



Picture: Wave by AGC

## **Glass antennas – an unobtrusive and effective way to provide mobile coverage in city centres**

**The rise of 5G and the need for mobile coverage in the narrow streets of old city centres present fresh challenges for architects, construction firms, mobile operators and especially antenna manufacturers. AGC recently started deploying its technological expertise in glass manufacturing and processing for high-tech applications with a view to providing unique antennas in the form of transparent panes of glass.**

The roofs and walls of homes in city centres are bristling with antennas, cables and transmitters. While that might be the current reality, not many people like it. At the same time, the demand for good mobile coverage continues to rise. The rollout of new networks, including 5G, will make it necessary to install even more antennas. Fortunately, we have new technology that can prevent the onslaught of unsightly antennas, thus enhancing the aesthetics of well-preserved facades, old homes and cities in general.

At the T-Mobile headquarters in Prague, glass antennas manufactured by WAVE by AGC were recently tested for the first time ever in Europe. We asked Pavel Čumpelík, Business Development Manager for Central and Eastern Europe at AGC's Czech subsidiary in Teplice, about their possibilities and benefits. In addition to ongoing innovations used in architecture, the automotive industry and consumer electronics, this traditional glass manufacturer clearly has a lot to offer the telecommunications industry.

### **Glass antennas – that sounds really futuristic! Is this technology tried and tested?**

It may sound futuristic, given the new ways these antennas are being used and the new technology developed for the modern communication industry, but glass antennas have been around for years – though we may not have noticed them. At AGC, we've been active in this field since 1974. Glass antennas were primarily used in the automotive industry. Today, it's quite common for as many as eight antennas to be built into a single glass element of a car.

It's quite easy to conceal antennas in car glass – they can pass for heating elements or can be hidden near the edges. The question is why, until now, a similar solution hasn't been used for buildings, even though architects and developers also need to use antenna technology in an unobtrusive and aesthetically acceptable way.

Nowadays, glass antennas can be used to provide mobile coverage for indoor and outdoor areas in old and new homes alike. They offer new opportunities for densifying mobile networks, which is something the entire telco industry will have to address soon – for 5G technology and beyond. That's where WAVE by AGC comes in. We've got a simple vision of what we offer and why: an inconspicuous low-output glass antenna with an optimised range, enabling the operation of state-of-the-art telco technology without visually spoiling its surroundings. It's just as unobtrusive as any glass we see every day, in other words generally perceived as a natural part of the urban environment.

### **Are these antennas really made entirely of glass?**

The antennas are fully transparent, although they also contain other advanced materials in addition to clear glass. But this is perfectly normal for many types of car glass and windows. It's a layered structure comprising ultra-thin glass, transparent film and conductive materials. Just think of the safety glass used in cars, facades and smartphone screens.



*Even on closer inspection, the glass antenna looks like a normal piece of glass - picture: Wave by AGC*

The important thing is that our antennas can, to a certain extent, adapt to the location where they are installed, the shape of windows and the colour of the facade. We can even factor in the colour and aesthetic appearance of the glass. We've already explored the necessary technology and we've used it for other products. The glass antenna can be coloured or can have a pattern or reflective surface applied to its surface. However, these options are still something we're considering for the future, as most of the current demand is focused on a clear, neutral and transparent design. It's very important for us to be able to manufacture our antennas on a certain scale so that production and installation are technically and economically feasible and efficient.

### **What sizes can the antennas be produced in?**

The size of the antenna depends on the coverage requirements (frequency range, etc.) and on its location just behind the window on the inside of the structure. Naturally, the antenna dimensions must comply with the size of the windows in old buildings. The maximum dimensions are 30 x 60 cm but most antennas are much smaller, about the size of an A4 sheet of paper (20 x 30 cm). We're also looking into an outdoor version. Our partners are very interested in antennas that can be concealed in traffic signs, small shop signs and other common street elements. In these cases, the glass antennas must retain their compact flat design.

## **Technically speaking, how do glass antennas compare with the conventional antennas we see fitted on roofs and poles?**

Compared to conventional transmitters, the output of glass antennas is lower. This is in line with the general trend towards saving power, lowering costs and preventing electromagnetic waves from radiating into the environment where they are neither wanted nor used. Of course, we should only compare like with like, i.e. antennas with similar specifications operating under similar conditions. I believe that in such a comparison, our innovative solution can be really successful, as the indoor installation is often easier and cheaper.

The output of the antenna can be about 5W per port, which is plenty given the high network density planned.

**“ The antennas are also fairly good at directing the signal: each one covers about 50-200 metres in just one street. So one antenna can effectively cover a large yard, a garden or another area where good coverage is required. ”**

This type of installation has been proven effective by the test project installed on the T-Mobile building, where we managed to perfectly cover a troublesome area around the building with two antennas using the 1.8 and 2.1 GHz frequencies.

Our long-term goal is to provide coverage in a form that's both energy-optimised and socially acceptable. The signals provided by multiple small glass antennas will complement each other and their combined strength will be balanced, energetically sound and sufficient for users both outdoors and indoors. In addition to glass antennas, we also offer a solution for modifying insulating glazing in order to improve indoor coverage. The solution is maintenance-free, futureproof and passive. Combining this solution with a glass antenna is logical and sometimes even necessary. But that's a long story, so maybe we should talk about it another time.

## **Do you expect glass antennas to become a widely used solution for ensuring urban mobile coverage in the future?**

Most of the requests we get are for improving coverage in areas where the signal is poor and where further densification of the network is expected, but where the conventional solution isn't possible. Glass antennas are also required for 5G-related pilot projects and future launches, since they can play an important role in conjunction with 5G technology . They can be especially useful in the narrow streets typically found in city centres, or in areas with newly built obstacles that block coverage, such as new buildings . Improving coverage in city centres, where glass antennas can be really effective, depends on the mobile operators themselves and also on the awareness of architects and municipal officials responsible for approving new ways to provide mobile coverage. All procedures must be coordinated with these partners. Of course, we can adapt our solutions to the technical requirements of mobile operators and we're open to the views of all parties involved in the process.

## **How can glass antennas become the go-to solution for city centres?**

With our glass antennas, we provide an unobtrusive, practical and functional solution that can be successfully deployed in city centres. For renovation projects and new builds, there are severe restrictions on installing conventional antennas – it's getting harder and harder to obtain the necessary permits and approvals for new installations, even outside the city centre. It requires a lot of time and money to provide new locations , and sometimes it's downright impossible. However, glass antennas can successfully overcome most of these limitations and restrictions. They can also be an effective solution to the kinds of conflicts between investors and heritage preservation institutions that typically occur during the reconstruction of windows and facades.

We enable the unobtrusive installation of antennas in buildings, especially indoors behind windows. Windowpanes let a certain amount of signal through and our technology protects users by directing the signal outside the building .

We are ready to discuss this solution with all stakeholders. AGC has been working in city centres for many years and this area is pretty familiar to me personally. Around the year 2000, we demonstrated a new type of glass in Prague – an imitation of old-fashioned ‘drawn glass’ and ideal for old buildings. We’ve been involved in a number of projects to reconstruct buildings in Prague, and over the years, we’ve provided very advanced technological solutions with multifunctional glass that’s been used for thermal and acoustic insulation, anti-burglary protection, solar control, and so on. The fact that you cannot detect these qualities visually is, in my opinion, the best proof that this solution is ideal for old buildings and that we really know what we’re doing. Apart from that, a number of bold renovation projects intentionally showcased our glass, such as the critically acclaimed reconstruction of the Museum Kampa building featuring modern glass elements. However, the use of glass antennas isn’t limited to certain types of buildings – they are perfectly applicable to and suitable for modern homes and office spaces.

### **What can you offer architects and developers?**

Architects, developers and construction companies like to use new solutions and materials that enable them to meet market needs and requirements effectively. AGC has traditionally cooperated with architects involved in modern projects and historic buildings, and we will continue in this cooperation as WAVE by AGC. Our plan is to mobilise bold architects who aren’t afraid of timeless solutions, such as glass antennas. This must be understood in the context of us being ready to launch our antennas on the European market. These days, we're still in the prototype and design phase, but next year we plan to start ramping up production in response to growing demand from our business partners.



*Antenna installation in offices - picture: Wave by AGC*



### **Are you collaborating with European mobile operators?**

In Japan, where the use of glass antennas is already being tested in real-life situations, we are collaborating with NTT DOCOMO. In Europe, we're still in the initial stages. This is in line with our regional expansion strategy. WAVE by AGC has begun negotiations with mobile operators across Europe. We're talking to many important players in this region, especially in the EU countries. We're proud to be the first company in Europe to start a pilot project – with T-Mobile in the Czech Republic. T-Mobile are very interested in testing our antennas in the real world and our collaborative efforts are ongoing.

### **So the development of glass antennas is a response to the requirements of mobile operators?**

Glass antennas are being developed in various ways. The technical requirements differ between countries and regions, and mobile operators also have their own preferences. This is both natural and logical. We need to adapt to global trends as well as to the specific requirements of regional market players. The key part of this development process is our AGC European R&D Centre in Belgium. We are also collaborating with numerous external partners, including universities. Our academic contacts in the Czech Republic include, for example, UCEEB ČVUT. I believe our WAVEATTOCH glass antennas will soon become part of the communication network in city centres and beyond, and we will come to view them – but not see them! – as a common part of our surroundings.