

How did MPEG-5 LCEVC enable UHD deployment with VVC for TV 3.0 in Brazil?

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Executive summary

TV 3.0, a project initiated in 2020 by the Brazilian standardization group Fórum SBTVD, defines a standard to enable the next-generation broadcast experience via OTA (over-the-air) and/or OTT (over-the-top) delivery. It employs the latest MPEG standards: VVC for core compression, MPEG-5 LCEVC for the enhancement layer, and MPEG-H for immersive audio.

This paper outlines the steps taken by Fórum SBTVD to define an advanced transmission system capable of supporting up to 8K resolution. The proposed solution is backed by leading companies and is poised for adoption in other countries, starting with Latin America and extending globally, wherever UHD deployment at 4K or 8K is needed.

Contents

Executive Summary	1
UHD Definition	3
General Overview	3
UHD Status in Brazil	3
TV 3.0 in a nutshell	4
Video code selection	5
Resolution and device considerations	6
Receiver profile	6
Role of LCEVC in TV 3.0	6
Ecosystem and integration	7
Conclusion	8
References	9

UHD definition

General overview

UHD (Ultra-High Definition) generally encompasses UHD-1 (4K) and UHD-2 (8K). For the Brazilian Digital Terrestrial TV Project (Forum SBTVD), the scope includes both 4K and 8K, although 4K is expected to be the initial focus.

UHD-1 definition:

- **Video:** 2160p60 HDR
- **Audio:** Next-Generation Audio (NGA)

In this document, “UHD” is used as shorthand for UHD-1.

UHD status in Brazil

Brazil's journey with UHD began in 2016 when Globoplay launched UHD support for both VOD and live events, including the Olympics and FIFA World Cup. Competing SVOD services such as Netflix, Amazon Prime, and Disney also offer UHD.

In broadcasting, HD SDR has long been available on DTT. TV 2.5 recently introduced SL HDR-1 and MPEG-H Audio. The next step is a standard supporting UHD and up to 8K resolution.

TV 3.0 in a nutshell

TV 3.0 is Brazil's new standard, enabling up to 8K content delivery for both OTA and OTT. Its key features include:

- Superior audiovisual quality compared to the first-generation Brazilian DTTB system.
- Support for fixed and mobile reception with external and internal antennas.
- Integration of broadcast and internet-delivered content.
- App-based user interface.
- Content segmentation by geography and viewer preferences.
- Optimized use of RF spectrum for terrestrial TV broadcasting.
- New access methods for cultural, educational, and informational content.

The system adopts:

- A greenfield approach, not backward compatible with existing devices.
- The latest codecs.
- MIMO modulation for transmission.

The specification was developed collaboratively with standards organizations such as ATSC and ARIB, and tested by Brazilian universities (University of Brasília, Mackenzie University). The resulting specification [1] is shown in Figure 1.

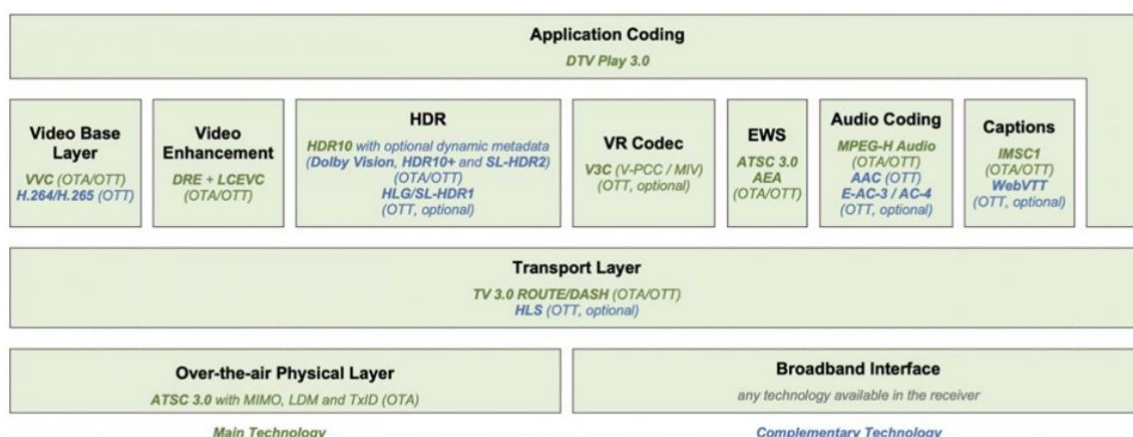


Figure 1: TV 3.0 Specification

One of the main characteristics of the TV 3.0 system is that, in the worst-case scenario, a single channel must fit within one frequency band. With ATSC modulation, this translates to a constant bitrate (CBR) channel for audio and video, with the final bitrate determined by the field trial tests described in the following sections.

Update from August 2025:

The specification was finalized in July 2024 and officially confirmed by presidential decree on 27 August 2025.

Video codec selection

Technology selection enables lab testing in 2024, nationwide trials in 2025, and commercial deployment in 2026, pending regulatory approvals. Decisions made in 2023 were based on available products, even if not yet fully in production.

Brazil chose VVC (Versatile Video Codec) for its compression efficiency and futureproofing, making it the first country to adopt VVC for broadcasting. The challenge was whether VVC alone could efficiently encode a live 2160p60 HDR channel within the target channel constraints of the required quality.

MPEG-5 LCEVC, tested initially by MPEG [2], showed efficiency gains when combined with VVC. Subjective tests [3] conducted by the University of Brasília using real-time encoders, and later confirmed by the Fórum SBTVD, reinforced these results. Additional results are published in [4].

Three test scenarios were evaluated using a 2160p60 HDR source:

- **Native:** 2160p HDR VVC encoded output.
- **VVC + LCEVC:** 2160p, made of a 1080p HDR VVC base layer with LCEVC enhancement.
- **Upsampled:** 1080 HDR in VVC upsampled to 2160p.

Tests used professional equipment and sequences displayed on a 65" LG OLED C2. Results are shown in Table 1.

Test	Output	Max Bitrate	Comparison	Max Bitrate
1	2160p HDR10 VVC	16.58 Mbps	1080p HDR10 VVC	7.52 Mbps
2	2160p HDR10 VVC + LCEVC	7.59 Mbps	1080p HDR10 VVC	7.52 Mbps

Table 1: TV 3.0 Codec Configuration Test Results

The results indicate a **54% saving with VVC + LCEVC** compared to VVC alone in the worst-case scenario, ensuring 2160p HDR fits within an 8 Mbps CBR channel. Across all sequences, VVC + LCEVC achieved a **41% bitrate saving** compared to 1080p HDR VVC.

Resolution and device considerations

The tests used a high-end 65" LG OLED C2, which may not reflect average Brazilian TVs. At around \$2,000, such models represent only a small percentage of the installed base. Lower-end TVs are more likely to show reduced quality when upscaling 1080p HDR, making VVC + LCEVC critical. Globally, about 40% of UHD TVs have limited upscaling capability, which can reduce perceived quality of 1080p HDR streams.

Looking ahead, average TV sizes are increasing, with 85" UHD sets growing in popularity. By 2036, as 8K TVs (currently ~1% of 4K volumes) become more common, high-quality 4K content will be essential, as 1080p will no longer be adequate.

Receiver profile

An interoperability profile for TVs receiving TV 3.0 is in development, with release expected in Q1 2025.

Role of LCEVC in TV 3.0

LCEVC, combined with VVC, enables delivery of 2160p HDR content within an 8 Mbps CBR channel. This ensures consistent quality across UHD TVs, maximizes spectrum efficiency, and meets consumer demand for true 4K content.

The VVC + LCEVC combination also generates significant bandwidth savings compared to TV 2.5, reducing costs and freeing spectrum for other uses.

Ecosystem and integration

As demonstrated during the LCEVC Showcase at recent tradeshows, support for both VVC and MPEG-5 LCEVC standards is steadily increasing. Companies visibly backing the TV 3.0 stack include leading encoder vendors such as Ateame and MainConcept, major SoC manufacturers like Amlogic and Realtek, and TV manufacturers such as Hisense.

The first major international trial of TV 3.0 took place during the FIFA World Cup 2022. This showcase was made possible through the cooperation of Fórum SBTVD members (Ateame, Fraunhofer IIS, Globo, V-Nova) and their partners (MediaTek, Neumann/Sennheiser, Spin Digital, and Telos Alliance) [5].

The second major international trial of TV 3.0 was held during the Paris 2024 Olympics [6]. This live streaming demonstration of VVC combined with MPEG-5 LCEVC featured contributions from a broad ecosystem of participating companies.

Companies	Function									
	Emission					Reception				
	Video		HDR	Audio	Gateway	Video		HDR	Audio	Display
	VVC	LCEVC	See [1]	MPEG-H		VVC	LCEVC	See [1]	MPEG-H	
ATEME	V	X	V	V	NA	NA	NA	NA	NA	NA
MainConcept	V	V	V	V	NA	NA	NA	NA	NA	NA
ENESYS	NA	NA	NA	NA	V	NA	NA	NA	NA	NA
Hisense TV (1)	NA	NA	NA	NA	NA	V				
LG TV (2)	NA	NA	NA	NA	NA	V	X	V	V	V
SEI STB (3)	NA	NA	NA	NA	NA	X (4)	V	V	V	NA
Jiuzhou STB (5)	NA	NA	NA	NA	NA	V		V	V	NA

Table 2: Paris 2024 Olympics TV 3.0 trial

- (1) Powered by MediaTek SoC
- (2) Powered by LG SoC
- (3) Powered by Amlogic SoC
- (4) HEVC base layer
- (5) Powered by Realtek SoC

The 2160p60 HDR video with VVC + LCEVC was live encoded at 10 Mbps, demonstrating a 40 percent reduction compared to standalone 2160p60 HDR VVC. This positions Brazil at the forefront of global compression efficiency for UHD transmission. Further announcements are expected in 2025 as the decoder profile is published, and additional encoder and decoder companies confirm support.

Update from August 2025:

In 2025, Globo also launched pilot DTV+ transmissions in Rio de Janeiro, marking the first consumer-facing deployments under the new standard. At IBC 2025, more vendors will present products that are TV 3.0 compliant, including encoder vendors, SOC manufacturers and TV/STB devices.

Conclusion

TV 3.0 is the most advanced broadcast and broadband standard for greenfield UHD deployments. The integration of MPEG-5 LCEVC with VVC ensures unparalleled efficiency and quality. With nationwide field trials underway in 2025 and commercial deployment confirmed for 2026, Brazil provides a blueprint for efficient UHD adoption worldwide.

References

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- [3] TV 3.0 Project - Phase 3 - Real-Time Video Coding Subjective Quality Assessment: https://forumsbtvd.org.br/wpcontent/uploads/2024/03/SBTVD-TV_3_0-P3-VC-Report.pdf
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- [5] FIFA world cup'22: <https://www.sportsvideo.org/2022/11/29/globoshowcases-next-generation-tv-technology-for-fifa-world-cupqatar-2022-matches/>
- [6] Paris Olympics'24: <https://www.thebroadcastbridge.com/content/entry/20784/vnova-successfully-deploys-lcevc-enhancement-for-globos-tv-3.0- paris-2024>

About MPEG-5 LCEVC technology

MPEG-5 Part 2 LCEVC is an ISO/IEC video compression standard from MPEG that works alongside any codec to improve efficiency and quality. It delivers up to 40% better compression and can cut transcoding costs and power use by up to 70%. Now mandated as part of Brazil's DTV+ (TV 3.0) standard, LCEVC runs across broadcast, streaming and device platforms and is supported by LCEVC capable devices and AI ready workflows. Learn more at www.lcevc.org.

About V-Nova

V-Nova, a London based IP and software company, is dedicated to improving data compression by building a vast portfolio of innovative technologies based on the game-changing use of AI and parallel processing for data, video, imaging, point cloud compression, with applications across several verticals.

This is achieved through deep-science R&D (300+ international patents) and the development of products that test, prove and continuously enhance the technology portfolio.

V-Nova LCEVC is the industry's first highly optimized library for encoding and decoding enhanced video streams with MPEG-5 Part 2, Low-Complexity Enhancement Video Coding (LCEVC). V-Nova VC-6 is a high-performance AI-powered software library for SMPTE VC-6 (ST-2117-1) which is used primarily for professional production workflows and imaging applications.

V-Nova has developed multiple award-winning software products to kickstart the ecosystems for its technologies and allow their immediate deployment, addressing use cases in TV, media, entertainment, social networks, eCommerce, ad-tech, security, aerospace, defence, automotive and gaming. V-Nova's business model is to monetize its technologies through software licensing, IP royalties and product sales.

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