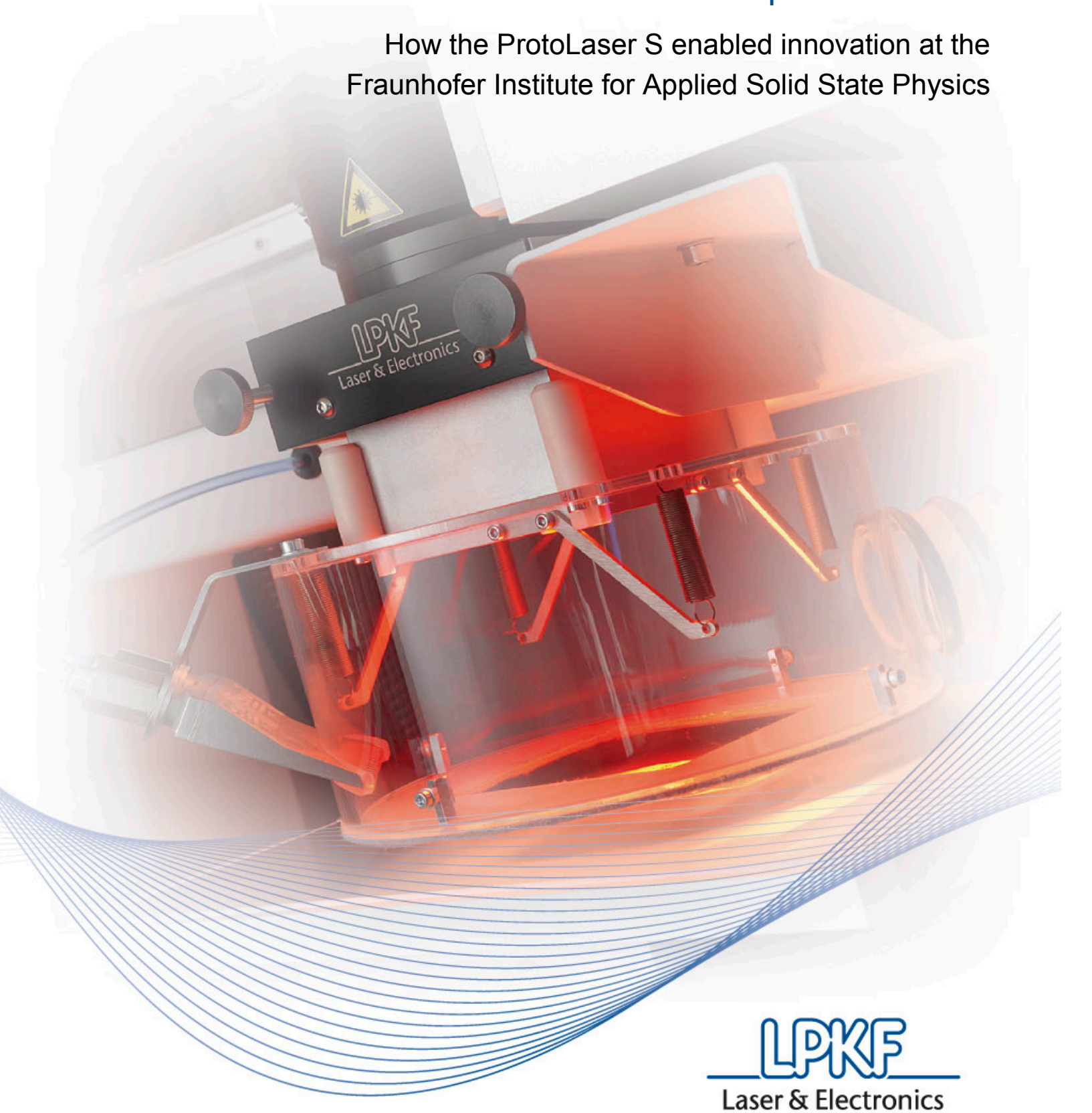
Closing the Terahertz Gap at the Speed of Laser

How the ProtoLaser S enabled innovation at the Fraunhofer Institute for Applied Solid State Physics



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For many years, the terahertz range was something akin to an episode of *The Outer Limits*. Directly between the microwave and infrared spectrums lurked this mysterious electromagnetic range that was capable of reading organic "fingerprints" and, due to its non-ionizing status, registering medical imagery without the damaging effects caused by X-rays. Yet despite its potential, so little was known about how to utilize the terahertz range that it became known simply as the terahertz *gap*.

Seeking to close this gap, research organizations across the globe have begun in recent years to scratch the surface of what is possible with the terahertz range. One of the leading organizations in this quest is the Fraunhofer Institute for Applied Solid State Physics.

The Fraunhofer Institute, which is named after nineteenth century German physicist Joseph von Fraunhofer, has made waves in its research of the terahertz range, specifically when it comes to the development of chips for ultrahigh frequencies in excess of 300 gigahertz. Such chips are able to produce radiation in the terahertz range, opening the door for applications in the industrial metrology, safety engineering, and environmental survey fields.

As an industry-centric research organization, the Fraunhofer Institute branches beyond the theoretical when it comes to terahertz applications, seeking solutions that can be implemented in real-world production environments. In order to measure this type of functionality, chips are tested under production-representative power requirements and thermal conditions. Tests include endurance testing and testing for optimal configuration.

The technological feat of producing terahertz radiation combined with advanced testing measures imposes demanding standards on the research environment. One, sufficient fabrication technologies must be in place in order to produce the chips. Two, quick turnaround is required to keep up with the testing schedule. In order to meet these standards and close the gap, the Fraunhofer Institute needed a better option than outsourcing its terahertz work.

After researching options, the Fraunhofer Institute turned to the ProtoLaser S by LPKF Laser & Electronics. The ProtoLaser S is a lab-ready IR laser system capable of processing a wide variety of materials at the highest of speeds. Designed specifically for prototyping and small production runs, the ProtoLaser S has enabled the Fraunhofer Institute to work on the right materials while staying far ahead of testing deadlines.

Michael Kuri, an engineer specializing in combining RF semiconductors with circuit carrier systems, says of the switch to the ProtoLaser S, "In-house prototyping facilitates several iteration cycles per day and production on demand." Indeed, as what used to take the Fraunhofer Institute three days now takes a mere two *minutes*.

The ProtoLaser S uses a patented process to etch design wiring onto circuits. A quick scan of materials processed by the ProtoLaser S reveals nearly every material one could image: FR4, aluminum-coated PET films, TMM, RT/Duroid, PTFE, and ceramic substrates. On the latter, the ProtoLaser S reaches unmatched precision in circuit board processing, etching conductive traces as small as 50 µm (2 mil) and track spaces as small as 25 µm (1 mil).

In the case of the Fraunhofer Institute, the technological capabilities of the ProtoLaser S were used to fabricate a number of applications, including those in the terahertz range. One of these was a four channel intermediate frequency (IF) amplifier for a 94 GHz radar module (Figure 1).

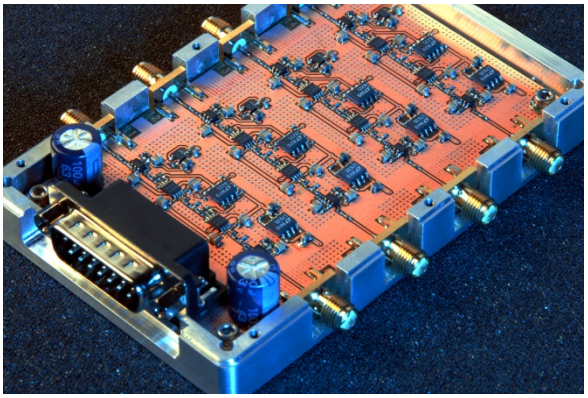

Figure 1: Four channel IF amplifier

Another application was the production of a 15 GHz voltage controlled oscillator (VCO) for a multiplexer that generates signals in the 90GHz range. This application in particular displays the remarkable benefits the ProtoLaser S provides to the testing environment, as multiple iterations were required before the circuit was production-ready. Figure 2 displays a test board on the left and the finished circuit on the right.

Figure 2: 15 GHz VCO

For the Fraunhofer Institute, the ProtoLaser S was the perfect fit. Providing accurate, versatile processing technology while prototyping at the speed of laser, the ProtoLaser S has enabled the Fraunhofer Institute to make its mark on closing the terahertz gap.

About the Fraunhofer Institute

Founded in 1957, the Fraunhofer Institute for Applied Solid State Physics is part of Europe's largest application-oriented research organization. Located in Freiburg, Germany, the institute focuses on researching and developing micro and optoelectronic circuits, modules, and systems. Around 240 employees research and develop applications in the safety, communications, environmental, and medical technology fields.

For more information on the Fraunhofer Institute, visit http://www.iaf.fraunhofer.de/en.html or call +49 (761) 159-458

About LPKF Laser & Electronics

Established in 1976, LPKF Laser & Electronics manufactures machines and laser systems used in circuit board and microelectronics fabrication, medical technology, the automotive sector, and the production of solar cells. Around 20 percent of the workforce is engaged in research and development.

For more information on the ProtoLaser S or other LPKF systems, visit www.lpkfusa.com or call 503-454-4200.