

PUBLIC RELEASE: 18-FEB-2019

# Gearing up for 5G: A miniature, low-cost transceiver for fast, reliable communications

TOKYO INSTITUTE OF TECHNOLOGY



Researchers at Tokyo Institute of Technology (Tokyo Tech) have designed a 28 GHz transceiver that integrates beamforming[1] with dual-polarized multiple-input and multiple-output (MIMO[2]) technology. Measuring just 3 mm by 4 mm, this tiny transceiver could help improve performances of fifth-generation cellular network (5G) and Internet of Things (IoT) devices.

A team of researchers led by Kenichi Okada at Tokyo Tech's Department of Electrical and Electronic Engineering has devised a strategy with a clear eye on supporting high-speed mobile data access using the millimeter-wave spectrum for 5G, the highly-anticipated wireless network of the near future.

Their proposed 28-GHz transceiver combines beamforming, a very efficient signal processing method, with dual-polarized MIMO capabilities, meaning that its array of antennas can respond to both horizontal and vertical radio waves at the same time.

Preliminary testing showed that the maximum data rate achieved was 15 gigabits per second (Gb/s) in the 64-QAM format. This data rate is 25 percent higher than that achieved by previous comparable models.

As a continuation of Okada and his group's work on developing top-level transceivers using minimal components, the researchers achieved a design that fits into an area measuring just 3 mm by 4 mm, which is around half the size achieved to date. The smaller the chip, the better for 5G, owing to the anticipated demand for high-performance, area-efficient transceivers for use in tiny and portable sensors and devices.

"Compared with the conventional switch-based bi-directional approach, our bi-directional amplifier completely shares the inter-stage matching networks between the transceiver and the receiver. Thus, the required on-chip area is further minimized," Okada explains.

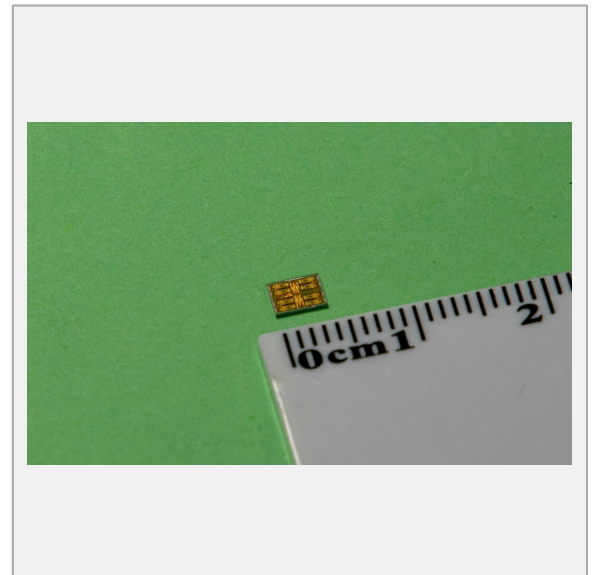


IMAGE: THE PROPOSED CHIP, FABRICATED IN A STANDARD 65-NANOMETER CMOS PROCESS, TAKES UP A TOTAL AREA OF JUST 12 MM<sup>2</sup>. [view more](#) ☰

CREDIT: ATSUSHI SHIRANE

Japan is currently stepping up efforts to prepare for 5G ahead of the Tokyo 2020 Olympic and Paralympic Games. There are big hopes for 5G services to enable higher data throughput for applications such as live-streaming high-definition (HD) video and for potentially trillions of new IoT devices that can share data around the clock, as well as to increase the speed and responsiveness of communication networks overall.

The research was partially supported by SCOPE, an initiative led by Japan's Ministry of Internal Affairs and Communications that focuses on promoting innovations in information and communication technologies.

Further details of the study are being presented as part of the 4G/5G Transceivers Session at the 2019 International Solid-State Circuits Conference (ISSCC) to be held in San Francisco from 17 to 21 February 2019.

###

#### Technical terms

[1] Beamforming: A signal processing technique that involves "pointing" antenna arrays in optimal directions.

[2] MIMO: A technology that utilizes multiple antennas at both ends of the transceiver (transmitter and receiver) to boost data rates.

#### Related links

New 28-GHz transceiver paves the way for future 5G devices <https://www.titech.ac.jp/english/news/2018/041732.html>

Kenichi Okada - Wiring the world wirelessly | Tokyo Tech Research Story [https://www.titech.ac.jp/english/research/stories/faces8\\_okada.html](https://www.titech.ac.jp/english/research/stories/faces8_okada.html)

Disclaimer: AAAS and EurekAlert! are not responsible for the accuracy of news releases posted to EurekAlert! by contributing institutions or for the use of any information through the EurekAlert system.



#### Media Contact

Emiko Kawaguchi  
[media@jim.titech.ac.jp](mailto:media@jim.titech.ac.jp)  
81-357-342-975

<http://www.titech.ac.jp/english/index.html>

#### More on this News Release

Gearing up for 5G: A miniature, low-cost transceiver for fast, reliable communications

TOKYO INSTITUTE OF TECHNOLOGY

#### FUNDER

Japan's Ministry of Internal Affairs and Communications

## KEYWORDS

---

ELECTRICAL ENGINEERING/ELECTRONICS

INDUSTRIAL ENGINEERING/CHEMISTRY

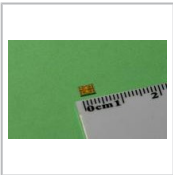
INTERNET

TECHNOLOGY/ENGINEERING/COMPUTER SCIENCE

TELECOMMUNICATIONS

## MULTIMEDIA

---



The New Transceiver Measures Only 3mm X 4mm  
(IMAGE)

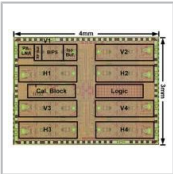
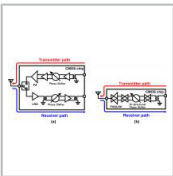


Image of the New Transceiver Designed for 5G  
(IMAGE)



The Conventional Transceiver Structure  
(IMAGE)

## ORIGINAL SOURCE

---

<https://www.titech.ac.jp/english/news/2019/043432.html>

## RELATED JOURNAL ARTICLE

---

<http://dx.doi.org/10.1109/ISSCC.2019.8662324>

### More in Technology & Engineering

- Pitt and CMU researchers discover how the brain changes when mastering a new skill**  
UNIVERSITY OF PITTSBURGH
- How cryptocurrency discussions spread**  
DOE/PACIFIC NORTHWEST NATIONAL LABORATORY
- Antennas of flexible nanotube films an alternative for electronics**  
RICE UNIVERSITY

▮ **Researchers 'stretch' the ability of 2D materials to change technology**  
UNIVERSITY OF ROCHESTER

[View all in Technology & Engineering ▮](#)

### Trending News Releases

▮ **Ancient DNA from Roman and medieval grape seeds reveal ancestry of wine making**  
UNIVERSITY OF YORK

▮ **Mysterious holes in Antarctic sea ice explained by years of robotic data**  
UNIVERSITY OF WASHINGTON

▮ **Personality traits of drug users**  
UNIVERSITY OF LEICESTER

▮ **Mountain-dwellers can adapt to melting glaciers without caring about climate change**  
EARTH INSTITUTE AT COLUMBIA UNIVERSITY

[View all latest news releases ▮](#)



▮ [Latest News Releases RSS Feed](#)

▮ [All EurekAlert! RSS Feeds](#)

▮ [@EurekAlert](#)

▮ [facebook.com/EurekAlert](#)

---

[Help / FAQ](#)

[Disclaimer](#)

[Privacy Policy](#)

[Terms & Conditions](#)

[Contact EurekAlert!](#)

---

Copyright © 2019 by the American Association for the Advancement of Science (AAAS)

