Breakthrough for post-4G communications

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(PhysOrg.com) -- With much of the mobile world yet to migrate to 3G mobile communications, let alone 4G, European researchers are already working on a new technology able to deliver data wirelessly up to 12.5Gb/s.

The technology - known as 'millimetre (mm)-wave' or microwave photonics - has commercial applications not just in telecommunications (access and in-house networks) but also in instrumentation, radar, security, radio astronomy and other fields.

Despite the quantum leap in performance made possible by combining the latest radio and optics technologies to produce mm-wave components, it will probably only be a few years before there are real benefits for the average EU citizen.

This is thanks to research and development work being done by the EU-funded project IPHOBAC, which brings together partners from both academia and industry with the aim of developing a new class of components and systems for mm-wave applications.

The mm-wave band is the extremely high frequency part of the radio spectrum, from 30 to 300 gigahertz (GHz), and it gets it name from having a wavelength of one to 10mm. Until now, the band has been largely undeveloped, so the new technology makes available for exploitation more of the scarce and much-in-demand spectrum.

IPHOBAC is not simply a 'paper project' where the technology is

researched, but very much a practical exercise to develop and commercialise a new class of products with a ‘made in Europe’ label on them.

While several companies in Japan and the USA have been working on merging optical and radio frequency technologies, IPHOBAC is the world’s first fully integrated effort in the field, with a lot of different companies involved. This has resulted in the three-year project, which runs until end-2009, already having an impressive list of achievements to its name.

It recently unveiled a tiny component, a transmitter able to transmit a continuous signal not only through the entire mm-wave band but beyond. Its full range is 30 to 325GHz and even higher frequency operation is now under investigation. The first component worldwide able to deliver that range of performance, it will be used in both communications and radar systems. Other components developed by the project include 110GHz modulators, 110GHz photodetectors, 300GHz dual-mode lasers, 60GHz mode-locked lasers, and 60GHz transceivers.

Truly disruptive technology

Project coordinator Andreas Stöhr says millimetre-wave photonics is a truly disruptive technology for high frequency applications. “It offers unique capabilities such as ultra-wide tunability and low-phase noise which are not possible with competing technologies, such as electronics,” he says.

What this will mean in practical terms is not only ultra-fast wireless data transfer over telecommunications networks, but also a whole range of new applications (www.iphobac-survey.org).

One of these, a 60GHz Photonic Wireless System, was demonstrated at

the ICT 2008 exhibition in Lyon and was voted into the Top Ten Best exhibits. The system allows wireless connectivity in full high definition (HD) between devices in the home, such as a set-top box, TV, PC, and mobile devices. It is the first home area network to demonstrate the speeds necessary for full wireless HD of up to 3Gb/s.

The system can also be used to provide multi-camera coverage of live events in HD. “There is no time to compress the signal as the director needs to see live feed from every camera to decide which picture to use, and ours is the only technology which can deliver fast enough data rates to transmit uncompressed HD video/audio signals,” says Stöhr.

The same technology has been demonstrated for access telecom networks and has delivered world record data rates of up to 12.5Gb/s over short- to medium-range wireless spans, or 1500 times the speed of upcoming 4G mobile networks.

One way in which the technology can be deployed in the relatively short term, according to Stöhr, is wirelessly supporting very fast broadband to remote areas. “You can have your fibre in the ground delivering 10Gb/s but we can deliver this by air to remote areas where there is no fibre or to bridge gaps in fibre networks,” he says.

Systems for outer space

The project is also developing systems for space applications, working with the European Space Agency. Stöhr said he could not reveal details as this has not yet been made public, save to say the systems will operate in the 100GHz band and are needed immediately.

There are various ongoing co-operation projects with industry to commercialise the components and systems, and some components are already at a pre-commercial stage and are being sold in limited numbers.

There are also ongoing talks with some of the biggest names in telecommunications, including Siemens, Ericsson, Thales Communications and Malaysia Telecom.

“In just a few years time everybody will be able to see the results of the IPHOBAC project in telecommunications, in the home, in radio astronomy and in space. It is a completely new technology which will be used in many applications even medical ones where mm-wave devices to detect skin cancer are under investigation,” says Stöhr.

More information: IPHOBAC project: www.ist-iphobac.org/

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