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FOR IMMEDIATE RELEASE

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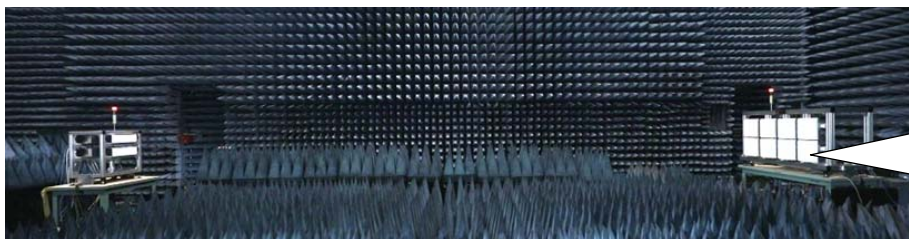
Mitsubishi Electric Demonstrates 16-beam Spatial-multiplexing Technology and Achieves 25.5Gbps Throughput in 5G Base Station

Expected to contribute to ubiquitous connection of devices via broadband transmission

TOKYO, February 14, 2018 – [Mitsubishi Electric Corporation](http://www.mitsubishielectric.com) (TOKYO: 6503) announced today that it has developed a 16-beam spatial-multiplexing technology operating at 28GHz for fifth-generation (5G) mobile base stations and that it has demonstrated what is believed to be the world’s first¹ 5G system to achieve 25.5Gbps for one user device at 28GHz with 500MHz bandwidth. Mitsubishi Electric expects its new mobile system to help realize a society in which mobile devices are connected ubiquitously via broadband transmission. The details of the system will be announced at the IEICE Technical Committee on Radio Communication Systems conference on February 28. Outdoor trials are planned in fiscal 2018.

¹ According to Mitsubishi Electric research as of February 14, 2018

16-beam Spatial-multiplexing Transmission Trial



User equipment
(16 antennas)

Base station
(2-beam massive element RF unit x 8)

2-beam antenna RF unit with
massive antenna elements
(512 antenna elements)

Key Features

The 16-beam spatial-multiplexing technology consists of eight analog, front-end processing, low-power units to form 16 beams and a multiple-input multiple-output (MIMO) digital processing algorithm to reduce inter-beam interference. The new system’s realizes the gain of 4,096 antenna elements while its computational

complexity is just that of 16 antenna elements. The new mobile telecommunication system operating at 28GHz yielded spectral efficiency of 63.7bps/Hz² and a downlink transmission rate of 25.5Gbps, both believed to be world's firsts, with 500MHz bandwidth for one user device.

² Time occupancy for downlink transmission is assumed to be 80% during the transmission interval. The remainder of the interval is used for uplink transmission.

The two-beam massive MIMO antenna RF module includes two active phased array antenna (APAA) units operating at 28GHz, each consisting of densely integrated 256 antenna elements and RF devices. The RF module's thickness of just 7cm, roughly one-third that of a predecessor unit, will enable easy installation for wide deployment of 5G systems.

Overview

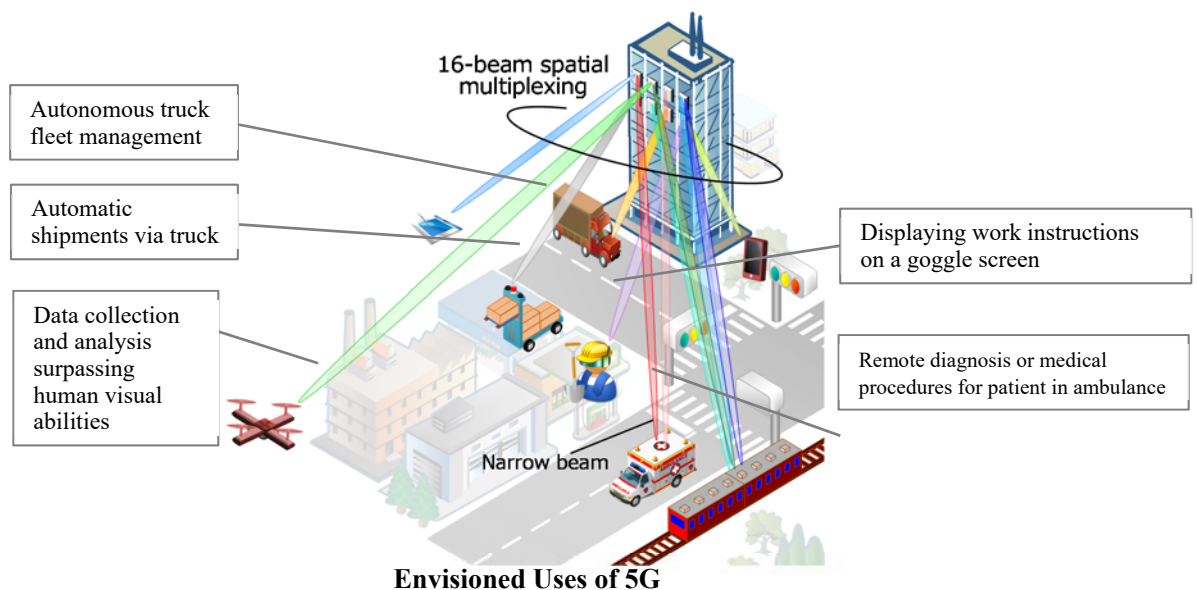
	Transmission parameters	Maximum throughput	Featured spatial transmission technology
5G	500MHz 16-stream parallel transmission	25.5Gbps	Single user ³ 16-beam spatial multiplexing technology
Conventional (4G)	60MHz 4-stream parallel transmission	788Mbps ⁴	Single user MIMO technology

³ One user device

⁴ Latest 4G mobile communication system in Japan in February 2018

Background

Research of 5G technologies has accelerated globally, aiming for deployment of 5G systems from 2020 to meet increasing demands to accommodate growing traffic due to IoT applications. Such systems are expected to achieve data transmission rates of around 20Gbps, much higher than the achievable maximum rate of 788Mbps in current 4G systems.



Detailed Features

High frequency bands such as 28GHz offer wide bandwidth needed for the practical deployment of 5G systems. Massive MIMO technology capable of spatially multiplexing multiple signals on the same frequency and time is effective to combat the large attenuation loss that frequently occurs in high frequency bands. However, implementation of such a fully digitalized technology could require a prohibitive increase in the size of the digital circuitry and large power consumption. In response, Mitsubishi Electric has been conducting research on hybrid beamforming based 16-beam spatial-multiplexing technology combined with MIMO digital processing algorithm to reduce inter-beam interference. The company's newly developed system achieves the gain of 4,096 antenna elements while its computational complexity is just that of 16 antenna elements.

With 4G, it has been challenging to establish high data-rate communication for a single mobile device using more than four streams. But now, Mitsubishi Electric's 16-beam spatial-multiplexing technology has achieved parallel transmission of 16 streams to a single device in a line-of-sight test⁵ in an anechoic chamber⁶. Spectral efficiency of 63.7 bps per hertz and a downlink transmission rate of 25.5Gbps, both believed to be world's firsts, were achieved with 500MHz bandwidth and 0.8 downlink time occupancy.

⁵ There was no obstacle between the base station and device; the environment was challenging for parallel transmission

⁶ External electromagnetic waves could not enter the environment and generated electromagnetic waves were not reflected inside the environment

Complex analog circuitries required in the antenna RF module add thickness to the device, which would make deployment in metro areas impractical. Accordingly, Mitsubishi Electric reduced the size of its antenna RF module using a densely integrated RF device compatible with APAA technology. The compact RF module, which is positioned precisely behind the 256 antenna elements, contains two APAA units with heatsinks. The module measures just 7cm in thickness but is capable of wideband and wide-angle beamforming.

The news release includes a part of the results of "The research and development project for realization of the fifth-generation mobile communications system" commissioned by Japan's Ministry of Internal Affairs and Communications.

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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