



Joint Press Release—for immediate release

Success with 5G Communications Using “Vehicle Glass Mounted Antenna” for 5G Connected Car

- World's first 28 GHz band compatible antenna achieves 8 Gbps super high-speed communications with high-speed vehicle -

Tokyo, July 25, 2018—AGC Inc. (AGC) and NTT DOCOMO, INC. (DOCOMO) today achieved the world’s first¹ 8 Gbps 5G communications with a fast-moving vehicle equipped with “vehicle glass mounted antennas” (On-Glass Antennas) in a field trial conducted in conjunction with Ericsson Japan.

The 5G 28 GHz band compatible On-Glass Antennas used in the field trial were designed and developed by AGC. The antennas are not easily seen from the exterior and can be installed on glass surfaces without affecting the vehicle design.

Radio waves in the 28 GHz band have a large propagation loss and have difficulty propagating over long distances. By installing an On-Glass Antenna on the vehicle, radio waves above 6 GHz can be transmitted and received using the “beam forming function”, which concentrates radio waves in a specific direction, and the “MIMO function”, which improves communication speed by simultaneously transmitting different data from multiple antennas. This allows stable, high-speed communications even for vehicles in operation.

For this field trial, 5G high-speed communications using both the beam forming function and the MIMO function was performed with a vehicle equipped with On-Glass Antennas. The trial was held at the National Institute for Land and Infrastructure Management in Ibaraki Prefecture, Japan. While moving at high speeds of approximately 100 km/h, a maximum communication speed of 8 Gbps was achieved, and a maximum of 11 Gbps was achieved at a speed of approximately 30 km/h, confirming that high-speed in-vehicle communications in the 28 GHz band can be achieved by utilizing On-Glass Antennas.

AGC, DOCOMO and Ericsson Japan will continue working toward utilizing 5G in various environments including in-vehicle communication modules, etc., aiming to see 5G connected cars become a reality.

*1 According to research carried out by DOCOMO (as of July 25, 2018).

For media inquiries regarding this subject	
AGC Corporate Communications & Investor Relations: Morinaga TEL: 03-3218-5603 FAX: 03-3201-5390	NTT DOCOMO Public Relations Department: Toyoda, Imai TEL: 03-5156-1366 FAX: 03-5501-3408

Details of 5G Field Trial Using “Vehicle Glass Mounted Antenna”

1. Field trial outline and results

The trial was carried out at a straight section of test course approximately 2.2 km long at the National Institute for Land and Infrastructure Management. 5G data communications were carried out using the 28 GHz band between the moving test vehicle equipped with a 5G mobile station to which several On-Glass Antennas were connected and three 5G base stations set up along the sides of the course.

For this trial, a total of eight On-Glass Antenna elements were installed in the test vehicle on the windshield, both side windows, and rear window, so that radio waves could be received from various directions.

By utilizing the On-Glass Antennas to receive signals in combination with the MIMO function and the beam forming function with up to four beams supporting vertical and horizontal polarization, 5G high-speed communications were realized, with up to 8 Gbps at a moving speed of approximately 100 km/h, and 11 Gbps at a moving speed of approximately 30 km/h.



Fig. 1 Scene of field trial

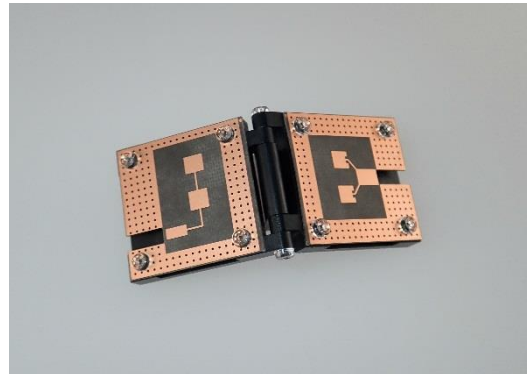


Fig. 2 On-Glass Antenna element



Fig. 3 Installation examples of On-Glass Antennas



Fig. 4 Exterior of vehicle with On-Glass Antennas installed

2. Test period

June 28, 2018 – July 25, 2018

3. Frequency band used

28 GHz band (bandwidth: 732 MHz)

4. System configuration for field trial

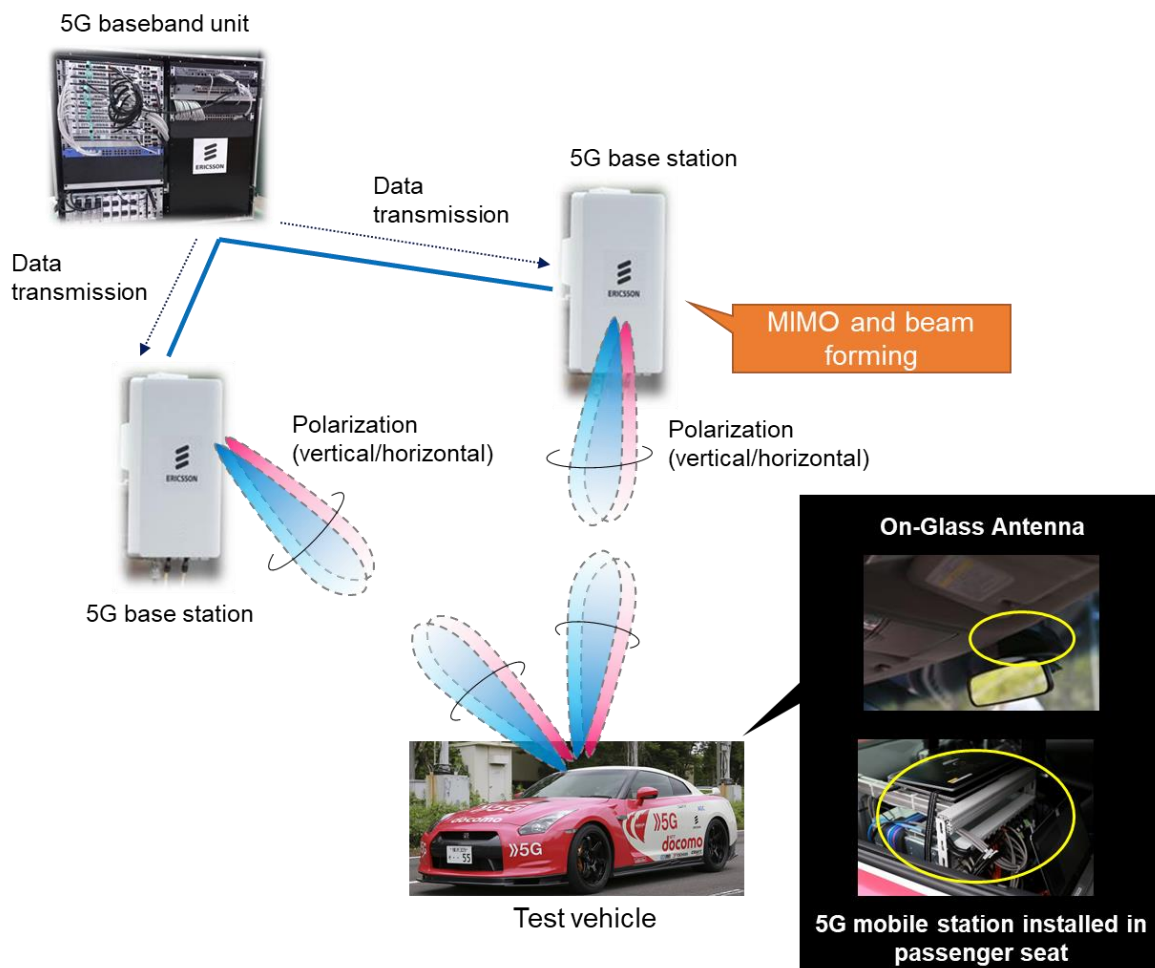


Fig. 5 System configuration

Main Specifications of Field Trial		
5G system	5G base stations	<ul style="list-style-type: none"> • MIMO function (supporting vertical/horizontal polarization, 2×64 elements for each polarization, transmitting up to two beams per base station during trial) • Beam forming function, beam-tracking function
	5G On-Glass Antenna	<ul style="list-style-type: none"> • Supporting vertical/horizontal polarization, four elements for each polarization
	5G mobile station	<ul style="list-style-type: none"> • Receiving up to four beams
Test vehicle		<ul style="list-style-type: none"> • NISSAN GT-R

5. Roles of each company

Company Name	Role
AGC	<ul style="list-style-type: none"> • Design and development of On-Glass Antenna
DOCOMO	<ul style="list-style-type: none"> • Planning and promotion of entire field trial • 5G area design
Ericsson Japan	<ul style="list-style-type: none"> • Provision and operation of 5G base station and mobile station equipment

6. Video of experiment

URL: <https://youtu.be/kSS74DvyWUY>

About the AGC Group

AGC Inc. (Headquarters: Tokyo, President & CEO: Takuya Shimamura) is the parent company of the AGC Group, a world-leading glass solution provider and supplier of flat, automotive and display glass, chemicals, ceramics and other high-tech materials and components. Based on more than a century of technical innovation, the AGC Group has developed a wide range of cutting-edge products.

The AGC Group employs some 50,000 people worldwide and generates annual sales of approximately 1.5 trillion Japanese yen through business in about 30 countries. For more information, please visit www.agc.com/en

About NTT DOCOMO

NTT DOCOMO, Japan's leading mobile operator with over 76 million subscriptions, is one of the world's foremost contributors to 3G, 4G and 5G mobile network technologies. Beyond core communications services, DOCOMO is challenging new frontiers in collaboration with a growing number of entities ("+d" partners), creating exciting and convenient value-added services that change the way people live and work. Under a medium-term plan toward 2020 and beyond, DOCOMO is pioneering a leading-edge 5G network to facilitate innovative services that will amaze and inspire customers beyond their expectations. DOCOMO is listed on the Tokyo Stock Exchange (9437). www.nttdocomo.co.jp/english