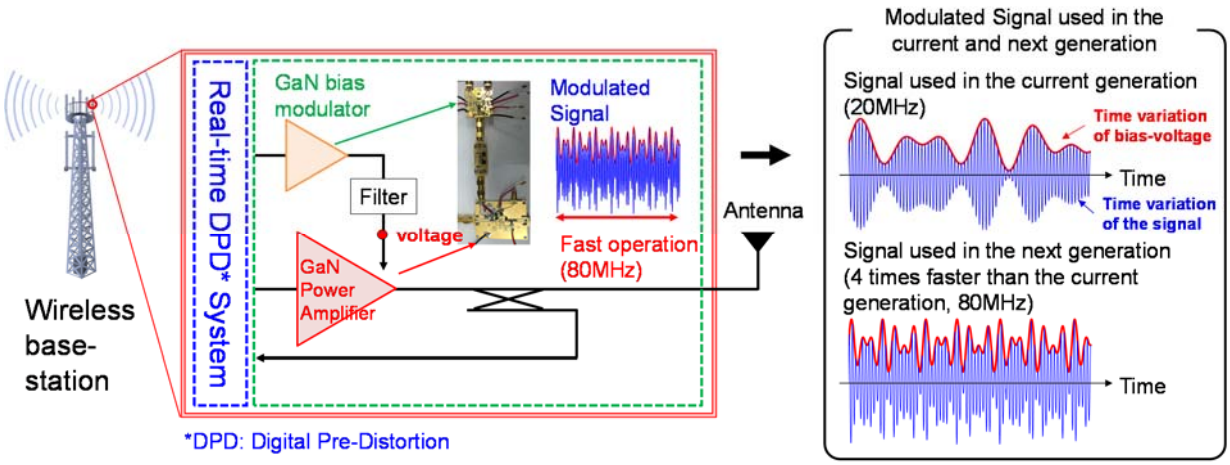
Mitsubishi Electric, Nokia Bell Labs, UC San Diego Develop World's First Ultra-Fast GaN Envelope-tracking Power Amplifier for Next-generation Wireless Base Stations

High-speed operation of envelope-tracking power amplifier will help reduce energy consumption of next-generation wireless base stations

TOKYO, May 19, 2017 – Mitsubishi Electric Corporation (TOKYO: 6503), Nokia Bell Labs and the Center for Wireless Communications at UC San Diego announced today their joint development of the world's first ultra-fast gallium nitride (GaN) envelope-tracking power amplifier, which supports modulation bandwidth up to 80MHz and is expected to reduce energy consumption in next-generation wireless base stations. Technical details will be presented during the IEEE MTT International Microwave Symposium (IMS) 2017, which will be held in Honolulu, Hawaii, USA from June 4 to 9.



Bias-controlled power amplifier in next-generation wireless base stations

To help meet the demand for increasing wireless capacity, mobile technologies are shifting to next-generation systems that use complex modulated signals with large peak-to-average power ratio (PAPR) and extra-wide modulation bandwidth. This will require power amplifiers to operate most of the time at backed-off power levels that are well below their saturation levels. Generally, power amplifiers achieve high efficiency near their saturation power levels, but significantly degraded efficiency at backed off levels, as in the case of 4G LTE* signals (>6dB PAPR). Envelope-tracking power amplifiers have been studied extensively as a means to enhance power-amplifier efficiency, but so far the supply-modulator circuit has been the bottleneck limiting modulation bandwidth for advanced wireless communications, such as LTE-Advanced.

The newly developed ultra-fast GaN envelope-tracking power amplifier achieves state-of-art performance thanks in part to Mitsubishi Electric's high-frequency GaN transistor technology and design innovation for the GaN supply-modulator circuit. Using Nokia Bell Labs' real-time digital pre-distortion (DPD) system, the

power amplifier has demonstrated efficient operation even with 80MHz modulated LTE signals, the world's widest modulation bandwidth for this purpose as of May 19, 2017.

Key Features

The new GaN envelope-tracking power amplifier uses Mitsubishi Electric high frequency GaN in supply-modulation circuits, which enable high-speed operation. The result is highly efficient amplification of complex signals with modulation bandwidth up to 80MHz, which is four times wider than the signals reportedly used in other envelope-tracking power amplifiers. The technology achieves a world-class drain efficiency of 41.6% in such wide-bandwidth operation, thereby reducing base-station energy consumption while increasing wireless communication speed and capacity.

Further, the real-time DPD system enables pre-distortion for wideband signals to correct the output signal from the power amplifier, resulting in an adjacent channel leakage ratio (ACLR) of -45dBc for LTE 80MHz signals, which satisfies the wireless communication standards.

In view of its leading system-level performance, the new envelope-tracking power amplifier is believed to be a highly promising candidate for next-generation wireless base stations.

Specifications

Ultra-Fast, Wideband GaN Envelope-tracking Power Amplifier				
Carrier Frequency	Output Power	Drain Efficiency	ACLR	Modulation Signal
0.9–2.15GHz	30–30.7dBm	36.5–41.6%	-45dBc	80MHz LTE Advanced 6.5dB PAPR

**LTE is a trademark of European Telecommunications Standards Institute (ETSI)*

Inquiries

Customer Inquiries

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About Mitsubishi Electric Corporation

With over 90 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded consolidated group sales of 4,238.6 billion yen (US$ 37.8 billion*) in the fiscal year ended March 31, 2017. For more information visit:
www.MitsubishiElectric.com
*At an exchange rate of 112 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2017

About Nokia

Nokia is a global leader innovating the technologies at the heart of our connected world. Powered by the research and innovation of Nokia Bell Labs, we serve communications service providers, governments, large enterprises and consumers, with the industry's most complete, end-to-end portfolio of products, services and licensing.
From the enabling infrastructure for 5G and the Internet of Things, to emerging applications in virtual reality and digital health, we are shaping the future of technology to transform the human experience.
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About UC San Diego

The University of California, San Diego, is one of the leading Universities in mixed-signal, microwave and mm-wave RFICs, digital communications, applied electromagnetics, RF MEMS (microelectromechanical systems) and nano-electronics research, and is home to the Center for Wireless Communications (CWC). The CWC is a University-Industry partnership with several industry partners, including Mitsubishi Electric and Nokia. UCSD has an annual research budget exceeding $850M, and its Jacobs School of Engineering is ranked as Number 13 in the US-News and World Report 2017 ranking. The Electrical and Computer Engineering Department, consisting of 46 teaching tenured faculty, trains approximately 400 graduate students per year. For more information, please visit www.ece.ucsd.edu and www.ucsd.edu.