FORUM SBTVD

BRAZILIAN DIGITAL TERRESTRIAL TV FORUM

Call for Proposals: TV 3.0 Project

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17 July 2020

Brazilian Digital Terrestrial Television System Forum

Table of Contents

1 Introduction

The SBTVD Forum was created by the Brazilian Presidential Decree # 5 280 / 2006, to advise the Brazilian Government regarding policies and technical issues related to the approval of technical innovations, specifications, development, and implementation of the Brazilian Digital Terrestrial Television System (SBTVD). The SBTVD Forum is composed of representatives of the broadcasting, academia, transmission, reception, and software industry sectors, and has the participation of Brazilian Government representatives as non-voting members.

Free-to-air terrestrial television is the main audiovisual distribution platform in Brazil, covering almost all Brazilian households and used in more than 70% of them. It secures to most of the Brazilian population a free-of-charge, universal and democratic access to information and entertainment, made by Brazilians for Brazilians. It is, therefore, an important social cohesion, national and cultural identity factor.

For its first generation Digital Terrestrial Television system, after thorough testing and careful studies, the Brazilian Government adopted in June 2006 the ISDB-T standard, incorporating technological innovations that were deemed relevant, such as MPEG-4 AVC (H.264) video coding, MPEG-4 AAC audio coding, an appropriate closed caption character set for the Brazilian Portuguese, and a new middleware for interactive applications (Ginga).

The SBTVD Forum developed the first SBTVD standards, that were published in 2007, allowing the official opening of transmissions in that same year. Since then, the standards have been continuously revised and updated by the Forum. The technological innovations proposed by Brazil were incorporated into the International ISDB-T standard, which is currently adopted by 20 countries.

In 2016, Brazil started a safe and gradual analog TV switch-off process, that was designed to assure that no one would be deprived of the terrestrial free-to-air TV. The process was divided into two stages: in the first stage (2016 to 2019) the analog television switch-off was performed in all the state capitals, metropolitan areas and other areas where it was required to release the 700 MHz band; on the second stage (up to 2023) the analog television switch-off would be performed in the remaining of the country. During the first stage, 1 362 cities in 47 different clusters were impacted, accounting for nearly 128 million people (62% of the population). More than 12 million Digital TV reception kits were distributed for low-income families. The analog switch-off had no significant impact on the free-to-air terrestrial TV audience. Regarding the second stage, the remaining 38% of the population (more than 79 million people) is distributed in 4 208 cities. After the implementation of Digital Terrestrial Television Brazil adopted an industrial policy that determined that all flat-panel TVs manufactured from 2012 must have an integrated Digital TV receiver and from 2013 no more CRT TVs were manufactured. Therefore, it is anticipated, based on the expected product lifetimes, that by 2023 Brazil would have nearly all its TV sets already equipped with an integrated Digital TV receiver, thus facilitating the analog television switch-off without additional Digital TV reception kits distribution.

As the Brazilian digital television switch-over began, the SBTVD Forum started considering the next steps for the evolution of the Brazilian Television. The analog TV (that we conventionally call "TV 1.0"), which started in Brazil in 1950, was black and white with monophonic sound. Then, some backward-compatible improvements (that we conventionally call "TV 1.5"), such as color (in the 1970s), stereo sound and closed caption (in the 1980s) were added to it. From 2007, the first generation of Digital Terrestrial Television (that we conventionally call "TV 2.0") was introduced in Brazil, bringing high-definition video, surround sound, mobile reception, and interactivity. Since then, the technological landscape changed a lot. The rhythm of development and introduction of innovations is increasingly accelerated. These innovations create new consumption habits and increase the expectations of technological services users regarding the quality and convenience of these services. Since the introduction of SBTVD, new immersive audio and video formats emerged, and are already present in the new TV sets available in the market. The TV sets currently available have resolution and contrast greater than those supported in the first generation SBTVD standard. That is the opposite of the market situation when Digital TV was launched in Brazil, as the HDTV sets offer was very low. The availability and the speed of Internet access in Brazil, especially in metropolitan areas, increased significantly, enabling the consumption of on-demand audiovisual content. This connectivity is already in use by TV sets (Smart TVs) and by broadcasters' OTT offers. However, in the first generation SBTVD standard, there was not an integration between the broadcasting service and the Internet content offer. Furthermore, new techniques for signal coding, transport, and modulation were also developed, allowing greater efficiency in audiovisual transmission. Many Digital Terrestrial Television systems have also been evolving, including in this evolution not only enhancements in quality and efficiency but also new convergent services between the broadcasting and the Internet. Based on this technological landscape, the SBTVD Forum recognized the necessity to evolve the SBTVD. It also acknowledged that changing the physical layer, the transport layer, and/or audiovisual coding would not be backward-compatible. Nevertheless, the transition to a new generation of Digital Terrestrial Television is a long process, based on the investments required for both broadcasters and consumers and the expected life span of TV transmitters and receivers. It was, therefore, deemed necessary to increase the life span of the existing Digital Terrestrial Television system as much as possible through a backward-compatible evolution (a project we called "TV 2.5") and to start the development of the next generation Digital Terrestrial Television system (the project we called "TV 3.0").

The "TV 2.5" project comprised two aspects: broadcast-broadband integration and audiovisual quality. The first aspect involved the development of a new receiver profile for the middleware Ginga (receiver profile D, a.k.a. "DTV Play"), addressing use cases such as on-demand video, synchronized companion device, audiovisual enhancement over the Internet and targeted content. The second aspect was addressed through the introduction of three new optional immersive audio codecs (MPEG-H Audio, E-AC-3 JOC, and AC-4) while retaining MPEG-4 AAC main audio for backward-compatibility, and through the introduction of two new optional HDR video formats (SL-HDR1 dynamic metadata and HLG "preferred transfer characteristics" signaling) while keeping MPEG-4 AVC (H.264) / 8-bit / BT.709 / 1080i for backward-compatibility. The revision of the SBTVD standards containing both "TV 2.5" aspects has already been published (available at https://forumsbtvd.org.br/legislacao-e-normas-tecnicas/normas-tecnicas-da-tv-digital/english/).

For the "TV 3.0" project, the SBTVD Forum, after agreeing on its requirements (use cases and corresponding technical specifications), decided to release this Call for Proposals for any interested organization to submit its proposed candidate technologies for any of the system components or sub-components. The new system is expected to start operating in the next few years, but based on the Brazilian experience on the transition from analog to digital television, the complete transition from the current SBTVD to the TV 3.0 is expected to last at least 15+ years.

2 Glossary

2.0	stereo (two full-bandwidth channels) sound
3D	Three-Dimensional
3DoF	Three Degrees of Freedom
5.1	surround (five full-bandwidth channels and one low-frequency effects channel) sound
5.1 + 4H	3D (five full-bandwidth channels, one low-frequency effects channel, and four overhead channels) sound
6DoF	Six Degrees of Freedom
A/V	Audio / Video
ABNT	*Associação Brasileira de Normas Técnicas* (Brazilian Technical Standards Association)
ADM	Audio Definition Model
API	Application Programming Interface
AR	Augmented Reality
BW64	Broadcast Wave 64-bit
C/N	Carrier-to-Noise ratio
DTH	Direct-To-Home
DTT	Digital Terrestrial Television
DTTB	Digital Terrestrial Television Broadcasting
fps	frames per second
HDR	High Dynamic Range
HOA	Higher-Order Ambisonics

IP	Internet Protocol
IPTV	Internet Protocol Television
ISDB-T	Integrated Services Digital Broadcasting-Terrestrial
MIMO	Multiple-Input and Multiple-Output
MOS	Mean Opinion Score
MUSHRA	MUltiple Stimuli with Hidden Reference and Anchor
NBR	*Norma Brasileira Regulamentadora* (Brazilian National Standard)
OASIS	Organization for the Advancement of Structured Information Standards
PNG	Portable Network Graphics
PR	Protection Ratio
reuse-1	the use of the same RF channel by independent stations covering adjacent service areas
RF	Radio Frequency
SBTVD	*Sistema Brasileiro de Televisão Digital* (Brazilian Digital Television System)
SDO	Standards Developing Organization
SDR	Standard Dynamic Range
TIFF	Tagged Image File Format
VR	Virtual Reality
WCG	Wide Color Gamut
XR	eXtended Reality

3 TV 3.0 Architecture

The TV 3.0 system components described in this Call for Proposals reflect the reference TV 3.0 architecture, as depicted in Figure 1.

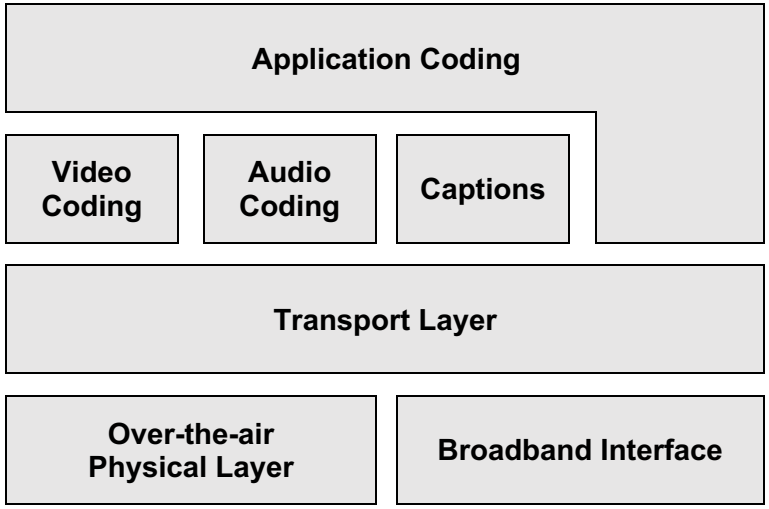

Figure 1: TV 3.0 Architecture

The system considers two complementary delivery methods: over-the-air and Internet. The Internet access physical interface (Broadband Interface) is out of the scope of TV 3.0 system definitions and is assumed to be any bidirectional IP-based broadband access interface. The over-the-air physical layer comprises the unidirectional broadcast modulation/demodulation scheme and the error correction.

The transport layer comprises the multiplexing and transport of video, audio, captions, and applications, as well as all the required metadata.

Video coding, audio coding, and captions are self-evident.

The application coding in TV 3.0 includes, besides the interactivity functions and broadcast-broadband integration, handling the presentation of all audiovisual content.

Accessibility and Emergency Warning features and requirements are embedded as sub-components of these system components, as appropriate.

4 TV 3.0 Requirements

Section 4.1 introduces TV 3.0 general requirements, and the following subsections (4.2 to 4.7) introduce the specific requirements of each system component, as described in the TV 3.0 Architecture (see Section 3). Some of the information requested in the general requirements are due at the Phase 1 deadline (see Section 5) and others are due at the Phase 2 deadline (see Section 5), as indicated. The specific requirements are presented in tables containing use cases and the corresponding technical specifications. If a specification is indicated as "required", it means that every proposal of a candidate technology for that system component (or sub-component) shall comply with it. Please note that, exceptionally, if no candidate technology proposal meets a given requirement, it can be relaxed. If a specification is indicated as "recommended", it means that there is a strong preference for proposals of candidate technologies that comply with it. If a specification is indicated as "desirable", it means that there is a slight preference for proposals of candidate technologies that comply with it. If a specification is indicated as "not required", the compliance with it is indifferent. The compliance form of the appropriate components or sub-components corresponding to the proposed candidate technology is due at the Phase 1 deadline (see Section 5). Additional requirements are also provided for each system component, considering general information and resources needed for evaluating and comparing the proposed candidate technologies, which are due at the Phase 2 deadline (see Section 5). Further information and requirements for Phase 2 will be provided by 15 September 2020, along with the test procedures for evaluating and comparing the proposals of candidate technologies.

4.1 General Requirements

Subsections 4.1.1 to 4.1.3 introduce the technical, commercial, and intellectual property requirements, respectively, that are applicable to all proposals of candidate technologies, regardless of the system component or sub-component addressed.

4.1.1 General Technical Requirements

GT1. A contact person that can provide further technical details of the technical proposal shall be informed. (Phase 1)

GT2. It is recommended that a proponent representative is available to participate in SBTVD Forum Technical Module meetings when necessary (remote participation and English meetings are possible). (Phase 1)

GT3. All technical proposals shall be fully specified, preferably in technical standards of internationally recognized SDOs. (Phase 2)

GT4. The full specification of the technical proposal shall be made available for the SBTVD Forum free of charge. (Phase 2)

4.1.2 General Commercial Requirements

GC1. If the proponent is a for-profit organization, SBTVD Forum membership will be required for the submission of the proposal. (Phase 1)

GC2. A contact person that can provide further commercial details of the technical proposal shall be informed. (Phase 1)

GC3. It is recommended that a proponent representative is available to participate in SBTVD Forum Market Module meetings when necessary (remote participation and English meetings are possible). (Phase 1)

4.1.3 General Intellectual Property Requirements

GI1. A contact person that can provide further licensing or commercialization details of the technical proposal shall be informed. (Phase 1)

GI2. It is recommended that a proponent representative is available to participate in SBTVD Forum Intellectual Property meetings when necessary (remote participation and English meetings are possible). (Phase 1)

GI3. All technical proposals licensing or any other form of commercialization shall adhere to fair, reasonable, and non-discriminatory terms, as specified in the SBTVD Forum Intellectual Property Rights Policy (see Annex A). (Phase 2)

4.2 Over-the-air Physical Layer

One important aspect regarding the TV 3.0 over-the-air physical layer is to consider that it should, in principle, be deployed in the bands currently allocated for DTT in Brazil (High-Band VHF and UHF), using the 6 MHz channel raster and it should co-exist with adjacent ISDB-T channels for a long time without mutual interference.

The specifications outlined for the physical layer in this Call for Proposals are based on the frequency reuse-1, i.e. the use of the same RF channel by independent stations covering adjacent service areas. It would provide great flexibility for the transmission network, that could be freely expanded and subdivided (enabling over-the-air geo-targeted content) using the same channel. It would also increase the network resilience and robustness. Furthermore, it would reduce the demand for additional spectrum for the technological transition. Additionally, after the technology transition, all channels could be used simultaneously and independently in all locations, significantly increasing the capacity available for Digital TV, especially in locations that currently have few channels (note that the distribution of TV channels in the Brazilian territory is currently uneven, depending on the demand of each market). If the neighboring countries to Brazil also adopt reuse-1 technology, after the technological transition the international coordination of TV channels in border areas would be greatly simplified.

Reuse-1 broadcast requires C/N ≤ 0 dB. Taking advantage of such robustness, the new physical layer is also meant to target both mobile outdoor and fixed indoor reception with the same signal, with a single modulation, encoding, and quality, maintaining the current network topology (High-Power, High-Tower), so as not to increase the cost of distributing the signal. The indoor reception target implies that the C/N target is to be considered in a Rayleigh channel. The reason to change the traditional fixed outdoor reception target to a fixed indoor reception target is that the outdoor antenna at 10 meters high with 10 dBd of gain, currently used as a reference in network planning, is becoming less and less representative as the population moves predominantly to apartments instead of houses and many buildings have no communal antenna system. Indoor antennas are also easier to install, and, as they are not directional, new TV transmitters can be added in different locations without the need to repoint antennas. In the future, antennas could be built-in the TV sets, for an even more "plug and play" user experience.

Nevertheless, C/N ≤ 0 dB in a Rayleigh channel implies a very limited channel capacity (bit rate). To compensate that, MIMO 2x2 and channel bonding are required. Channel bonding is intended to be used in conjunction with scalable video coding (one channel with the base layer and the other with the enhancement layer), allowing simpler receivers (e.g. HD TVs and mobile receivers) to receive only one channel while more sophisticated receivers (e.g. UHD TVs) could receive 2 aggregated channels for improved video resolution. Furthermore, every system component should have state-of-the-art efficiency.

Another feature required for the TV 3.0 physical layer is to carry a "wake-up" signaling (to turn on stand-by receivers) in case of an emergency warning.

Finally, it should be noted that the physical layer shall enable future extensions (e.g. to support new modulation schemes).

use case		minimum technical specification			over-the-air delivery
PL1	Enable side-by-side operation with existing ISDB-T systems in the same frequency bands, with minimum impact over existing network planning.	**PL1.1.1**	frequency band	174-216 MHz	required
		PL1.1.2		174-230 MHz	not required for Brazil, but may be useful for other countries that may wish to adopt the same DTTB system
		PL1.1.3		470-698 MHz	required
		PL1.1.4		other frequency bands	desirable to provide more flexibility to the system
		PL1.2.1	channel bandwidth	6 MHz	required
		PL1.2.2		7 MHz	not required for Brazil, but may be useful for other countries that may wish to adopt the same DTTB system
		PL1.2.3		8 MHz	
		PL1.2.4		other channel bandwidths	desirable to provide more flexibility to the system
		PL1.3	co-channel PR (wanted: ISDB-T / unwanted: TV 3.0)	≤ 19 dB	required
		PL1.4	adjacent-channel PR (wanted: ISDB-T / unwanted: TV 3.0)	≤ -36 dB	required
PL2	Enable scalable broadcast network deployment (in terms of coverage and capacity), flexible frequency reuse with spatial content segmentation (reuse-1), and the most efficient spectrum use possible, targeting both fixed indoor and mobile (high-speed) outdoor reception.	**PL2.1**	MIMO	2x2	required
		PL2.2	multi-RF channel transmission	channel bonding - content is spread over two or more RF channels	support to bonding at least 2 channels is required
		PL2.3	high-speed reception	120 km/h	required
		PL2.4	spectrum efficiency	bit/s/Hz @ C/N ≤ 0 dB in Rayleigh channel	higher is better
PL3	Provide "wake-up" capability for compatible receivers in case of an emergency warning.	**PL3.1**	"wake-up" capability		required
PL4	Enable future extensions to the physical layer (e.g. to support new modulation schemes).	**PL4.1**	extensibility		required

4.2.1 Additional Requirements

PL-AR1. Provide free of charge reference modulator and demodulator (hardware or software-defined radio) with its corresponding documentation, strictly for temporary technical evaluation of the SBTVD Forum (non-commercial usage).

PL-AR2. Provide information about available implementations of the modulator and demodulator, the latter both for professional (broadcast) and consumer electronic applications.

PL-AR3. Provide some reference information about the demodulator for TV sets manufacturing.

4.3 Transport Layer

The TV 3.0 transport layer shall enable frame-accurate synchronization of audio, video, and data across multiple distribution platforms for seamless dynamic content replacement or for using audio/video/data enhancement layers. It shall be IP-based. Non-real-time media (download/push) shall be supported. It should be as reliable and efficient as possible (low latency, error detection with low-overhead, avoiding unnecessary metadata duplication). It shall enable Internet content delivery with encryption. Taking advantage of the physical layer reuse-1, each transmission station shall be uniquely identified (e.g. using its latitude and longitude coordinates). The originating station and the TV network shall also be uniquely identified. Emergency warnings shall be supported, over-the-air and over the Internet, as specified in the following table. The Brazilian Government uses OASIS Common Alerting Protocol 1.2 in its emergency warning system. To facilitate interoperability with it, the TV 3.0 emergency warning shall support at least the required elements of that protocol. The transport layer shall enable future extensions (e.g. to support transporting new audio, video, and data formats).

use case		minimum technical specification			over-the-air delivery	Internet delivery
TL1	Enable frame-accurate synchronization of video, audio, and data, either carried on the same platform (e.g. over-the-air) or mixed on different distribution platforms (e.g. DTT, cable, IPTV, DTH satellite, fixed broadband, 4G/5G mobile broadband) for seamless dynamic content replacement or for using audio/video/data enhancement layers.	**TL1.1**	single platform audio/video/data sync	frame-accurate	required	required
		TL1.2	multi-platform audio/video/data sync	frame-accurate	required	required
TL2	Facilitate content rebroadcasting over different distribution platforms (e.g. DTT, cable, IPTV, DTH satellite, fixed broadband, 4G/5G mobile broadband) and for the home network. Support non-real-time media (download/push).	**TL2.1**	IPv4-based transport		required	required
		TL2.2	IPv6-based transport		desirable	required

use case		minimum technical specification			over-the-air delivery	Internet delivery
TL3	Enable reliable and efficient multiplexing (low latency, error detection with low-overhead, avoiding unnecessary metadata duplication).	**TL3.1**	latency	ms	lower is better	lower is better
		TL3.2	error detection		required	required
		TL3.3	overhead	%	lower is better	lower is better
		TL3.4	avoid unnecessary metadata duplication		recommended	recommended
TL4	Enable Internet content delivery with encryption.	**TL4.1**	encryption support		not required	required
TL5	Enable the identification of the TV network, the originating station, and the transmission station.	**TL5.1**	identification of the TV network, the originating station, and the transmission station		required	N/A
TL6	Provide appropriate signaling of whether the channel transports emergency warnings (over-the-air or by the Internet) or not.	**TL6.1**	provide appropriate signaling of whether the channel transports emergency warnings (over-the-air or by the Internet) or not		required	required
TL7	Provide Internet-based "wake-up" capability for compatible receivers in case of an emergency warning.	**TL7.1**	Internet-based "wake-up" capability		N/A	desirable
TL8	Support as much as possible the same Alerting Protocol used by the Brazilian Government, or a similar one.	**TL8.1**	support OASIS Common Alerting Protocol 1.2 required elements		required	required

use case		minimum technical specification		over-the-air delivery	Internet delivery
TL9	Enable flexible geographic targeting for emergency warnings.	**TL9.1**	countrywide alert (with country identification)	required	required
		TL9.2	list of up to 14 federative units within a country to be alerted (with country identification) (at least 27 federative unit codes) (federative unit codes list should be updatable over-the-air and by Internet)	required	required
		TL9.3	list of up to 14 federative units within a country not to be alerted (with country identification) (at least 27 federative unit codes) (federative unit codes list should be updatable over-the-air and by Internet)	required	required
		TL9.4	list of up to 427 municipalities within a federative unit to be alerted (with country and federative unit identification) (at least 5 570 municipality codes) (municipality codes list should be updatable over-the-air and by Internet)	required	required
		TL9.5	list of up to 427 municipalities within a federative unit not to be alerted (with country and federative unit identification) (at least 5 570 municipality codes) (municipality codes list should be updatable over-the-air and by Internet)	required	required
		TL9.6	list of up to 1 000 postal codes entries to be alerted (with country identification) (including individual entries and ranges) (supporting wildcard characters) (Brazilian postal code format: 8 numeric digits)	required	required
		TL9.7	list of up to 1 000 postal codes entries to be alerted (with country identification) (including individual entries and ranges) (supporting wildcard characters) (other postal code formats, up to 10 alphanumeric digits)	not required for Brazil, but may be useful for other countries that may wish to adopt the same DTTB system	
TL10	Enable future extensions to the transport layer (e.g. to support transporting new audio, video, and data formats).	**TL10.1**	extensibility	required	required

4.3.1 Additional Requirements

TL-AR1. Provide free of charge reference multiplexer and demultiplexer (software or hardware) with its corresponding documentation, strictly for temporary technical evaluation of the SBTVD Forum (non-commercial usage).

TL-AR2. Provide information about available implementations of the multiplexer and demultiplexer, the latter both for professional (broadcast) and consumer electronic applications.

TL-AR3. Provide some reference information about the demultiplexer for TV sets manufacturing.

4.4 Video Coding

TV 3.0 video coding shall support HDR / UHDTV as specified in the following table. It should provide state-of-the-art coding efficiency and support live (real-time) encoding with minimum end-to-end latency. A second (vertical with alpha blending) video stream with a sign language interpreter to be optionally activated by the user shall also be supported according to the specifications provided. If activated, the main (horizontal) video would be downscaled and both videos would be reproduced side by side (with no overlap). An optional background still image can be defined by the broadcaster. It is desirable to support emergency warning information sign language video and new immersive video services (such as VR / AR / XR / 3DoF / 6DoF). Seamless and frame-accurate stream splicing or ad-insertion at any time instance, even if some of the streams come from different distribution platforms (e.g. switch between over-the-air and Internet delivery) shall be supported. Finally, the video coding shall be interoperable with different distribution platforms and shall support scalability and extensibility as specified.

use case		minimum technical specification			over-the-air delivery	Internet delivery
VC1	Provide improved video resolution, adequate to consumer electronics display evolution.	**VC1.1.1**	resolution	7 680 x 4 320	not required	required
		VC1.1.2		5 120 x 2 880	recommended	recommended
		VC1.1.3		3 840 x 2 160	required	required
		VC1.1.4		2 560 x 1 440	recommended	recommended
		VC1.1.5		1 920 x 1 080	required	required
		VC1.1.6		1 280 x 720	required	required
		VC1.2	scanning	progressive	required	required
		VC1.3	aspect ratio	16:9	required	required
		VC1.4	sampling	YCbCr 4:2:0	required	required
VC2	Provide improved video dynamic range and color space, adequate to consumer electronics display evolution.	**VC2.1**	bit depth	10-bit/component	required	required
		VC2.2.1	dynamic range	HDR	required	required
		VC2.2.2		HDR Dynamic Mapping	desirable	required
		VC2.2.3		SDR	not required	required
		VC2.3	colorimetry	WCG (Rec. ITU-R BT.2020 / BT.2100)	required	required

use case		minimum technical specification			over-the-air delivery	Internet delivery
VC3	Provide sharp images (reducing motion blur), even on content with fast motion (e.g. sports, action movies).	**VC3.1.1**	frame rate	120 fps	recommended	required
		VC3.1.2		119.88 fps (120/1.001)	recommended	required
		VC3.1.3		60 fps	recommended	required
		VC3.1.4		59.94 fps (60/1.001)	required	required
		VC3.1.5		30 fps	not required	required
		VC3.1.6		29.97 fps (30/1.001)	not required	required
		VC3.1.7		24 fps	not required	required
		VC3.1.8		23.976 fps (24/1.001)	not required	required
		VC3.1.9		100 fps	not required for Brazil, but may be useful for 50Hz countries that may wish to adopt the same DTTB system	
		VC3.1.10		50 fps		
		VC3.1.11		25 fps		
VC4	Provide state-of-the-art coding efficiency, to allow better quality video in limited capacity channels (over-the-air or Internet).	**VC4.1**	bit rate	Mbps @ MOS 4 or equivalent objective metric	lower is better	lower is better
VC5	Provide live video with minimum end-to-end latency.	**VC5.1**	real-time encoding		required	required
		VC5.2	latency	ms	lower is better	lower is better

use case		minimum technical specification			over-the-air delivery	Internet delivery
VC6	Enable second video stream with a sign language interpreter to be optionally activated by the user (to be rendered at the side of the main video, that should be proportionally downscaled to fit the horizontal space left, with no overlap; an optional background still image can be defined by the broadcaster).	**VC6.1.1**	resolution	2 160 x 3 840 (when using 7 680 x 4 320 main video)	not required	required
		VC6.1.2		1 440 x 2 560 (when using 5 120 x 2 880 main video)	recommended	recommended
		VC6.1.3		1 080 x 1 920 (when using 3 840 x 2 160 main video)	required	required
		VC6.1.4		720 x 1 280 (when using 2 560 x 1 440 main video)	recommended	recommended
		VC6.1.5		540 x 960 (when using 1 920 x 1080 main video)	required	required
		VC6.1.6		360 x 640 (when using 1 280 x 720 main video)	required	required
		VC6.2	scanning	progressive	required	required
		VC6.3	aspect ratio	9:16	required	required
		VC6.4	sampling	YCbCr 4:2:0	required	required
		VC6.5	alpha blending		required	required
		VC6.6	bit depth	10-bit/component	required	required
		VC6.7.1	dynamic range	HDR	required	required
		VC6.7.2		HDR Dynamic Mapping	desirable	required
		VC6.7.3		SDR	not required	required
		VC6.8	colorimetry	WCG (Rec. ITU-R BT.2020 / BT.2100)	required	required
		VC6.9.1	frame rate	30 fps	recommended	required
		VC6.9.2		29.97 fps (30/1.001)	required	required
		VC6.9.3		24 fps	not required	required
		VC6.9.4		23.976 (24/1.001)	not required	required
		VC6.9.5		25 fps	not required for Brazil, but may be useful for 50Hz countries that may wish to adopt the same DTTB system	
		VC6.10	bit rate	Mbps @ MOS 4 or equivalent objective metric	lower is better	lower is better
		VC6.11	real-time encoding		required	required
		VC6.12	latency	ms	lower is better	lower is better

use case		minimum technical specification			over-the-air delivery	Internet delivery
VC7	Enable emergency warning information delivery using sign language video.	**VC7.1**	emergency warning information sign language video		desirable	desirable
VC8	Enable new immersive video services.	**VC8.1**	VR / AR / XR / 3DoF / 6DoF support		desirable	desirable
VC9	Enable seamless decoding and A/V alignment.	**VC9.1**	seamless and frame-accurate stream splicing or ad-insertion at any time instance, even if some of the streams come from different distribution platforms (e.g. switch between over-the-air and Internet delivery)		required	required
VC10	Enable interoperability with different distribution platforms (e.g. DTT, cable, IPTV, DTH satellite, fixed broadband, 4G/5G mobile broadband, home network).	**VC10.1**	interoperability with different distribution platforms		required	required
VC11	Enable scalability (e.g. to improve over-the-air video quality with an Internet-delivered enhancement layer) and extensibility (support new settings and/or features in the future, in a backward-compatible way).	**VC11.1.1.**	scalability	spatial	required	required
		VC11.1.2.		temporal	recommended	recommended
		VC11.1.3.		quality (bit rate)	recommended	required
		VC11.2	extensibility		required	required

4.4.1 Additional Requirements

VC-AR1. Provide free of charge test content (consecutively numbered TIFF files) with the required technical specification, strictly for technical evaluation of the SBTVD Forum (non-commercial usage). The content shall not contain commercial brands.

VC-AR2. Provide free of charge reference encoder and decoder (software or hardware) with its corresponding documentation, strictly for temporary technical evaluation of the SBTVD Forum (non-commercial usage).

VC-AR3. Provide information about available implementations of the encoder and decoder, the latter both for professional (broadcast) and consumer electronic applications.

VC-AR4. Provide some reference information about the decoder for TV sets manufacturing.

4.5 Audio Coding

TV 3.0 audio coding shall support immersive and interactive audio as specified in the following table. It should provide state-of-the-art coding efficiency and support live (real-time) encoding with minimum end-to-end latency. It shall also support audio description delivery in the same stream as the main audio, as an alternative full mix or as an additional audio object with associated metadata. It is desirable to support emergency warning information audio description and new immersive audio services (such as VR / AR / XR / 3DoF / 6DoF). Seamless and frame-accurate configuration changes, production changes, user interaction, stream splicing, or ad-insertion at any time instance, even if some of the streams come from different distribution platforms (e.g. switch between over-the-air and Internet delivery) shall be supported. Finally, the audio coding shall enable a single delivery format for multiple audio playback configurations, enable consistent loudness across programs and inside the same program, provide frame-accurate audio/video synchronization, be interoperable with different distribution platforms and support scalability and extensibility as specified.

use case		minimum technical specification			over-the-air delivery	Internet delivery
AC1	Enable immersive (3D) audio.	**AC1.1.1**	channel-based	2.0	required	required
		AC1.1.2		5.1	required	required
		AC1.1.3		5.1 + 4H	required	required
		AC1.2	object-based		required	required
		AC1.3	scene-based (HOA)		desirable	desirable
AC2	Enable end-user interactivity/personalization when allowed by the broadcaster (e.g. switch among different languages, sports commentators, adjust the commentator loudness level and position).	**AC2.1**	switch components (audio objects and alternative full mix substreams)		required	required
		AC2.2	adjust object loudness		required	required
		AC2.3	adjust object position		required	required
		AC2.4	enable interactivity when using external sound reproduction devices		required	required
AC3	Enable audio description delivery in the same stream as the main audio, as an alternative full mix or as an additional audio object with associated metadata.	**AC3.1**	audio description delivery in the same stream as the main audio		required	required
		AC3.2	audio description delivery as an alternative full mix		required	required
		AC3.3	audio description delivery as an additional audio object with associated metadata		required	required
AC4	Enable emergency warning information delivery using audio description.	**AC4.1**	emergency warning information audio description		desirable	desirable
AC5	Enable a single delivery format for multiple audio playback configurations (TV loudspeakers, soundbars, home theaters, binaural).	**AC5.1**	flexible loudspeaker configuration render		required	required
		AC5.2	binaural render		required	required

use case		minimum technical specification			over-the-air delivery	Internet delivery
AC6	Enable consistent loudness across programs and inside the same program.	**AC6.1**	consistent loudness across programs		required	required
		AC6.2	consistent loudness after user interaction		required	required
AC7	Enable seamless configuration changes and A/V alignment.	**AC7.1**	seamless playback during configuration changes (e.g. from 5.1+4H to stereo)		required	required
		AC7.2	seamless playback during user interaction (e.g. enable/disable several audio elements)		required	required
		AC7.3	seamless playback during changes in production (e.g. broadcaster removes one object)		required	required
		AC7.4	seamless and sample-accurate stream splicing or ad-insertion at any time instance, even if some of the streams come from different distribution platforms (e.g. switch between over-the-air and Internet delivery)		required	required
AC8	Provide state-of-the-art coding efficiency, to allow better quality audio in limited capacity channels (over-the-air or Internet).	**AC8.1**	bit rate	kbps @ MOS 4 / MUSHRA > 80 or equivalent objective metric	lower is better	lower is better
AC9	Provide live audio with minimum end-to-end latency.	**AC9.1**	real-time encoding		required	required
		AC9.2	latency	ms	lower is better	lower is better
AC10	Provide audio/video synchronization.	**AC10.1**	A/V sync	frame-accurate	required	required
AC11	Enable new immersive audio services.	**AC11.1**	VR / AR / XR / 3DoF / 6DoF support		desirable	desirable
AC12	Enable interoperability with different distribution platforms (e.g. DTT, cable, IPTV, DTH satellite, fixed broadband, 4G/5G mobile broadband, home network).	**AC12.1**	interoperability with different distribution platforms		required	required
AC13	Enable scalability (e.g. to enhance the over-the-air audio experience with additional Internet-delivered audio content, such as new sports commentator options) and extensibility (support new settings and/or features in the future, in a backward-compatible way).	**AC13.1**	scalability		required	required
		AC13.2	extensibility		required	required

4.5.1 Additional Requirements

AC-AR1. Provide free of charge test content (BW64 file with ADM metadata) with the required technical specification, strictly for technical evaluation of the SBTVD Forum (non-commercial usage). The content shall not make any reference to commercial brands.

AC-AR2. Provide free of charge reference encoder and decoder (software or hardware) with its corresponding documentation, strictly for temporary technical evaluation of the SBTVD Forum (non-commercial usage).

AC-AR3. Provide information about available implementations of the encoder and decoder, the latter both for professional (broadcast) and consumer electronic applications.

AC-AR4. Provide information about available implementations of production tools: authoring and monitoring for live and post-production.

AC-AR5. Provide some reference information about the decoder for TV sets manufacturing.

4.6 Captions

TV 3.0 captions shall enable frame-accurate synchronization with video, support the complete character set currently used for closed captioning in Brazil, enable live and offline closed-captioning, enable text styling control, enable sending sign language gloss as a separate caption stream to be synthesized as sign language video by an appropriate app and support emergency warning information captions (text), as specified in the following table. It is desirable to support images (e.g. PNG) to enable displaying non-textual information, and to support emergency warning information delivery using sign language gloss and caption images. Finally, the TV 3.0 captions shall enable interoperability with different distribution platforms as specified.

use case		minimum technical specification			over-the-air delivery	Internet delivery
CC1	Enable frame-accurate synchronization with video.	**CC1.1**	video/caption sync	frame-accurate	required	required
CC2	Support the complete character set currently used for closed captioning in Brazil.	**CC2.1**	support the complete character set currently used for closed captioning in Brazil (as specified in ABNT NBR 15610-1)		required	required
		CC2.2	support other languages character sets (Latin and non-Latin)		not required for Brazil, but may be useful for other countries that may wish to adopt the same DTTB system	
CC3	Enable live and offline closed-captioning.	**CC3.1**	live closed-captioning		required	required
		CC3.2	offline closed-captioning		required	required
CC4	Enable text styling control.	**CC4.1**	control text horizontal and vertical position		required	required
		CC4.2	control text horizontal and vertical alignment		required	required
		CC4.3	select text font		required	required
		CC4.4	control text size		required	required
		CC4.5	select font style (normal, bold, italic and underline)		required	required
		CC4.6	select text color		required	required
		CC4.7	select background-color		required	required
CC5	Support images (e.g. PNG) to enable displaying non-textual information.	**CC5.1**	support images (e.g. PNG) to enable displaying non-textual information		desirable	desirable

use case		minimum technical specification			over-the-air delivery	Internet delivery
CC6	Enable sending sign language gloss as a separate caption stream to be synthesized as sign language video by an appropriate app.	**CC6.1**	enable sending sign language gloss as a separate caption stream		required	required
CC7	Enable emergency warning information delivery using captions.	**CC7.1.1**	emergency information media format	captions (text)	required	required
		CC7.1.2		captions (image)	desirable	desirable
		CC7.1.3		sign language (gloss)	desirable	desirable
CC8	Enable interoperability with different distribution platforms (e.g. DTT, cable, IPTV, DTH satellite, fixed broadband, 4G/5G mobile broadband, home network).	**CC8.1**	interoperability with different distribution platforms		required	required
		CC8.2	convertibility between the new caption format and the format specified in ABNT NBR 15610-1		required	required

4.6.1 Additional Requirements

CC-AR1. Provide free of charge reference caption encoder and decoder/renderer (hardware or software) with its corresponding documentation, strictly for temporary technical evaluation of the SBTVD Forum (non-commercial usage).

CC-AR2. Provide information about available implementations of the encoder and decoder/renderer, the latter both for professional (broadcast) and consumer electronic applications.

CC-AR3. Provide some reference information about the decoder/renderer for TV sets manufacturing.

4.7 Application Coding

The SBTVD Forum members have invested a lot of time and effort in developing DTV Play (Ginga receiver profile FSD_09 as defined in ABNT NBR 15606-1) for the "TV 2.5" project. It addresses use cases such as on-demand video, synchronized companion device, audiovisual enhancement over the Internet, and targeted content. Its first implementations are about to be released in the market. Therefore, it is very important that the TV 3.0 application coding enable application re-use/interoperability with DTV Play, re-use, as much as possible, the implementation of DTV Play, and support all the use cases supported in DTV Play. It shall be a further development on top of DTV Play, rather than a full replacement.

Currently, Digital TV is based on audiovisual program services that can contain interactive applications. The application coding in TV 3.0 includes, besides the interactivity functions and broadcast-broadband integration, handling the presentation of all audiovisual content. The user experience with TV will now be "application-oriented".

To enable the application coding to handle the presentation of all audiovisual content, it shall support TV 3.0 transport layer, video coding, audio coding, and captions. To take further advantage of the new physical layer and the new architecture, the application coding shall be able to access lower-level (physical-layer/transport-layer/operating-system) information, such as the receiver front-end parameters (RF channel, reception power in dBm and C/N in dB), the identification of the TV network, the originating station, and the transmission station, and geolocation information.

It shall include multi-device and multi-user support and provide an audience measurement common interface while protecting user privacy, as specified in the following table. It shall enable IP convergence, enable the streaming of accessibility services to a Smart TV or companion device app, support 3D object-based immersive audio interaction, support optimized application transport, and support multi-sourced scalable content. It is desirable to support further enhanced user interfaces, machine-learning APIs, Internet of Things protocols and mechanisms, emergency warning information interactive application, and further immersive TV features such as sensory effects, 3DoF / 6DoF / VR / AR / XR, etc. Finally, the application coding shall enable future extensions to the middleware (e.g. to support new features in future receiver profiles) as specified.

NOTE: Some requirements may be addressed in different abstraction levels, so the feature may be implemented as a middleware component or as part of an application logic module. It is expected the proponent to include API specifications, testing procedures, and source code examples for each addressed requirement.

use case		minimum technical specification		over-the-air delivery	Internet delivery
AP1	Enable application re-use/interoperability with FSD_09 Ginga receiver profile (as defined in ABNT NBR 15606-1).	**AP1.1**	FSD_09 Ginga receiver profile application re-use/interoperability	required	required
AP2	Re-use, as much as possible, the implementation of the middleware components and subsystems used in FSD_09 Ginga receiver profile (as defined in ABNT NBR 15606-1).	**AP2.1**	FSD_09 Ginga receiver profile middleware components and subsystems implementation re-use	required	required
AP3	Support all the use cases supported in FSD_09 Ginga receiver profile (as defined in ABNT NBR 15606-1).	**AP3.1**	FSD_09 Ginga receiver profile use cases support	required	required
AP4	Support the new technologies to be adopted in the TV 3.0 project.	**AP4.1**	support TV 3.0 transport layer	required	required
		AP4.2	support TV 3.0 video coding	required	required
		AP4.3	support TV 3.0 audio coding	required	required
		AP4.4	support TV 3.0 captions	required	required
AP5	Enable accessing lower-level (physical-layer/transport-layer/operating-system) information.	**AP5.1**	access the identification of the TV network, the originating station, and the transmission station	required	N/A
		AP5.2	access the receiver front-end parameters (RF channel, reception power in dBm and C/N in dB)	required	N/A
		AP5.3	geolocation API with multiple sources of data such as transmission station, GPS, and assisted GPS (using Wi-Fi networks)	required	required

use case		minimum technical specification		over-the-air delivery	Internet delivery
AP6	Enable application-oriented TV.	**AP6.1**	application-oriented user experience with TV	required	required
		AP6.2	handling the presentation of all audiovisual content	required	required
		AP6.3	application switching delay	lower is better	lower is better
AP7	Support for Enhanced User Interface.	**AP7.1**	voice interaction, pre-defined commands, and natural language	desirable	desirable
		AP7.2	gesture interaction, at least with pre-defined gestures	desirable	desirable
		AP7.3	multi-touch interaction, at least with pre-defined gestures	desirable	desirable
		AP7.4	multimodal interaction, free input compositions	desirable	desirable
		AP7.5	multi-device support, synchronous and asynchronous modes	required	required
		AP7.6	multi-user identification support	required	required
		AP7.7	multi-user interaction support	desirable	desirable
AP8	Provide audience measurement common interface.	**AP8.1**	standardized audience measurement API (taking multi-user identification support into account)	required	required
AP9	Machine-learning support for context-awareness.	**AP9.1**	machine-learning APIs	desirable	desirable
AP10	Protect user privacy.	**AP10.1**	API-based user privacy	required	required
		AP10.2	compliance with Brazilian General Personal Data Protection Act (Law nº 13.709/2018)	required	required
AP11	Enable IP convergence.	**AP11.1**	full IP convergence, both in broadcast and broadband channels	required	required
		AP11.2	Internet of Things protocols and mechanisms	desirable	desirable
		AP11.3	IP-based application push delivery	required	required
		AP11.4	low-latency content forwarding	required	required
AP12	Enable the streaming of accessibility services to a Smart TV or companion device app.	**AP12.1**	audio description streaming to a Smart TV or companion device app	required	required
		AP12.2	closed caption streaming to a Smart TV or companion device app (for it to display the closed caption or to perform automatic translation and adaptation from the closed caption to sign language)	required	required
		AP12.3	sign language gloss streaming for a client-side application (in the Smart TV or companion device) to perform the synthesis of the sign language video	required	required
		AP12.4	sign language video streaming to a Smart TV or companion device app	required	required

use case		minimum technical specification		over-the-air delivery	Internet delivery
AP13	Enable emergency warning information delivery using an interactive application.	**AP13.1**	emergency warning information interactive application	desirable	desirable
AP14	Support for Immersive TV.	**AP14.1**	sensory effects (lighting, temperature, wind, scents, vibration)	desirable	desirable
		AP14.2	3DoF video interaction	desirable	desirable
		AP14.3	6DoF video interaction	desirable	desirable
		AP14.4	3D object-based immersive audio interaction	required	required
		AP14.5	3D media positioning and interaction	desirable	desirable
		AP14.6	VR / AR / XR support	desirable	desirable
AP15	Support optimized application transport.	**AP15.1**	inherent compression support	required	required
		AP15.2	multi-sourced application delivery	required	required
AP16	Support multi-sourced scalable content.	**AP16.1**	multi-sourced scalable content API	required	required
AP17	Enable future extensions to the middleware (e.g. to support new features in future receiver profiles).	**AP17.1**	extensibility	required	required

4.7.1 Additional Requirements

AP-AR1. Provide interoperability test suite with its corresponding documentation.

AP-AR2. Provide information about available prototypes of the proposed middleware components.

AP-AR3. Provide some reference information about the middleware for TV sets manufacturing.

5 Schedule

The overall schedule for TV 3.0 standardization involves receiving proposals of candidate technologies in the second semester of 2020, evaluating and comparing the proposals in the first semester of 2021, selecting the appropriate technologies for each system component by July 2021, and developing the standards in the second semester of 2021. Subsection 5.1 presents the deadlines and procedures for responding to this Call for Proposals. Subsection 5.2 outlines the next steps for candidate technologies evaluation.

5.1 Responding to this Call for Proposals

The response to this Call for Proposals is divided into two phases.

Phase 1 responses are due by 30 November 2020. It comprises the identification of each proposed candidate technology and of appropriate contact persons (as indicated in Subsection 4.1) and filling the compliance form of the appropriate components or sub-components corresponding to the proposed candidate technology (as indicated in the tables of Subsections 4.2 to 4.7). Please note that, as indicated in Subsection 4.1.2, if the proponent is a for-profit organization, SBTVD Forum membership will be required for the submission of the proposal. Responses shall be provided using the online form available at https://forms.gle/6DUWE9bFVbHFou4n8.

Phase 2 responses are due by 29 January 2021. It comprises providing the full specification of the proposed candidate technology and adhering to the SBTVD Forum Intellectual Property Rights Policy (as indicated in Subsection 4.1) and the additional requirements considering general information and resources needed for evaluating and comparing the proposed candidate technologies (as indicated in Subsection 4.2). Further information and requirements for Phase 2 will be provided by 15 September 2020, along with the test procedures for evaluating and comparing the proposals of candidate technologies and instructions on providing Phase 2 responses.

Questions related to this Call of Proposals should be directed to:

Luiz Fausto, Chair, Technical Module, SBTVD Forum: luiz.fausto@forumsbtvd.org.br

Doris Guardia, Secretary, SBTVD Forum: secretaria@forumsbtvd.org.br

Questions related to SBTVD Forum membership should be directed to:

Mauricio Kakassu, Superintendent, SBTVD Forum: superintendencia@forumsbtvd.org.br

Doris Guardia, Secretary, SBTVD Forum: secretaria@forumsbtvd.org.br

6 SBTVD Forum Disclaimers

SBTVD Forum reserves the right to modify or withdraw this Call for Proposals without notice.

SBTVD Forum reserves the right not to revise existing standards or to develop new standards based upon this Call for Proposals.

SBTVD Forum will not provide compensation for responses to this Call for Proposals that result in specifications embodied in the SBTVD standards.

Annex A: SBTVD Forum Intellectual Property Rights Policy

INITIAL CONSIDERATIONS

CONSIDERING that the Forum of the Brazilian Digital Television System ("SBTVD Forum"), aims to promote the definition, development and planning of the technical and strategic standards, voluntary or mandatory, of the Brazilian Digital Terrestrial Television System - SBTVD-T, proposing the implementation of such standards, in accordance with its Bylaws;

CONSIDERING, in particular, that SBTVD Forum is also responsible for proposing guidelines for solving intellectual property issues in the creation and implementation of the Brazilian Digital Terrestrial Television System (SBTVD-T);

CONSIDERING the need to establish a policy that governs the use by members of the SBTVD Forum of the intellectual property rights involved in the implementation of the specifications of the Brazilian Digital Television System;

Members of the SBTVD Forum agree to establish these rules governing the use of intellectual property in accordance with the common objectives of the members and the Forum.

MISCELLANEOUS

Art. 1. The members of the SBTVD Forum commit themselves to act in good faith, respecting and complying with all rules related to the intellectual property rights described in this instrument, Brazilian legislation and international treaties governing the matter.

Art. 2. The members, through their legal representatives, commit themselves to communicate to the SBTVD Forum, in the person of the Chairman of the Deliberative Committee, within a period of 60 (sixty) days from the date of publication of the minutes that formalize the decision to use the technology, ownership of any intellectual property rights that may be used in the development of the Brazilian Digital Television System, in order to avoid misuse or violation of third party rights.

Art. 3. The creations, specifications, norms and procedures developed within the scope of the SBTVD-T Forum will be widely disseminated under Brazilian law so as to publicize norms, including for non-members of the Forum that may directly or indirectly have interests or properties related to SBTVD-T.

INTELLECTUAL PROPERTY TREATMENT

Art. 4. The SBTVD Forum aims to provide the joint creation, by its members, of standardized technical standards and specifications for the implementation of the Brazilian Digital Television System, with the Forum, as organizer, being the holder of the intellectual property rights over the set of creations.

§1. All development of new technologies, procedures, specifications or activities by the SBTVD Forum that involve the use of new knowledge will be preceded by a previous search under the responsibility of the SBTVD Forum in databases on intellectual property rights of worldwide scope.

§2. Members are not required to disclose to the SBTVD Forum any intellectual creations they hold, whether registered or not. However, an associate who does not manifest ownership of any intellectual property used within the SBTVD Forum, within 60 (sixty) days from the date of publication of the minutes that formalize the decision to use the proprietary technology, will not have the right to demand any subsequent financial claim.

§3. The associate who owns the intellectual property on technologies, processes and products that may be used in SBTVD-T specifications or standards by its legal representative may formally assign rights to the use of intellectual property to the SBTVD Forum on fair, reasonable and non-discriminatory terms.

BINDING OF ASSOCIATES OF INTELLECTUAL PROPERTY POLICY

Art. 5. Adherence to the terms of this instrument shall be carried out upon the disclosure of its approval by the SBTVD Deliberative Committee.

BRANDS, STAMPS AND WARRANTIES TO SBTVD-T PRODUCTS AND SERVICES USERS

Art. 6. Members of the SBTVD Forum shall have the right to exclusively use the Trademarks owned by the Forum to indicate the conformity and regularity of their products and services with the Brazilian standard of digital television.

CONFIDENTIALITY

Art. 7. The members commit themselves to maintain the confidential nature of confidential information, marked as such at the time of disclosure, which they may have access to because of their participation and attributions with the SBTVD Forum, and may be held responsible for the unauthorized disclosure of confidential information, and also undertakes to take all appropriate measures to protect this information, especially the representatives and employees, among other persons involved in the execution of activities related to their participation in the Forum.

§1. The following information is excluded from the confidentiality obligation contained in this article: (a) publicly available; (b) who are already in the possession of the member as a result of their own research, provided that the member can prove this fact; (c) the disclosure of which is required of an associate as a result of law, judicial determination or any governmental body; and, (d) received from third parties, without breach of the obligation of confidentiality provided herein.

§2. The obligation of confidentiality will be fully valid for 5 (five) years, counted from the date of disclosure of the information marked as confidential.

FINAL DISPOSITIONS

Art. 8. For the purpose of counting the deadlines defined in this policy, the official communications of the Forum will be held exclusively by electronic means for the contact previously indicated by the members. It will be the responsibility of the member to indicate and keep up-to-date their respective contact in the Forum database.

ARBITRATION CLAUSE

Art. 9. Any dispute or disagreement arising out of or relating to this Policy and any subsequent changes thereto, including without limitation its formation, validity, effectiveness, interpretation, execution, noncompliance or termination, as well as non- contractual claims, shall be subject to mediation according to with the WIPO Mediation Regulation. The mediation will take place in São Paulo/SP. The language that will be used in mediation will be Portuguese (BR).

Sole paragraph: If the dispute, controversy or claim has not been settled by virtue of the mediation, or insofar as it has not been settled within a period of ninety (90) days from the commencement of the mediation, this will be, upon presentation of a Request for Arbitration by the associate or by the Chairman of the SBTVD Forum, submitted to, and ultimately resolved by, arbitration under the Accelerated Arbitration Rules of WIPO. Notwithstanding, if, before the expiration of said period of ninety (90) days, either party abstains from participating or continuing to participate in mediation, the dispute, controversy or demand shall be, upon presentation of an Arbitration Request by the arbitration under the Accelerated Arbitration Rules of WIPO. The arbitral tribunal shall consist of a single arbitrator. The arbitration will take place in São Paulo/SP. The language to be used in the arbitration procedure will be Portuguese (BR). The dispute, controversy or claim submitted to arbitration shall be decided in accordance with Law no. 9,307, September 23, 1996.