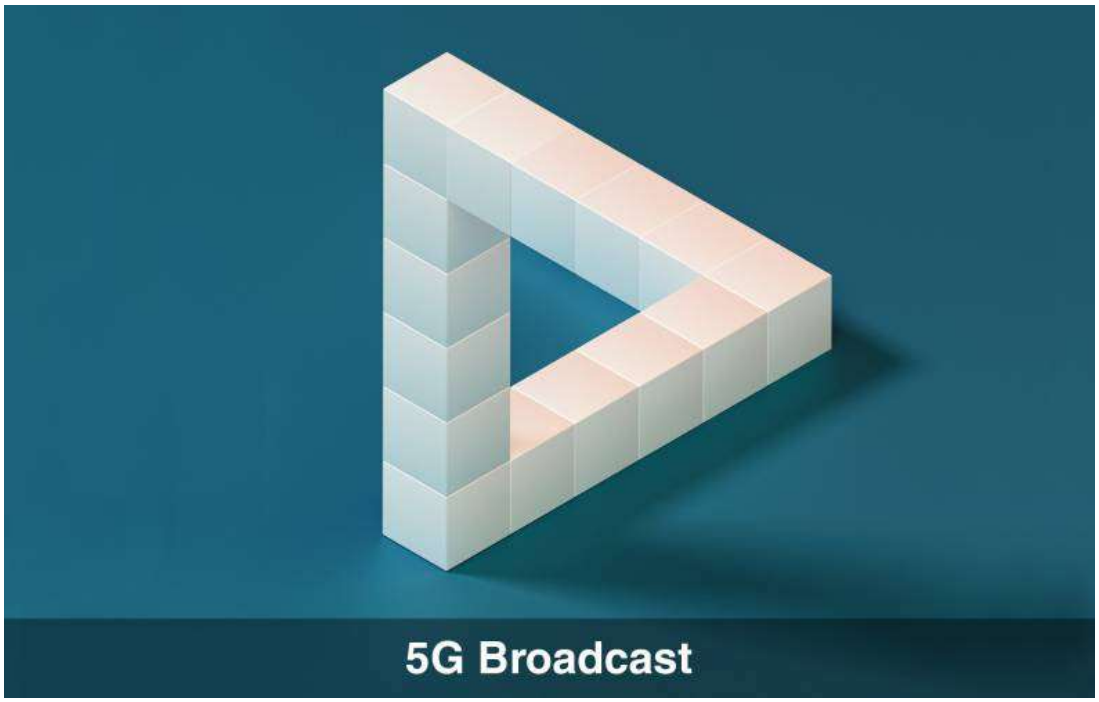
5G Broadcast: Part 3 - 5G Broadcast Trials & Launches



5G Broadcast is approaching commercial deployment by some video service providers after a raft of trials were completed in 2023. The first tentative commercial services are arriving from the likes of Boston based WWOO in the USA.

Other articles in this series:

- **5G Broadcast: Part 1 - A Major Milestone For Mobile Broadcast**
- **5G Broadcast: Part 2 - 5G Broadcast Unites & Divides Different Factions**

After all the earlier false starts the era of mobile broadcast truly dawned in 2020 when the 3GPP standards group introduced full support in its Release 16. That has been followed by further enhancements in Release 17 with more to come when Release 18 comes out in 2024. We have established in two earlier articles of this series why mobile broadcast really is coming under 5G, with a big question now being whether it takes over from digital terrestrial completely as the predominant over the air medium for broadcast TV, or operates in parallel largely for delivering services to mobile devices.

One major difference now is that 5G Multicast and Broadcast has been pitched squarely at broadcasters, many of which have responded with greater enthusiasm and interest than before. Equally importantly, 5G Multicast/Broadcast exploits existing modem chip technologies in consumer devices, especially smartphones, and is also part of the 5G standard.

As a result, no upgrades to other infrastructure or devices are needed to support 5G multicast and broadcast. Furthermore, it can harness existing terrestrial infrastructure and run as a separate overlay layer on top of 5G networks via the High Power High Tower (HPHT) model, integrating with existing unicast streaming but not competing with it for network capacity.

This has drawn broadcasters new and old into trials, to establish that 5G Broadcast can dovetail with their existing distribution, and deliver sufficient performance. In many cases such trials are coinciding with migration towards streaming generally for provision of their live and linear services.

Such migration has been aided by technologies from broadcasting standards groups, notably the European DVB group with its DVB-I specifications designed to enable migration of linear TV from legacy technologies to internet delivery without sacrifice in quality. The DVB realized these specifications needed enhancing to accommodate mobile delivery via 5G broadcast, as well as fixed broadband networks.

This led the DVB to introduce modifications to DVB-I in July 2023 to embrace 5G Multicast and Broadcast. This recognized that the internet is effectively a service delivery layer on top of multiple physical networks for the last mile, including fixed wire and wireless. The DVB has identified six specific use cases that broadcasters might want to support over 5G networks, starting with basic unicast streaming, suitable for delivering VoD content on request from users, or for niche linear content.

Second is hybrid unicast/multicast, suitable for linear channels that are not much watched but occasionally at sufficient volume to make multicast more efficient than unicast, by avoiding sending multiple streams over links within the delivery chain.

The third DVB use case is delivery to fixed or standalone devices, such as traditional TVs or set top boxes, but still over the roaming mobile network. The fourth case is Fixed Wireless Access, where the mobile network replaces a traditional wired broadband service, with no roaming, and delivery to CPE that may be high on a wall or rooftop.

Use case five is then TV delivery to vehicle infotainment systems, having to cater for faster movement, which can be more technically challenging near the edges of cells. The final sixth category is then the full hybrid, catering for delivery to any device, whether stationery or fast moving, including large screen TVs as well as small handhelds.

These revisions and extensions were guided by a major DVB-I pilot in Germany that kicked off in September 2022, building on earlier work by the country's ARD group comprising regional public service broadcasters. Although some participants might contest this, 5G Broadcast was almost an afterthought in this pilot before later coming close to center stage. It was particularly relevant for one of the pilot's work areas, event streams, or temporary special events that generate short term spikes in traffic. Given that more and more viewing of major live sports and other events is over mobile networks, 5G Multicast came into the equation as a way of converting from unicast during an event as viewing ramps up.

This use case was also one of several covered by one of the most substantial and comprehensive 5G Broadcast trials so far, conducted by Italy's national broadcaster RAI, still publicly owned by the country's Ministry of Economy and Finance. This trial featured at IBC 2023 in one of the event's papers.

Indeed, this trial verified ability to switch transparently between the three delivery states, unicast, multicast, and broadcast, and sustain these as users roamed between mobile cells. These technical aspects will be described in detail in a future article in this series.

The RAI trial was also notable for bringing in the various interested stakeholders more than broadcasters have tended to do in the past. This included mobile operators, device makers, content producers, and end consumers, as well as some target sectors of interest. The latter included enterprises generally, but also the automotive industry, which has emerged as an interesting evolving market for broadcast content in the 5G era. The trial evaluated scope for delivery of high value ultra HD content to vehicles over mobile networks using 5G Multicast and Broadcast.

One technical challenge lies in catering for the Doppler effect which ordains that frequency of a signal depends on the relative velocity of the two communicating parties. It might seem that the speed of a car is so negligible compared with that of light that it does not matter, but at the very high frequencies being used for some 5G deployments it can be enough to cause a single symbol to arrive fractionally too soon or too late. Tolerances can be built into the network to cater for this, but the degree may have to be increased to support high value applications to fast moving devices.

The RAI trial was also valuable at the infrastructure level as it sought to lay the ground for country-wide integration of the HPHT overlay model with its own digital terrestrial transmission network. For RAI, this dovetails with another significant development for the broadcaster, the launch in May 2023 of its Rai Way edge data center network. This comprises 18 edge data centers embracing 20 Italian regions, designed to combine satellite, cellular, and broadcast TV infrastructure across Italy, with 5G Broadcast much in the frame. This will be connected by a national fiber optic backbone engineered to minimize latency out to these edge data centers, which are smaller than traditional ones and distributed closer to the end-users.

This is being done not just with traditional TV in mind but also new areas, including automated industrial systems, cloud gaming and telemedicine. RAI's mantra is that traditional broadcasters must come out fighting and attack new areas, rather than just defend an ever-shrinking fiefdom.

Emerging video service providers have no fiefdom to defend and some of these are looking at 5G Broadcast as their sole medium of delivery. One of these is the US company Milachi Media, which in July 2023 was granted approval by regulator the FCC for an experimental license with the Federal Communications Commission (FCC) to test a 5G broadcast system in the area of Westmoreland, New Hampshire.

The company then launched the first commercial US 5G Broadcast station in September 2023, delivering content from French state-owned international news network France 24 at “full HD” 1080p resolution, alongside provisional emergency alert services. Wireless chip maker Qualcomm was among technology partners for development of the station.

This station arrived at a time of renewed interest in, and rising demand for, over-the-air TV reception in the US, with 5G Broadcast entering the frame as an alternative to ATSC 3.0. They each have pros and cons. ATSC 3.0 has proved higher performing over the air for reception by fixed TVs, but not surprisingly perhaps 5G Broadcast does best for mobile devices, especially when they are actually moving. 5G Broadcast is also better optimized for mobile devices such as smartphones that are more restricted in their capacity for data storage and caching.

ATSC 3.0 has some advantage at the infrastructure level, which may mean that a given level of service coverage can be provided with fewer transmitters. But it may well be that ability to support consumer devices beyond the TV set more readily, as well as global rather than just regional support, will prove more decisive.

Consumer adoption of ATSC 3.0 has been limited to fixed TV sets so far with little immediate sign of gaining widespread traction beyond that. Meanwhile, Qualcomm has been adding 5G Broadcast support to its mobile device SoCs (System on Chips) and that is starting to filter through to devices.

ATSC 3.0 on the other hand requires additional hardware, and therefore extra cost for mobile devices, which will almost certainly prohibit investment in that outside North America at any rate. ATSC 3.0’s performance advantages for reaching fixed TV sets are based on time-interleaving, which requires more memory. Time interleaving is a form of parallel signal processing designed to overcome the minimum technical limit on time intervals between sampling of incoming signals through analog-to-digital converters. By sampling in parallel, great signal density and therefore bandwidth can be obtained, but it requires more temporary storage.

Of course the boot is on both feet. Just as ATSC 3.0 cannot become a ubiquitous broadcast and streaming platform without support in mobile devices, neither can 5G Broadcast if it is incompatible with fixed TV sets. The outcome of the ATSC 3.0 versus 5G Broadcast battle will therefore depend particularly on whether the latter does gain support in TVs. The signs from major TV makers such as Samsung and Sony are that such support will be coming, even if the TV sets do not at first incorporate the SIM capabilities needed to access other services over mobile networks.