ATSC WHITE PAPER

Realizing the Full Benefits of ATSC 3.0 Broadcasts in the U.S.

Executive Summary

The next-generation broadcast standards (technically documented as ATSC 3.0) developed by ATSC, the Broadcast Standards Association, represent a transformative leap forward in broadcasting technology, offering superior technical capabilities and consumer benefits over the current ATSC 1.0 digital television standard. However, the benefits of ATSC 3.0 in the United States are constrained, due to the FCC-mandated simulcast of ATSC 1.0 and severely limited broadcast RF spectrum.

As the next-gen broadcast technology authority and a noted international standards development organization, ATSC respectfully offers technical insights on the limitations of continued simulcasting with the goal of providing policymakers and businesspeople with useful background to make informed decisions. As such, ATSC notes that phasing out ATSC 1.0 broadcasts is necessary to reap the full benefits of the next generation of broadcasting.

The ultimate transition to the Internet Protocol-based hybrid broadcast technology encompassed in ATSC 3.0 is essential for delivering higher quality pictures and immersive sound, personalized experiences, broader accessibility options, real-time data applications, and enhanced connectivity, as well as access to a wealth of emerging AI applications. Delaying these benefits through continued simultaneous ATSC 1.0 transmissions risks limiting innovation and stalling progress in a world increasingly reliant on advanced integrated technologies.

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1 Why ATSC 3.0 is Superior to ATSC 1.0

ATSC 3.0 redefines broadcasting, integrating advanced IP-based technologies and reliable, robust over-the-air delivery while seamlessly integrating with internet delivered content on connected, smart receiving devices. ATSC 3.0 enables broadcasters to offer superior features as listed below.

1.1 Unmatched Video and Audio Quality

- Video enhancements
  - Enables 4K Ultra HD (UHD), 4 times the resolution of ATSC 1.0 HDTV broadcasts;
  - Delivers High Dynamic Range (HDR), and Wide Color Gamut for stunning visuals; and
  - Offers potential for even more broadcast channels, or “digi-nets”, to increase viewer choices for content.
- Audio enhancements
  - Incorporates immersive audio technologies, such as Dolby Atmos, for superior soundscapes;
  - Provides immersive, customizable audio experience for viewers;
  - Enhances dialog for those who may struggle hearing voices in complex audio mixes; and
  - Facilitates multi-lingual audio services; and
  - Improved loudness control.

1.2 Enhanced Spectrum Efficiency

- Employs advanced compression, IP transport and flexible modulation/coding technology;
- Highly robust transmissions can improve reception for consumers, including with indoor antennas;
- Offers the ability to operate as a Single Frequency Network (SFN) providing uniform signal strength for reliable reception throughout the service area; also offers the ability to operate as a Multiple Frequency Network (MFN) enabling mobile reception across broadcast boundaries;
- Achieves further efficiency gains through the use of Layered Division Multiplexing (LDM) enabling simultaneous mobile and fixed high-speed services; and
- Enables carrying roughly five times the number of TV programs compared with ATSC 1.0 at equivalent program quality.

1.3 Flexibility

- 4K UHD video delivery service;
- Multiple 2K HD services which may utilize HDR enhancements;
- Mobile services that require more bandwidth to ensure proper content and data delivery; and
- Higher data rates than ATSC 1.0 further enhanced by utilizing Single Frequency Network configurations and Layer Division Multiplexing implementations.

1.4 Next-Generation Interactivity

- Hybrid broadcast-broadband services, localized content, and tailored advertising; and
- Two-way communication for applications such as real-time viewer polling and video-on-demand.

1.5 Personalization and AI-Driven Data Capabilities

- Facilitates intelligent content personalization and advanced viewing analytics, enabling broadcasters to create and distribute highly relevant content;
- Provides the infrastructure for real-time data applications, supporting emerging ecosystems such as smart cities and connected vehicles; and
- Internet protocol foundation enables easy interface for emerging AI techniques such as deep fake detection, content provenance, data security and many others.

1.6 Accessibility

- Multiple language audio;
- Multiple language closed captioning for the hearing impaired;
- Enhanced descriptive video for the visually impaired – multiple language capability;
- Picture-in-picture, user-selectable sign language interpretation; and
- Improved loudness control.

1.7 Public Safety Communications for First Responders and Other Industry Stakeholders

- Supports robust wireless broadband data transmission to first responders, with superior in-building penetration;
- Supports mobile reception capabilities;
- Supports encrypted communications; and
- Supports the Broadcast Position System (BPS), currently being evaluated by the broadcast industry and U.S. government as a complement to the Global Positioning System (GPS) and other applications in the Position Navigation and Timing (PNT) sector. The lack of a backup to GPS is a major vulnerability issue in the U.S.

1.8 Public Safety Communications for Civilians

- Traditional EAS messaging enhanced with the potential of multiple audio tracks to accommodate different languages;
- Non-EAS emergency messaging – the option to include an emergency audio track for alerts that would meet and exceed FCC requirements for accessibility and desires for multilingual alerts;
- Enhanced Advanced Emergency Information (AEI) messaging including text, audio, video, mapping, and other critical information from civil authorities and broadcasters;
- Functional service operation during large area power outages; and
- The possibility of a nationwide meshed "self-healing" network relaying public alert and disaster response data across long distances even in challenging terrain.

2 Simulcasting ATSC 1.0 and 3.0 is the Barrier to Unlocking the Full Potential of ATSC 3.0

The spectrum allocated to TV broadcasting is in three frequency bands assigned as 6 MHz channels: five channels in Low VHF (54-88 MHz except 72-76 MHz), seven channels in High VHF (174-216 MHz) and twenty-three channels in UHF (470-608 MHz) for a total allocation of 210 MHz. The required concurrent operation of ATSC 1.0 and ATSC 3.0 broadcasts in the U.S. in this spectrum undermines the realization of ATSC 3.0's benefits. The barriers are listed below.

2.1 Spectrum Resources

- Transmitting signals simultaneously in both the ATSC 1.0 and ATSC 3.0 standards consumes the scarce spectrum resources allocated to broadcast, limits the introduction of high data rate services (such as 4K UHD), increased robustness for better reception, and dilutes operational resources, delaying the full deployment of ATSC 3.0.
    - The FCC requires that broadcasters who transition to ATSC 3.0 must continue to provide their primary channel content over an ATSC 1.0 broadcast, as well as the ATSC 1.0 content simulcasting requirement;
    - Stations enter into channel sharing agreements to free up at least one channel in a market for ATSC 3.0 broadcasts;

- As of January 2025, there were approximately 437 ATSC 3.0 program services carried on 103 ATSC 3.0 transmitters in 80 markets, covering 76% of TV households;
- Because four, five or six broadcasters in a market often share one station's 6 MHz RF channel for ATSC 3.0 programs, each broadcaster only has one-fourth, one-fifth, or one-sixth of the channel's overall data capacity available to use for ATSC 3.0 services. Consequently, the remaining ATSC 1.0 channels are used to carry all of the broadcast services of the participants to comply with the simulcast requirement which can cause a degradation for all broadcast ATSC 1.0 services due to the reduced amount of spectrum used;
- Due to the lack of available spectrum resources in many markets, the pace of further channel sharing and creation of ATSC 3.0 stations is likely to be relatively slow. Some markets will not be able to offer ATSC 3.0 services at all due to spectrum scarcity, while some markets with only one transmitter and broadcast provider cannot transition because there is no other broadcaster partner available for a channel sharing arrangement;
- When ATSC 1.0 broadcasts are ended, each of the approximately 1,700 full power broadcasters in the U.S. will gain access to 100% of the data capacity of their licensed broadcast RF channel for delivering ATSC 3.0 services and be able to realize the full benefits of ATSC 3.0; and
- Spectrum scarcity for ATSC 3.0 is not as much of a problem in several other regions of the world, such as Brazil and South Korea, where additional broadcast spectrum has been, or will be, allocated for ATSC 3.0 transmissions.

2.2 Consumer, Manufacturer and Retailer Hesitation

- Current law requires that 100% of new TV sets sold must be able to receive ATSC 1.0 broadcasts. However, as of the end of 2024, only about 11% of new TV sales were equipped with ATSC 3.0 integrated electronics; and
- The constrained services broadcasters are able to deploy and the less-than-nationwide footprint of ATSC 3.0 broadcasts reduce the incentive for manufacturers to build – and consumers to buy – ATSC 3.0 TVs. What's more, consumer and retailer confusion is common, reducing ATSC 3.0 adoption.

2.3 Operational Inefficiencies

- Maintaining multiple broadcast transmission systems and complex channel sharing arrangements impose significant costs on broadcasters; and
- Operating two systems diverts funds from innovation and next-generation development.

3 ATSC 3.0 is the Future

ATSC 3.0 enables transformative changes in broadcast services. In addition to a much-improved traditional TV experience, an IP-based hybrid broadcast system is essential to meet the demands of an emerging digital world which includes AI applications that require high-speed data transmission, low latency, and seamless integration with intelligent systems. Retiring ATSC 1.0 and enabling

broadcasters access to their full RF channel for ATSC 3.0 services support advancing innovation, maximizing spectrum efficiency, and promoting sustainability and economic growth.

3.1 Advancing Innovation

- Gives TV households access to advanced services from all broadcasters;
- Accelerates implementation of technologies that position the U.S. as a global leader in broadcasting; and
- Empowers the television ecosystem to contribute to AI-driven advancements in personalized content, predictive analytics, and machine learning applications.

3.2 Maximizing Spectrum Efficiency

- Frees broadcasters' wireless spectrum for delivery of ATSC 3.0's superior television experience; and
- Enables advanced capabilities and other critical technologies such as IoT and autonomous systems.

3.3 Sustainability and Economic Growth

- Encourages eco-friendly, future-proof technologies;
- Creates jobs and drives investment in the television and broadcast industry.

4 Conclusion

Technical, practical and financial limitations in the United States constrain realizing the full benefits of ATSC 3.0. Obligations to simulcast ATSC 1.0 and severely limited broadcast RF spectrum significantly impede innovation and hinder progress in a digitally powered world where consumers and the media ecosystem are increasingly reliant on advanced integrated technologies. ATSC offers its technical expertise to help guide the industry toward a future all-ATSC 3.0 broadcast service.

ATSC Board of Directors

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