Per Vices Corporation

CASE STUDY

Per Vices SDRs for GPS/GNSS Simulation

PROJECT OVERVIEW/GOALS

To develop a custom platform to meet the strict RF performance requirements associated with the simulation of hostile environments for GPS effectiveness testing.

CHALLENGE

This project had a combination of high performance RF and digital requirements for testing of both high and low power signals across multiple GPS bands.

SOLUTION

The final solution consisted of a new hardware design which enabled up to 16 transmit radio channels to be used with custom filtering to meet the performance requirements associated with the project. In addition, the solution combined both high power and low power signal outputs to be transmitted over the same radio port (SMA).

STEPS TAKEN

The customer first worked with our stock Crimson TNG platform to validate the performance of a 4 channel system. The next step was working with us to optimize some of the RF performance on the Crimson TNG platform to ensure we could meet the project's objectives, and the final step was for us to design a new system to meet all of the objectives.

WHY PER VICES

The customer was evaluating different options but ultimately chose Per Vices as the preferred designer and manufacturer for this project. This decision was made due to the following major factors:

- **Performance:** we demonstrated our ability to meet the very aggressive RF performance requirements

- **Risk Management:** the availability of a COTS product allowed the customer to have the project proceed with each stage incrementally while validating performance

- **Communication:** each step of the way we provided fast and effective communication between both parties' engineering and purchasing teams

- **Complexity:** we provided a reduction in supply chain complexity by having only one supplier as opposed to 100s

CUSTOMER SAVES

$4M+

in development costs

48 months

in development time

"I was profoundly impressed with the unit... again I was blown away. There is no doubt: we purchased the right system."

- Senior Engineer

CHALLENGE AND SOLUTION

The customer requirements resulted in Per Vices coming up with a new, performance focused, hardware design to deliver a high channel count transmitter with aggressive channel masking and very high dynamic range for use across the L1 and L2 GPS bands. The solution consisted of both hardware and firmware.

HARDWARE
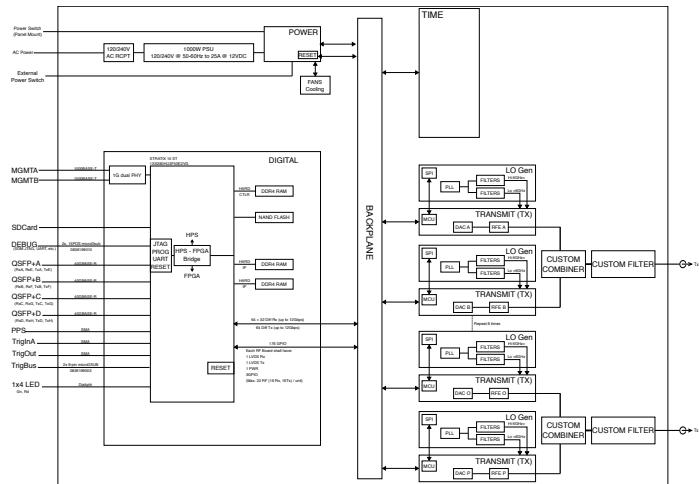
From a hardware perspective, we needed to undertake activities for designing a new architecture to support the operation of up to 16 radio chains, combine radio chain pairs to give 8 outputs (each having high and low power outputs over the same SMA), the digital resources to process 16 radio chains, and the ability to accommodate custom filtering to meet the objectives (Figure 1). This additional hardware was necessary to meet the performance figures the customer required, including those associated with:

- channel count
- bandwidth
- phase coherency
- phase skew
- amplitude skew
- channel-to-channel isolation
- spurious free dynamic range
- spectrum profile/output power mask

Figure 1.

As part of the work, we designed a suitable architecture while working closely with manufacturers to ensure the best components were selected for performance and longevity, ran simulations to validate the design and expected RF performance, completed the schematics, layout, and manufacturing activities for the the new product.
The end hardware solution met all requirements while offering the best performance and a number of test suites for the customer to validate overall performance.

NEAR THEORETICAL MAXIMUMS REACHED

FIRMWARE

As part of the project we needed to incorporate and extend our existing IP to support the higher channel counts, bandwidth, and new digital interface. We also worked closely with the customer to ensure the end solution was easy to integrate and interface with their existing equipment.

HOW WAS IT ACCOMPLISHED?

After all NDAs were put in place, we had discussions with the customer about their specific requirements in a very timely manner. We entered into a proof of concept contract to make changes to our

Crimson TNG platform in order to demonstrate our ability to meet the phase coherency, phase skew, and amplitude skew requirements the customer needed from the platform. Following the proof of concept contract, we entered into a full integration contract in which we designed the new system including hardware, firmware, and software to meet the complete RF and digital requirements.
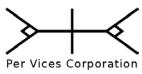
ACTIVITIES COMPLETED

HARDWARE/FIRMWARE	COMMUNICATION
Designed a new system while re-using our existing IP to deliver the hardware meeting the customer requirements	Provided continuous communication to update the customer of the status of the project
Simulated performance based on component selection that would meet the customer objectives	Delivered on milestone objectives set at the start of the project
Completed a new mechanical design to accommodate customer's physical requirements and locations of inputs and outputs	Worked closely with our supply chain to ensure components selected were not nearing end of life (EOL), ensured full traceability on all components used, and ensured we could have custom filters developed to meet the requirements for this project
Integrated the new hardware and firmware together	Managed the manufacturing activities associated with the new system
Performed all testing and validation of the new design	Shipped to customer with on site support for setup, operation, and integration

WHY WAS PER VICES SELECTED?

Although there were 4 major factors that led to the customer selecting Per Vices, there were also many other reasons why we were selected.

• Performance: in addition to offering the best performance SDRs available in each class, we also have the expertise to design out even higher performance systems as required by our customers. This project was no exception, as we were able to have the customer start working with our Crimson TNG platform to validate the performance of our systems while we leveraged our existing knowledge and IP to develop a solution meeting their strict requirements.

• Path for reducing risk: in addition to the high performance of the product, we also worked with the customer to reduce risk by continuously providing small developments to demonstrate the next step in the proof of concept (POC); allowing the customer to become familiar with working with our company. This ultimately led to full confidence in our ability to hit the requirements on time and within the quoted budget.

- Quick responses and communication: not only during the initial conversations did we provide clear, concise, and quick responses to the questions asked but we provided regular updates throughout the course of each project. In addition, we were transparent on the pricing, expectations, timelines, and milestones which were communicated through a formal statement of work.

- Lower costs and faster time to market: we were able to save a considerable amount of development time and costs by having the customer first start working with our stock products and then using our expertise in designing systems to meet the system requirements. The re-use of existing IP also allowed for a fast turn around time and lower overall project costs as the customer was able to benefit from our economies of scale.

- Reduction in supply chain complexity: acting as a single vendor of a system that replaced hundreds of components, the customer saved a considerable amount of time and logistical complexity by only needing to order and source the components through a single vendor: us. We further reduced complexity by ensuring all goods are manufactured in Canada and with features that ensure it is not a controlled good, thus not being restricted in our ability to export to the customer.

Do you have an upcoming project with demanding RF and digital requirements?

Let us know and we may be able to help. We have done this for many customers and can usually help you **save time, costs, and reduce the overall complexity** of your system and your supply chain.

More information is available at www.pervices.com.
If you have any questions, please contact us at solutions@pervices.com.