key technologies offer up to 2 GB/s dedicated per-slot bandwidth for real-time data streaming from the RF module to the hard drive, as well as high-performance timing and synchronization capabilities. In addition, the software components were created using the flexibility of LabVIEW 8.5. Avera packaged the system for mobile use in an RF shielded box that prevents noise and interference. It ships with a DC/AC converter, a pre-amplifier system to optimize recordings with Automatic Gain Control (AGC), and multimedia recording capabilities. In short, using off-the-shelf components from NI, Avera has put together a

reliable, turnkey system that the customer can use from day 1, already assembled and with no application software development required (see Figures 2-3).

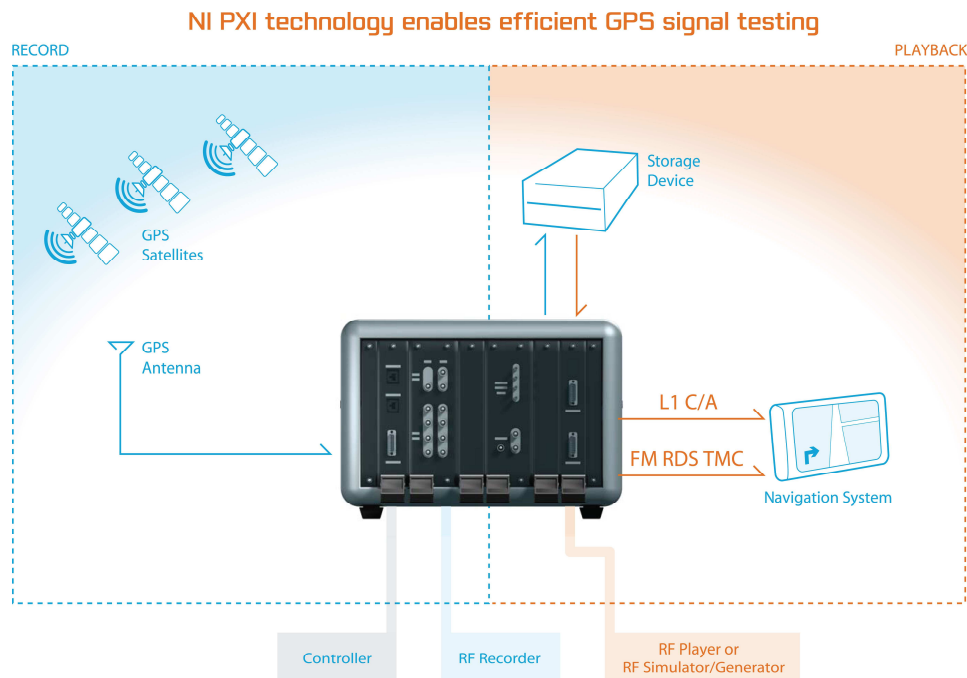


Figure 2 – NI PXI Technology Enables Efficient GPS Signal Testing



Figure 3 – RF Shielded Box Protects against Interference

Building a Custom RF Test Signal Library

Engineers at IAV are able to take the Record & Playback System on test drives in the trunk or backseat of a vehicle, with the DC power supply connected to the vehicle's battery. Once the antenna is connected to the system, test engineers access the GUI through a laptop (and LAN connection) to control signal frequency, bandwidth, and amplification while recording a dynamic signal. IAV uses this method to record a variety of radio and navigation signals, as they build their proprietary test file library for convenient playback at any time.

To enrich this library even further, IAV records video and GPS data to capture the environmental context affecting the signal(s). Where exactly was the vehicle when the impairment occurred, and what were the precise weather and road conditions?

Because IAV engineers do not need to perform as much field testing as they used to, the time saved can now be invested into further improving device quality by subjecting the devices to a larger number of real-world signals and impairments — in a condensed period of time.

Troubleshooting Made Easy

With the Record & Playback System, IAV can now share recorded data instantly with device manufacturers, component manufacturers and automakers, so that all parties can troubleshoot in-vehicle radio and navigation devices with identical signals, impairments, and environmental contexts to find the source of the problem. In this way, devices can be troubleshot remotely by those responsible for product quality.

Conclusion

“When you’re dealing with the most prestigious automakers in the world, quality is of the utmost concern,” said Hans-Joachim Tepper, Test Engineer at IAV. “The high-throughput RF streaming capabilities of NI PXI technology has made it efficient for us to record and play back all common analog and broadcast signals in use today, including AM/FM, GPS and HD Radio™ (IBOC), as well as a stunning range of impairments. The URT Record and Playback System by Avera was instrumental in packaging those capabilities, and giving us the repeatability we needed to meet the exacting standards of our customers. We are confident that this solution will help us to significantly improve our long-term test efficiency.”