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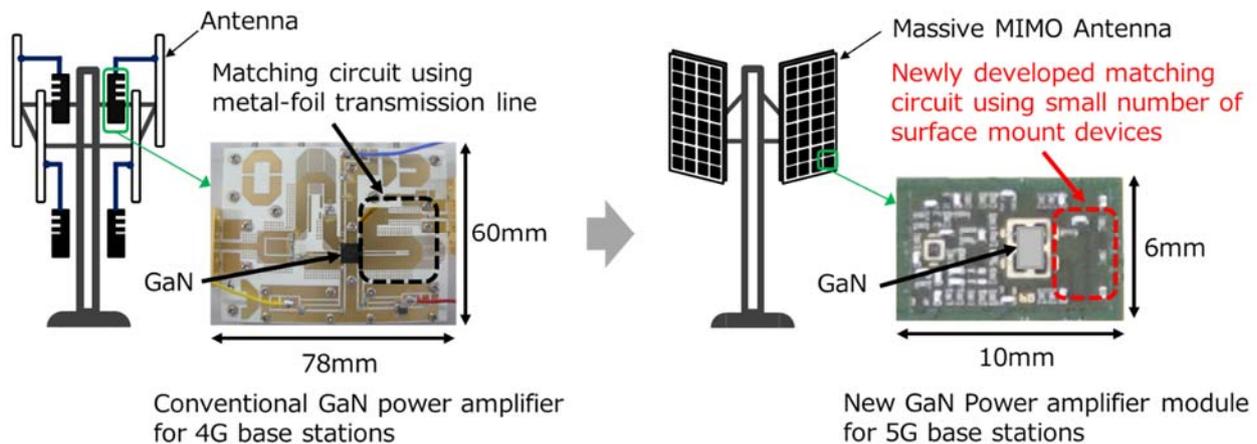
Mitsubishi Electric Develops New Technology to Realize Small, High-efficiency GaN Power Amplifier Module for 5G Base-Station

Combines 6mm-by-10mm size and world-leading 43% power efficiency

TOKYO, July 14, 2020 – [Mitsubishi Electric Corporation](http://www.mitsubishielectric.com) (TOKYO: 6503) announced today they have developed a new technology to realize a gallium nitride (GaN) power amplifier module for 5G base-stations that offers a combination of compact (6mm by 10mm) footprint and extra-high power-efficiency¹, the latter exceeding an unprecedented rating of 43%². The module, which uses a minimum number of chip components in the matching circuit to control high-quality signal output, is expected to help realize 5G base-stations that are widely deployable and highly power efficient. Technical details of the new module will be presented at the IEEE International Microwave Symposium this coming August.

¹ According to Mitsubishi Electric research as of July 14, 2020

² Using the 5G frequency range of 3.4-3.8GHz



Key Features

1) *High-density mounting technology to realize compact (6mmx10mm) power amplifier module for more widely deployable 5G base-stations*

- In 4G base-stations, which do not use massive Multiple-Input and Multiple-Output (mMIMO) antennas, power amplifiers use metal-foil transmission lines for the matching circuit. While this lowers power loss, resulting in high-efficiency operation, transmission lines take up space and make it difficult to realize base stations that are both extra small and extra power efficient. Mitsubishi Electric’s new technology eliminates the need for transmission lines in 5G power amplifiers.
- The new amplifier module’s matching circuit is integrated with surface mount devices (SMDs), such as capacitors and inductors. By introducing a highly accurate electromagnetic field analysis method and applying a unique technology for the dense arrangement of SMDs, Mitsubishi Electric was able to reduce the amplifier’s size to just one-ninetieth that of conventional power amplifiers.³

³ Mitsubishi Electric’s 4G power amplifiers released on January 12, 2017

2) *World’s highest power efficiency reduces 5G base-station’s power consumption*

- High-efficiency GaN transistors help to increase the efficiency of the power amplifier.
- Using SMDs for the matching circuit can reduce the amplifier’s size but also can decrease power efficiency because SMDs tend to have high power loss. Mitsubishi Electric’s new technology, however, creates a matching circuit using a small number of SMDs. Furthermore, the SMDs offer the same electrical characteristics as those of metal-foil transmission lines. The resulting power amplifier module achieves a world-leading power efficiency rating of more than 43% in the 3.4-3.8GHz bands used for 5G communications.

Specifications

	Size	Carrier Configuration	Output Power	Efficiency	ACLR ⁴
Conventional model ³	60×78mm ²	20MHz	34~35dBm	39~43%	-50dBc
New model	6×10mm ²	20MHz	38~39dBm	43~48%	-50dBc
		200MHz	37.5dBm	43.9%	-50dBc

⁴ ACLR: Adjacent Channel Leakage Ratio. Characteristics obtained using Digital Front End (DFE) linearization solution developed by NanoSemi, Inc. (USA)

Background

5G base stations, which use mMIMO antennas to form multiple radio-frequency beams for simultaneous connection with other base-stations and massive users, coordinate radio-frequency component operation on the mMIMO antenna panel. Since the components are arranged densely on the panel, each one must be very small. The power amplifier, which consumes the most energy in the antenna, also must be very efficient to avoid problems with heat dissipation.

R&D Facilities Involved

Information Technology R&D Center, Mitsubishi Electric Corporation
Mitsubishi Electric Research Laboratories, Inc.

About Mitsubishi Electric Research Laboratories (MERL)

Mitsubishi Electric Research Laboratories (MERL) is the North American subsidiary of the corporate research and development organization of Mitsubishi Electric Corporation. MERL conducts application-motivated basic research and advanced development in optimization, control and signal processing. For more information visit: www.merl.com

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About Mitsubishi Electric Corporation

With nearly 100 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. Mitsubishi Electric enriches society with technology in the spirit of its corporate statement, "Changes for the Better," and environmental statement, "Eco Changes." The company recorded a revenue of 4,462.5 billion yen (U.S.\$ 40.9 billion*) in the fiscal year ended March 31, 2020. For more information, please visit www.MitsubishiElectric.com

*U.S. dollar amounts are translated from yen at the rate of ¥109=U.S.\$1, the approximate rate on the Tokyo Foreign Exchange Market on March 31, 2020