DRIVING THE FUTURE:

JAPAN'S 5G GLASS ANTENNAS TRANSFORMING CARS

FOR SAFER, SMARTER MOBILITY

As technological innovations in automobiles rapidly accelerate toward autonomous driving and electrification, connected technologies essential for safe autonomous operation are gaining attention. Japan's high-performance on-glass antennas, equipped with 5G communication capabilities, are paving the way for a new era of mobility.

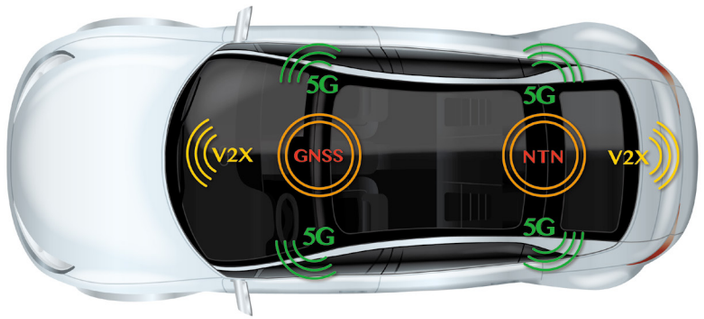
CASE, a keyword driving transformation in the automotive industry, stands for "Connected" (constant network connectivity), "Autonomous" (automated driving), "Shared" (innovative services like ride- and car-sharing), and "Electric" (vehicles powered by clean energy).

If CASE is to become a reality, it is expected to help address societal challenges, such as resolving driver shortages caused by a shrinking population through automation and reducing greenhouse gas emissions via car-sharing and electric vehicles.

Being "connected" is one of today's technologies that is increasingly becoming important. A stable, low-latency communication environment (massive data processing with minimal delay) is essential for accurately understanding surrounding road conditions and ensuring safe autonomous driving. Seamless connectivity with AI that learns from vast amounts of traffic data and automated updates of autonomous driving software are equally crucial.

With the advent of 5G mobile communications, which can transmit data at high speeds, and high capacity, the realization of connected technologies has taken a significant leap forward. AGC Inc., a Japanese global leader in automotive glass manufacture with one of the highest market shares worldwide, has focused its efforts on developing glass antennas that integrate antenna functionality into front, rear, and roof glass panels. The company has a long history stretching back to the 1970s of developing glass products with integrated antenna features for radios and televisions.

The front windshield of a car with a transparent 5G communication antenna (bottom) embedded into the top. An sticker type antenna installed on the bottom of the glass enables high gain, which indicates good reception sensitivity, stabilizing and speeding up communications. According to NOBUOKA Kiyoshi of AGC Inc.'s Automotive Company, glass antennas, which lack protrusions, preserve the sleek design of the vehicle.



Connected Roof with various antennas:
V2X = Vehicle to Everything, **GNSS** = Global Navigation Satellite System, **NTN** = Non-Terrestrial Network

An illustration of next-generation communication antennas integrated into a single glass roof. The increasingly popular large panoramic roof openings are well-suited for installing satellite communication antennas. The strength of glass manufacturers lies in their ability to ensure both safety and comfort, such as heat reflection, while incorporating communication capabilities.

"What matters most for automotive glass is safety," says NOBUOKA Kiyoshi, senior manager at AGC's Automotive Company. "As a glass manufacturer, we ensure safety while adding value with features such as UV protection and heat shielding, culminating in glass with integrated antennas."

In 2023, AGC developed integrated glass antennas compatible with the 5G Sub-6 band, which uses frequencies below 6 GHz to cover a wide area and is more popular because it can be applied to current 4G technology. While the practical application of built-in antennas is still in progress, sticker type 5G-compatible antennas were adopted in the same year by Halo.Car, a U.S. startup offering rental car services. Using cameras installed in the vehicle, video footage is transmitted to the company's operations center, where remote pilots operate the car to facilitate unmanned delivery and collection of rental vehicles.

The variety of in-vehicle antennas has expanded significantly, ranging from radio and digital television to Wi-Fi and 5G. Installing multiple antennas within a single panel of glass requires advanced technology to prevent signal interference among them. Additionally, reception quality varies based on the antenna's placement. AGC has fully equipped anechoic chambers to measure and evaluate the electromagnetic characteristics of glass and wireless devices in three locations—the United States, Europe, and Japan—where they conduct rigorous antenna testing.

At the Consumer Electronics Show (CES), scheduled to take place in Las Vegas in January 2025, AGC plans to showcase a mock-up vehicle featuring a panoramic roof glass equipped with multiple antennas, including 5G and ultra-wideband (UWB), which is well-suited for precise positioning. At CES 2024, when AGC displayed a sample of the glass, it received an extremely positive response from attendees. In addition, a retrofitted 5G glass antenna for remote monitoring and operation systems will also be showcased.

The U.S. startup Halo.Car adopted AGC's glass antennas to provide remotely piloted rental car deliveries and collections. AGC plans to further strengthen collaborations with such startups in the future.

While the development of the environment and technology for autonomous driving is progressing rapidly, there are still some issues to be addressed, such as safety improvement and community understanding. It will thus likely take some time before fully autonomous driving becomes a reality.

However, as Nobuoka said, "By utilizing glass antennas, it could, for example, become possible one day to assist elderly individuals who find driving difficult by driving remotely and supporting them. In this sense, mobility will become an even more public-oriented field." He went on to say, "We aim to contribute to society through our in-vehicle antenna technology." ●