

General Information

Optical Millimetre-Wave Generation

**Pushing the
Boundary of
Millimetre-Wave
Photonic
Components
and Systems**

Contact

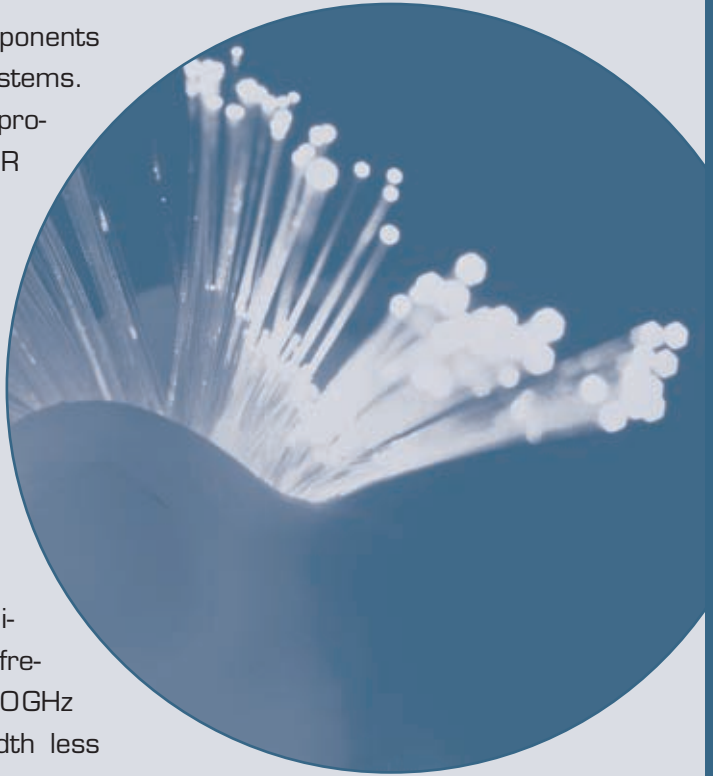
Lasers

Modulators and Detectors

Millimetre-Wave Photonic Generation

Diode lasers are key components for almost all photonic systems. Within IPHOBAC it will be proven that sophisticated DBR and DFB semiconductor lasers are capable of generating spectrally pure mm-wave signals up to ultra high frequencies. In particular, IPHOBAC will develop:

- Integrated quantum-dot based mode-locked lasers, generating millimetre-wave signals at frequencies in excess of 60GHz with a spectral linewidth less than 10kHz.



- Integrated dual-mode lasers with a frequency tuning range from 10 to 300GHz and a low spectral linewidth of about 1 MHz.

Both types of lasers have the possibility to allow external modulation within an Optical Phase Locked Loop (OPLL) to further reduce phase noise.

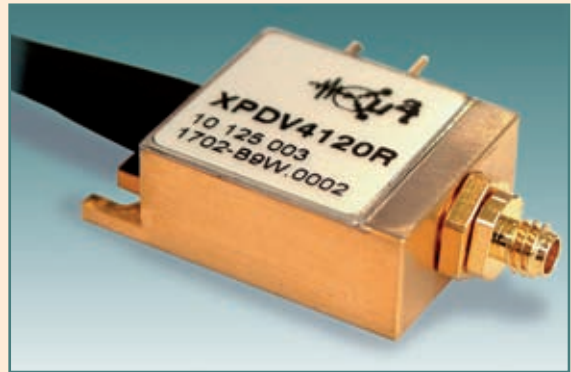


Advanced High-Power Millimetre-Wave Photodiodes and Millimetre-Wave Modulators

One of the ambitious goals of the European IPHOBAC project is the development of millimetre-wave high-power photodiode and modulator modules for communications, security/radar and instrumentation applications. The activities are well balanced between technological chip fabrication and new package developments.

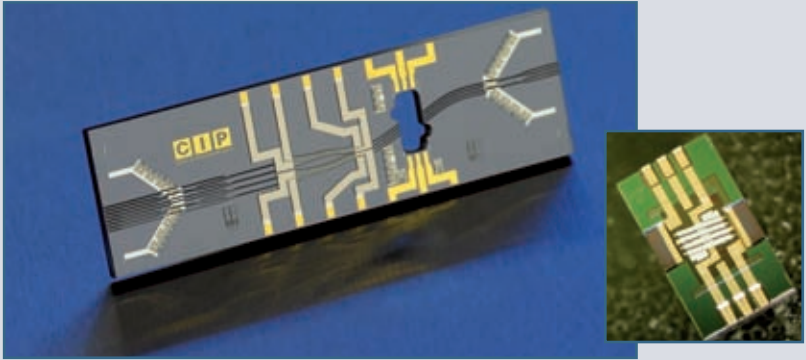
IPHOBAC will provide photodiode and modulator chips & modules for different frequency ranges: broadband (DC-110GHz), narrow-band (55-65GHz & 75-110GHz) as well as wide-band (30-300GHz) operation. Some details are listed below:

- Broadband (DC-110GHz) and high-output power (>0dBm) photodiode modules using a fibre-optic package with w1-coaxial output connectors and integrated bias-T. Prototypes are already available!
- Narrow-band antenna integrated photomixers for operation at around 60GHz and WR10 coupled photodiodes for 75-110GHz operation.



- Ultra-wideband (30-300GHz) photomixer modules with integrated planar antennas. The PD chips are mounted in novel fibre-optic packages providing wideband quasi-optical millimetre-wave radiation.
- Reflective 60GHz picocell transceivers with integrated optical amplifier to boost both the received and transmitted optical signals.
- Broadband optical transmitter modules for mm-wave signals up to 100GHz consisting of a high power DFB laser with 1.55 μ m wavelength and an integrated ultra-high speed electro-absorption modulator.

Integrated Photonic Functions



IPHOBAC is investigating mm-wave photonic system functions that can be achieved using combinations of the developed components. These photonic functions will be demonstrated either through the use of hybrid integration offering a route towards low cost miniaturisation or by laboratory bench demonstration.

Some of these objectives are:

- To develop an integrated widely tuneable (up to 300GHz) optically generated mm-wave source.
- To develop a semi-integrated optical injection phase locked loop for high mm-wave signal purity.
- To validate experimentally 10Gbit/s QPSK vectorial modulation and demodulation using IPHOBAC components.
- To validate experimentally a broadband 1 Gb/s ultra-wide-band (UWB) link operating at 60GHz using IPHOBAC components.

European Leadership in Millimetre-Wave Photonics

IPHOBAC, a 3 years European integrated project, is developing innovative photonic components and integrated functions for millimetre-wave applications in the fields of communications, instrumentation and security.

IPHOBAC's innovative approaches form the basis for a new class of advanced and very compact photonic solutions, including highly stable, spectrally pure millimetre-wave sources, ultra-wide tunable millimetre-wave sources (10GHz-300GHz) or ultra-wideband millimetre-wave transmitters (110GHz). Also individual millimetre-wave photonic components including broadband ($f_{3dB} > 80\text{GHz}$) or high-frequency (W-band) photodetectors, as well as transducers for 60GHz duplex communication and vectorial modulation/demodulation schemes for 10Gb/s wireless transmission are currently being developed.

IPHOBAC integrates a chain of European partners contributing to the development and the commercialisation of such advanced millimetre-wave photonic components and functions:

- Universität Duisburg-Essen (DE),
- Thales Systemes Aeroportes (FR),
- Alcatel Thales III-V Lab (FR),
- Kista Photonics Research Center (SE),
- Centre National de Recherche Scientifique – IEMN (FR),
- France Telecom Recherche (FR),
- u²t Photonics AG (DE),
- Centre for Integrated Photonics (GB),
- University College London (GB),
- Universidad Politécnica de Valencia (ES),
- University of Ljubljana (SI).





IPHOBAC

**Integrated Photonic mm-Wave Functions
For Broadband Connectivity**

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