Doc T-23/1

PROGRAMME

VENUE: KBS TS-1, SEOUL

SATURDAY 28 OCTOBER

TC PROCEEDINGS

13:30–14:00 **Welcome Address**
Hamid Dehghan Nayeri, Chairman, ABU Technical Committee and
Director, International Technical Affairs & ABU Technical Liaison Officer, IRIB-Iran

Welcome Address from the Host
Kim Byung Guk, Executive Managing Director, Technology Division, KBS-Korea

Opening Address
Ahmed Nadeem, Secretary-General, ABU

ABU ENGINEERING AWARDS 2023

14:00-14:30 **Announcement of Winners of the Annual ABU Engineering Awards and Technical Review Prizes 2023**

KEYNOTE PRESENTATION

14:30-15:00 **Emerging Technologies for Future Public Media**
Masakazu Iwaki, Executive Research Engineer, NHK-STRL, Japan

15:00-15:30 *BREAK: Tea, coffee & networking*

TC PROCEEDINGS

15:30-16:00 **Confirmation of the Agenda and TC-2022 Proceedings and Appointment of Rapporteurs**

ABU Technology Activity Report

Bureau Proposals (Introduction)

THE HOST PRESENTS

16:00-17:00 **Moderator:** Cho Sung Rae, Director of Technology Management, KBS Technology Division, KBS-Korea and Honorary Vice-Chairman, ABU Technical Committee

AI-powered production: less repetitive, more creative
Lee Yoon Jae, Deputy Manager (Team Leader), KBS Media Technical Research Institute, Korea

The Role and Efforts of Korea for Broadcasting Development in the Asia-Pacific Region
Joonam Lee, Deputy General Manager, Radio Wave & Broadcasting Industry Strategy Division, Korea Radio Promotion Association (RAPA)

End of TC Day 1

SUNDAY 29 OCTOBER

TOPIC AREA REPORTS

09:00–09:40 **Production**
Kazim Pektaş, Chief Engineer, Studio Planning Department, TRT-Türkiye
Distribution
Yuji Nagata, Expert Engineer, Engineering Administration Department, NHK-Japan
Spectrum
Dr Li Leilei, Professor, Academy of Broadcasting Planning, NRTA-China
Training & Services
P. Das, Advisor, Doordarshan, Prasar Bharati-India

09:40-10:15 **Information Exchange and Status Reports**

10:15-10:30 **Bureau Proposals (Final Reading)**

10:30-11:00 *Tea, coffee & networking*

ELECTION OF OFFICE BEARERS | ABU TC

11:00-12:30 **TC Elections**

12:30-13:30 *Networking lunch*

INVITED PRESENTATIONS | ADVANCEMENTS IN BROADCAST TECHNOLOGY & SERVICES

13:30-15:00 **Moderator:** Masashi Kamei, Senior Research Engineer, NHK STRL-Japan and Vice-Chairman, ABU Technical Committee

Technical perspectives of content exchange & media accessibility for hearing-impaired (tbc)
Hamid Dehghan Nayeri, Director, International Technical Affairs, IRIB-Iran

Lost in Transmission: Exploring the Pitfalls of Broadcast to Mobiles
Dr Peter Siebert, Adcom Member & VP, IEEE Broadcast Technology Society

Emergency Warnings: a co-operative approach to disaster alerting
Lindsay Cornell, Principal Systems Architect, BBC and Chairman, WorldDAB Technical Committee

Latest updates in DVB media delivery ecosystem (tbc)
Peter MacAvock, Chairman, DVB

15:00-15:30 *BREAK: Tea, coffee & networking*

INVITED PRESENTATIONS | LATEST TECHNOLOGY IMPLEMENTATIONS & USE CASES

15:30-16:30 **Moderator:** Kazim Pektas, Chief Engineer, Studio Planning Department, TRT-Türkiye and Vice-Chairman, ABU Technical Committee

Developments in the digital space - An ABC case study
Joel Brydon, Head of Digital Product, ABC-Australia

Asia-Pacific Going Big on DRM Digital Radio
Alexander Zink, Vice Chairman DRM Consortium and Chief Business Development Manager, Fraunhofer IIS

Beijing Winter Olympics 8K UHD TV International Public Signal Production
Mei Jianping, Director, Data Application Department, China Media Group, China

Broadcast, Content Distribution & Media Solutions
Ina Lui, Senior Vice President, Commercial, Business Development and Strategy, AsiaSat

MEMBER UPDATES & CLOSING

16:30-17:00 **New Members and Updates from Sister Unions & Intl Organisations**

Future Meetings
ABU DBS 2024, Kuala Lumpur, 4-7 March 2024

Appointment of Honorary Vice-Chairman from the host of the 2024 ABU General Assembly

Closing remarks by TC Chairman

18:00-18:45 **Welcome Cocktail Party @ KBS Hall**

19:30-21:30 **ABU TV Song Festival @ KBS Hall**

Technical Committee Meeting

28.10.2023 - 13:30-17:00 & 29.10.2023 - 9:00-17:00

ABU 2023 SEOUL

Doc T-23/2

AGENDA

Day 1 | Saturday 28 October

1. Opening Session

    1.1 Welcome address by Chairman, ABU Technical Committee
    1.2 Welcome address by host, KBS-Korea
    1.3 Opening address by ABU Secretary-General
    1.4 Announcement and Presentation of the 2023 ABU Technical Review Prizes and Engineering Awards

2. Keynote Presentation

3. Confirm Agenda and TC-2022 Proceedings

4. Appointment of Rapporteurs

5. ABU Technology Activity Report

6. Bureau Proposals (Introduction)

7. The Host Presents

Day 2 | Sunday 29 October

8. Report from Topic Area Chairmen

9. Information Exchange and Status Reports

10. Bureau Proposals (Final Reading)

11. Election of Office Bearers | ABU Technical Committee

12. Invited Presentations: Advancements in Broadcast Technology & Services

13. Invited Presentations: Latest Technology Implementations and Use Cases

14. Members' Updates

15. Future Meetings

16. Appointment of TC 2024 Honorary Vice-Chairman and Welcome to Istanbul

17. Closing

Doc T-23/3

ABU TECHNOLOGY

LIST OF DOCUMENTS

Doc No	Source	Title of the Document
T-23/1	ABU TD	Programme
T-23/2	ABU TD	Agenda
T-23/3	ABU TD	List of Documents
T-23/4	ABU TD	TD Activity Report
T-23/5	ABU TD	Report on the Mid-year Meeting of the Technical Bureau
T-23/6	TA-P	Topic Chairman's Report – Production
T-23/7	TA-T	Topic Chairman's Report – Distribution
T-23/8	TA-TS	Topic Chairman's Report – Training & Services
T-23/9	TA-S	Topic Chairman's Report – Spectrum
T-23/10	ABU TB	Implementing Attendance Policy for Bureau Meetings
T-23/12-1	ABU TB	Appointment of Topic Area Chair – Distribution Topic Area
T-23/12-2	ABU TB	Terms of Reference – Topic Areas and Projects
T-23/13	ABU TD	Calendar of Events
T-23/14	ABU TD	List of Delegates
T-23/20	**STATUS REPORTS**	
T-23/20-1	Tonga Broadcasting Commission - Tonga	
T-23/20-2	Television Broadcasts Limited Hong Kong - China	
T-23/20-3	National Broadcasting Services of Thailand - Thailand	
T-23/20-4	Radio Television Hong Kong - China	
T-23/20-5	Nepal Television Corporation - Nepal	
T-23/20-6	Radio Broadcasting Service - Nepal	
T-23/20-7	Korean Broadcasting System - South Korea	
T-23/20-8	The Voice of Vietnam - Vietnam	
T-23/20-9	National Radio and Television Administration - China	
T-23/20-10	Turkish Radio Television Corporation - Türkiye	
T-23/20-11	Japan Broadcasting Corporation - Japan	
T-23/20-12	Kiribati Hope Radio - Kiribati	

Doc No	Source	Title of the Document
T-23/21	**INFORMATION DOCUMENTS**	
T-23/21-1		Introduction of 5G Channel Technology White Paper, Guo Changxiong, Suzhou Broadcasting System
T-23/21-2		6DoF VR video content production, distribution and multi-platform real-time interaction, Wei Na, Academy of Broadcasting Science, NRTA
T-23/21-3		Automatic AI-based Sports Events Production Revolution, Yan Kaihua, China Broadcasting Network Chongqing Co., Ltd
T-23/21-4		Introduction of 5G New Radio Multicast Broadcast, Xue Kaixin China Broadcasting Network Group Corporation Ltd
T-23/21-5		Research and Application Demonstration of Intelligent Recommended Channels for Cable TV, Dong Yuan, YaoMiaohua, Cao Yali Beijing Gehua CATV Network Co., Ltd., Wasu Media & Network Co., Ltd., BesTV NetTV Technology Development Co., Ltd.
T-23/21-6		Introduction of a Smart TV Operating System, Sheng Zhifan Academy of Broadcasting Science, NRTA
T-23/21-7		Upgrade and Application of Beijing Radio & Television Station 8K Ultra HD Technology System, Zhang Xiaodan, Wang Lidong Beijing Radio and Television Station
T-23/21-8		Introduction of the Third Generation AVS Video Coding Standard (AVS3), Zhou Yun Academy of Broadcasting Science, NRTA
T-23/21-9		China V Chain: Digital Copyright Protection and Transaction Application in The Radio and Television Industry Based on Blockchain Technology, Guan Jingrong, Li Liang, Huang XiHunan Malanshan Tianze Weilian Technology Co., Ltd.
T-23/21-10		Virtual Digital Human, Guxiaoyu Fang Chencen Zhejiang Satellite TV& Tencent Interactive Entertainment
T-23/21-11		Introduction of key technologies of audiovisual media microservices, Xiangdong Deng, Tao Jia Radio, Film and Television Information Network Center, NRTA
	PRESENTATIONS	
T-23/30	**THE HOST PRESENTS**	
T-23/30-1	KBS-Korea	AI-powered production: less repetitive, more creative
T-23/30-2	RAPA	The Role and Efforts of Korea for Broadcasting Development in the Asia-Pacific Region
T-23/31	**Advancements In Broadcast Technology & Services**	
T-23/31-1	IRIB-Iran	Technical perspectives of content exchange & media accessibility for hearing impaired
T-23/31-2	IEEE BTS	Lost in Transmission: Exploring the Pitfalls of Broadcast to Mobiles
T-23/31-3	WorldDAB TC	Emergency Warnings: a co-operative approach to disaster alerting
T-23/31-4	DVB	Latest updates in DVB media delivery ecosystem
T-23/32	**Latest Technology Implementations & Use Cases**	
T-23/32-1	ABC-Australia	Developments in the digital space – An ABC case study
T-23/32-2	Fraunhofer IIS	Asia-Pacific Going Big on DRM Digital Radio
T-23/32-3	CMG-China	Beijing Winter Olympics 8K UHD TV International Public Signal Production
T-23/32-4	AsiaSat	Broadcast, Content Distribution & Media Solutions
T-23/33	**OPENING & CLOSING SESSIONS**	
T-23/33-1	IRIB-Iran	Welcome Address – Mr Hamid Dehghan Nayeri, Chairman, ABU Technical Committee, Director, International Technical Affairs & ABU Technical Liaison Officer, Islamic Republic of IranBroadcasting (IRIB-Iran)
T-23/33-2	KBS-Korea	Welcome Address from the Host – Kim Byung Guk, Executive Managing Director, Technology Division, Korean Broadcasting System (KBS-Korea)
T-23/33-3	ABU	Address by ABU Secretary-General, Mr Ahmed Nadeem
T-23/33-4	IRIB-Iran	Closing Address – Mr Hamid Dehghan Nayeri, Chairman, ABU Technical Committee

Technical Bureau Mid-Year Meeting

09 & 10 June 2023 | Mediacorp, Singapore

ABU Technical Department organized the ABU Technical Bureau Mid-Year Meeting on June 9th and 10th in Mediacorp Campus, Singapore. The meeting was hosted by ABU's full member, Mediacorp Pte. Ltd., and was conducted in hybrid mode. Some members were able to make it to the meeting joined physically and others participated virtually via Zoom. The meeting was chaired by ABU Technical Committee Chairman, Mr Hamid D Nayeri of IRIB-Iran, and was joined by the Vice-Chairmen, Mr Sunil of DD-India, Mr Masashi Kamei of NHK Japan and Mr Kazim Pektas of TRT-Türkiye. It was attended in-person by members from NHK-Japan, NBT-Thailand, Phoenix-Hong Kong-China, RTM-Malaysia, VTV-Vietnam, Mediacorp-Singapore, and RTPRC-China. While other members from IRIB-Iran, PB-India, TRT-Türkiye, KBS-Korea, NTV-Nepal, and VOV-Vietnam joined remotely.

The Secretary-General, Ahmed Nadeem, in his opening remarks emphasised on the importance of collaboration and sustainability. He expressed to maintain the same level of engagement and relationship with the members as he transitioned from Director of Technology to the Secretary-General. The bureau welcomed Dr Veysel Binbay who was recently appointed as the new Director of ABU Technology.

The meeting began with the updates from all members on the current situation, measures taken during the pandemic, and organization-wide projects. This information sharing exercise proved beneficial to members, allowing them to learn from experiences by others and appreciate the situation of other members. The bureau was presented with the activity report from the Secretariat since the online TC2022 meeting last November. This included updates on different activities, one of which was the DBS2023. The symposium received an incredible amount of support from participants, industry partners, and sponsors who were interested in the programme. The event was attended by close to 1000 participants representing 277 organisations from 48 countries.

The majority of the report's other activities were online webinar sessions on various topics of technology implementation and applications.

The report also provided an update on other activities that were managed by the Technology department including International Cooperation and Partnership such as A23 Global Conference, Broadcast Asia 2023 & Technical Review Magazine Publications.

The Bureau also approved the ABU Young Engineers' Broadcasting Award Guidelines recently recommended by a task group to review the existing Engineering Awards and its guidelines. The members also heard outcomes and suggestions from the new task group to review the study projects under the four Study Topic Areas, including their terms of reference. The secretariat is now in the process of putting together the revised Terms of Reference and update some Topic Areas at the annual meeting in October after completion of its study cycle.

Among other things, the bureau conducted a thorough review of the tasks and action items assigned since the last meeting. The bureau also reviewed the schedule for this year's annual Technical Bureau and Technical Committee meetings which will be held in Seoul South Korea in October.

The meeting was adjourned with the Chairman's final remarks, in which he wished everyone well and emphasised the importance of staying in touch during this difficult time. The Chairman thanked everyone for their attendance and contributions to the meeting.

Earlier, Mediacorp also provided a specially curated facility tour to the bureau members on 9th June. The tour was also joined by ABU the Secretary-General. They were taken through its world class facility equipped with classical and state of the art radio studio and tv production studios. The members also had the chance to observe the operation of Mediacorp hi-tech newsroom studio.

TECHNICAL BUREAU MID-YEAR MEETING

09 & 10 JUNE 2023 | MEDIACORP, SINGAPORE

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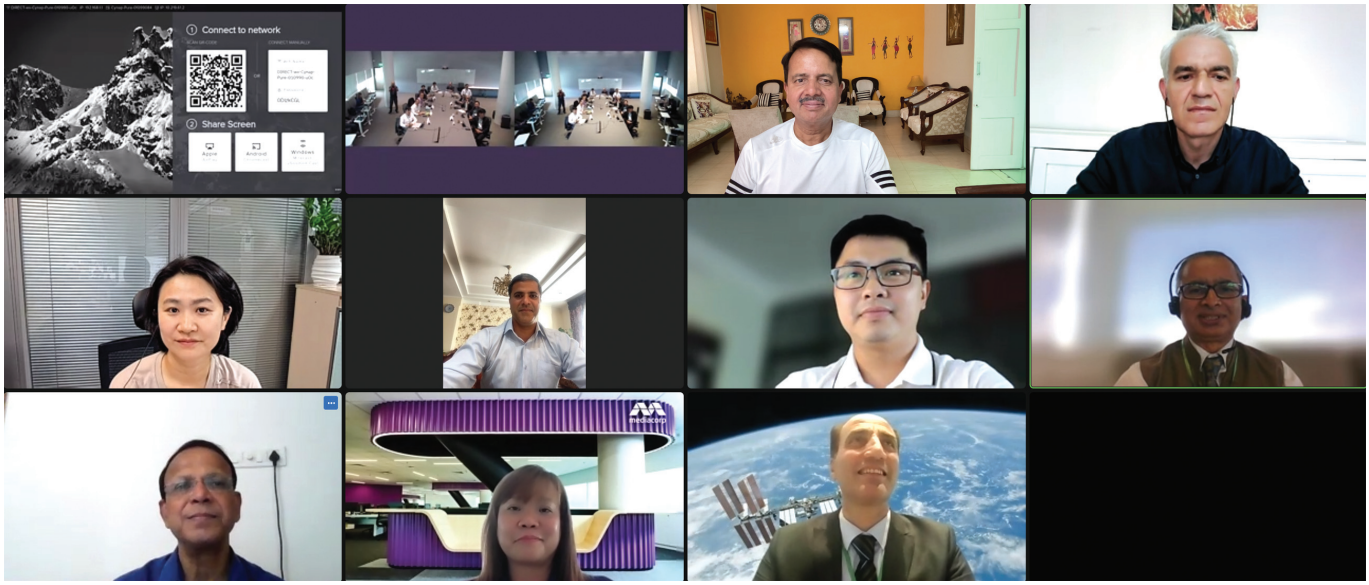

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ABU Technical Department

REPORT OF TOPIC CHAIRMAN DISTRIBUTION TOPIC AREA

Topic Chairman	**:**	**Yuji Nagata (NHK)**
Period of Report	**:**	**December 2022 to October 2023**
Date of Report	**:**	**28 October 2023**

Introduction

Distribution topic area comprises four projects. The matters concerning digital terrestrial television broadcasting, digital satellite broadcasting, digital sound broadcasting and these frequency planning are studied or investigated by these projects. This topic area also covers research on IBB and OTT, including platforms and standards, etc.
This document has been submitted for this Technical Committee Annual meeting.

1. Next Generation Terrestrial Broadcasting (D/NGTB)

Project Manager: **Mr. Akihiko Sato** (NHK, Japan)
Co-project Manager: **Dr. Jeon Sungho** (KBS, Korea)
Mr. Chen Delin (ABS, China)
Mr. Halil Us (TRT, Turkey)
Mr. D.P. Singh (India)
Mr. Rajesh Meena(India)
Mr. A K Mangalgi(DDI, India)
Mr. Zhang Yu (ABS/China)
Mrs. Xiao Jingting (ABS, China)

Reports from the project managers and the contributor are as follows.

1.1 Investigate efforts toward the realization of next-generation terrestrial broadcasting in Japan
1.2 Development of ATSC 3.0 & 5G-Broadcbast Transmission Techniques in the Republic of Korea

The reports for D/NGTB are attached as Annex 1.

2. Integrated Broadcast-Broadband and OTT (D/IBBOTT)

Project Manager: **Dr. Go Ohtake** (NHK, Japan)
Co-project Manager: **Mr. A. K. Mangalgi** (DDI, India)
Mr. R.P. Joshi
Ms. Momoko Suyama (NHK, Japan)
Dr. Shinya Abe (NHK, Japan)
Mrs. Zhang Dingjing(ABS, China)
Zhang Yu(ABS, China)
Zhang Wei(ABS, China)
He Jing(ABS, China)
Wang Lei(ABS, China)

Reports from the project managers and the contributor are as follows.

2.1 Standardization of Integrated Broadcast-Broadband System in Japan
2.2 Studies in ITU-R
2.3 Studies in ITU-T
2.4 Cyber Security in Ireland

The reports for D/IBBOTT are attached as Annex 2

Project: Integrated Broadcast-Broadband and OTT (D/IBBOTT)

Project Manager: **Dr. Go OHTAKE** (NHK, Japan)
Co-project Manager: **Mr. A. K. Mangalgi** (DDI, India)
Mr. R.P. Joshi
Ms. Momoko Suyama (NHK, Japan)
Dr. Shinya Abe (NHK, Japan)
Mrs. Zhang Dingjing (ABS, China)
Zhang Yu (ABS, China)
Zhang Wei (ABS, China)
He Jing (ABS, China)
Wang Lei (ABS, China)

2. Status report

This clause describes recent updates on IBB and OTT standards and related technologies identified and studied by this project. And it describes also recent update on standards and technologies of information security for broadcasting services and cyber security in broadcasting industry for protecting the broadcasting systems.

2.1 Standardization of Integrated Broadcast-Broadband System in Japan

IPTV Forum Japan standardizes specifications of Hybridcast in Japan. Technical specification of Hybridcast is composed of two technical standards and an operational guideline listed below and the latest versions are published in January 2022.

- IPTVFJ STD-0010 'Integrated Broadcast-Broadband System Specification', version 2.4
- IPTVFJ STD-0011 'HTML5 Browser Specification', version 2.7
- IPTVFJ STD-0013 'Hybridcast Operational Guideline', version 2.10

In the revision in November 2020 several new features were added to the Hybridcast technical specifications. Major updates are as follows:

- Addition of the new application type named "Broadcast-independent managed application"
  An application of this type runs in the state that no broadcast channel is being tuned so that service providers can offer application services regardless of their broadcasting area.
- Enhancement to the streaming video playback function
  The CMAF[*1] is added as a supported container format of streaming video, including low-latency playback features. Support for stream event delivery mechanisms

such as an 'event message' (emsg) box and an 'Event' XML element of MPEG DASH[*2] are also added.

- Enhancement to the companion device function
  UHDTV broadcasting services, i.e. 4K and 8K satellite broadcasting in Japan, are added to the available channels for tuning from a companion device.
- Addition of the three-dimensional audio codec support
  The enhanced AC-3[*3] is added to the available audio codecs for video streaming.

*1 ISO/IEC 23000-19 "Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media".
*2 ISO/IEC 23009-1 "Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats".
*3 ETSI TS 102 366 "Digital Audio Compression (AC-3, Enhanced AC-3) Standard".

In the revision in January 2022, several features related to terminated VOD services were deleted from the Hybridcast technical specifications.

2.2 Studies in ITU-R

ITU-R WP6B is working for the study on IBB systems. The working party is now studying on harmonization of IBB systems by making comparison of Hybridcast (Japan), HbbTV2.0 (Europe), TOPSmedia (South Korea) and Ginga (Brazil).
At the meeting held in April 2019 in Geneva, the working party developed the comparison of application life-cycle and application transition of the IBB systems, and revised Report ITU-R BT.2267 "Integrated broadcast-broadband systems" to add a new part on the harmonization of Integrated Broadcast-Broadband (IBB) systems' applications. To allow the exchange of services covered by the IBB systems and to deploy these services in an area where other systems are used, it is important to harmonize the IBB systems, to ensure compatibility with the IBB applications and interoperability across systems.
At the meeting, the working party revised Report ITU-R BT.2342 to replace information on TTML Text and Image Profiles for Internet Media Subtitles and Captions 1.0 (IMSC1.0) with the updated IMSC1.1 and to update a list of current EBU specifications pertinent to the content of the Report.

At the meeting held in July 2019 in Geneva, the working party revised Report BT.2267 to add the companion application to execute the application on a receiver. The working party also developed the new use cases of IBB system which provides object-based sound services via MPEG-DASH streams.
The working party also developed the global platform. The working party revised Report ITU-R BT.2400 "Usage scenarios, requirements and technical elements of a global platform for the broadcasting service" to add the specific reference to the ATSC 3.0 standard and some examples to show its Internet Protocol-based capabilities to integrate broadcast and broadband services. New digital terrestrial transmission standards such as the ATSC 3.0 system can help effectuate a converged broadcast and broadband platform, which is an important aspect of a global platform for broadcasting services.

At the meeting held in October 2020, the working party revised Recommendation ITU-R BT.2075 "Integrated broadcast-broadband system" to update an application execution mechanism of Hybridcast, with which a companion device sends a command to a receiver to tune to a designated channel and launch a Hybridcast application.

At the meeting held in March 2021, the working party prepared a revised draft report of Recommendation BT.2075 by adding information regarding commonality among IBB systems and equivalency of their functions as described in Report BT.2267 Part 3. The working party also prepared a draft revision to report BT.2267 on IBB systems to align with Recommendation ITU-T J.208 on harmonization of applications between IBB systems.

At the meeting held in September 2022, the working party revised Recommendation ITU-R BT.2075 "Integrated broadcast-broadband system" and Report BT.2267 "Integrated broadcast-broadband systems" to add a Broadcast-independent managed application, that is an application launched when broadcast services are not selected but still authenticated by broadcasters.

2.3 Studies in ITU-T

ITU-T SG9 is also working for the study on IBB system applied to Cable Digital TV. At the meeting held in November 2018 in Bogota, Colombia, the Study Group started the work to revise IBB system Recommendation (ITU-T Recommendation J.207 "Specification for integrated broadcast and broadband digital television application control framework") to add the function of device collaboration with companion devices in Hybridcast. Recommendation J.207 is a twin of IBB system Recommendations in ITU; Recommendation ITU-R BT.2075 is another twin on this topic. So, the Study Group continue to work to revise the Recommendation according to revision of Recommendation ITU-R BT.2075. The Study Group is studying the work of smart TV operating system for hybrid cable Digital TV services including IBB DTV service provided by cable television operators and third-party providers. At the Bogota meeting, the study group make progress the work of the architecture of smart TV operating system. The study group consent the Recommendation of "The functional requirements of smart TV operating system" as ITU-T Recommendation J.1201.

At the meeting held in June 2019 in Geneve, the study group consent Recommendation J.207 to add the function of device collaboration in Hybridcast. The study group also make progress the work of drafting new Recommendation "Harmonization of Integrated Broadcast-Broadband DTV application control framework". As for the smart TV operating system, the study group consent the Recommendation of "The architecture of smart TV operating system" as ITU-T Recommendation J.1202. In addition, making a new Recommendation for the specification of smart TV operating system was started in the study group.

At the meeting held in July 2020, the study group reached the AAP consent for the draft new Recommendation ITU-T J.1204. It is now approved and is part of a set of already approved Recommendations as follows:

- J.1201: Functional requirements of a smart TV operating system
- J.1202: The architecture of a smart TV operating system
- J.1203: The specification of a smart TV operating system
- J.1204: The security framework of a smart TV operating system

The group also consent new Recommendation ITU-T J.208 "Harmonization of Integrated Broadcast-Broadband DTV application control framework" at its November 2020 meeting. The recommendation is created based on Report ITU-R BT.2067 which defines the methods to harmonize IBB systems by identifying commonalities across the IBB systems.

2.4 Cyber Security in Ireland

On February 2023, Virgin Media television, one of Ireland's most popular TV broadcasts, has suffered what it has deemed an "unauthorised attempt" to access its systems, taking down several of its TV channels in Ireland. The company has 3.4 million customers, including more than a million in Ireland. The attack affected numerous services. These include recorded programming on Virgin Media Three, Four, More and VMTV. Virgin Media said that "Our ongoing security monitoring system has identified an unauthorised attempt to access our systems in recent days. Due to the precautions, we have implemented there will be temporary effects to the broadcasting of some of our recorded programming on Virgin Media Three, Four, More and VMTV Player." Virgin Media later confirmed that the breach had been, "fully contained, isolated terminated". After that, Virgin Media has said that a cyber attack that affected programming on some of its channels was not a ransomware attack.

Source:

https://techmonitor.ai/technology/cybersecurity/virgin-media-television-suffers-major-hack

https://www.businesspost.ie/news/virgin-media-television-says-major-hack-was-not-ransomware/

https://www.siliconrepublic.com/enterprise/virgin-media-television-tv-hack-cyberattack-breach
https://www.rte.ie/news/2023/0220/1357832-virgin-media-hack/

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3. Satellite Broadcasting (D/SB)

Project Manager: **Dr. Masashi Kamei** (NHK, Japan)
Co-project Manager: **TBD**

Reports from the project managers and the contributor are as follows.

3.1 ITU-R documents related to satellite broadcasting systems
3.2 Latest topics on satellite broadcasting

The reports for D/SB are attached as Annex 3.

Annex 1

Project: Next Generation Terrestrial Broadcasting (T/NGTB)

Project Manager: **Mr. Akihiko Sato** (NHK, Japan)

Co-project Manager: **Dr. Jeon Sungho** (KBS, Korea)
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Mr. Halil US (TRT, Turkey)
Mr. D.P. Singh (India)
Mr. Rajesh Meena (India)
Mr. A K Mangalgi (India)
Mr. Zhang Yu (ABS, China)
Mrs. Xiao Jingting (ABS, China)

1.1 Investigate efforts toward the realization of next-generation terrestrial broadcasting in Japan

1.1.1. Introduction

Next-generation digital terrestrial television broadcasting will be dominated by UHDTV applications. UHDTV broadcasts consist of a huge amount of data and therefore require large-capacity transmission paths.

Japan has been conducting research and development on an advanced DTTB system. The objective of the advancement is to provide improved transmission performance compared with ISDB-T in terms of increased transmission capacity and reduced *C*/*N* required. The advanced system has been designed to provide UHDTV services for fixed reception together with HDTV services for mobile reception simultaneously. R&D projects on the advanced DTTB system have been conducted in three phases.

– Phase 1: R&D project on basic technologies for a next-generation DTTB system (2013-2016)
– Phase 2: R&D project on the advanced DTTB system (2016-2018)
– Phase 3: Technical verification of new DTTB systems (2019-2022)

During technical verification phase, trials were conducted to verify the transmission performance and feasibility of new DTTB systems. Additional features were also demonstrated. The trials conducted during the technical verification phase are detailed in § 1.1.3.

1.1.2. Overview of advanced DTTB system specification and evaluation of its transmission characteristic

With the aim of improving the quality and expanding the functions of digital terrestrial television broadcasting services, advanced transmission systems have been developed that inherit the key functions of integrated services digital broadcast-terrestrial (ISDB-T) systems, which employs hierarchical transmission based on frequency division multiplexing (FDM) and a segment structure. The advanced DTTB system has a new signal frame structure that enables bandwidth to be flexibly allocated to multiple services for different reception scenarios, such as fixed reception and mobile reception, compared with ISDB-T. In order to expand transmission capacity, adoption of new transmission technologies such as higher order modulation (256QAM, 1024QAM, and 4096QAM), non-uniform constellations (NUCs), low density parity check (LDPC) code, dual-polarized multiple-input multiple-output (MIMO) and Channel Bonding have been studied. Currently, verification of the transmission technologies are in progress.

The following are documents to help you get more information about the advanced DTTB system:

[1] A Study on the Transmission System of an Advanced ISDB-T
https://ieeexplore.ieee.org/document/8971915
This report describes an overview of the transmission system for a next-generation DTTB called the advanced ISDB-T and its basic transmission performance.

[2] Transmission System Design of UHD-1/4K and UHD-2/8K Terrestrial Television Broadcasting and its Performance Proof by Large-Scaled Field Experiments
https://ieeexplore.ieee.org/document/9136826
This paper presents the concept and specifications of the proposed system. The verification results of a computer simulation, and laboratory and large-scale field experiments are also described.

[3] Fixed Reception Performance of FDM-based Transmission System for Advanced ISDB-T
https://www.set.org.br/ijbe/ed6/Artigo1.pdf
This paper provides a BICM selection guideline based on the simulation results for fixed reception scenarios toward the practical application of advanced ISDB-T.

1.1.3 End-to-end demonstration in technical verification phase (2019-2022)

To conclude the verification phase, end-to-end technical demonstrations were conducted in four metropolitan areas in Japan. Objectives of the field experiments were to verify the interconnectivity of all layers of the prototype equipment and the feasibility of the next-generation DTTB systems. Two new DTTB systems were verified. One system, the advanced DTTB system (i.e. advanced ISDB-T), adopts various advanced transmission technologies for improved transmission performance that will enable delivery of new services in one RF channel. Another system, the compatible DTTB system using LDM, transmits the new and current services simultaneously using layered division multiplexing (LDM) in one RF channel. End-to-end technical demonstrations were conducted and were on-aired from large-scale experimental stations in four metropolitan cities in Japan from November 2022 to January 2023.

1.1.3.1 Overview of Advanced DTTB system (advanced ISDB-T)

The objective of the advanced DTTB system is to provide improved transmission performance compared with ISDB-T in terms of increased transmission capacity and reduced *C/N* required in order to deliver new services in one RF channel. The advanced system has been designed to inherit the features of ISDB-T; i.e. it aims to provide a 4K or 8K UHDTV services for fixed reception and an HDTV service for mobile reception simultaneously by frequency division multiplexing (FDM) within a single RF channel. It also uses a frequency-segmented structure that allows partial reception. The bandwidth per segment is reduced to increase the number of segments from 13 (for ISDB-T) to 35, allowing flexible bitrate distribution between layers such as the mobile reception layer and fixed reception layer. Depending on the upgraded BICM technologies used, frequency utilization improves by 1.7 times in comparison with ISDB-T at the same required *C/N*. R&D continues with the goal of making further improvements to the performance and provide additional features including hybrid FDM/TDM, LDM, channel bonding, and low-delay transmission.

1.1.3.2 Overview of Compatible DTTB system

The objective of the compatible DTTB system is to deliver new DTTB services together with existing services in the same RF channel as used for the current DTTB services during the transitional period The system has backward compatibility with ISDB-T, i.e. the system inherits the physical layer protocol of ISDB-T, so that existing commercial ISDB-T receivers can detect and demodulate the signal for existing services. This method is assumed to be used in circumstances where a vacant channel cannot be identified or created to introduce a new DTTB service. The compatible DTTB system multiplexes an existing DTTB signal and a new DTTB signal in the physical layer with Layered Division Multiplexing (LDM). Figures 1.1.1 and 1.1.2 show a brief block diagram and the signal structure of the system, respectively. The signal for the new service is modulated with the bit-interleaved coded

modulation (BICM) technologies of the advanced DTTB system, i.e. higher-order modulations, NUCs and LDPC code, and the other blocks are the same as in ISDB-T. The injection level is defined as the power ratio between the existing ISDB-T signal and the signal for the new service. Carrier power of the signal for the new service is set much lower than the carrier power of the ISDB-T signal.

The transmission capacity and the service areas of the existing service and new service are in a trade-off. If the transmission capacity of the existing service is maintained, the service area of the existing service will be reduced due to interference from the signal of the new service. If the service area of existing service is to be retained, the transmission capacity of the existing service needs to be reduced to improve robustness against interference. To reduce the interference to the existing service, the transmission power of the new service needs to be decreased, i.e. injection level needs to be increased, thereby reducing the service area of the new service. In the case where a higher-order modulation scheme (e.g., 64-QAM-7/8) is used for the existing service and/or under an SFN environment, the injection level may need to be increased. On the other hand, in the case where the existing service uses a lower-order modulation scheme (e.g. 16-QAM-2/3), the injection level may be reduced. To achieve the same service area for the new service as the existing service even with the reduced transmission power, transmission parameters offering higher robustness must be employed, which reduces the transmission capacity. If a narrow service area is acceptable for the new service, transmission parameters offering higher transmission capacity can be used to deliver UHDTV.

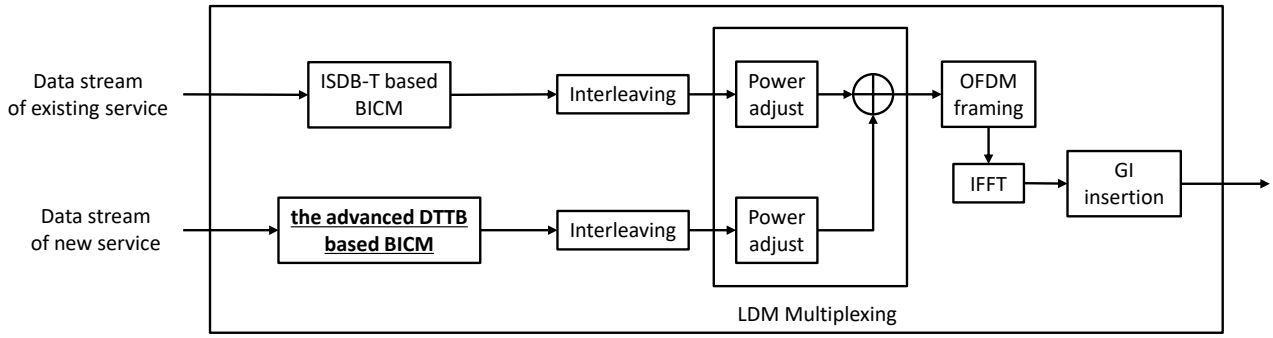
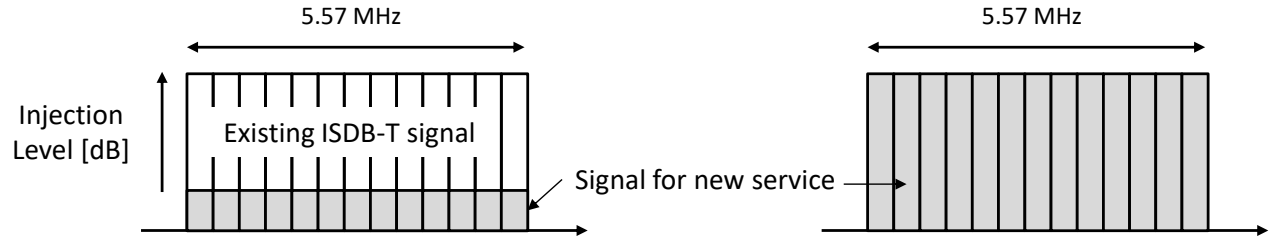


FIGURE 1.1.1 Compatible DTTB system using LDM



a) During transition b) After transition

FIGURE 1.1.2 Signal structure of compatible DTTB system using LDM

1.1.3.3 Transmission parameters

A prototype modulator and demodulator were developed for the two systems and their performances were confirmed in laboratory experiments. The feasibility of the systems was verified through large-scale field trials in four metropolitan cities in Japan.

The parameters listed in Table 1.1.1 were used in the field experiments of the advanced DTTB system. The occupied bandwidth was expanded by about 5% compared with that of ISDB-T to increase transmission capacity. 26 and 9 segments out of 35 segments were assigned for UHDTV (fixed reception) and HDTV (mobile reception) services, respectively. As for error-correcting code and carrier modulation, low density parity check (LDPC) code and NUCs were used for the UHDTV and HDTV services to enhance transmission robustness. Real-time encoder and decoders implementing Versatile Video Coding (VVC) and MPEG-H 3D Audio were used.

TABLE 1.1.1 Parameters for field experiments of the advanced DTTB system

Modulation method	OFDM	
Occupied bandwidth	5.83 MHz	
Multiplexing system	FDM	
Reception scenario	Fixed (Rooftop)	Mobile (Car-mounted)
Number of segments	26	9
Carrier modulation	1 024 NUC QAM	16 NUC QAM
FFT size (number of radiated carriers)	16k (15,121)	
OFDM symbol duration	2 592 μs	
Guard interval ratio (guard interval duration)	800/16 384 (126 μs)	
Error-correcting code	Inner: LDPC, code rate = 9/16 Outer: BCH	Inner: LDPC, code rate = 7/16 Outer: BCH
Transmission capacity	21.5 Mbit/s	2.2 Mbit/s
Video coding	VVC Main10	
Video format	3 840 × 2 160/60/P (4K)	1 920 × 1 080/60/P (2K)
Video bit rate	9.0 Mbit/s (4K) * 2	0.7 Mbit/s (2K) * 2
Audio coding	MPEG-H 3D Audio Baseline Profile	
Audio bit rate	704 kbit/s (22.2ch + 4 objects)	96 kbit/s (2ch + 2 objects)

The parameters listed in Table 1.1.2 and Table 1.1.3 were used in the field experiments of the compatible DTTB. Two parameter sets were verified: one for during the transition and the other for after the transition. The occupied bandwidth and the OFDM signal structure were the same as in ISDB-T. The parameter set for during the transition is for transmitting both the existing and new services in one RF channel using LDM. 12 segments and 1 segment were assigned out of 13 segments to the existing HDTV (fixed reception) and SDTV (mobile reception) services, respectively, and 13 segments were assigned to the new service (fixed reception). As for the error-correcting code and carrier modulation, LDPC code

and NUCs were used in the new service layer. The injection level was set to 21 dB. As for the required C/N, the fixed layers of the existing service and new service are approximately 20 dB, which is the same as the current link budget in Japan. The parameter set for after the transition is to transmit new services in one RF channel. 13 segments were assigned to the new service, and LDPC code and NUCs were also used. 256 NUC QAM with a code rate of 11/16 for the LDPC code was used.

TABLE 1.1.2 Parameters for field experiments of compatible DTTB system using LDM (during the transition)

Modulation method	OFDM		
Occupied bandwidth	5.57 MHz		
Multiplexing system	LDM		
Injection Level	21 dB		
Service	New service	Existing service	
Reception scenario	Fixed (Rooftop)		Mobile (Car-mounted)
Number of segments	13	12	1
Carrier modulation	QPSK	64-QAM	QPSK
FFT size (number of radiated carriers)	8k (5 617)		
OFDM symbol duration	1 008 μs		
Guard interval ratio (guard interval duration)	1/8 (126 μs)		
Error-correcting code	Inner: LDPC code rate = 4/16 Outer: BCH	Inner: Convolutional Code, code rate = 2/3 Outer: Reed-Solomon	Inner: Convolutional Code, code rate = 2/3 Outer: Reed-Solomon
Transmission capacity	2.17 Mbit/s	14.9 Mbit/s	416 kbit/s
Video coding	HEVC	MPEG-2	H.264
Video format	1 920 × 1 080/60/P	1 440 × 1 080/60/I (2K)	320×240/15/I (QVGA)
Video bit rate	1.6 Mbit/s*	12.5 Mbit/s	220 kbit/s
Audio coding	MPEG-2 AAC	MPEG-2 AAC	
Audio bit rate	201 kbit/s	201 kbit/s	51 kbit/s

* Offline encoding.

TABLE 1.1.3 Parameters for field experiments of compatible DTTB system using LDM (after the transition)

Modulation method	OFDM
Occupied bandwidth	5.57 MHz
Service	New service
Reception scenario	Fixed (Rooftop)
Number of segments	13
Carrier modulation	256 NUC QAM
FFT size (number of radiated carriers)	8k (5 617)
OFDM symbol duration	1 008 μs
Guard interval ratio (guard interval duration)	1/8 (126 μs)
Error-correcting code	Inner: LDPC : code rate = 11/16 Outer: BCH
Transmission capacity	24.1 Mbps

Video coding	HEVC
Video format	3 840 × 2 160/60/P (4K)
Video bit rate	16.5 Mbit/s *
Audio coding	MPEG-2 AAC
Audio bit rate	201 kbit/s

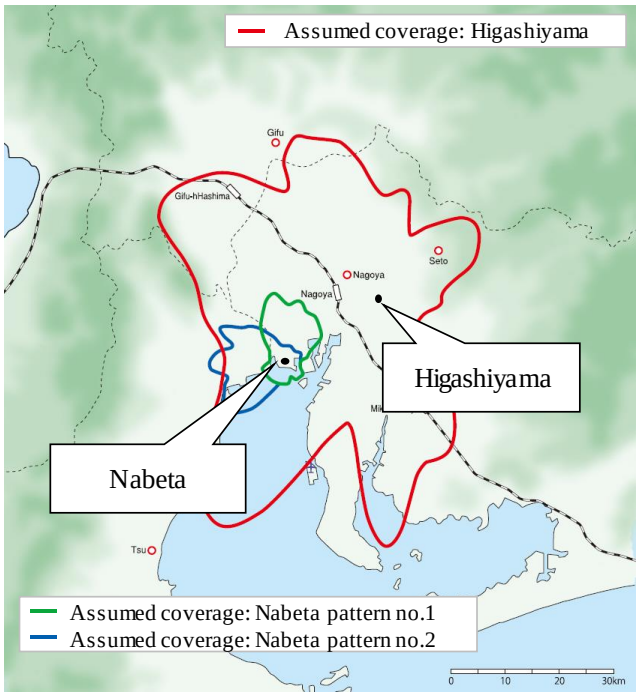
* Offline encoding.

1.1.3.4 Field trials

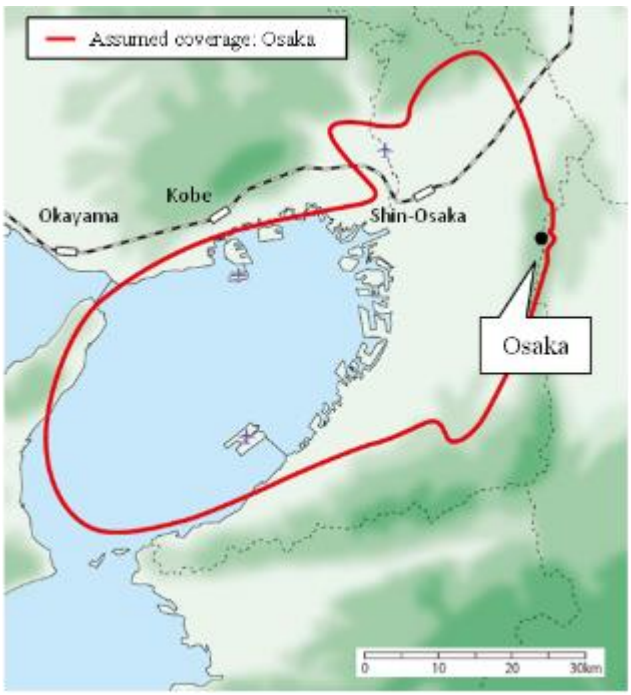
1.1.3.4.1 Experimental environment

Large-scale experiments were conducted to evaluate the performance of the new DTTB systems in different propagation environments in four metropolitan cities, Tokyo, Nagoya, Osaka and Fukuoka. Figure 1.1.3 shows the transmitter sites and assumed coverage areas for the experimental parameters in Tables 1.1. to 1.1.3. Table 1.1.4 lists the specifications of the transmission stations. These coverage areas were on the same scale as those of currently used main DTTB stations. Although each transmission station is equipped for MIMO with two transmitters and two antennas for horizontally and vertically polarized waves, the end-to-end demonstrations used the SISO system with horizontal polarization. Figures 1.1.4 to 1.1.7 show the locations of the transmitting and receiving sites in the four areas.

a) Tokyo area



b) Nagoya area



c) Osaka area

d) Fukuoka area

FIGURE 1.1.3 Experimental environments

TABLE 1.1.4 Transmission parameters

	Tokyo area	**Nagoya area**	**Osaka area**	**Fukuoka area**
Transmitter site	Shiba (Tokyo)	Higashiyama (Nagoya City, Aichi)	Osaka (Higashi Osaka City, Osaka)	Fukuoka (Fukuoka City, Fukuoka)
Transmission frequency	563.143 MHz UHF 28ch	605.143 MHz UHF 35ch	509.143 MHz UHF 19ch	701.143 MHz UHF 51ch
Polarization	Horizontal, Vertical			
Transmission power	Horizontal: 1 kW, Vertical: 1 kW			
e.r.p.	Horizontal: 2.1 kW Vertical: 2.1 kW	Horizontal: 980 W Vertical: 980 W	Horizontal: 4.6 kW Vertical: 4.6 kW	Horizontal: 1.5 W Vertical: 1.5 W
Transmitting antenna height	280 m above sea level	203 m above sea level	570 m above sea level	218 m above sea level

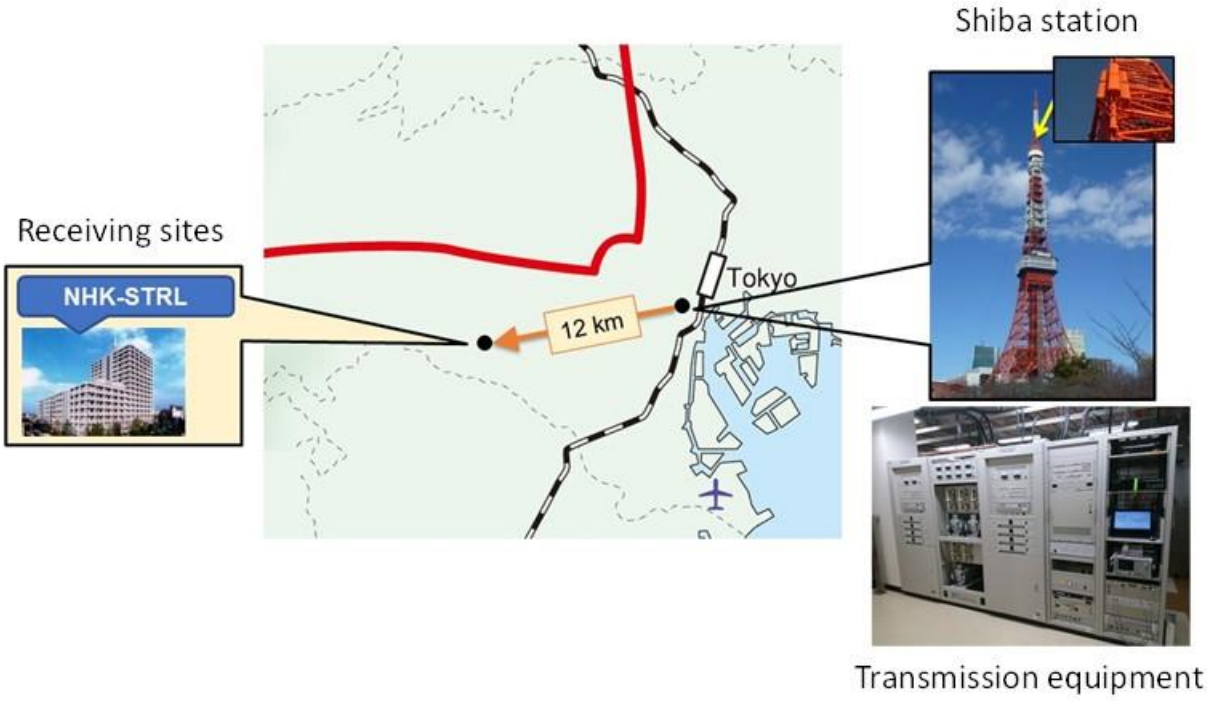


FIGURE 1.1.4 Locations of transmitting and receiving sites in Tokyo

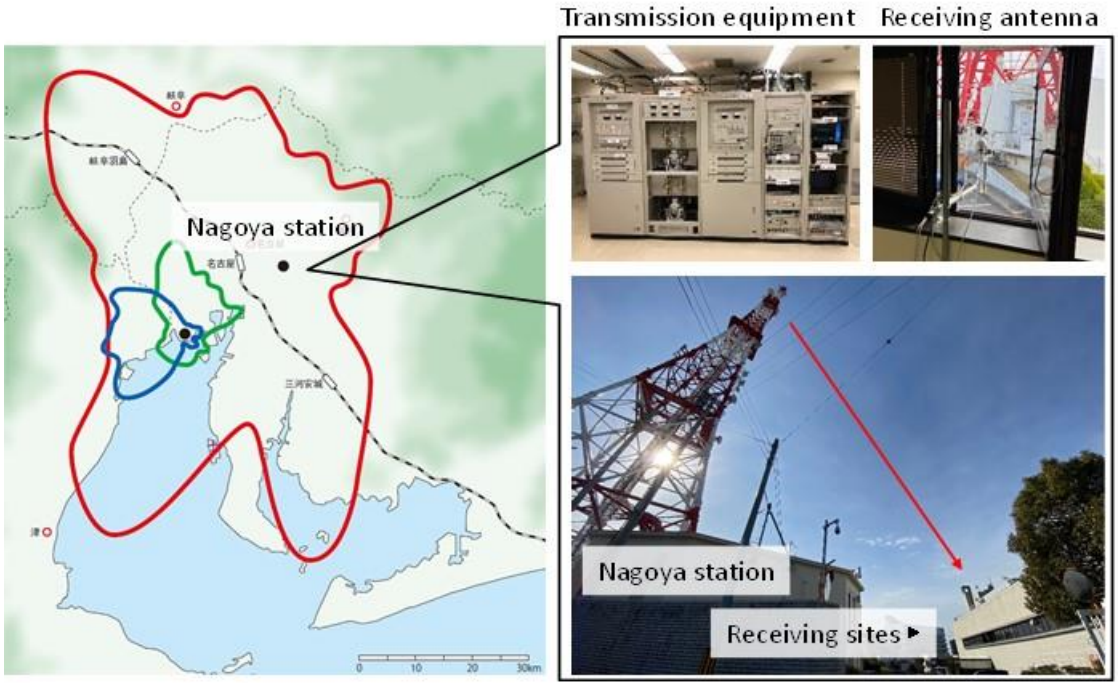


FIGURE 1.1.5 Locations of transmitting and receiving sites in Nagoya

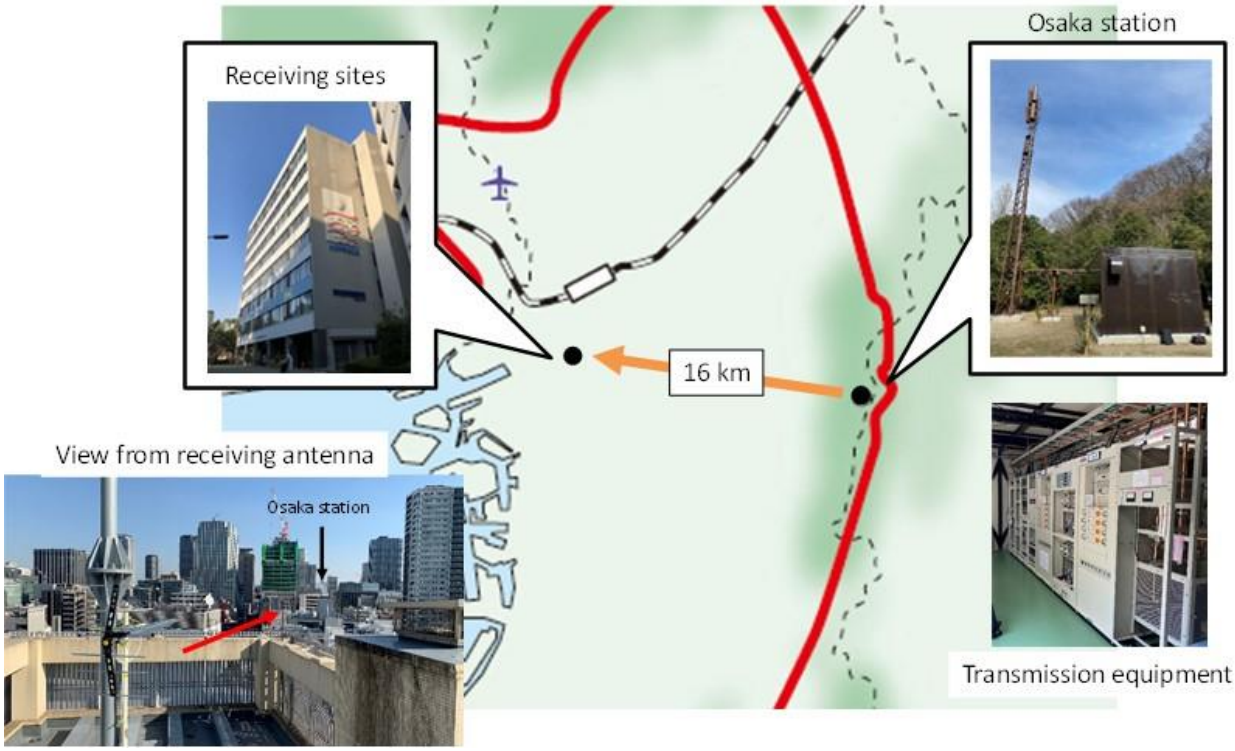


FIGURE 1.1.6 Locations of transmitting and receiving sites in Osaka

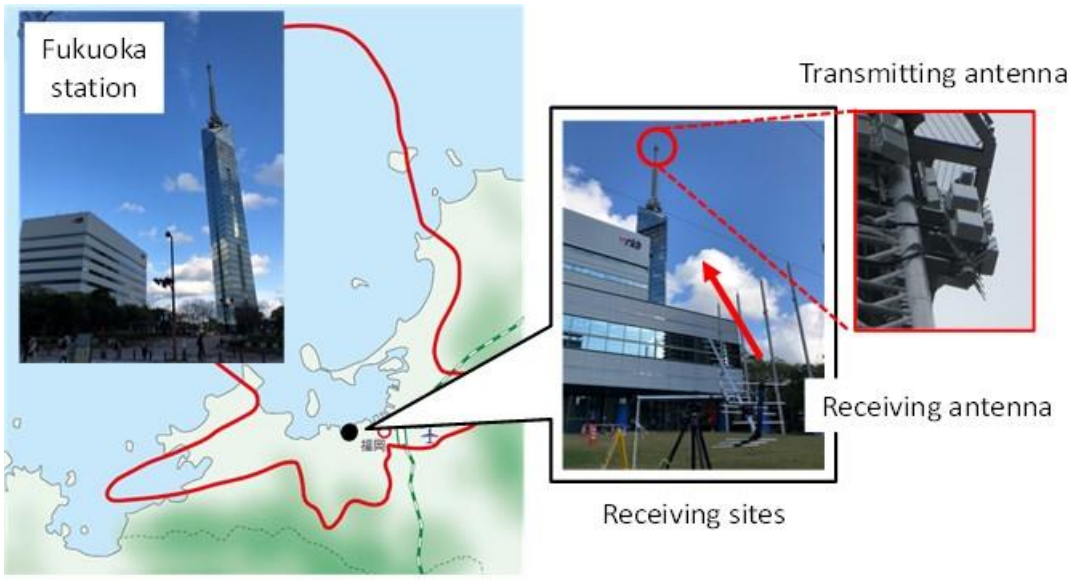


FIGURE 1.1.7 Locations of transmitting and receiving sites in Fukuoka

1.1.3.4.2 Trials of the advanced DTTB system

The demonstration of the advanced DTTB system involved field trials of hierarchical transmission of two UHDTV (fixed reception) and one HDTV (mobile reception) signal. The block diagrams of the transmitting and receiving systems are shown in Figures 1.1.8. Figure 1.1.9 shows the spectrum of the received signals in Tokyo. Figures 1.1.10 and 1.1.11 show the delay profile and constellation of the received signal. As for the delay profile, there

were almost no reflected waves (Fig. 1.1.10). The end-to-end connection using the real-time VVC/MPEG-H 3DA encoder/decoder, re-multiplexer and modulator/demodulator of the advanced DTTB system was successfully demonstrated in all four areas.

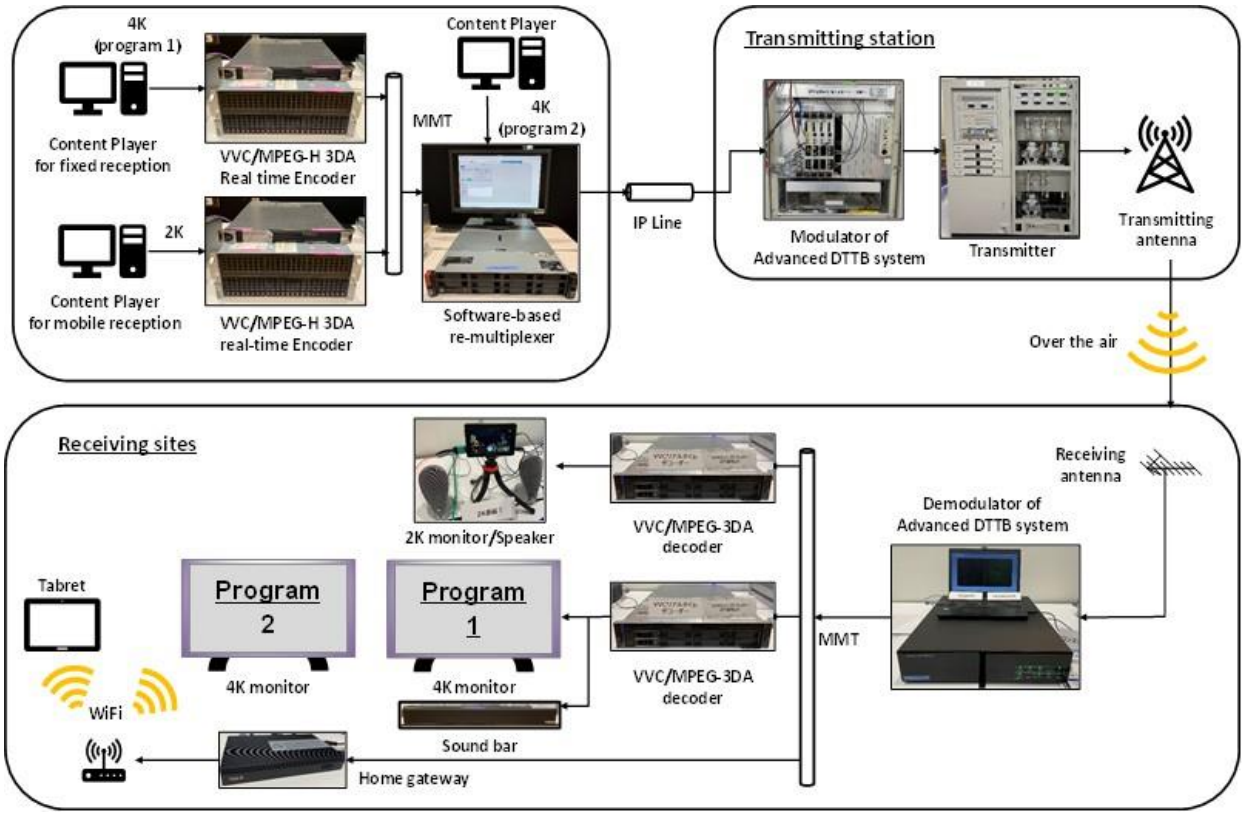


FIGURE 1.1.8 Block diagram of transmitting and receiving systems of the advanced DTTB system

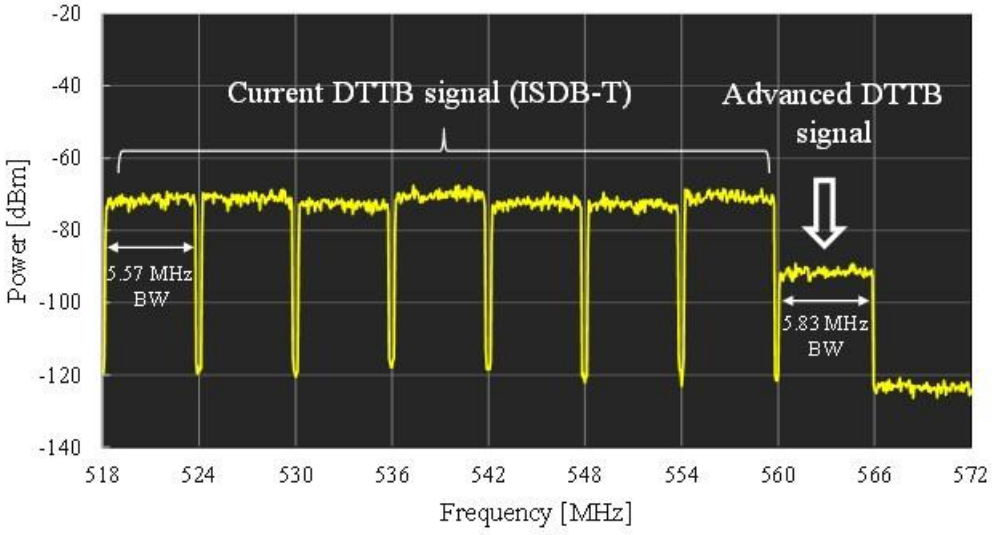


FIGURE 1.1.9 Spectrum of received signal

Note: This figure shows the receiving signal in Tokyo. The advanced DTTB signal was allocated upper-adjacently to the current DTTB signals. The difference in received power between the advanced DTTB signal and the current DTTB signals is due to the different transmitting powers and transmitting points.

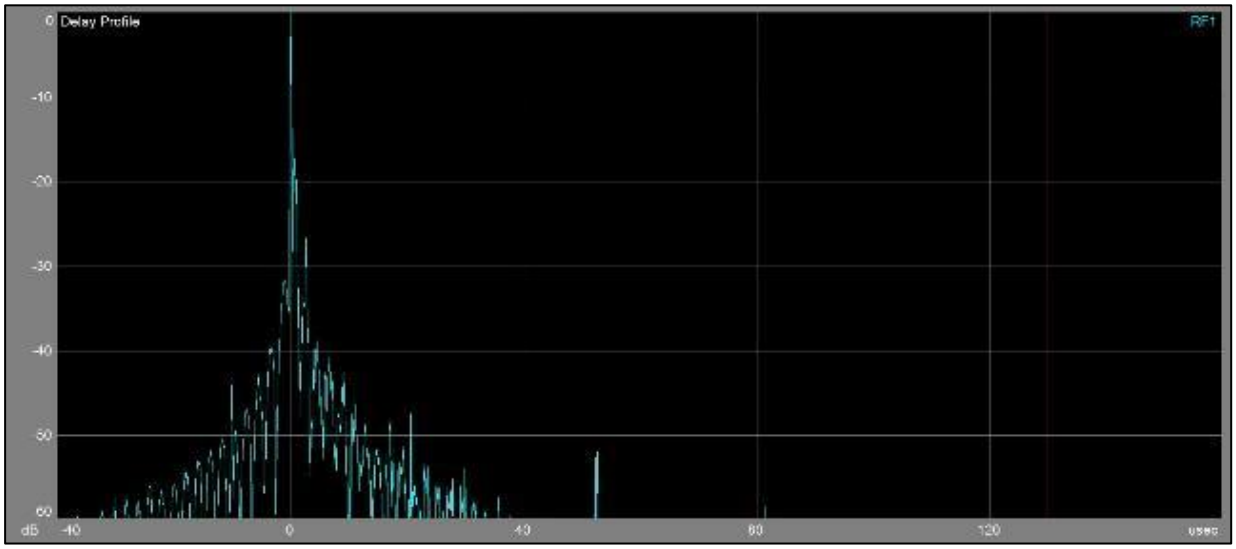
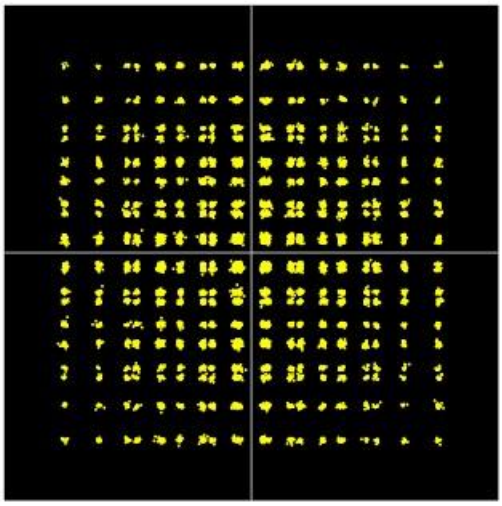
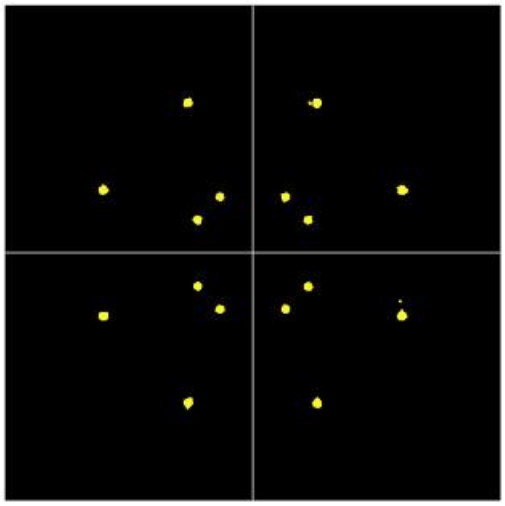


FIGURE 1.1.10 Delay profile of received signal



(a) 1024 NUC QAM for UHDTV



(b) 16 NUC QAM for HDTV

FIGURE 1.1.11 Constellations of received signal of the advanced DTTB system

1.1.3.4.3 Trials of the compatible DTTB system

The demonstration of the compatible DTTB system aimed to show feasibility of the two transmission modes for during and after the transition. The block diagram of the transmitting and receiving systems is shown in Figure 1.1.12.

Figure 1.1.13 shows the spectrum of the received signals in Tokyo. Figures 1.1.14 and 1.1.15 show the constellation of the received signals for during the transition and for after the transition. In the constellation for during the transition (Fig. 1.1.14), both the mobile

and fixed layers of the existing service signals were multiplexed with the QPSK modulated signals for new service. This demonstrated that, using the compatible DTTB system, a new service can be received by new receivers while existing commercial ISDB-T receivers can receive the existing service.

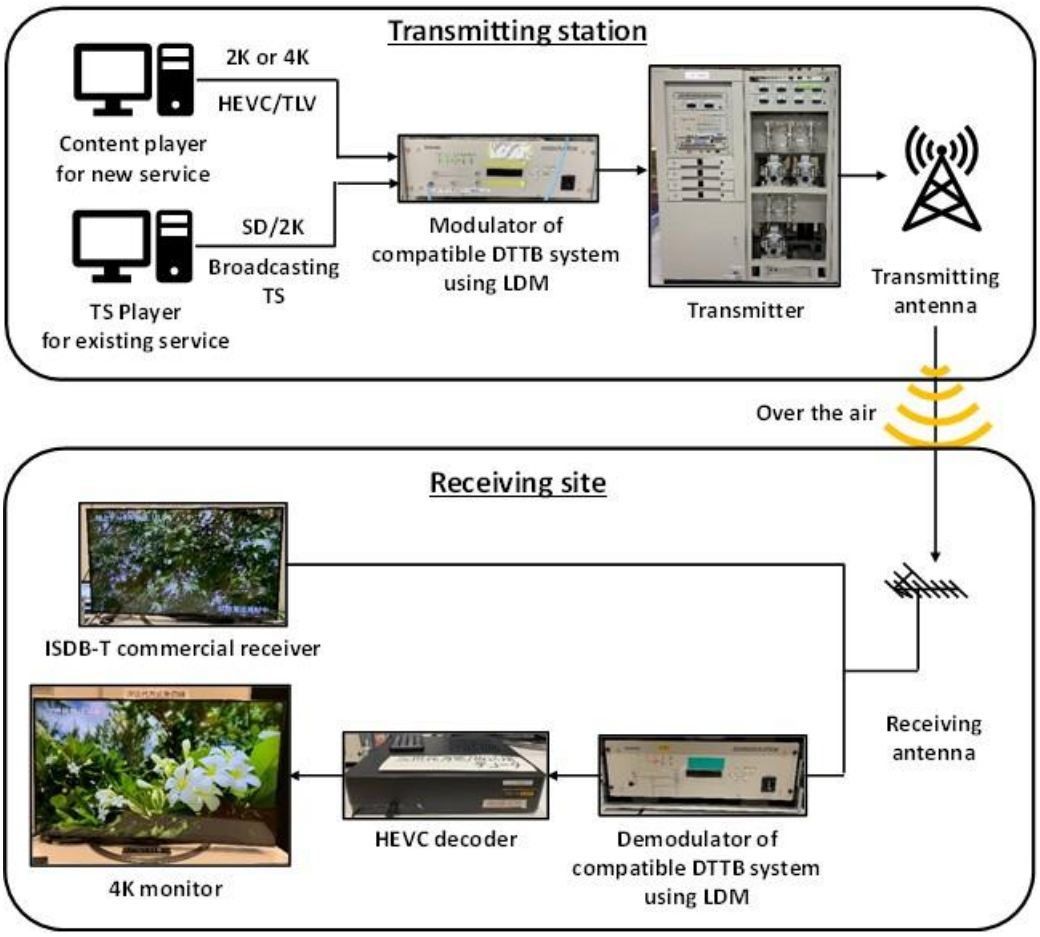


FIGURE 1.1.12 Block diagram of transmitting and receiving system of compatible DTTB system

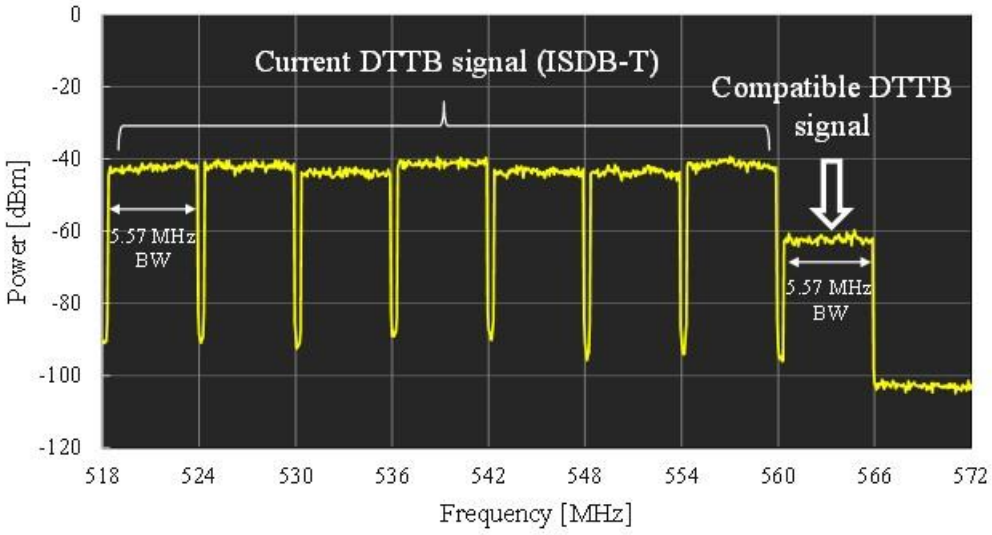
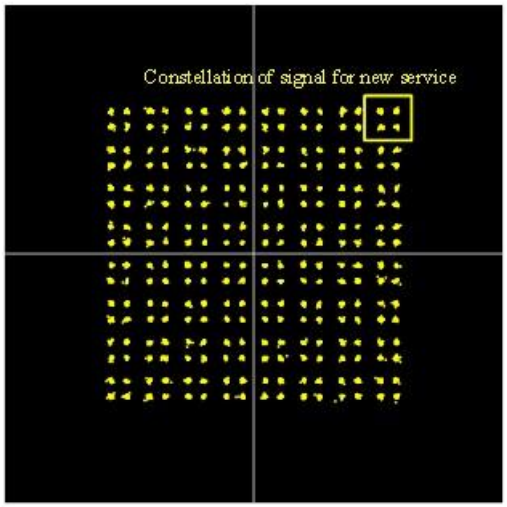
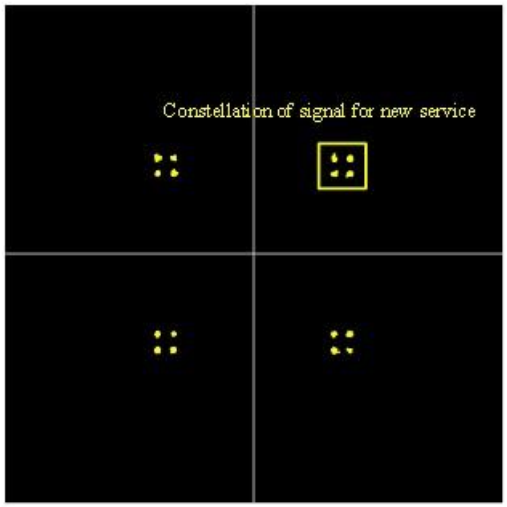


FIGURE 1.1.13 Spectrum of received signal

NOTE: This figure shows the receiving signal in Tokyo. The compatible DTTB signal was allocated upper-adjacently to the current DTTB signals. The difference in received power between the compatible DTTB signal and the current DTTB signals is due to the different transmitting powers and transmitting points.



(a) fixed layer of ISDB-T
existing service 64-QAM for HDTV + new service QPSK for HDTV
with injection level of 21 dB



(b) mobile layer of ISDB-T
existing service QPSK for SDTV + new service QPSK for HDTV
with injection level of 21 dB

FIGURE 1.1.14 Constellations of received signal
(Compatible DTTB system with parameters set for during the transition)

256 NUC QAM for UHDTV

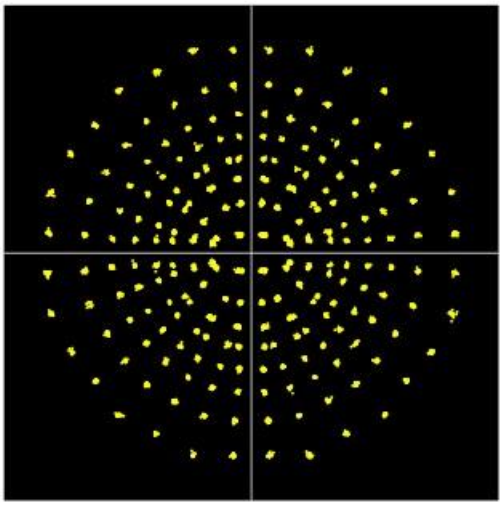


FIGURE 1.1.15 Constellations of received signal
(Compatible DTTB system with parameters set for after the transition)

1.1.4 8K-UHDTV field experiments with channel bonding

Channel bonding technologies use two or more radio frequency (RF) channels to transmit data from a single physical layer pipe (PLP) that exceeds the capacity of a single RF channel. These multiple RF channels may be located at any channel frequency and may not necessarily be adjacent to each other. To verify the channel bonding technology, an 8K-UHDTV field experiment of the channel bonding was conducted using two RF channels.

1.1.4.1 Transmission parameter and equipment

A field experiment was conducted with channel bonding using two RF channels based on the advanced system described in § 1.1.2. The transmission parameters are presented in Table 1.1.5. Each transmitting station for the two individual RF channels was composed of two transmitters for horizontal and vertical polarized waves. A dual-polarized dipole antenna was used for transmitting antennas. Simultaneous transmission of a UHDTV service for fixed reception and an HDTV service for mobile reception was assumed using FDM. A block diagram of the transmitting side is presented in Fig. 1.1.15.

TABLE 1.1.5 Parameters for field experiments of channel bonding

Transmitter site	Kinuta, Tokyo		
Transmission frequency	599.143 (UHF Ch 34)	581.143 MHz (UHF Ch 31)	
Transmission power	Horizontal: 1 W, e.r.p.: 1.3 W Vertical: 1 W, e.r.p.: 1.45 W	Horizontal: 1 W, e.r.p.: 9.3 W Vertical: 1 W, e.r.p.: 9.3 W	
Transmitting antenna height	104 m above sea level (74 m above ground level)	126 m above sea level (96 m above ground level)	
Modulation method	OFDM		
Occupied bandwidth	5.57 MHz	5.57 MHz	
Reception scenario	Fixed (Rooftop)		Mobile (Car-mounted)
Number of segments	33	24	9
Carrier modulation	1024 NUC QAM		16 NUC QAM
FFT size (number of radiated carriers)	16 k (15 121)		
Guard interval ratio (guard interval duration)	800/16 384 (126 μs)		
Error-correcting code	Inner: LDPC, code rate = 9/16 Outer: BCH		Inner: LDPC, code rate = 7/16 Outer: BCH
Transmission capacity (each)	52.4 Mbit/s (MIMO)	38.0 Mbit/s (MIMO)	4.4 Mbit/s (MIMO)
Transmission capacity(total)	90.4 Mbit/s (MIMO)		
Video coding	HEVC		

Video format	7 680 × 4 320/60/P (8K)	1 920 × 1 080/60/P (2K)
Video bit rate	MIMO: 80 Mbit/s (8K)	MIMO: 4.0 Mbit/s (2K)

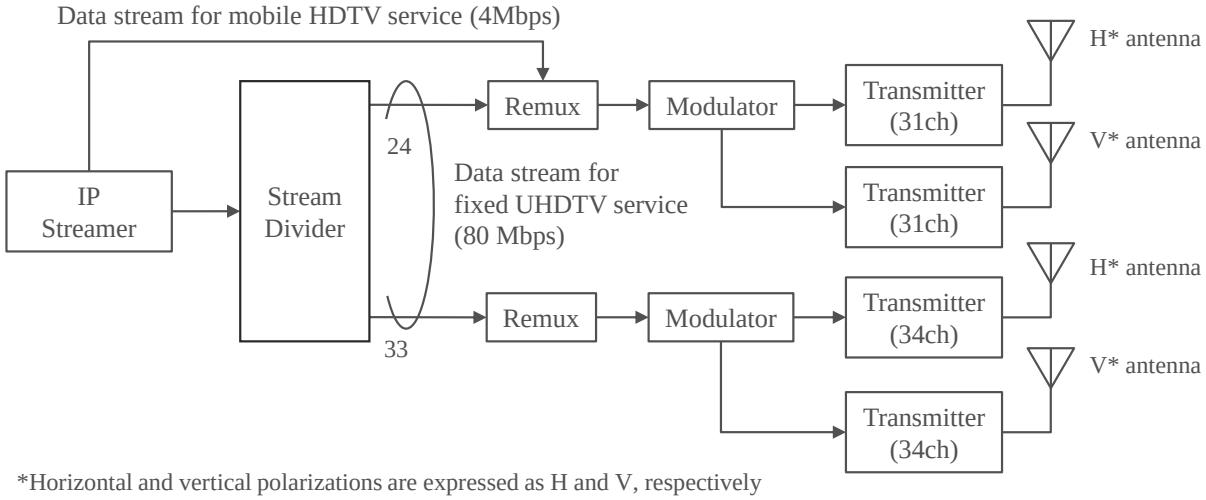


FIGURE 1.1.15 Block diagram of transmitter site

1.1.4.2 Field measurement

The transmitted signals were received at a line-of-site point located 4.5 km from the transmitter site. A block diagram of the receiving side is illustrated in Fig. 1.1.16. A dual-polarized Yagi-antenna was used to receive both the horizontal and vertical signals. Each signal transmitted in Ch 31 and Ch 34 was demodulated individually. The spectrum, constellations, and bit error rate (BER)s of the received signals are presented in figures 1.1.17, 1.1.18 and 1.1.19 respectively. The output data streams from the demodulators for the fixed reception UHDTV service were combined and fed to an MPEG media transport (MMT) /high-efficiency video encoding (HEVC) decoder, and the data stream for mobile reception HDTV service was fed to another MMT/HEVC decoder. The decoded UHDTV and HDTV images are displayed in Fig. 1.1.20.

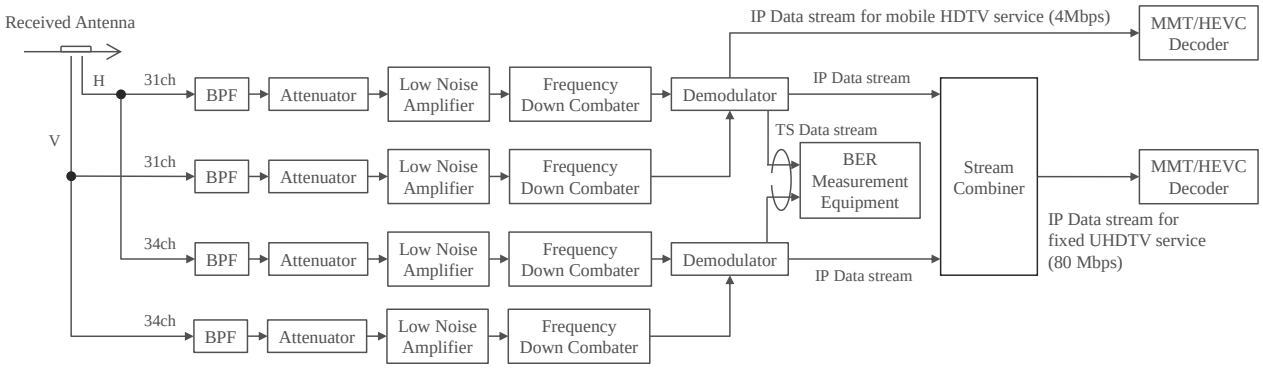
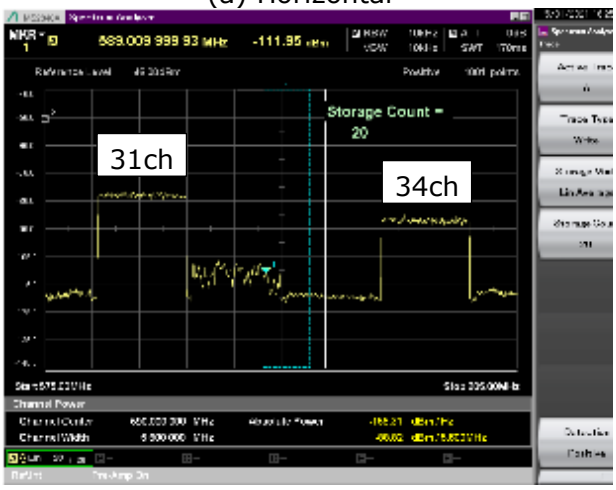


FIGURE 1.1.16 Block diagram of receiver side

(a) Horizontal



(b) Vertical

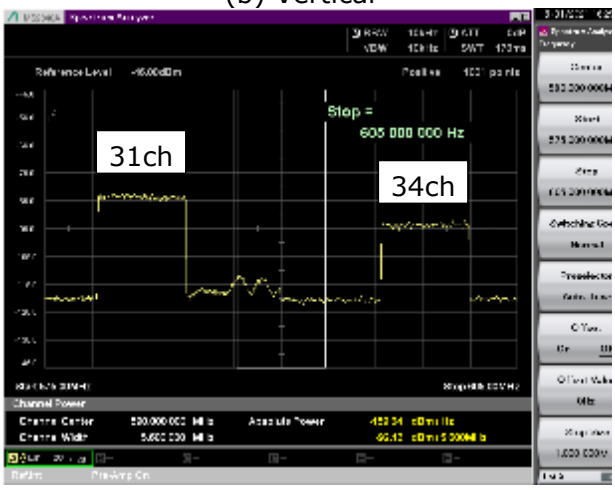
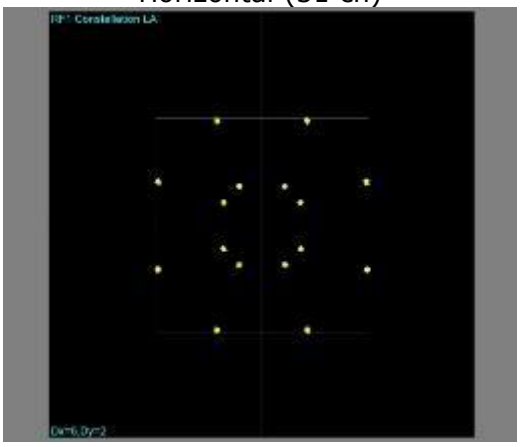


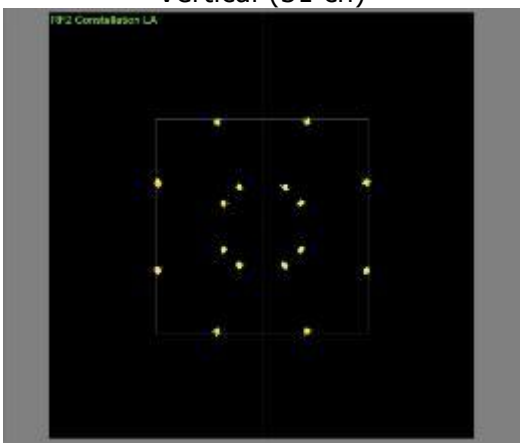
FIGURE 1.1.17 Spectrum of received signals

(a) Mobile reception layer
Horizontal (31 ch)



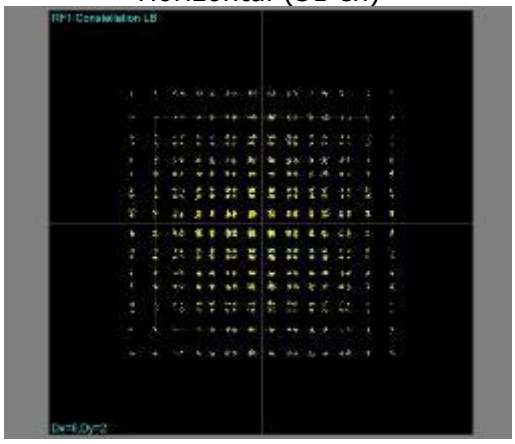
MER = 33.8 dB

(b) Mobile reception layer
Vertical (31 ch)



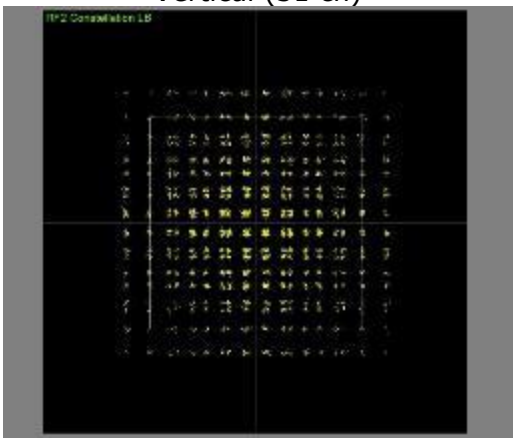
MER = 33.5 dB

(c) Fixed reception layer
Horizontal (31 ch)



MER = 34.3 dB

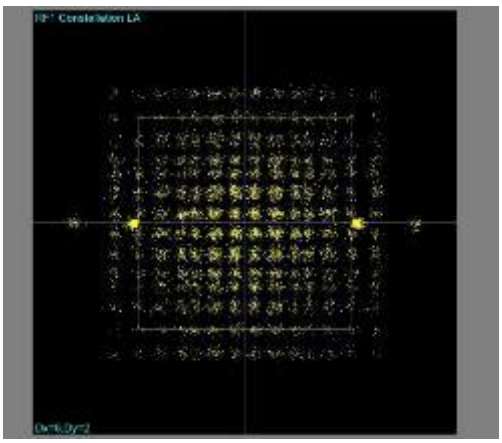
(d) Fixed reception layer
Vertical (31 ch)



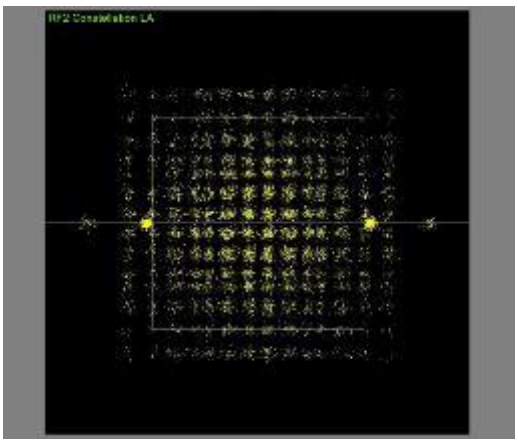
MER = 34.0 dB

(e) Fixed reception layer
Horizontal (34 ch)

(f) Fixed reception layer
Vertical (34 ch)



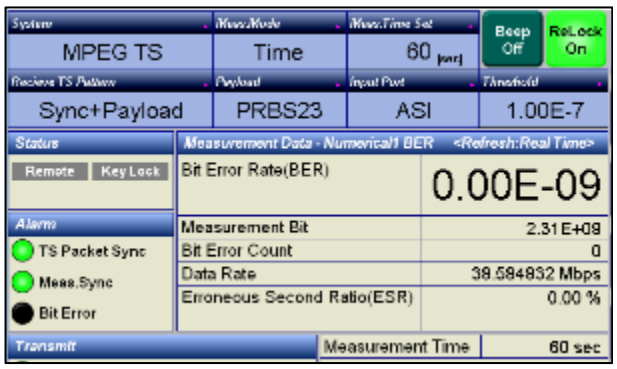
MER = 27.2 dB



MER = 27.0 dB

FIGURE 1.1.18 Constellation of received signals

(a) Fixed reception layer – 31 ch



(b) Fixed reception layer – 34 ch

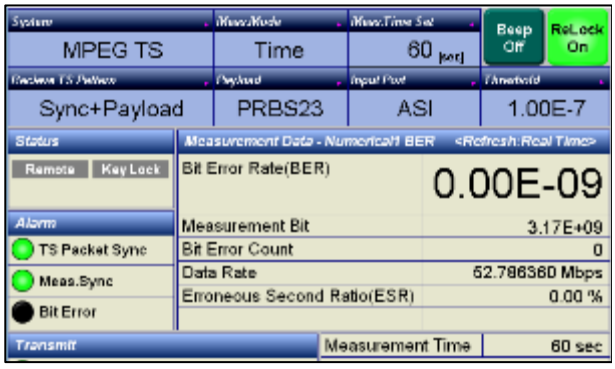


FIGURE 1.1.19 Measurement results of bit error rates

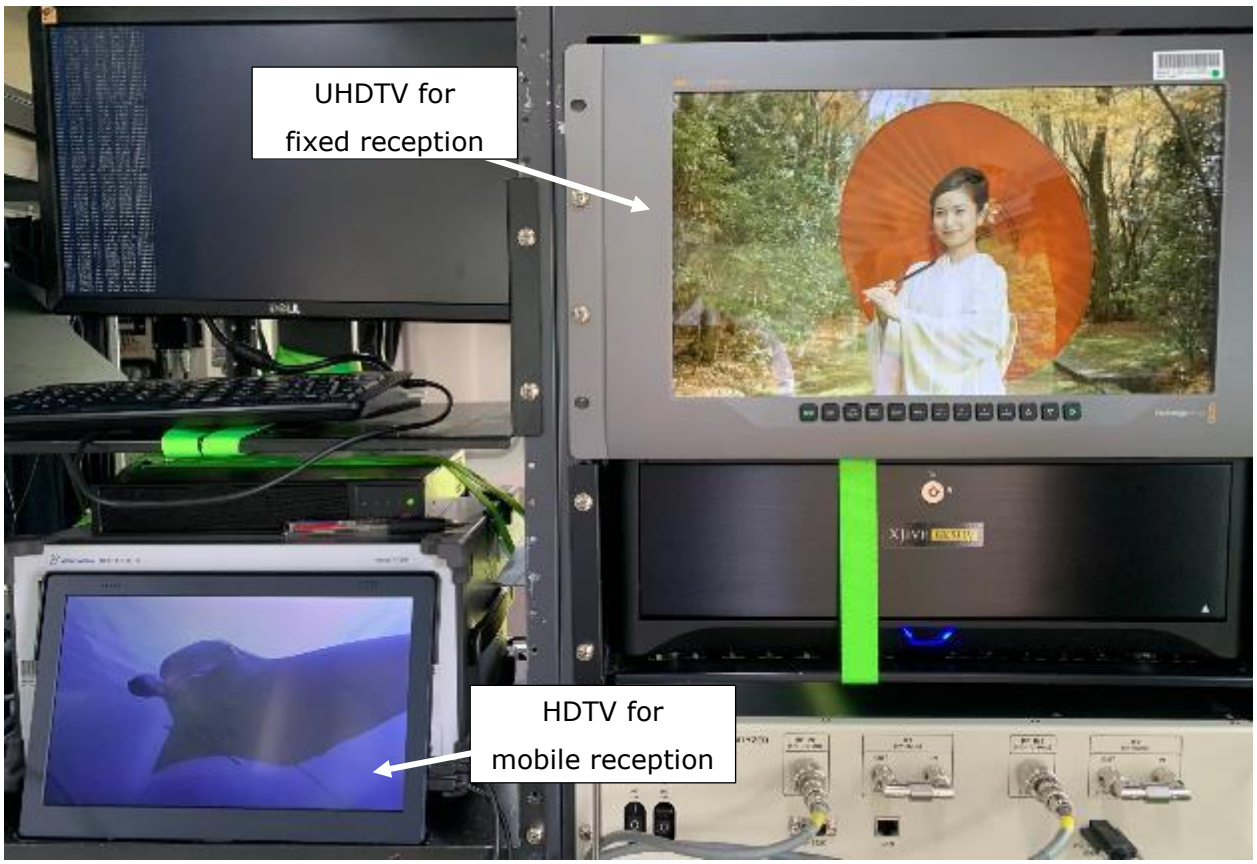


FIGURE 1.1.20 Received video of UHDTV and HDTV

1.1.5. Summary

In the field of broadcasting, UHDTV has the potential to succeed HDTV.

Japan has launched an R&D project aiming at developing an advanced DTTB system and evaluating its performance through field trials in large-scale experimental environments constructed in urban areas.

These field experiments will show the feasibility of terrestrial UHDTV transmission using several key technologies, including dual-polarized MIMO, 4096-QAM carrier modulation, LDPC code, NUC and channel bonding. The UHDTV system to be used in Japan will be selected on the basis of further consideration and examination of various technical possibilities and future trends.

More information such as transmission parameters, experimental results on R&D project phase-1 and phase-2 were described in reference documents [1]-[3] (in § 1.1.2) and the Rep. ITU-R BT.2343-8. (http://www.itu.int/pub/R-REP-BT.2343)

1.2. Development of ATSC 3.0 & 5G-Broadcbast Transmission Techniques in the Republic of Korea

South Korea was at the forefront in adopting ATSC 3.0, introducing its NextGen TV standard in 2016 and launching regular 4K ultra high definition (UHD) broadcasts in May 2017 based on the ATSC 3.0 standard. Currently, ATSC 3.0 services cover over 80% of the population. Beyond UHD, South Korean broadcasters are continuously innovating new services, aligned with the nation's ATSC 3.0 service roadmap.

In line with the South Korean government's policy, KBS expands its broadcast network based on the ATSC 3.0 standard every year. This year, we started regular broadcasting in the Jeonju and Cheongju areas. We are also preparing for regular broadcasting in the Chuncheon and Changwon areas next year. Starting with the UHD 1-channel main broadcast in the Seoul metropolitan area in May 2017, from January 2023, we are now simultaneously transmitting a fixed-reception UHD 1-channel (9-1) and a mobile-reception HD 1-channel (9-2). Furthermore, using the two-way Integrated Broadcast and Broadband (IBB) standard, we have been continuously offering the TIVIVA service since 2019.

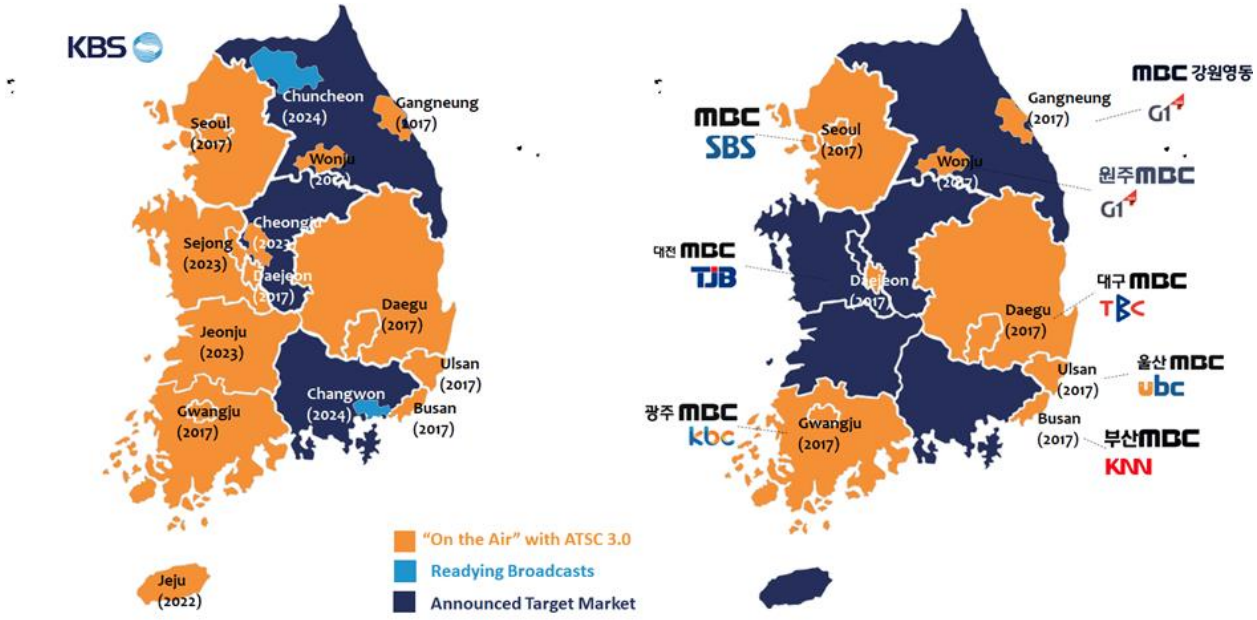


FIGURE 1.2.1 South Korea ATSC 3.0 Regular Broadcasting Service Area (Source) https://www.atsc.org/nextgen-tv/deployments/

1.2.1. Establishment of the National SFN Integrated Monitoring System for Stable SFN Operation

According to the government's policy, there is a plan to fully transition to ATSC 3.0 by 2027. For this transition, ensuring the stability of ATSC 3.0 operation is a pre-requisite. To achieve this, it's essential to establish guidelines for stable SFN broadcast network operation. Still,

there's no such ATSC standard in North America. In this context, in December 2021, KBS, MBC, and SBS – leading South Korean broadcast technology teams – reflecting their over 5 years of operational experience, pioneered the establishment of the 'TTAK.KO-07.0154 Terrestrial UHD System Monitoring Guidelines' standard ahead of North America. Based on this, we have independently developed and are operating a system, as shown in Fig. 1.2.2, that can rigorously monitor the status of the national broadcasting network in real-time, with one-second intervals.

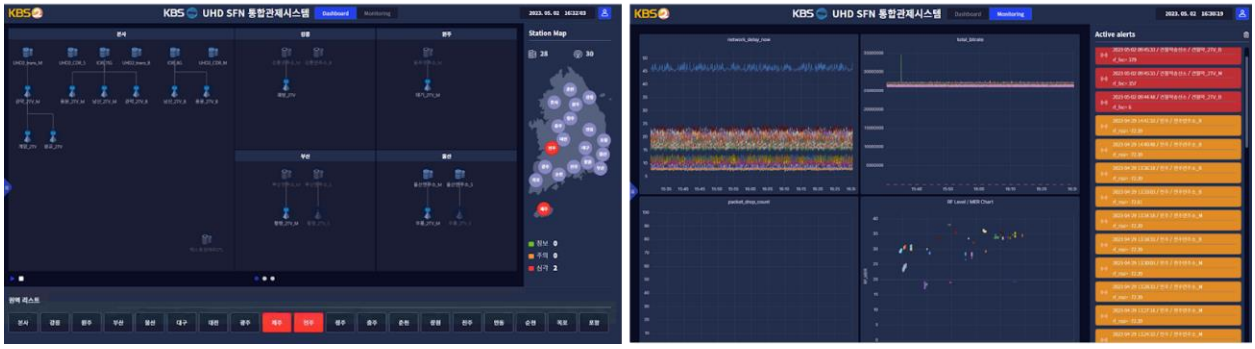


FIGURE 1.2.2 South Korea's TTA Standard-based 'National SFN Integrated Monitoring System' (Left) Network status monitoring dashboard (Right) Real-time key measurement value monitoring dashboard.

The National SFN Integrated Monitoring System, connected to the KBS control line closed network, provides both headquarters and regional operators with identical and prompt views of the nationwide situation. This not only enables immediate observation of the conditions of the organically linked SFN broadcasting network but also offers the advantage of mutually checking situations in other regions. It plays a crucial role in precisely identifying where and what kind of malfunction has occurred and in immediately taking emergency measures to resolve it.

1.2.2. Operation of the country's only Multi-channel Broadcast (MMS) channel that allows mobile viewing

On July 19, 2021, just before the opening ceremony of the Tokyo Summer Olympics, ATSC 3.0 multi-channel test broadcasting was launched. As detailed in Tab. 1.2.1, within the designated television frequency band of 6MHz, the transmission bit rate was adjusted to accommodate channels 9-2 and 9-3, both designed for mobile reception, alongside the already broadcasting UHD 9-1 channel. As of 2023, only channel 9-2, capable of simultaneous broadcasting, remains operational. Efforts are currently being made to introduce experimental

multi-channel radio broadcasts at a transmission rate of 96 kbps. This initiative aims to digitize and enhance FM radios, predominantly used within vehicles.

TABLE 1.2.1 KBS Multi-Channel Broadcasting Operational Status

<table>
<tr><th colspan="2" rowspan="2">Channel</th><th rowspan="2">Reception Environment</th><th colspan="6">2021</th><th colspan="12">2022</th><th colspan="6">2023</th></tr>
<tr><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>~</th></tr>
<tr><td rowspan="4">UHF CH52 (701 MHz)</td><td>9-1 UHD</td><td>Fixed</td><td colspan="18">Regular broadcasting</td></tr>
<tr><td rowspan="2">9-2 HD</td><td rowspan="3">Fixed / Mobile</td><td>Olympic Dedicated Channel</td><td colspan="12">Disaster Specialized Channel</td><td colspan="6">Simulcast (9-1 DTV)</td></tr>
<tr><td>9-3 Visual Radio</td><td colspan="13">Visual KBS1 Radio
+ KBS Panorama / Missing Child Alerts / Weather Life Information</td><td colspan="6">Discontinued</td></tr>
<tr><td>Datacasting</td><td colspan="18">Advanced Emergency Alerts</td></tr>
</table>

KBS has proactively launched a nationwide mobile channel, in line with the government's policy, which caters to viewers on the move. This initiative spurred domestic manufacturers to explore the development of in-vehicle direct-reception devices. It also facilitated diverse testing in various reception environments across the country, leading to the introduction of globally verified products with robust performance. Consequently, the roadmap for integrating ATSC 3.0 receivers into vehicles is becoming increasingly defined each year. Soon, viewers are expected to enjoy KBS content seamlessly, wherever and whenever they wish.

1.2.3. Center of Terrestrial Broadcasting New Technology Research and Development: KBS Kyunggi Gamaksan (Bukgamak) Experimental Station

In a collaborative effort, KBS and ETRI are spearheading national projects focused on 'Broadcast-Communication Convergence Technology Demonstration' and the development of '8K-UHD Broadcasting Related Technology'. To assess the large-scale impact and outcomes of these national projects, an experimental station has been established and is currently operational on Gyeonggi Gamaksan (Bukgamak), as depicted in Fig. 1.2.3. At present, not only are transmitters that adhere to the ATSC 3.0 standard installed, but also ATSC 3.0 transmitters equipped with dual-polarization MIMO antennas, and the 5G-Broadcast transmitters that meet the 3GPP Rel-16/17 standards. These transmitters marked the inaugural launch of experimental waves in South Korea. This year, there is an agenda to

enhance the transmitter to support ATSC 3.0-5G Time-Division Multiplexing (TDM) transmission from a singular source. Additionally, there's a plan to construct a new Channel Bonding ATSC 3.0 transmitter, consolidating UHF CH52+CH56, two broadcasting channels.

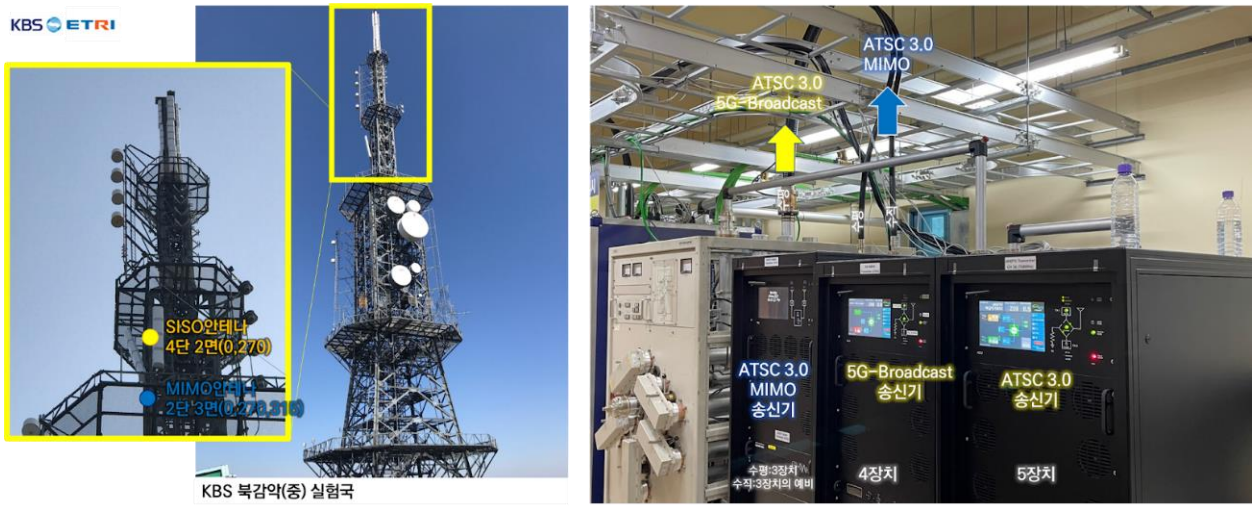


FIGURE 1.2.3 KBS Bukgamak Experimental Station (Left) 4-stacked 2-sided SISO antenna and 2-stacked 3-sided MIMO antenna installed on the transmission tower. (Right) Experimental transmitters installed in the 3rd-floor equipment room of the relay station. These devices have officially obtained South Korea's radio station permits.

TABLE 1.2.2 Status of National Projects Using KBS Gyeonggi Gamaksan Experimental Station (as of October 2023)

Project Name	Research Period	Research Objective & Details
Development of Integrated Transmission Technology for 5G and Broadcasting Network (ATSC 3.0)	April 2019 - December 2023 (45 months)	Aim to develop a technology that enables simultaneous transmission of both a fixed reception channel (adhering to the ATSC 3.0 standard) and a mobile reception channel (in line with the 5G-FeMBMS standard). This will be executed within a UHD broadcasting channel utilizing time-division multiplexing.
Development of Terrestrial 8K Media Broadcast Transmission and Reception Technology	April 2022 - December 2026 (57 months)	Focus on developing a transmission system proficient in supporting both 'channel bonding' and 'multiple antenna' technologies. This will pave the way for the delivery of 8K-UHD media over terrestrial broadcasting networks, achieving a maximum of 200Mbps.
Development of 4-Rx Diversity Mobile Reception ATSC 3.0 Chip	April 2023 - December 2026 (45 months)	Design and introduce a state-of-the-art mobile broadcasting reception chip characterized by its high performance and sensitivity. This chip will be engineered with multiple receiving antennas, all consistent with the ATSC 3.0 standard. Initiate the production and launch of a set-top box, specifically designed for vehicular use, ensuring it meets the benchmarks set by commercial product standards.

1.2.3.1. Development of Integrated Transmission Technology for 5G and Broadcasting Network (ATSC 3.0)

Currently, there's ongoing development for the technology that simultaneously transmits a fixed reception channel (compliant with the ATSC 3.0 standard) and a mobile reception channel (based on the 5G-FeMBMS standard) within a terrestrial UHD broadcasting channel using time-division multiplexing. A recent field test confirmed its successful operation.

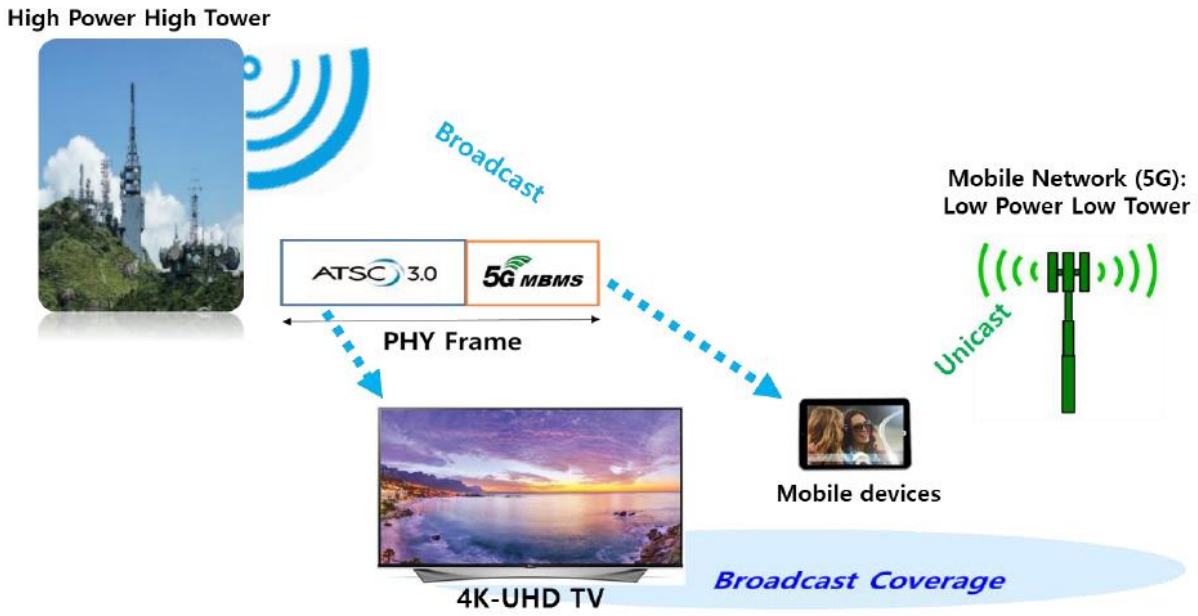


FIGURE 1.2.4 Diagram of the simultaneous transmission based on TDM (Time-Division Multiplexing) for both ATSC 3.0 and 5G Broadcast.

Through the 5G Broadcast based on 3GPP Rel-17, it's anticipated that mobile broadcast services can be provided to 5G devices within the UHD broadcasting channel without needing a separate UHD (ATSC 3.0) reception chip. This will not only expand direct reception but also extend the scope from television receivers to mobile devices, laying the foundation for technology that can be widely applied.

The computer simulation and laboratory performance comparison results between ATSC 3.0 and 5G Broadcast Physical Layer have been published in a paper [A] in IEEE Transactions on Broadcasting.

[A] Seok-Ki Ahn, Sungjun Ahn, Jeongchang Kim, et. al., "Evaluation of ATSC 3.0 and 3GPP Rel-17 5G Broadcasting Systems for Mobile Handheld Applications," IEEE Transactions on Broadcasting, vol. 69, no. 2, pp. 338 - 356, June 2023.

Starting from July 2023, the field test for the simultaneous transmission of ATSC 3.0 – 5G Broadcast TDM has commenced and is scheduled to continue until the end of this year. In alignment with South Korea's channel bandwidth of 6MHz, four Configuration Modes have

been defined to maintain a consistent transmission rate. Quantitative reception performance evaluations have been conducted through field tests for both fixed and mobile reception.

TABLE 1.2.3 Detailed settings of physical layer parameters according to four transmission rates: (Top) ATSC 3.0 (Bottom) 5G-Broadcast

Common Configuration (ATSC 3.0)		
Common parameters	**FFT size**	8192
	Guard interval	GI6_1536 (222.222 us)
Payload OFDM parameters	**Subcarrier spacing**	0.844kHz
	Pilot pattern	SP4_2
	# of payload symbols	138
	Time interleaver	CTI with a depth of 1024
	Frequency interleaver	On
Frame length		200 ms
Bandwidth		6MHz

	Configuration 0	Configuration 1	Configuration 2	Configuration 3
Outer code	5/15-LDPC (64800)	5/15-LDPC (64800)	7/15-LDPC (64800)	10/15-LDPC (64800)
Constellation	4-QAM	16-NUC	64-NUC	64-NUC
Data rate	**2.73 Mbps**	**5.47 Mbps**	**11.53 Mbps**	**16.51 Mbps**

Common Configuration (5G Broadcast)	
FFT size	12288
Guard interval	200us
Pilot pattern	SP3_2
Subcarrier spacing	1.25KHz
MCS table	Table 7.1.7.1-1 (TS 36.213) Max 64-QAM table
Bandwidth	6MHz (30RBs)

	Configuration 0	Configuration 1	Configuration 2	Configuration 3
MCS index	5	11	19	24
TBS	2664	5352	10680	16416
Code rate	0.373	0.373	0.498	0.764
Constellation	4-QAM	16-QAM	64-QAM	64-QAM
Data rate	**2.60 Mbps**	**5.22 Mbps**	**10.41 Mbps**	**16.00 Mbps**

The measurement vehicle was configured to simultaneously measure the ATSC 3.0 and 5G Broadcast signals at once. For fixed measurements, the antenna mast was raised up to a

height of 9m, and for mobile measurements, it was measured at the height of the vehicle's roof (2.6m). Both fixed and mobile measurements used an Omni-Antenna.

[Fixed Reception Results]

Field tests were conducted at four different measurement points located 3.4km, 6.0km, 9.3km, and 11.7km away from the transmission point of the test station. Each location presented unique Multipath characteristics. The results were summarized in Tab. 1.2.4.

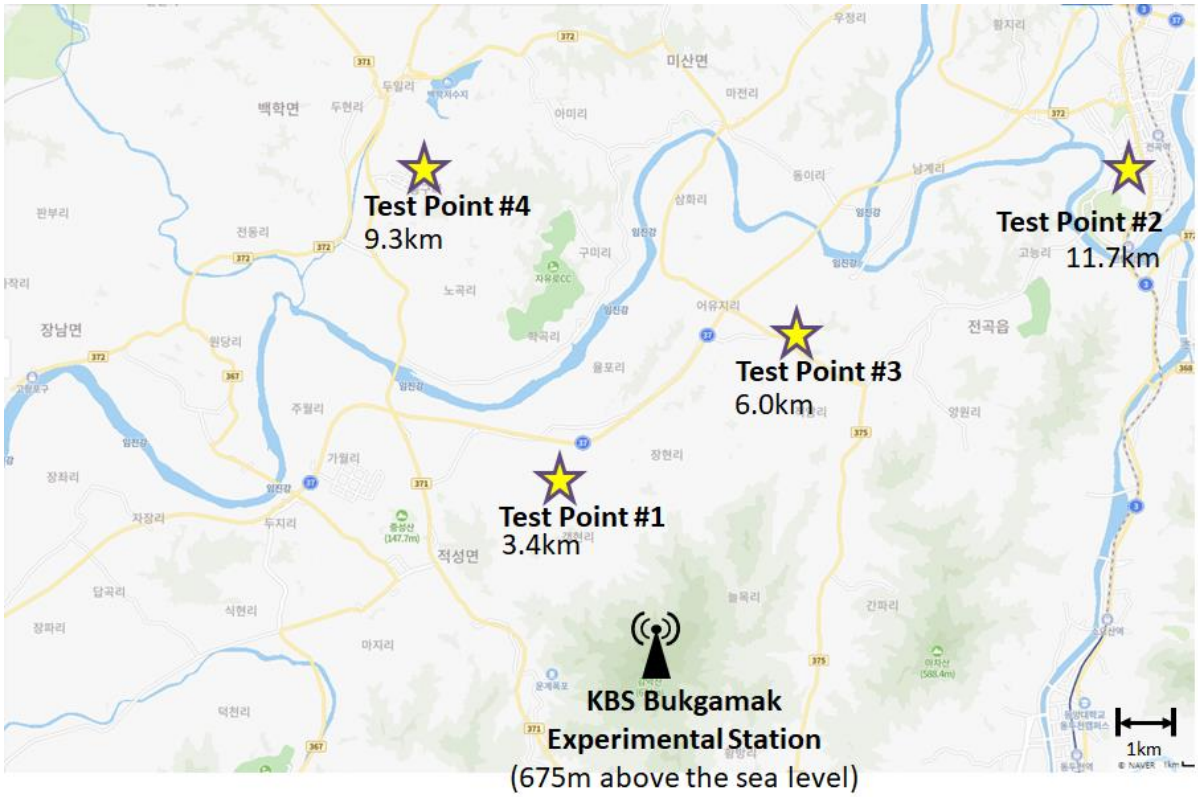


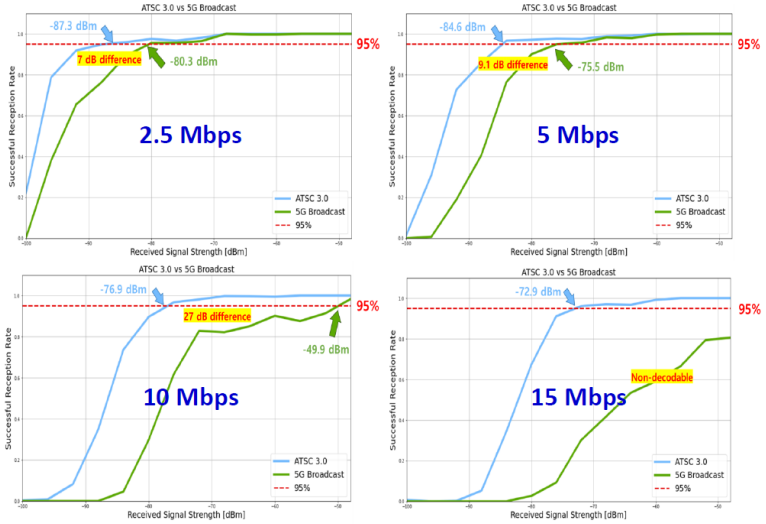
FIGURE 1.2.5 Locations of the 4 measurement points and their distances from the transmission point

TABLE 1.2.4 Comparison of ATSC 3.0 and 5G Broadcast based on ToV C/N criteria.

Config.	Reception Point	ATSC 3.0	5G Broadcast	Difference	Average Diff.
2.5 Mbps	Test Point #1	-0.32	0.31	0.63	0.8
	Test Point #2	0.18	1.33	1.15	
	Test Point #3	-0.11	0.58	0.69	
	Test Point #4	0.42	1.16	0.74	
5 Mbps	Test Point #1	3.51	4.67	1.16	1.05
	Test Point #2	4.71	5.70	0.99	
	Test Point #3	4.58	5.05	0.47	
	Test Point #4	5.05	6.62	1.57	
10 Mbps	Test Point #1	9.75	11.39	1.64	1.85 (Test point #4 excluded)
	Test Point #2	11.71	14.15	2.44	
	Test Point #3	11.93	13.41	1.48	
	Test Point #4	12.18	Non-decodable	∞	
15 Mbps	Test Point #1	14.57	18.59	4.02	3.67 (Test point #2 and #4 excluded)
	Test Point #2	15.63	Non-decodable	∞	
	Test Point #3	16.96	20.27	3.31	
	Test Point #4	Non-decodable	Non-decodable	N/A	

[Mobile Reception Results]

Within the coverage of the experimental station, mobility measurements were carried out on the same path, only varying the Configuration Mode. The mobility path had an RSSI ranging from a minimum of -99dBm to a maximum of -42dBm, with an average of about -72dBm. The measurements were carried out at an average speed of about 40km/h.



Config.	ATSC 3.0	5G Broadcast	Difference
2.5 Mbps	-87.3 dBm	-80.3 dBm	7.0 dB
5 Mbps	-84.6 dBm	-75.5 dBm	9.1 dB
10 Mbps	-76.9 dBm	-49.9 dBm	27 dB
15 Mbps	-72.9 dBm	Non-decodable	∞

[Mobile reception performance comparison results]

FIGURE 1.2.6 (Left) Successful Reception Rate Curve for ESR5 calculation (Right) Comparison of ATSC 3.0 and 5G Broadcast reception performance at the 95% location.

1.2.3.2. Development of Terrestrial 8K Media Broadcast Transmission and Reception Technology

Last year and this year, an ATSC 3.0 MIMO transmitter capable of emitting through a dual-polarization (horizontal/vertical) antenna was developed for a single transmitter. After installing it at the experimental station, field tests confirmed its ability to transmit across 4 UHD channels.

FIGURE 1.2.7 In the measurement vehicle, 4 UHD channels were successfully received at a rate of 15Mbps each, totaling 60 Mbps, using the prototype ATSC 3.0 MIMO transmitter and receiver.

By the end of 2023, an ATSC 3.0 Channel Bonding transmitter, which can double the transmission rate by bundling two terrestrial broadcast channels while still using the existing horizontal polarization transmission antenna, is planned to be fully installed. As soon as the renewal permission for the experimental station is granted, field tests for the ATSC 3.0 Channel Bonding will commence.

Ultimately, the goal is to install a transmitter that can improve the total transmission rate by four times: doubling with channel bonding technology, doubling with dual-polarization MIMO technology, and simultaneously utilizing both techniques. Verification tests will be carried out through field tests at the KBS Bukgamak experimental station.

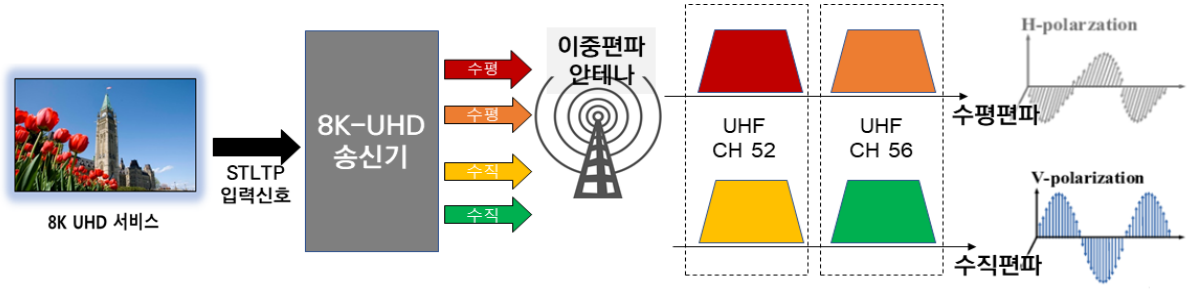


FIGURE 1.2.8 Diagram of the development plan for an 8K-UHD transmitter that utilizes both ATSC 3.0 Channel Bonding and MIMO technologies simultaneously.

1.2.3.3. Development of ATSC 3.0 Mobile Broadcasting Reception Chip

The goal is to develop a reception chip optimized for in-car mobile broadcasting, supporting 4-Rx Diversity Reception. This will significantly enhance the performance of the existing single-antenna-based TV ATSC 3.0 mobile broadcast reception chip.
Once this reception chipset is developed, it's expected to facilitate the integration of the ATSC 3.0 receiver in vehicles, as vehicle receiver manufacturers can be provided with high-performance chipsets at reasonable prices.

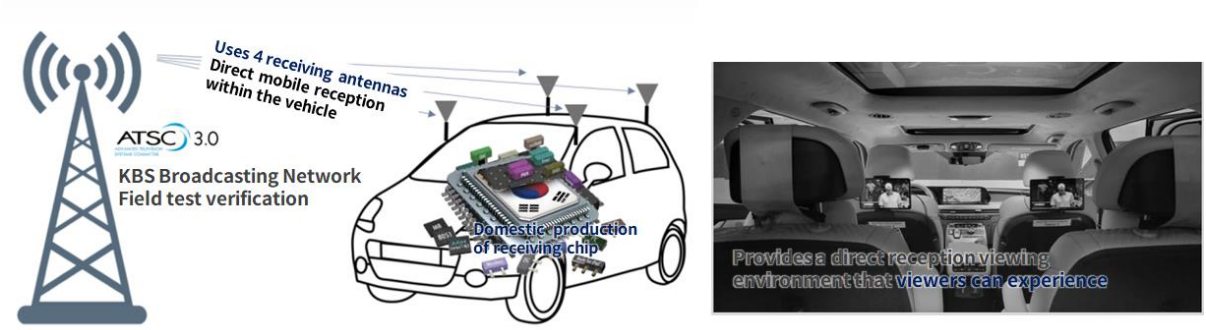


FIGURE 1.2.9 Diagram of the ATSC 3.0 vehicular reception chip supporting 4-Rx Diversity functionality.

1.2.4. KOBA Show 2023 Exhibition and Busan Global DTT Workshop

The achievements of the research and development were showcased at the KOBA SHOW 2023 held in Seoul COEX in June 2023, promoting to the public.

FIGURE 1.2.10 Displayed at the KBS booth during the KOBA Show

Displayed at the KBS booth during the KOBA Show were exhibits that highlighted ATSC 3.0 multi-channel, mobile, bidirectional, and radio demonstrations (Fig. 1.2.10). One of the significant features was the UHD 4-channel simultaneous transmission leveraging ATSC 3.0 MIMO technology, alongside the 5G Broadcast transmission and reception rooted in 3GPP Rel-17.

Additionally, global broadcasting technology experts from around the world were invited to Busan for the Global DTT Workshop. Insights and outcomes were disseminated through hands-on demonstrations and presentations of relevant content. Details of the event schedule and presentation materials can be accessed through the links provided:

- Workshop agenda: https://sites.google.com/view/globaldtt/schedule
- Presentation materials: https://drive.google.com/drive/folders/1Mn2Emy394ONWKH7oty4lNqiMprDvd3nK?usp=shari

Time	ATSC 3.0 Now (19th July)	ATSC 3.0 Moving Forward (20th July)	Global DTT Trends (21st July)	
08:30 ~ 09:00	Registration & Technical Demos	Technical Demos	Technical Demos	
09:00 ~ 11:30		**Session 3: New Developments**	**Session 6: Global DTT Status**	
11:30 ~ 12:40	Sponsored Meal & Demos	Sponsored Meal & Demos	Sponsored Meal	
12:40 ~ 18:00	**Opening Address & MOU**	**Session 4: New Diverse & Business Cases (1)**	Social Networking	BK21: CLMC Performance Sharing Event
	Session 1: ATSC 3.0 History from Inception to D2M & D2V			
	Coffee Break & Demos	Coffee Break & Demos		
	Session 2: Current & Future	**Session 5: New Diverse & Business Cases (2)**		
19:00 ~ 21:00	Welcome Reception	Banquet		

FIGURE 1.2.11 Program booklet of the Global DTT Workshop, group photo of all attendees, and an outline of the workshop schedule.

Annex 2

Project: Integrated Broadcast-Broadband and OTT (D/IBBOTT)

Project Manager: **Dr. Go OHTAKE** (NHK, Japan)
Co-project Manager: **Mr. A. K. Mangalgi** (DDI, India)
Mr. R.P. Joshi
Ms. Momoko Suyama (NHK, Japan)
Dr. Shinya Abe (NHK, Japan)
Mrs. Zhang Dingjing (ABS, China)
Zhang Yu (ABS, China)
Zhang Wei (ABS, China)
He Jing (ABS, China)
Wang Lei (ABS, China)

2. Status report

This clause describes recent updates on IBB and OTT standards and related technologies identified and studied by this project. And it describes also recent update on standards and technologies of information security for broadcasting services and cyber security in broadcasting industry for protecting the broadcasting systems.

2.1 Standardization of Integrated Broadcast-Broadband System in Japan

IPTV Forum Japan standardizes specifications of Hybridcast in Japan. Technical specification of Hybridcast is composed of two technical standards and an operational guideline listed below and the latest versions are published in January 2022.

- IPTVFJ STD-0010 'Integrated Broadcast-Broadband System Specification', version 2.4
- IPTVFJ STD-0011 'HTML5 Browser Specification', version 2.7
- IPTVFJ STD-0013 'Hybridcast Operational Guideline', version 2.10

In the revision in November 2020 several new features were added to the Hybridcast technical specifications. Major updates are as follows:

- Addition of the new application type named "Broadcast-independent managed application"
  An application of this type runs in the state that no broadcast channel is being tuned so that service providers can offer application services regardless of their broadcasting area.
- Enhancement to the streaming video playback function
  The CMAF[*1] is added as a supported container format of streaming video, including low-latency playback features. Support for stream event delivery mechanisms such as an 'event message' (emsg) box and an 'Event' XML element of MPEG DASH[*2] are also added.

- Enhancement to the companion device function
  UHDTV broadcasting services, i.e. 4K and 8K satellite broadcasting in Japan, are added to the available channels for tuning from a companion device.
- Addition of the three-dimensional audio codec support
  The enhanced AC-3[*3] is added to the available audio codecs for video streaming.

*1 ISO/IEC 23000-19 "Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media".
*2 ISO/IEC 23009-1 "Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats".
*3 ETSI TS 102 366 "Digital Audio Compression (AC-3, Enhanced AC-3) Standard".

In the revision in January 2022, several features related to terminated VOD services were deleted from the Hybridcast technical specifications.

2.2 Studies in ITU-R

ITU-R WP6B is working for the study on IBB systems. The working party is now studying on harmonization of IBB systems by making comparison of Hybridcast (Japan), HbbTV2.0 (Europe), TOPSmedia (South Korea) and Ginga (Brazil).
At the meeting held in April 2019 in Geneva, the working party developed the comparison of application life-cycle and application transition of the IBB systems, and revised Report ITU-R BT.2267 "Integrated broadcast-broadband systems" to add a new part on the harmonization of Integrated Broadcast-Broadband (IBB) systems' applications. To allow the exchange of services covered by the IBB systems and to deploy these services in an area where other systems are used, it is important to harmonize the IBB systems, to ensure compatibility with the IBB applications and interoperability across systems.
At the meeting, the working party revised Report ITU-R BT.2342 to replace information on TTML Text and Image Profiles for Internet Media Subtitles and Captions 1.0 (IMSC1.0) with the updated IMSC1.1 and to update a list of current EBU specifications pertinent to the content of the Report.

At the meeting held in July 2019 in Geneva, the working party revised Report BT.2267 to add the companion application to execute the application on a receiver. The working party also developed the new use cases of IBB system which provides object-based sound services via MPEG-DASH streams.
The working party also developed the global platform. The working party revised Report ITU-R BT.2400 "Usage scenarios, requirements and technical elements of a global platform for the broadcasting service" to add the specific reference to the ATSC 3.0 standard and some examples to show its Internet Protocol-based capabilities to integrate broadcast and broadband services. New digital terrestrial transmission standards such as

the ATSC 3.0 system can help effectuate a converged broadcast and broadband platform, which is an important aspect of a global platform for broadcasting services.

At the meeting held in October 2020, the working party revised Recommendation ITU-R BT.2075 "Integrated broadcast-broadband system" to update an application execution mechanism of Hybridcast, with which a companion device sends a command to a receiver to tune to a designated channel and launch a Hybridcast application.

At the meeting held in March 2021, the working party prepared a revised draft report of Recommendation BT.2075 by adding information regarding commonality among IBB systems and equivalency of their functions as described in Report BT.2267 Part 3. The working party also prepared a draft revision to report BT.2267 on IBB systems to align with Recommendation ITU-T J.208 on harmonization of applications between IBB systems.

At the meeting held in September 2022, the working party revised Recommendation ITU-R BT.2075 "Integrated broadcast-broadband system" and Report BT.2267 "Integrated broadcast-broadband systems" to add a Broadcast-independent managed application, that is an application launched when broadcast services are not selected but still authenticated by broadcasters.

2.3 Studies in ITU-T

ITU-T SG9 is also working for the study on IBB system applied to Cable Digital TV. At the meeting held in November 2018 in Bogota, Colombia, the Study Group started the work to revise IBB system Recommendation (ITU-T Recommendation J.207 "Specification for integrated broadcast and broadband digital television application control framework") to add the function of device collaboration with companion devices in Hybridcast. Recommendation J.207 is a twin of IBB system Recommendations in ITU; Recommendation ITU-R BT.2075 is another twin on this topic. So, the Study Group continue to work to revise the Recommendation according to revision of Recommendation ITU-R BT.2075. The Study Group is studying the work of smart TV operating system for hybrid cable Digital TV services including IBB DTV service provided by cable television operators and third-party providers. At the Bogota meeting, the study group make progress the work of the architecture of smart TV operating system. The study group consent the Recommendation of "The functional requirements of smart TV operating system" as ITU-T Recommendation J.1201.

At the meeting held in June 2019 in Geneve, the study group consent Recommendation J.207 to add the function of device collaboration in Hybridcast. The study group also make progress the work of drafting new Recommendation "Harmonization of Integrated Broadcast-Broadband DTV application control framework". As for the smart TV operating

system, the study group consent the Recommendation of "The architecture of smart TV operating system" as ITU-T Recommendation J.1202. In addition, making a new Recommendation for the specification of smart TV operating system was started in the study group.

At the meeting held in July 2020, the study group reached the AAP consent for the draft new Recommendation ITU-T J.1204. It is now approved and is part of a set of already approved Recommendations as follows:

- J.1201: Functional requirements of a smart TV operating system
- J.1202: The architecture of a smart TV operating system
- J.1203: The specification of a smart TV operating system
- J.1204: The security framework of a smart TV operating system

The group also consent new Recommendation ITU-T J.208 "Harmonization of Integrated Broadcast-Broadband DTV application control framework" at its November 2020 meeting. The recommendation is created based on Report ITU-R BT.2067 which defines the methods to harmonize IBB systems by identifying commonalities across the IBB systems.

2.4 Cyber Security in Ireland

On February 2023, Virgin Media television, one of Ireland's most popular TV broadcasts, has suffered what it has deemed an "unauthorised attempt" to access its systems, taking down several of its TV channels in Ireland. The company has 3.4 million customers, including more than a million in Ireland. The attack affected numerous services. These include recorded programming on Virgin Media Three, Four, More and VMTV. Virgin Media said that "Our ongoing security monitoring system has identified an unauthorised attempt to access our systems in recent days. Due to the precautions, we have implemented there will be temporary effects to the broadcasting of some of our recorded programming on Virgin Media Three, Four, More and VMTV Player." Virgin Media later confirmed that the breach had been, "fully contained, isolated terminated". After that, Virgin Media has said that a cyber attack that affected programming on some of its channels was not a ransomware attack.

Source:

https://techmonitor.ai/technology/cybersecurity/virgin-media-television-suffers-major-hack
https://www.businesspost.ie/news/virgin-media-television-says-major-hack-was-not-ransomware/
https://www.siliconrepublic.com/enterprise/virgin-media-television-tv-hack-cyberattack-breach
https://www.rte.ie/news/2023/0220/1357832-virgin-media-hack/

Annex 3

Project: Satellite Broadcasting (T/SB)

Project Manager: **Mr. Masashi KAMEI** (NHK, Japan)

Co-project Manager: **TBD**

3.0 Objectives

This clause describes technologies on the latest satellite systems for UHDTV broadcasting and specifications of the latest satellite broadcasting systems. And it describes also the latest topics on advanced satellite broadcasting technologies using Ka-band, etc.

3.1 ITU-R Documents Related to Satellite Broadcasting Systems

3.1.1 Radio Regulations

ARTICLE 23 Section 2 "Broadcasting-satellite services"

APPENDIX 30 "Provisions for all services and associated Plans and List for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5GHz (in Region 1) and 12.2-12.7 GHz (in Region 2)

APPENDIX 30A "Provisions and associated Plans and List for feeder links for the broadcasting-satellite service (11.7-12.5GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2

RESOLUTION 506 "Use by space stations in the broadcasting-satellite service operating in the 12 GHz frequency bands allocated to the broadcasting-satellite service of the geostationary-satellite orbit and no other"

RESOLUTION 507 "Establishment of agreements and associated plans for the broadcasting-satellite service"

RESOLUTION 528 "Introduction of the broadcasting-satellite service (sound) systems and complementary terrestrial broadcasting in the frequency bands allocated to these services within the range 1-3 GHz."

RESOLUTION 536 "Operation of broadcasting satellites serving other countries."

RESOLUTION 548 "Application of the grouping concept in Appendices 30 and 30A in Regions 1 and 3"

RESOLUTION 552 "Long-term access to and development in the frequency band 21.4-22 GHz in Regions 1 and 3"

RESOLUTION 553 "Additional regulatory measures for broadcasting-satellite networks in the frequency band and 21.4-22 GHz in Regions 1 and 3 for the enhancement of equitable access to this frequency band"

RESOLUTION 554 "Application of pfd masks to coordination under No. 9.7 for broadcasting-satellite service networks in the band 21.4-22 GHz in Regions 1

and 3”

RESOLUTION 555 “Additional regulatory provisions for broadcasting-satellite service networks in the frequency band 21.4-22 GHz in Regions 1 and 3 for the enhancement of equitable access to this frequency band”

RESOLUTION 557 “Consideration of possible revision of Annex 7 to Appendix 30 of the Radio Regulations”

3.1.2 Recommendations (https://www.itu.int/rec/R-REC-BO/en)

BO.1213 “Reference receiving Earth station antenna pattern for the broadcasting-satellite service in the 11.7-12.75 GHz band”

BO.1408 “Transmission system for advanced multimedia services provided by integrated services digital broadcasting in a broadcasting-satellite channel”

BO.1443 “Reference BSS earth station antenna patterns for use in interference assessment involving non-GSO satellites in frequency bands covered by RR Appendix 30”

BO.1516 “Digital multiprogramme television systems for use by satellites operating in the 11/12 GHz frequency range”

BO.1659 “Mitigation techniques for rain attenuation for broadcasting-satellite service systems in frequency bands between 17.3 GHz and 42.5 GHz”

BO.1696 “Methodologies for determining the availability performance for digital multi-programme BSS systems, and their associated feeder links operating in the planned bands”

BO.1724 “Interactive satellite broadcasting systems (television, sound and data)”

BO.1774 “Use of satellite and terrestrial broadcast infrastructures for public warning, disaster mitigation and relief”

BO.1784 “Digital satellite broadcasting system with flexible configuration (television, sound and data)”

BO.1900 “Reference receive earth station antenna pattern for the broadcasting-satellite service in the band 21.4-22 GHz in Regions 1 and 3”

BO.2063 “Alternative BSS earth station antenna radiation pattern for 12 GHz BSS bands with effective apertures in the range 55-75 cm”

BO.2098 “Transmission system for UHDTV satellite broadcasting”

3.1.2 Reports (https://www.itu.int/pub/R-REP-BO/en)

BO.2007 “Considerations for the introduction of broadcasting-satellite service of high-definition television and ultra-high-definition television systems in the band 21.4-22 GHz”

BO.2071 “Broadcasting-satellite service system parameters between 17.3 GHz and 42.5 GHz and associated feeder links”

BO.2101 “Digital satellite broadcasting system (television, sound and data) with flexible

configuration”

BO.2102 “Multiple-feed BSS receiving antennas”

BO.2397 “Satellite transmission for UHDTV satellite broadcasting”

BO.2497 “Characteristics and effectiveness of frequency sharing criteria for the broadcasting-satellite service in Regions 1 and 3 subject to RR Appendix 30”

3.2 Latest Topics on Satellite Broadcasting

3.2.1 Development of Large-capacity Content Transmission Equipment for Flexible Provision of Immersive Services cooperated with 21- and 12-GHz-band Satellite Broadcasting Channels and IP Network

To offer viewers the opportunity to enjoy immersive content –that is, to make viewers feel as though they are transported to other worlds– NHK STRL is conducting R&D on three-dimensional and omnidirectional image presentations, technologies for reproducing sound fields tied to images, and content delivery techniques capable of providing tactile sensations of three-dimensional shapes and textures.

One example of a transmission technology to provide immersive content with large capacity and high flexibility, NHK STRL developed a transmission equipment that can bundle satellite broadcasting channels in 21- and 12-GHz bands and IP network.

The 21-GHz-band satellite broadcasting allocated to the frequency band of 21.4–22.0 GHz in ITU-R Regions 1 and 3 is expected to be utilized as transmission channels for new broadcasting services with large capacity. Therefore, we assumed two 300-MHz-class wideband transponders in the 21-GHz band and developed a wideband modem with the nominal symbol rate of 250 Mbaud. The 12-GHz-band satellite broadcasting allocated to the frequency band of 11.7–12.2 GHz in ITU-R Regions 1 and 3 is widely utilized for HDTV and UHDTV services. In Japan, UHDTV (4K and 8K) services have been provided since Dec. 2018 by the “ISDB-S3” transmission system with the symbol rate of 33.7561 Mbaud.

The large-capacity content transmission equipment enables us to bundle one wideband modem for a 21-GHz-band satellite broadcasting channel and two ISDB-S3 modems for 12-GHz-band satellite broadcasting channels and an IP network to provide large-capacity content beyond the transmission capacity in each channel or network. It also enables us to allocate the channels and network in accordance with objects that are distinguished from the information in IP packets such as the destination IP address, the UDP port numbers, or the payloads.

A laboratory experiment was conducted to evaluate the functionality of this equipment using free-viewpoint AR content. Figure 3-1 shows the laboratory experimental system. The AR content consists of high and standard resolution images and the sounds of six players and their instruments. Here, the objects are assigned by each of their associated images or sounds. In this experiment, the AR content was classified into three layers: a base content layer comprising the standard resolution images (Object ID = 9 to 15) of four players

and their instruments in the center and the sounds (Object ID = 17 to 23) of all players and instruments; an enhancement content layer #1 comprising the standard resolution images (Object ID = 7,8 and 16) of the remaining two players and their instruments; and an enhancement content layer #2 comprising all high resolution images (Object ID = 1 to 6). The base content layer was about 85 Mbps and was transmitted by the ISDB-S3 modem. The enhancement content layer #1 was about 45 Mbps and was transmitted by the network simulator. The enhancement content layer #2 was about 270 Mbps and was transmitted by the wideband modem. On the receiver side, AR content with the total bitrate of about 400 Mbps was reproduced and was transmitted to a tablet via a Wi-Fi router.

In the experiment, when the connection from the wideband demodulator and the network emulator to the large-capacity content receiver was terminated, the four players and their instruments in the center and all sounds were maintained as the base content layer, while the other two players and their instruments disappeared. These results demonstrate that the large-capacity content transmission equipment can operate successfully and is able to provide a flexible content production and representation of immersive content appropriate for various viewer environments.

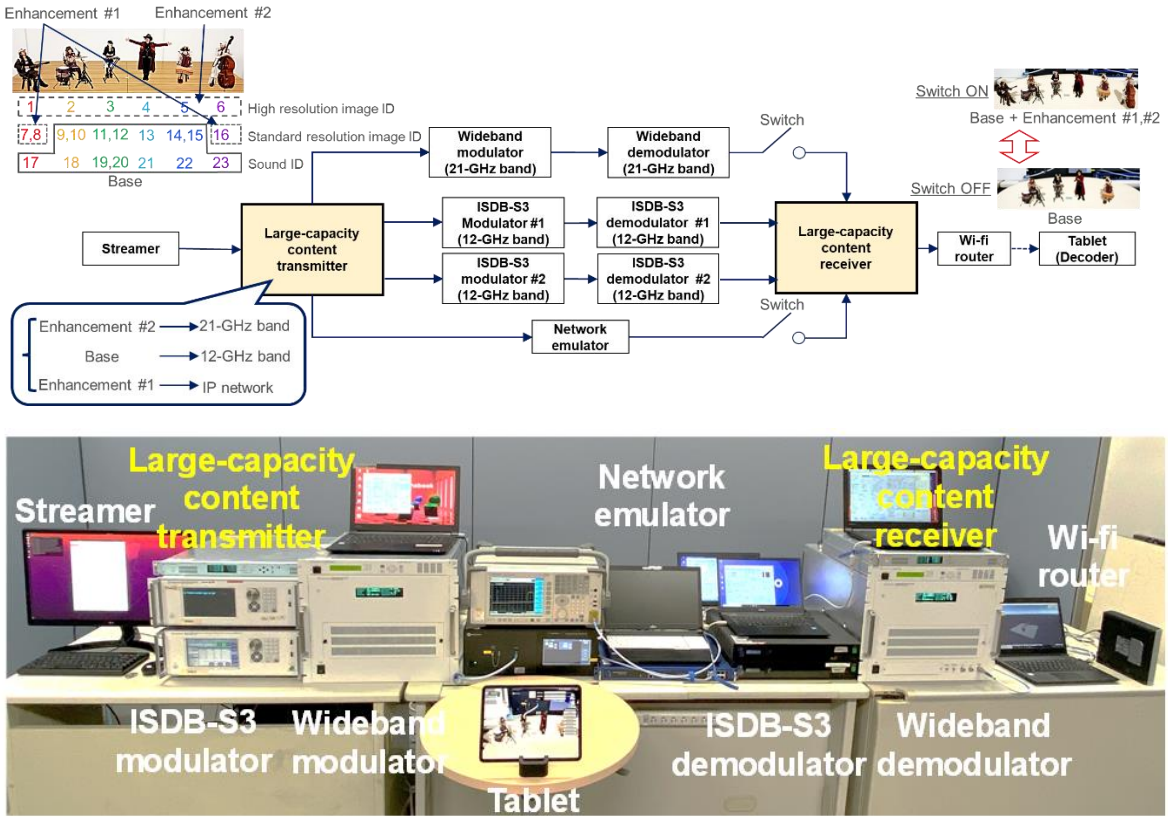


Figure 3-1 Laboratory experimental system of
large-capacity content transmitter equipment with AR content.

TOPIC AREA: Training & Services

Topic Chairman Report for the period Dec 2022-Oct 2023

A lot of technological advancements in media and broadcasting including innovations have been taking place at a quite faster rate. As new technologies emerge, professionals in the industry need to update their skills to stay relevant. The transition from traditional broadcasting to digital platforms, the rise of streaming services, and the adoption of high-definition and 4K technologies are driving the need for training in the latest tools and techniques.

Additionally, the growing demand for diverse and localized content has led to an increased need for trained professionals who understand the cultural nuances and preferences of different markets within the Asia-Pacific region. This requires specialized training programs to develop skills in content creation, adaptation, and localization.

Furthermore, the expansion of the broadcasting industry itself contributes to the demand for trained personnel. As more channels, platforms, and production houses emerge, there is a need for a skilled workforce to meet the demands of a competitive and evolving market.

Regulatory changes and standards in the broadcasting sector can also drive the demand for training. Professionals may need to stay informed and trained on compliance issues, ethical standards, and industry regulations.

Under such scenario having more demand for training from ABU members is obvious. In a nutshell, the surge in training demand in the broadcasting sector in the Asia-Pacific region is a response to technological advancements, the need for diverse and localized content, industry expansion, and regulatory changes.

This is certainly posing a tough challenge before the ABU Technology Division to meet the training needs of its members as this region is highly diversified towards adoption of technology innovations.

2) The Training & Services Topic Area plays an important role in assisting ABU Technology Division for developing technical skills and knowledge of ABU members through various approaches like Collaborations, MoUs, Industry involvements, Streamlining of process, understanding members needs, etc. To cover the above, the Topic Area identified following project topics :

i) Technical Training Priorities and Members Requirements (TS/TTPMR)
ii) Skill Development Programme for Managerial, and Occupational Safety (TS/ SDPMOS)
iii) Technical Skill Building and Knowledge Sharing (TS/TSBKS) OR High-Tech Exposure &Knowledge Sharing (TS/TEKS)

3) Some of the tasks /deliverables under the projects are routine in nature and are being carried out periodically. ABU Technology Division has been working on these tasks on regular basis.

4) The status of project topics including Action Taken Report (ATR) in respect of each tasks during the period Dec 2022 to Oct 2023 has been consolidated and given below:

a) Technical Training Priorities and Members Requirements (TS/TTPMR)

	TASKS	**Action Taken Report/Present Status**
i.	Conduct surveys periodically to understand the requirements and priority areas of members	ABU Technology Division conducts the survey every 2 to 3 years. The last survey was conducted during 8-22 October 2021. Based on the survey inputs the training requirements have been shortlisted and prioritised. Accordingly, ABU Technical Division has been organising training programmes to meet members requirements. Next survey is already due and is likely to be executed before TBM 2024.

ii.	Identify requirement of Technical Advisory Services for Members	Following two ABU TAS missions are in pipeline: - As per TAS request from BPA-Kiribati, a Hands-on training on the AM Transmitter Harris DX10 to be conducted in their premises. An expert has been identified and awaiting travel schedule & support from BPA-Kiribati. - ABU-VOV Workshop on Digital Transformation (in-house) at Hanoi. ABU is looking out for an expert to visit VOV and study its technical infrastructure first and conduct a day training to its technical staff. Following TAS has been completed: - Online assistance in VOV's National Online Radio platform: Technical expert team from MediaCorp Singapore had few online conference calls between July-September 2023 with VOV team to assist them. MediaCorp digital team learned VOV's plan and draft layout of the integrated OTT platform and suggested them necessary technical requirements and considerations in its implementation. However, due to internal workloads and limited human resources, MediaCorp experts were unable to travel to VOV Hanoi to assist them in-site, but committed their support online, if necessary.
iii.	Joint activities with ABU Media Academy (AMA)	ABU Technology organized following training : i) Webinar on Disaster Management: 'Simple steps you can take to Avoid the Hot-Seat' on 14 February 2023. ii) Webinar series on member innovations : - HDR vivid and Audio vivid Standards and Application on 27 April 2023 - 4K UHD live video broadcasting over 5G wireless transmission network on 27 April 2023 - Immersive Video in China on 24 May 2023 iii) Level -3 Engineering Fundamentals Course likely to held after GA2023 (in Pipeline)
iv.	Collaborate with other established	Details of collaborated training activities conducted :

	Media Training Academies	i) ABU-ASBU Workshop on Satellite Transmission (DVB-S) at ASBU academy HQ in Tunis from 09 to 13 October 2023. ii) ABU-ASBU- WorldDAB Technical Workshop (ONLINE) on DAB+ Digital Radio from 18 - 20 July 2023 hosted by ABU Technology. iii) ABU-IPPTAR Workshop on Archiving and Media Management from 1-3 August, 2023 in Kuala Lumpur organised in partnership with IPPTAR. It was attended by 48 participants representing 20 organizations from 8 countries.

b) Skill Development Programme for Managerial, and Occupational Safety (TS/ SDPMOS)

	TASKS	Action Taken Report/Present Status
i	Identify and develop training programmes for non-technical, managerial, financial and occupational safety and skills enhancement	Details of non-technical training programmes completed and ongoing this year as a series : i) Empowering Investigative Journalism Dec 2022, January & March 2023. ii) HEC Authentic Leadership Programme **:** Total 16 Sessions conducted from April-September 2023 and 42 participants joined the course from Asia-Pacific and Africa.

c) Technical Skill Building and Knowledge Sharing (TS/TSBKS)

	TASKS	Action Taken Report/Present Status
i	Work with industry partners and international events to identify applicable training opportunities available in broadcasting field eg: ITU, IABM, SMPTE etc.	i) Several Workshops organised during the DBS2023 jointly with international standard bodies such as DVB, ATSC, WorldDAB and ABU-UNDRR etc. ii) Status on partnership with international organizers related to training:

		- Korea Radio Promotion Association (RAPA) - MoU to be signed with Korea Radio Promotion Association (RAPA) during GA in Seoul for Korean Government ODA assistance to ABU Members.

5) Following activities are proposed to be undertaken during Nov 2023 to October 2024:

	PROJECT TOPIC	DELIVERABLES
i	Technical Training Priorities and Members Requirements TS/TTPMR	a) Survey for Technical Training Needs b) Database of training academies and training programmes offered by them. c) Databse of Production/ B'cast Technology/ equipment used by Members.
ii	Skill Development Programme for Managerial, and Occupational Safety TS/ SDPMOS	a) develop standard code of conduct and work ethics information manual b) Develop a disaster recovery and response manual that can be used in technical areas
III	Technical Skill Building and Knowledge Sharing TS/TSBKS	a) MoU with Industry Partners. b) Members' Information Exchange platform

In addition to above, Tasks and deliverables, which are routine in nature, will be carried out on regular basis.

Further, ABU Technology organised different webinars and physical workshop since last GA2022 and these activities will be covered in TD Director's Technical Activity Report.

6) It has been noticed that Project Managers and Co-Project Managers are not making any contribution for Project Topics under this Topic Area. Their active participation and contribution may help achieving the targets and deliverables timely.

P. Das

Topic Chairman – Training & Services

Technical Committee Meeting
28.10.2023 - 13:30-17:00 & 29.10.2023 - 9:00-17:00
ABU 2023 SEOUL

Doc T-23/9

REPORT OF TOPIC CHAIRMAN
SPECTRUM TOPIC AREA

Chairperson: **Dr. Li Leilei (NRTA)**
Period of Report: **NOV. 2019 to OCT.2023**
Date of Report : **OCT.2023**

Introduction about scope of the work:

This report is on the Topic Area Spectrum Issues which including the related WRC-23 Agenda items concerning broadcasting service and ABU spectrum issues.

Project Topic 1: **to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 245 (WRC-19) (WRC-23 AI 1.2)**
Project Manager:
Co- Project Manager: **Mr. Rajeev Kumar**
Time Period: **NOV. 2019 to OCT.2023**

The following tasks were considered for this project:
1. Follow developments of studies in WP 5D to identify and possible impact on Broadcasting Services.
2. Possible impact on broadcasting service in Asia-Pacific Area.

This report was provided by Dr. Li Leilei

1 Background

WRC-23 agenda item 1.2 is to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 245 (WRC-19) "Studies on frequency-related matters for the terrestrial component of International Mobile Telecommunications identification in the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz, and 10.0-10.5 GHz".

Resolution 245 (WRC-19) calls for studies of technical, operational and regulatory issues pertaining to the possible use of the terrestrial component of IMT in the frequency bands, as well as sharing and compatibility studies, with a view to ensuring the protection of services to which the frequency band is allocated on a primary basis, without imposing additional regulatory or technical constraints on those services, and also, as appropriate, on services in adjacent bands, for the frequency bands:
-3 600-3 800 MHz and 3 300-3 400 MHz (Region 2);
-3 300-3 400 MHz (amend footnote in Region 1);
-7 025-7 125 MHz (globally);
-6 425-7 025 MHz (Region 1);
-10 000-10 500 MHz (Region 2).

ITU-R Working Party 5D (WP 5D) has developed supporting materials for agenda item 1.2, which contain the results of sharing and compatibility studies (Document 5D/1555).

2 Methods in CPM Text

A number of methods to satisfy this agenda item are proposed in section 1/1.2/4 of CPM and are summarized below:

Band 1 – 3 300-3 400 MHz (amend footnote in Region 1)

- Method 1A: This method proposes no change to the Radio Regulations, except for suppression of Resolution 245 (WRC-19).
- Method 1B: This method proposes to modify existing footnotes RR No. 5.429A and RR No. 5.429B to add interested Region 1 countries that are in the area defined in RR No. 5.429B (south of 30° parallel north) to allocate the frequency band 3 300-3 400 MHz to the mobile service (except aeronautical mobile) on a primary basis and to identify it for IMT in those countries.
- Method 1C: This method proposes to modify existing footnotes RR No. 5.429A and RR No. 5.429B including the revision of given conditions and to add interested Region 1 countries to allocate the frequency band 3 300-3 400 MHz to the mobile service (except aeronautical mobile) on a primary basis (RR No. 5.429A) and to identify it for IMT in those countries (RR No. 5.429B).
- Method 1D: This method proposes a primary allocation to the mobile service (except aeronautical mobile) in the frequency band 3 300-3 400 MHz in interested Region 1 countries and identification of IMT through a new footnote. Note: Resolution 245 (WRC-19) refers only to amending an existing footnote for the frequency band 3 300-3 400 MHz in Region 1, but this method was included according to contributions of some administrations.
- Method 1E: This method proposes a primary allocation to the mobile service (except aeronautical mobile) in the frequency band 3 300-3 400 MHz by adding the band in the Table of Frequency Allocations for Region 1 and identification to IMT by modification of RR No. 5.429B to apply to Region 1, and any consequent modifications to RR No. 5429A. Note: Resolution 245 (WRC-19) refers only to amending an existing footnote for the frequency band 3 300-3 400 MHz in Region 1, but this method was included according to contributions of some administrations.
- Method 1F: This method proposes a primary allocation to the mobile service in the frequency band 3 300-3 400 MHz by adding the band in the Table of Frequency Allocations for Region 1 and identification to IMT without any condition by adding a new footnote. Note: Resolution 245 (WRC-19) refers only to amending an existing footnote for the frequency band 3 300-3 400 MHz in Region 1, but this method was included according to contributions of some administrations.

Band 2 – 3 300-3 400 MHz (Region 2)

- Method 2A: This method proposes no change to the Radio Regulations, except for suppression of Resolution 245 (WRC-19).
- Method 2B: This method proposes to allocate the frequency band 3 300-3 400 MHz to the mobile service on a primary basis in Region 2 and identify it for IMT, by:
  - upgrading the existing secondary mobile allocation on the Table of Frequency Allocations;
  - modifying the existing RR footnote (RR No. 5.429C) applying it only to the fixed service;
  - modifying the existing RR footnote (RR No. 5.429D) for IMT identification in Region 2, specifying that stations in the MS operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to or claim protection from systems in the RLS.
- Method 2C: This method proposes to allocate the frequency band 3 300-3 400 MHz to the mobile, except aeronautical mobile, service on a primary basis in Region 2 and identify it for IMT, by:
  - upgrading the existing secondary mobile allocation, except aeronautical mobile, on the Table of Frequency Allocations;
  - modifying the existing RR footnote (RR No. 5.429C) applying it only to the fixed service;
  - modifying the existing RR footnote for IMT (RR No. 5.429D) identification in Region 2, specifying that stations in the MS operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to or claim protection from systems in the RLS.

Band 3 – 3 600-3 800 MHz (Region 2)

- Method 3A: This method proposes no change to the Radio Regulations, except for suppression of Resolution 245 (WRC-19).

– Method 3B: This method proposes to identify the frequency band 3 600-3 800 MHz for IMT in Region 2 by modifying RR No 5.434 to list the following condition: IMT systems shall not claim more protection from space stations than that provided in RR Table 21-4. In addition, conditions applicable to the MS in the frequency band equally apply to IMT.

– Method 3C: This method proposes to identify the frequency band 3 600-3 800 MHz for IMT in Region 2 by modifying RR No. 5.434 to list the following conditions:

- pfd limit used in RR No. 5.431B for the MS/IMT;
- IMT systems shall not claim more protection from space stations than that provided in RR Table 21-4;
- RR Nos. 9.17, 9.18.

– Method 3D: This method proposes to identify the frequency band 3 600-3 800 MHz for IMT in Region 2 by modifying RR No. 5.434 listing the following conditions:

- RR Nos. 9.17, 9.18;
- RR No. 9.21;
- IMT systems shall not claim more protection from space stations than that provided in RR Table 21-4;
- revised pfd limit for the MS/IMT.

– Method 3E: This method proposes to identify the frequency band 3 600-3 700 MHz for IMT in additional countries in Region 2 by adding names of countries to RR No. 5.434 while maintaining all existing conditions.

– Method 3F: This method proposes to identify the frequency band 3 600-3 700 MHz for IMT in Region 2 by modifying RR No. 5.434 while maintaining all existing conditions.

Band 4 – 6 425-7 025 MHz (Region 1)

– Method 4A: This method proposes no change to the Radio Regulations, except for suppression of Resolution 245 (WRC-19).

– Method 4B: This method proposes to identify the frequency band 6 425-7 025 MHz in Region 1 for IMT by creating a new RR footnote associated with a new Resolution without any additional conditions or constraints to the IMT deployment other than those existing in the Radio Regulations.

– Method 4C: This method proposes to identify the frequency band 6 425-7 025 MHz in Region 1 for IMT by creating a new RR footnote with conditions which are contained in a draft new WRC Resolution. Concerning the protection of FSS uplink, there are several alternatives for regulatory conditions under this method.

- Alternative 1: Pointing restrictions and power or TRP restriction (see Example 1 in resolves 2, of the draft new Resolution [A12-6 GHz])
- Alternative 2: Limit on the expected e.i.r.p. (see Example 2, 3, 4 in resolves 2 of the draft new Resolution [A12-6 GHz])
- Alternative 3: Maximum e.i.r.p. mask and base station density limit (see Example 5 in resolves 2 of the draft new Resolution [A12-6 GHz])

– Method 4D: This method proposes to identify the frequency band 6 425-7 025 MHz in Region 1 for IMT by creating a new RR footnote with conditions which are contained in a draft new WRC Resolution and which are applied only within portion of the frequency band 6 425-7 025 MHz.

– Method 4E: This method proposes to identify the frequency band 6 425-7 025 MHz in Region 1 for IMT by creating a new RR footnote, specifying the use is expected from 2030* onwards, in due time for launching IMT-2030 and in order to provide time for identifying solutions for users of the spectrum which may be affected (e.g. fixed links and EESS, with sea surface temperature measurements), with conditions which are contained in a new WRC Resolution.

Band 5 – 7 025-7 125 MHz (globally)

– Method 5A: This method proposes no change to the Radio Regulations, except for suppression of Resolution 245 (WRC-19).

– Method 5B: This method proposes to identify the frequency band 7 025-7 125 MHz for IMT by creating a new RR footnote associated with a new Resolution without any additional conditions or constraints to the IMT deployment other than those existing in the RRs.

– Method 5C: This method proposes to identify the frequency band 7 025-7 125 MHz for IMT by creating a new RR footnote with conditions which are contained in a draft new WRC Resolution.

– Method 5D: This method proposes to identify the frequency band 7 025-7 100 MHz for IMT by creating a new RR footnote with a requirement to implement technical and regulatory measures to protect and not impose constraints on existing services in the band above 7 100 MHz.

– Method 5E: This method proposes to identify the frequency band 7 025-7 125 MHz for IMT by creating a new RR footnote, clarifying that the use is expected from 2030* onwards, in due time for launching IMT-2030 and in order to provide time for identifying solutions for users of the spectrum which may be affected (e.g. fixed links at a national level and EESS, with sea-surface temperature measurements), with conditions which are contained in a draft new WRC Resolution.

Band 6 – 10.0-10.5 GHz (Region 2)

– Method 6A: This method proposes no change to the Radio Regulations, except for suppression of Resolution 245 (WRC-19).

– Method 6B: This method proposes to allocate the frequency band 10-10.5 GHz to the mobile service on a primary basis in the Frequency Allocation Table in Region 2, modify RR Nos. 5.480 and 5.481, and identify the frequency band for IMT by creating a new RR footnote with conditions which are contained in a draft new WRC Resolution. Various examples of resolves are included in the draft Resolution for conditions that may be considered when developing proposals, as appropriate.

– Method 6C: This method proposes to allocate the frequency band 10-10.5 GHz to the mobile, except aeronautical mobile, service on a primary basis in the Frequency Allocation Table in Region 2, and modify RR Nos. 5.480 and 5.481. In making the mobile service primary in Region 2, two RR footnotes are provided through two examples shown in Section 5 to ensure the protection of the radiolocation service, including those stations of the radiolocation service in 10.45-10.5 GHz in Regions 1 and 3.

All methods propose to suppress Resolution 245 (WRC-19).

3 Preliminary views

The frequency band 3 600-3 800 MHz (Region 2) is related to the frequency band 3 700-4 200MHz (air-to-earth), which is used for broadcasting service by some countries in Region 3. Consequently, these countries should pay attention to this agenda item.

The common views of the six regional telecommunity organizations were supportive in one case and neutral in five cases. CITEL expressed support for this agenda item by recommending the addition of IMT identification and simplification of the conditions in footnote No. 5.434, as a means of obtaining the consent of neighbouring countries. APT, on the other hand, maintained neutrality but stressed the importance of safeguarding existing businesses in Region 3. ASMG and ATU did not express any particular views and remained neutral. CEPT maintained a neutral stance but advocated the preservation of existing conditions, such as the 3400-3600MHz band. RCC similarly remained neutral and stressed the need to ensure the protection of FSS and FS.

Currently, there appears to be minimal impact on broadcasting satellite service in Region 3. Nevertheless, it remains crucial to strive for higher service standards in order to safeguard the rights and interests of broadcasting satellite service, especially in future ITU-R studies.

Project Topic 2: **to consider, in accordance with Resolution 247 (WRC-19), the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level (WRC-23 AI 1.4)**

Project Manager:
Co- Project Manager: **Mr. Rajeev Kumar**
Time Period: **NOV. 2019 to OCT.2023**

The following tasks were considered for this project:

1. Follow developments of studies in WP 5D to identify and possible impact on Broadcasting Services.
2. Possible impact on broadcasting service in Asia-Pacific Area.

This report was provided by Dr. Li Leilei

1 Background

HIBS are located in the stratosphere, providing both uplink and downlink mobile connectivity to the ground-based IMT mobile stations. HIBS are intended to be used as part of terrestrial IMT networks, as an application of the mobile service, and may use the same frequency bands with ground-based IMT base stations. The IMT mobile stations to be served by HIBS are proposed to be the same as the ground-based IMT base stations. Currently, the IMT mobile stations support a variety of frequency bands identified for IMT, including frequency bands below 2.7 GHz.

WRC-2000 identified through RR No. 5.388A the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and the frequency bands 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2 that may be used by high-altitude platform stations as base stations to provide IMT, in accordance with Resolution 221 (Rev.WRC-07). Furthermore, Resolution 221 (Rev.WRC-07) provides the technical conditions that need to be met by these high-altitude platform stations to ensure that emissions to neighbouring countries do not cause co-channel harmful interference to the other services and applications allocated in these frequency bands, including terrestrial IMT-2000 stations.

The work under WRC-23 agenda item 1.4 includes studying sharing and compatibility in the frequency bands 694-960 MHz, 1 710-1 885 MHz and 2 500-2 690 MHz, as well as appropriate modifications to the existing RR No. 5.388A and associated Resolution 221 (Rev.WRC-07). These studies are intended to allow the use of such frequency bands by HIBS. This would allow HIBS to provide mobile-broadband connectivity to underserved communities, and in rural and remote areas, while ensuring the protection of existing primary services in the same and adjacent frequency bands.

2 Methods in CPM text

- Issue A: HIBS in the frequency band 694-960 MHz

Method A1: No changes to Vols. I and II of the Radio Regulations, and suppression of Resolution 247 (WRC-19).

Method A2: Identification of the frequency band 694-960 MHz, or portions thereof, for the use of HIBS and to include a new WRC Resolution for the use of this band by HIBS.

Method A3: Identification of the frequency band 694-960 MHz, or portions thereof, for the use of HIBS not claiming protection from existing primary services and to include a new WRC Resolution for the use of this band by HIBS. HIBS shall be notified to the Bureau and RR Nos. 11.2, 11.9 and 11.26A are applicable for purposes of aiding planning and coordination with neighbouring and concerned countries. For the implementation of the above, the notifying administration of HIBS at the time of submission of the RR Appendix 4 information to the Radiocommunication Bureau (BR) shall send an objective, measurable and enforceable commitment undertaking that in case of causing unacceptable interference, those administrations shall immediately reduce the interference to the acceptable level.

Method A4: HIBS in 694-862 MHz and 862-960 MHz per Region. Due to the differences in existing services per Region, identify the relevant frequency bands within the frequency ranges 694-862 MHz and 862-960 MHz for the use of HIBS on a regional basis and to include a new WRC Resolution for the use of these bands by HIBS.

- Issue B: HIBS in the frequency band 1 710-1 885 MHz

Method B1: No changes to Vols. I and II of the Radio Regulations, and suppression of Resolution 247 (WRC-19).

Method B2: Identification of the frequency band 1 710-1 885 MHz, or portions thereof, for the use of HIBS in accordance with revised RR No. 5.388A and revised Resolution 221 (Rev.WRC-07).

Method B3: Identification of the frequency band 1 710-1 885 MHz, or portions thereof, for the use of HIBS not claiming protection from existing primary services in accordance with revised RR No. 5.388A and revised Resolution 221 (Rev.WRC-07). HIBS shall be notified to the Bureau and RR Nos. 11.2, 11.9 and 11.26A are applicable for purposes of aiding planning and coordination with neighbouring and concerned countries. For the implementation of the above, the notifying administration of HIBS at the time of submission of the RR Appendix 4 information to the Radiocommunication Bureau (BR) shall send an objective, measurable and enforceable commitment undertaking that in case of causing unacceptable interference, those administration shall immediately reduce the interference to the acceptable level.

Method B4: HIBS in 1 710-1 885 MHz per Region. Due to the differences in existing services per Region, identify the relevant frequency band within the frequency range 1 710-1 885 MHz for the use of HIBS on a regional basis in accordance with revised RR No. 5.388A, additional regional footnotes, and revised Resolution 221 (Rev.WRC-07) .

- Issue C: HIBS in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz

Method C1: No changes to Vols. I and II of the Radio Regulations, and suppression of Resolution 247 (WRC-19).

Method C2: Review existing conditions in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz, or portions thereof, for the use of HIBS in accordance with revised RR No. 5.388A and revised Resolution 221 (Rev.WRC-07) .

Method C3: Review of existing conditions in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and

2 110-2 170 MHz, or portions thereof, for the use of HIBS not claiming protection from existing primary services in accordance with revised RR No. 5.388A and revised Resolution 221 (Rev.WRC-07) . HIBS shall be notified to the Bureau and RR Nos. 11.2, 11.9 and 11.26A are applicable for purposes of aiding planning and coordination with neighbouring and concerned countries. For the implementation of the above, the notifying administration of HIBS at the time of submission of the RR Appendix 4 information to the Radiocommunication Bureau (BR) shall send an objective, measurable and enforceable commitment undertaking that in case of causing unacceptable interference, those administration shall immediately reduce the interference to the acceptable level.

- Issue D: HIBS in the frequency band 2 500-2 690 MHz

Method D1: No changes to Vols. I and II of the Radio Regulations, and suppression of Resolution 247 (WRC-19).

Method D2: Identification of the frequency band 2 500-2 690 MHz, or portions thereof, for the use of HIBS and to include a new WRC Resolution for the use of this band by HIBS.

Method D3: Identification of the frequency band 2 500-2 690 MHz, or portions thereof, for the use of HIBS not claiming protection from existing primary services and to include a new WRC Resolution for the use of this band by HIBS. HIBS shall be notified to the Bureau and RR Nos. 11.2, 11.9 and 11.26A are applicable for purposes of aiding planning and coordination with neighbouring and concerned countries. For the implementation of the above, the notifying administration of HIBS at the time of submission of the RR Appendix 4 information to the Radiocommunication Bureau (BR) shall send an objective, measurable and enforceable commitment undertaking that in case of causing unacceptable interference, those administrations shall immediately reduce the interference to the acceptable level.

Method D4: HIBS in 2 500-2 690 MHz per Region. Due to the differences in existing services per Region, identify the relevant frequency band within the frequency range 2 500-2 690 MHz for the use of HIBS on a regional basis and to include a new WRC Resolution for the use of this band by HIBS.

3 Preliminary views

We should pay attention to Issue A: HIBS in the frequency band 694-960MHz, which is related to the frequency band 470-702MHz used for terrestrial TV in Region 3 countries.

The common views of the six regional telecommunity organizations were supportive in four cases, opposed in one case and neutral in one case. RCC supports NOC (Method A1); ATU, CEPT and ASMG support identification for the use of HIBS without causing interference to neighbouring and concerned countries and without claiming protection from existing primary services (Method A3); CITEL supports identification for the use of HIBS (Method A2); APT does not reach a common view, but proposes to protect existing services.

Project Topic 3:	**to review the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review in accordance with Resolution 235 (WRC-15)(WRC-23 AI 1.5)**
Project Manager:	
Co- Project Manager:	**Mr. Rajeev Kumar**
Time Period:	**NOV. 2019 to JUN.2023**

The following tasks were considered for this project:

1. Follow developments of study results on WRC-23 AI 1.5 conducted in ITU-R TG 6/1
2. Possible impact on broadcasting service in Asia-Pacific Area.

This report was provided by Dr. Li Leilei

1 Background

Focus on scope and work of TG6/1 are as follows: to review the current spectrum use and study future spectrum needs in the frequency band 470-960 MHz as well as an assessment of the results of sharing and compatibility studies between the broadcasting and mobile, except aeronautical mobile, services in the frequency band 470-694 MHz, as well as other existing services for consideration of possible regulatory actions.

This agenda item addresses the future spectrum use of the band 470-694 MHz in Region 1. In that regard, a review of the current spectrum use and a study of future spectrum needs in the frequency band 470-960 MHz were requested as well as an assessment of the results of sharing and compatibility studies between the broadcasting and mobile, except aeronautical mobile, services in the frequency band 470-694 MHz, as well as other existing services in accordance with Resolution 235 (WRC-15) for consideration of possible regulatory actions.

The band 470-960 MHz, or parts thereof, is allocated to the following services on primary basis in Region 1: Broadcasting within the band, mobile, except aeronautical mobile, within 694-960 MHz, fixed within 790-960 MHz. The band, or parts thereof, is also allocated to the following services on a primary basis in some countries of Region 1: aeronautical radionavigation within the band 645-862 MHz and radio astronomy within 606-614 MHz.

In addition, parts of the band 470-960 MHz, are allocated to the following services on secondary basis in some countries of Region 1: radiolocation within 470-494 MHz, radio astronomy within 608-614 MHz, fixed within 470-582 MHz and 582-790 MHz, mobile, except aeronautical mobile, within 582-694 MHz, the land mobile service within 470-694 MHz, mobile-satellite, except aeronautical mobile-satellite, within 806-840 MHz and 856-890 MHz.

The Geneva 2006 Agreement ("GE06") applies.

2 Methods in CPM text

- Method A: No Change. For this method, two alternatives are developed.

Alternative A1: No change

Alternative A2: No change. Revision of Resolution 235 (WRC-15) to review the situation at future competent WRCs.

- Method B: Primary allocation to the mobile service in the frequency band 470-694 MHz with or without identification to IMT in the frequency band 470-694 MHz or parts thereof in Region 1. Suppression of Resolution 235 (WRC-15). For this method, three alternatives are developed.

Alternative B1: This alternative proposes an allocation to the mobile service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT through modification of RR No. 5.317A without any additional conditions to protect other services. RR No. 5.296 will be suppressed.

Alternative B2: This alternative proposes an allocation to the mobile service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 470-694 MHz for IMT through modification of RR No. 5.317A without any additional conditions to protect other services. RR No. 5.296 will be suppressed.

Alternative B3: This alternative proposes an allocation to the mobile service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 without any additional conditions. RR No. 5.296 will be suppressed.

- Method C: Primary allocation to the mobile, except aeronautical mobile, service in the frequency band 470-694 MHz and identification to IMT in the frequency band 470-694 MHz or parts thereof in Region 1. Suppression of Resolution 235 (WRC-15). For this method, nine alternatives are developed.

Alternative C1: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT through modification of RR No. 5.317A without any additional conditions to protect other services. RR No. 5.296 will be suppressed.

Alternative C2: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 470-694 MHz for IMT through modification of RR No. 5.317A without any additional conditions to protect other services. RR No. 5.296 will be suppressed.

Alternative C3: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT. This identification will be done by amending RR No. 5.317A. A new WRC Resolution will be referred to in a new footnote RR No. 5.A15 to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the band 470-694 MHz. RR No. 5.296 is modified to highlight the continued use of the frequency band 470-694 MHz for applications ancillary to broadcasting and programme-making in some countries in Region 1.

Alternative C4: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 470-694 MHz for IMT. This identification will be done by amending RR No. 5.317A. A new WRC Resolution

will be referred to in a new footnote RR No. 5.B15 to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the band 470-694 MHz. RR No. 5.296 is modified to highlight the continued use of the frequency band 470-694 MHz for applications ancillary to broadcasting and programme-making in some countries in Region 1.

Alternative C5: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 614-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT through modification of RR No. 5.317A. RR No. 5.296 is modified to highlight the continued use of the frequency band 470-614 MHz for applications ancillary to broadcasting and programme-making in some countries in Region 1. New footnote RR No. 5.C15 is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 614-694 MHz in some countries in Region 1.

Alternative C6: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 614-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT through modification of RR No. 5.317A. A new WRC Resolution will be referred to in a new footnote RR No. 5.D15 to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services. RR No. 5.296 is modified to highlight the continued use of the frequency band 470-614 MHz for applications ancillary to broadcasting and programme-making in some countries in Region 1. New footnote RR No. 5.E15 is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 614-694 MHz in some countries in Region 1.

Alternative C7: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis of the frequency band 470-694 MHz and identification of the band 614-694 MHz for IMT in some countries in Region 1. The allocation will be done by adding a new country footnote RR No. 5.F15 while the identification will be done via a modification to RR No. 5.317A. A new WRC Resolution is developed to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the band 470-694 MHz. RR No. 5.296 is modified to highlight the continued use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1. New footnote RR No. 5.G15 is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1.

Alternative C8: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis of the frequency band 470-694 MHz and identification of the band 470-694 MHz for IMT in some countries in Region 1. The allocation will be done by adding a new country footnote RR No. 5.H15 while the identification will be done via a modification to RR No. 5.317A. A new WRC Resolution is developed to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the frequency band 470-694 MHz. RR No. 5.296 is modified to highlight the continued use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1. New footnote RR No. 5.I15 is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1.

Alternative C9: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis of the frequency band 614-694 MHz and identification of the band 614-694 MHz for IMT in some countries in Region 1. The allocation will be done by adding a new country footnote RR No. 5.J15 while the identification will be done via a modification to RR No. 5.317A. A new WRC Resolution is developed to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the band 614-694 MHz. RR No. 5.296 is modified to highlight the continued use of applications ancillary to broadcasting and programme-making in the band 470-614 MHz and 614-694 MHz in some countries in Region 1. New footnote RR No. 5.K15 is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 614-694 MHz in some countries in Region 1.

- Method D: Primary allocation to the mobile, except aeronautical mobile, service within the band 470-694 MHz without IMT identification. Suppression of Resolution 235 (WRC-15). For this method, five alternatives are developed.

Alternative D1: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1. It recognizes that a co-primary allocation to the mobile service of the band 470-694 MHz in Region 1 would provide a regulatory option for administrations wishing to introduce mobile, except aeronautical mobile, services. RR No. 5.296 is proposed to be modified to highlight the continued use of this frequency band for applications ancillary to broadcasting and programme-making in Region 1. A new WRC Resolution [G15-ALTERNATIVE D1], which is referred to in a proposed new footnote RR No. 5.L15, will address the use of the frequency band 470-694 MHz by the mobile, except

aeronautical mobile, service.

Alternative D2: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 without any additional conditions. RR No. 5.296 is also proposed to be suppressed.

Alternative D3: This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the band 470-694 MHz in some countries in Region 1. This alternative would limit the co-primary allocation to the mobile service for to those countries listed in a new footnote (RR No. 5.M15). In addition, some bilateral discussions with affected countries could take place during WRC-23 to ensure that there is no objection for inclusion of a country name in this new footnote. Thus, the definition of this list of countries would take into account the possibility of coexistence with continued broadcasting use in neighbouring countries. In this respect, the possibility of use of the band by mobile and broadcasting services would be initially considered at WRC-23, not prejudging later bilateral or multilateral detailed agreements. RR No. 5.296 is proposed to be modified to address countries included both in RR No. 5.296 and in the new footnote RR No. 5.M15. New footnote RR No. 5.N15 is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1. A new WRC Resolution, which is referred to in a proposed new footnote RR No. 5.M15, will address the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service.

Alternative D4: This alternative proposes a primary allocation to the mobile, except aeronautical mobile, service of the frequency band 470-694 MHz in Region 1 with later date of entry into force (e.g. not earlier than [01/01/2031]) in order to provide a regulatory option for administrations wishing to introduce mobile, except aeronautical mobile, service in the long term. Radio Regulations No. 5.296 is proposed to be modified to highlight the use of this frequency band by applications ancillary to broadcasting and programme-making in Region 1. A new WRC Resolution , which is referred to in a proposed new footnote RR No. 5.O15, will address the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service.

Alternative D5: This alternative proposes to apply similar regulatory actions for a new allocation to the mobile, except aeronautical mobile, service on a primary basis as described in Alternatives D1, D2, D3 or D4 above but limited to only a part of the frequency band 470-694 MHz (e.g. 614-694 MHz). Radio Regulations No. 5.296 will need to be modified to reflect continued use of the rest of the frequency band 470-694 MHz (e.g. 470-614 MHz) by applications ancillary to broadcasting and programme-making under a secondary mobile service in countries of Region 1 currently listed in RR No. 5.296 while a new footnote and/or amendment RR No. 5.296 will be needed to reflect the use of the newly allocated band (e.g. 614-694 MHz) by these applications under the primary mobile service and continued use under a secondary mobile service for those countries where a new allocation to the mobile, except aeronautical mobile, service has not been made.

- Method E: Primary allocation to the mobile, except aeronautical mobile, service of the band 470-694 MHz in Region 1 with technical conditions limiting mobile service operations to downlink in this band. Suppression of Resolution 235 (WRC-15).

- For Method F: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in Region 1. For this method three alternatives are developed.

Alternative F1: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in Region 1. This method recognizes the need for regulatory options in the short or long term and introduces the mobile, except aeronautical mobile, service with a secondary status only. Thus, for continued broadcasting service operations in countries wishing to do so, regulatory protection will be provided from a secondary mobile, except aeronautical mobile, service deployment in neighbouring countries. Some revisions to RR No. 5.296 should continue to highlight the use of this frequency band by applications ancillary to broadcasting and programme-making in Region 1. In addition, WRC-31 is invited to consider a possible upgrade of this allocation and Resolution 235 (WRC-15) is revised accordingly.

Alternative F2: The secondary allocation of the frequency band 470-694 MHz to the mobile, except aeronautical mobile, service in Region 1 would be conditioned that, such a secondary allocation also applies RR No. 9.21 with respect to neighbouring and concerned countries. In addition to that for the implementation of non-interference and non-protection of such a secondary allocation, if agreed by the WRC-23 shall also apply RR No. 9.21 together with a firm commitment to the Bureau when notifying the assignments in question that, in the case unacceptable interference is caused, the notifying administration of such secondary allocation shall immediately reduce the interference to the acceptable level or cease the emission. Some revisions to RR No. 5.296 should continue to highlight the use of this frequency band for applications ancillary to broadcasting and programme-making in Region 1.

Alternative F3: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in some countries in Region 1 with suppression of Resolution 235 (WRC-15). This alternative recognizes the need for

regulatory options in the short or long term and introduces the mobile, except aeronautical mobile, service with a secondary status only to those countries listed in a new footnote (RR No. 5.M15). Some revisions to the countries list of RR No. 5.296 are needed to highlight the use of this frequency band for applications ancillary to broadcasting and programme-making in countries not listed in the new footnote RR No. 5.M15. A new footnote RR No. 5.N15 should continue to highlight the use of this frequency band for applications ancillary to broadcasting and programme-making in countries listed in the new footnote RR No. 5.M15.

- For Method G: Considerations of the radio astronomy service.

3 Preliminary views

Although this agenda item is Region 1 issue, some Region 3 countries has boarders with Region 1. In addition, in order to avoid this agenda item expanding to Region 3, we need to closely track its research progress and put forward the protection requirements for broadcasting service.

The common views of the six regional telecommunity organizations were supportive in two cases, opposed in two cases and neutral in two cases. RCC and ATU support NOC (Method A1); CEPT supports mobile service allocated in the band 470-694MHz as a secondary service (Method F); ASMG supports mobile service allocated in the band 614-694MHz as a primary service and IMT identification (Method B). CITEL requests that the WRC-23 decision should not have any negative impact on Region 2; APT does not reach a common view on this agenda item, but expresses the view that the WRC-23 decision should not have any negative impact on Region 3.

Project Topic 4: **to consider a new primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2, while protecting existing primary services in the band, in accordance with Resolution 174 (WRC-19)(WRC-23 AI 1.19).**

Project Manager: **Dr. Li Leilei**

Co- Project Manager:

Time Period: **NOV. 2019 to OCT.2023**

The following tasks were considered for this project:

1. Follow developments of study results on WRC-23 AI 1.19 conducted in ITU-R WP 4A
2. Possible impact on broadcasting services.

This report was provided by Dr. Li Leilei

1 Background

In the 2019 World Radiocommunication Conference, Resolution **174 (WRC-19)** was established to consider a new primary allocation to the FSS in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2, which is already allocated to the broadcasting-satellite service (BSS) on primary status.

An FSS (space-to-Earth) emission is similar to a BSS (space-to-Earth) emission. Both consist of a space station transmitting a signal towards the Earth that will be received by fixed earth station terminals. In principle, the interference scenario with respect to other services should not be different; however, with this new allocation, the flexibility in possible uses of the band would be increased.

In Region 1, the frequency band is already allocated to the FSS, a new allocation in Region 2 progresses the principle of Regional harmonization, which allows for synchronization of frequency bands across both Regions. The consideration of Recommendation ITU-R BO.1834 and Recommendation ITU-R BO.1835, which address compatibility and sharing between the BSS networks using the Region 2 BSS allocation in the frequency band 17.3-17.8 GHz and feeder links of BSS networks using the worldwide FSS (Earth-to-space) allocation in the frequency band 17.3-17.8 GHz, is well suited for addressing an approach to study the proposed FSS (space-to-Earth) allocation with existing feeder links of BSS networks using the frequency band 17.3-17.8 GHz.

For the coordination between new FSS GSO (space-to-Earth) frequency assignments with respect to BSS frequency assignments and between new FSS GSO (space-to-Earth) frequency assignments, no modification to Radio Regulations would be required, since RR No. 9.7 already covers the coordination process and RR Appendix 5, Table 5-1 already contemplates a coordination trigger (8° of orbital arc).

2 Methods in CPM text

- Method A

Under this method, no change is proposed to the RR and the suppression of Resolution 174 (WRC-19).

- Method B

Modify footnotes in RR Article 5 that refer to the allocation of the frequency band 17.3-17.7 GHz in Region 2 to the FSS in the space-to-Earth direction and the suppression of Resolution 174 (WRC-19).

To address the new FSS allocation in the space-to-Earth direction, a modification to the Table of Frequency Allocations in Region 2, in the frequency band 17.3-17.7 GHz, is proposed.

To address the coordination between the FSS (space-to-Earth) in Region 2 and the receiving BSS feeder-link (Earth-to-space) operating under RR Appendix 30A, this method proposes modifications to Article 7 of RR Appendix 30A, to RR Article 22 and extend the coordination procedure (RR No. 9.7) that currently applies to similar services in Region 2 in the contiguous adjacent upper frequency band 17.7-17.8 GHz, by modifying RR Appendix 5.

Furthermore, this method contains two alternatives for several items to provide a wide range of options. The selection of Alternative 1 for all the items extends provisions used in Region 1 to Region 2, as well as the addition of other provisions, while the selection of Alternative 2 for all items results in more conservative conditions with the objective to provide further protection of the BSS feeder link AP30A receiving space station and GSO FSS system.

In order to avoid potential unacceptable interference to the receiving BSS feeder-link (Earth-to-space) operating under RR Appendix 30A, this method proposes some conditions for the operation of FSS (space-to-Earth) in Region 2 if Alternative 2 is selected in relevant items. Based on that Region 2 FSS requires to comply with a pfd limit at the edge of Earth's surface by modifying Annex 4 to RR Appendix 30A.This limitation would result in producing a low pfd value over portions of the Earth's surface with a very low receiving elevation angle which is also consistent with the mitigation technique outlined for the equatorial-limb case in Study 1. According to another item when Alternative 2 is being selected, Region 2 FSS, requires obtaining the explicit agreement of the affected administrations which have indicated disagreement (RR No. 11.41 does not apply) as well as those who fail to reply or to give a decision within the regulatory deadline (RR Nos. 9.60 to 9.62 do not apply) by adding a new provision in Article 7 to RR Appendix 30A.

In addition to the above-mentioned procedure it is proposed in Alternative 1 to modify RR No. 5.516A by adding Region 2 in this footnote. In Alternative 2, in order to ensure the protection of space stations receivers operating under RR Appendix 30A, it is proposed to also add to RR No. 5.516A a text indicating that in Region 2, the use of the fixed-satellite service in the frequency band 17.3-17.7 GHz shall not cause unacceptable interference to the space station receivers of the BSS feeder link in Regions 1 and 3 operating and those to be operated in the future under RR Appendix 30A; if such interference occurs the notifying administration of the FSS shall immediately eliminate this unacceptable interference.

To address the coordination between the FSS (space-to-Earth) and the BSS (space-to-Earth), no modifications to the RR are required, since the RR Article 9 coordination triggers are already contained in the RR Appendix 5, Table 5-1.

- Method C

Modify footnotes in RR Article 5 that refer to the allocation of the frequency band 17.3-17.7 GHz in Region 2 to the GSO FSS in the space-to-Earth direction and the suppression of Resolution 174 (WRC-19).

To address the new FSS allocation in the space-to-Earth direction, a modification to the Table of Frequency Allocations in Region 2, in the frequency band 17.3-17.7 GHz, is proposed.

To address the compatibility between earth stations of the FSS (space-to-Earth) in Region 2 and the BSS feeder-link earth stations operating under RR Appendix 30A, this method proposes to modify RR No. 5.516A by extending its application to Region 2. These modified footnotes including Region 2 also indicate that earth stations of the FSS (space-to-Earth) in Region 2 shall not claim protection from the BSS service feeder-link earth stations operating under RR Appendix 30A, nor put any limitations or restrictions on the locations of the BSS feeder-link earth stations anywhere within the service area of the feeder link.

To address the coordination between the FSS (space-to-Earth) in Region 2 and the receiving BSS feeder-link (Earth-to-space) operating under RR Appendix 30A, this method proposes modifications to Article 7 of RR Appendix 30A, to RR Article 22 and extend the coordination procedure (RR No. 9.7) that currently applies to similar services in Region 2 in the contiguous adjacent upper frequency band 17.7-17.8 GHz, by modifying RR Appendix 5.

In addition to the above-mentioned procedure it is proposed in Alternative 1 to modify RR No. 5.516A by adding Region 2 in this footnote. In Alternative 2, in order to ensure the protection of space stations receivers operating under RR Appendix 30A, it is proposed to also add to RR No. 5.516A a text indicating that in Region 2, the use of the fixed-satellite service in the frequency band 17.3-17.7 GHz shall not cause unacceptable interference to the space station receivers of the BSS feeder link in Regions 1 and 3 operating and those to be operated in the future under RR Appendix 30A; if such interference occurs the notifying administration of the FSS shall immediately eliminate this unacceptable interference.

To address the coordination between the FSS (space-to-Earth) and the BSS (space-to-Earth), no modifications to the RR are required, since the RR Article 9 coordination triggers are already contained in the RR Appendix 5, Table 5-1.

- Method D

Modify footnotes in RR Article 5 that refer to the allocation of the frequency band 17.3-17.7 GHz in Region 2 to the FSS in the space-to-Earth direction and the suppression of Resolution 174 (WRC-19).

To address the new FSS allocation in the space-to-Earth direction, a modification to the Table of Frequency Allocations in Region 2, in the frequency band 17.3-17.7 GHz, is proposed.

To address the compatibility between earth stations of the FSS (space-to-Earth) in Region 2 and the BSS feeder-link earth stations operating under RR Appendix 30A, this method proposes to modify RR No. 5.516A by extending its application to Region 2. These modified footnotes including Region 2 also indicate that earth stations of the FSS (space-to-Earth) in Region 2 shall not claim protection from the BSS service feeder-link earth stations operating under RR Appendix 30A, nor put any limitations or restrictions on the locations of the BSS feeder-link earth stations anywhere within the service area of the feeder link.

To address the coordination between the FSS (space-to-Earth) in Region 2 and the receiving BSS feeder-link (Earth-to-space) operating under RR Appendix 30A, this method proposes modifications to Article 7 of RR Appendix 30A, to RR Article 22 and extend the coordination procedure (RR No. 9.7) that currently applies to similar services in Region 2 in the contiguous adjacent upper frequency band 17.7-17.8 GHz, by modifying RR Appendix 5.

In addition to the above-mentioned procedure it is proposed in Method D to modify RR No. 5.516A by adding Region 2 in this footnote and also proposed footnote RR No. 22.5F.Y, for which "non-geostationary-satellite system operating in Region 2 shall meet the limits" to protect a receiving space station in the broadcasting-satellite feeder link of RR Appendix 30A.

To address the coordination between the FSS (space-to-Earth) and the BSS (space-to-Earth), modifications to RR No. 5.517 extend the applicability to the frequency range 17.3-17.8 GHz.

Finally, the modification to include the frequency range 17.3-17.7 GHz for Region 2, with respect to footnote RR No. 5.484A address the coordination of non-GSO FSS vis-à-vis other non-GSO and GSO FSS systems and networks. Additionally, the extension of the frequency range 17.3-17.7 GHz for Region 2, with respect to RR Article 22 limits found in RR Tables 22-1B and 22-3 addresses and ensures the protection of BSS and AP30A feeder link services, respectively.

At present, except for Method A, which is no change, three other methods consider the protection for the BSS feeder-link earth stations operating.

3 Preliminary views

The common views of the six regional telecommunity organizations were supportive in six cases. APT supports alternative 2 of Method B (except NGSO), and requests that it should not affect existing services in Region 3 and should be limited to the GSO system; CITEL supports the new allocation and NGSO needs to consider the restrictions in Article 22; RCC also requests that the protection of existing services be fully considered in this agenda item, then Method B can be considered. ASMG requires that any new allocation of FSS in Region 2 have no impact on existing services in the same and adjacent band in Region 1, and that technical and operational procedures be provided to protect these services; CEPT supports the new allocation of FSS in Region 2 and the extension of the conditions of use of Region 1 to Region 2.

Although this agenda item is a Region 2 issue, it is related to the receiving BSS feeder-link (Earth-to-space) operating in Region 3 under RR No. 5.516. In the draft CPM report, the new allocation of FSS has been added to the unconditional protection of BSS planning, and the hard limits of Table 22-1B and 22-3 in Article 22 have been added to achieve the protection of BSS Earth stations. Although this agenda item is limited to Region 2, it has the potential to achieve a uniform allocation of service globally. At WRC-23, we will strive for higher service protection standards in order to better protect the use of broadcasting satellite services in future analytical studies.

Doc T-23/10

DRAFT

DECISION 1/2023

Implementing Attendance Policy for Bureau Meetings

Considering

1. that, the Bureau, as the governing and decision-making body, plays a pivotal role in the direction and success of our organization.
2. that, regular attendance at Bureau meetings by all members is crucial to ensure that decisions are made with the collective wisdom and experience of the entire Bureau.
3. that, the essence of the Bureau's effectiveness lies in the collective participation of its members, and when members are absent, the Bureau loses out on their unique perspectives and expertise.
4. that, the diverse locations and schedules of our members necessitate flexible participation options.

Noting

1. that, the attendance of each Bureau member at Bureau meetings is currently monitored and recorded.
2. that, an online participation option can ensure that members have every opportunity to be part of the decision-making process, even if they cannot be physically present.

Recognizing

The importance of regular attendance in ensuring that decisions are made with a comprehensive understanding of all aspects and implications. Furthermore, recognizing the need to foster a culture of commitment and responsibility among Bureau members, and the value of both in-person and online participation in achieving this goal.

The ABU Technical Committee decides

1. An online participation option will be available for all Bureau meetings.
2. Every Bureau member should attend at least 50% or more of the Bureau meetings held during their term, either online or in person.
3. Member organizations that fail to meet the minimum attendance requirement will lose the right to seek re-election for the upcoming term. and organizations not meeting the minimum attendance requirement will be informed of their ineligibility to seek re-election.
4. Secretariat will be amending *the Rules of Procedure of ABU Standing Technical Committee*, according to this decision.

Doc T-23/12-2

ABU Technology

TERMS OF REFERENCE
TOPIC AREAS AND PROJECTS

Revised: October 2023

TOPIC AREA: PRODUCTION

Chairman: Mr Kazim Pektas, TRT, kazim.pektas@trt.net.tr
Secretary: Veysel Binbay, ABU-TD, veysel@abu.org.my

	PROJECT TOPIC	TASKS	DELIVERABLES	PROJECT MANAGER
1.	**Ultra High Definition TV and Advanced Immersive Sensory Media Systems P/UHDAISM (TBD)**	1. Monitor developments regarding UHDTV, and study its technical specifications. 2. Monitor developments regarding advanced immersive sensory media and study its technical specifications. 3. Study use cases of advanced immersive sensory media like VR, AR, 360° video, 3D video, audio, and haptic to enhance the audience experience. 4. Study the possibility of a programme exchange technology in ABU region.	1. Report to members on UHDTV developments, including applications and technical aspects. 2. Report to members on the latest technologies on advanced immersive sensory media. 3. Report to members on use cases on advanced immersive sensory media within broadcast and media organization. 4. Contributions to relevant working parties in ITU-R SG6, when necessary. **Time Period: Oct 2024**	**Mr Yoshiro Takiguchi** takiguchi.y-ji@nhk.or.jp **Co-Project Manager:** **Mr Byung Sun KIM, KBS** bskim2000@kbs.co.kr **Mr Halil Us, TRT** halil.us@trt.net.tr **Zhou Yun, ABS/RTPRC** zhouyun@abs.ac.cn **Hu Xiao, ABS/RTPRC** huxiao@abs.ac.cn **Mr. P.S.Srivastava** pss_18@yahoo.com
2.	**Systems for people with special needs P/SN**	1. Study activities related to broadcast service for people with special needs done by other organisations 2. Make possible contributions to international forums or organizations if necessary	1. Report to members outlining broadcast service and systems in place to serve people with special needs 2. Contributions to relevant international forums or organizations **Time Period: Oct 2024**	**Mr Masaki Takahashi, NHK** takahashi.m-iu@nhk.or.jp **Mr D Birlananth, Prasar Bharati** birlananth@prasarbharati.gov.in **Mr. R.P. Joshi** rpjoshi.delhi@gmail.com **KBS, TBS, RTPRC, TRT**
3.	**IT -based Production System and file-based workflows P/ITPS**	1. Study use cases of IT -based programme production systems, which are implemented, or being implemented in broadcasters' facilities. 2. Gather the information about operational know-how in total production chain of the systems above. 3. Collaborate with P/RTA if necessary, especially in metadata or storage issues. 4. Prepare a monograph on IT -based programme production systems if possible.	1. Report to members outlining use cases of IT-based programme production systems and the information about operational know-how in total production chain of the above systems. 2. Monograph on IT -based programme production systems. **Time Period: Oct 2024**	**Mr Okan Salman, TRT** okan.salman@trt.net.tr **Co-Project Manager** **Mr Daeyang Kim, KBS** kimdaeyang@kbs.co.kr **Mr Gökhan Tikit, TRT** gokhan.tikit@trt.net.tr **Mr Nguyen Duc Tue, VTV** tuend72@vtv.gov.vn **Mr P S Srivastava, DDI** pss_18@yahoo.com **Mr. R.P. Joshi** rpjoshi.delhi@gmail.com **Mr Alireza Abedin, IRIB** a_abedini@irib.ir **CCTV/RTPRC;TDM;TVB [Manufacturers]**

	PROJECT TOPIC	TASKS	DELIVERABLES	PROJECT MANAGER
4.	**Big Data, Personalisation and Artificial Intelligence** **P/BDAI**	1. Study use cases of Big Data and technologies like Artificial Intelligence (AI) within broadcasting and media organisations. 2. Gather information about how Data analysis is used for personalisation and how it can be utilised by broadcasters. 3. Study how AI technologies can be deployed and used within production environment and other related applications for broadcasters.	1. Report to members on use cases and applications of Big Data and AI within broadcast and media organisations. 2. Report on the use of Data analytics for personalisation and to understand audience requirements and preferences. **Time Period: Oct 2024**	**Project Manager** **Dr Byunghee Jung, KBS** bhjung@kbs.co.kr **Co-Project Manager** **Dr Jun GOTO, NHK** goto.j-fw@nhk.or.jp **Dr Sansung KIM, KBS TRI** sansung@kbs.co.kr **Li xiao, ABS/RTPRC** lix@abs.ac.cn **Zhao Ming, ABS/RTPRC** zhaoming@abs.ac.cn **Zheng Ruidi, ABS/RTPRC** zhengruidi@abs.ac.cn **Ms. Wang Yi, ABP/RTPRC** wangyiamy@abp2003.cn

TOPIC AREA: DISTRIBUTION

Chairman: Mr Yuji Nagata, NHK, nagata.y-gg@nhk.or.jp
Secretary: Shree Bhadra Wagle, ABU-TD, shreebhadra@abu.org.my

	PROJECT TOPIC	TASKS	DELIVERABLES	PROJECT MANAGER
1.	**Next Generation Terrestrial Broadcasting** **D/NGTB**	1. Investigate next generation broadcasting technologies for delivering UHD service. 2. Investigate efforts toward the realization of next-generation terrestrial broadcasting. 3. Investigate mobile reception of digital broadcasting services. 4. Study on TVWS (TV White Spaces). 5. Study/follow studies on the development of 5G technology and its broadcast related delivery/contribution and other applications	1. Preparation of report, including next generation broadcasting technologies. 2. Information on efforts toward the realization of next-generation terrestrial broadcasting. 3. Preparation of report on mobile broadcasting, including those on broadcasting to handheld/mobile devices. 4. Include report on 5G technologies and its developments **Time period: Oct 2024**	**Mr Akihiko Sato** satou.a-cg@nhk.or.jp **Co-Project Manager:** **Dr Jeon Sungho** jeonsh@kbs.co.kr **Mr Chen Delin, ABS/RTPRC** chendelin@abs.ac.cn **Mr Halil Us, TRT** halil.us@trt.net.tr **Mr. D.P. Singh** dpsingh@prasarbharati.gov.in **Mr Rajesh Meena** meena@prasarbharati.gov.in **Mr A K Mangalgi** amangalgi@yahoo.com **Zhang Yu, ABS/RTPRC** zhangyu@abs.ac.cn **Xiao Jingting, ABS/RTPRC** xiaojingting@abs.ac.cn **KBS**
2.	**Integrated Broadcast-Broadband and OTT** **D/IBBOTT**	1. Study the specifications of the various Integrated Broadcast-Broadband (IBB) platforms. 2. Investigation of developments concerning software standards (APIs, EPGs, subtitle, etc). 3. Investigation and consideration on technologies to enhance broadcasting services in various aspects. 4. Study on information security for broadcasting services via airwave and/or communication network (Content protection, Conditional access, Digital Rights Management system, etc). 5. Study on cyber security in broadcasting industry for protecting the broadcasting systems.	1. A report on technologies on the various IBB platforms. 2. Prepare a requirement of the subtitles in the ABU region. 3. Survey of information security for broadcasting services via airwave and/or communication network. 4. Survey of cyber security in broadcasting industry for protecting the broadcasting systems. **Time period: Oct 2024**	**Dr Go Ohtake, NHK** ohtake.g-fw@nhk.or.jp **Co-Project Manager:** **Mr A K Mangalgi** amangalgi@yahoo.com **Mr. R.P. Joshi** rpjoshi.delhi@gmail.com **Ms Momoko Suyama** suyama.m-gw@nhk.or.jp **Dr Shinya Abe, NHK** abe.s-jg@nhk.or.jp **Zhang Dingjing, ABS/RTPRC** zhangdingjing@abs.ac.cn **Zhang Yu, ABS/RTPRC** zhangyu@abs.ac.cn **Zhang Wei, ABS/RTPR** zhangwei@abs.ac.cn **He Jing, ABS/RTPRC** hejing@abs.ac.cn **Wang Lei, ABS/RTPRC** wanglei@abs.ac.cn
3.	**Satellite Broadcasting** **D/SB**	1. Investigate latest satellite broadcasting technologies for delivering UHD service. 2. Study the specification of latest satellite broadcasting system.	1. Report on technologies on the latest satellite systems for UHDTV broadcasting. 2. Report on specification of the latest satellite broadcasting systems.	**Mr Masashi Kamei, NHK** kamei.m-kw@nhk.or.jp **Co-Project Managers:**

	PROJECT TOPIC	TASKS	DELIVERABLES	PROJECT MANAGER
		3. Investigate advanced satellite broadcasting technologies using Ka band, etc.	3. Survey of the latest topics on advanced satellite broadcasting technologies using Ka band, etc Time period: **Oct 2024**	**Mr K K Rao** kkrao@prasarbharati.gov.in **TRT** **IRIB**
4.	**Digital Sound Broadcasting Systems** **D/DSBS**	1. Follow developments in respect of digitally modulated radio transmissions in broadcasting and examine issues related to transition from analogue services to digital applications and implementation. 2. Examine issues related to transition from analogue services to digital applications in the FM band. 3. Examine implementation in the Medium and Short wave band	1. An information document on digital radio in all relevant, including relevant information about the ITU-R recommended system(s) and digital receiver developments. 2. A report on implementation issues and possibilities. **Time period: Oct 2024**	**Project Manager** **Co-Project Managers:** **IRIB** **RRI** **TRT**

TOPIC AREA: TRAINING AND SERVICES
Chairman: Mr P Das, Prasar Bharati, pdasdelhi@gmail.com
Secretary: Shree Bhadra Wagle, ABU-TD, shreebhadra@abu.org.my

	PROJECT TOPIC	TASKS	DELIVERABLES	PROJECT MANAGER
1.	**Technical Training Priorities and Members Requirements TS/TTPMR**	1. Periodically conduct surveys among members to understand the requirements and priority areas by members and based on these suggest topics for training. 2. Identify requirement of Technical Advisory Services for Member organisations 3. Work with ABU Media Academy to develop: - curriculum-based training programmes - a certification system with different levels - effective monitoring and assessing methods to evaluate how beneficial the training workshops/seminars have been to members. 4. Collaborate with AMA and other established Media Training Academies of members	1. Survey Report on Member requirements 2. List of Priority Areas, Topics and Program Schedule for training 3. Certification and Evaluation Template 4. Database of training academies and training programmes offered by them 5. Databse of Production/ B'cast Technology/ equipment used by Members 6. Database of Resource Persons along with Topics, **Time period: Oct 2024**	**Project Manager:** **Mr. Prakash Veer, Prasar Bharati** p.veer@gov.in **Co-Project Managers:** **Mr. J.B.Roy, Prasar Bharati** jbroy@prasarbharati.gov.in **Mr. Ravinder Kumar, Prasar Bharati** ravinderkumar@prasarbharati.gov.in **Contributors:**
2.	**Skill Development Programme for Managerial, and Occupational Safety TS/ SDPMOS**	1. Identify and develop training programmes for non-technical, managerial, financial and occupational safety and skills enhancement 2. Conduct surveys to study members requirements on these areas such as General management, Health & Safety considerations. 3. Explore the best possible ways of delivery of such training and good practice methods within the industry	1. List of non-technical, managerial, financial Skills courses that can be organised. 2. Identify and suggest at least one such topic to be included in the TD training calendar annually based on member requirements 3. Find out Standard Operating Procedures (SOP) and best practice methods adopted by members on different situations and work environment in general 4. develop standard code of conduct and work ethics information manual 5. Develop a disaster recovery and response manual that can be used in technical areas 6. **Time period: Oct 2024**	**Project Manager**: **Mr. R.K.Joshi, Prasar Bharati** rkjoshi@prasarbharati.gov.in **Co-Project Managers:** **Mr. Ravinder Kumar, Prasar Bharati** ravinderkumar@prasarbharati.gov.in **Dr. D.K. Mazumder, Prasar Bharati** dkmazumder@prasarbharati.gov.in **Mr. Ashok Kr. Panigrahi, Prasar Bharati** akpanigrahi1@prasarbharati.gov.in **Contributors:**
3	**Technical Skill Building and Knowledge Sharing TS/TSBKS** **OR** **High-Tech Exposure & Knowledge Sharing TS/TEKS**	1. Work with industry partners and international events to identify applicable training opportunities available in broadcasting field eg: ITU, IABM, SMPTE etc. 2. Explore and develop a staff exchange or short-term attachment programme among members. 3. Explore easy ways how redundant or in excess equipment from members can be acquired and utilised by other members who can use them.	1. MoU with Industry Partners 2. Guidelines for staff exchange programme 3. Members' Information Exchange platform **Time period: Oct 2024**	**Project Manager:** **Mr. K. Murugan , Prasar Bharati**murugan_k@prasarbharati.gov.in **Co-Project Managers:** **Mr Devesh Kumar, Prasar Bharati** devesh@prasarbharati.gov.in **Mr. J. B. Roy, Prasar Bharati** jbroy@prasarbharati.gov.in **Contributors:**

TOPIC AREA: SPECTRUM
Chairperson: Dr Li Leilei, RTPRC, lileilei@abp2003.cn
Secretary: Veysel Binbay, ABU-TD, veysel@abu.org.my

	WRC-23 ISSUES			
	PROJECT TOPIC	**TASKS**	**DELIVERABLES**	**PROJECT MANAGER**
1.	**to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 245 (WRC-19)** **(WRC-23 AI 1.2)**	1. Follow developments of studies in WP 5D to identify and possible impact on Broadcasting Services. 2. Possible impact on broadcasting service in Asia-Pacific Area.	1. From time to time, circulate among ABU members, relevant information on sharing studies. 2. Preparation of ABU contributions to the relevant SGs and WPs of ITU-R, APT and others. **Reports: As required.** **Time Period: Oct 2024**	**Project Manager** **Co-Project Managers:** **Mr. Rajeev Kumar** rajeev00kumar@yahoo.com **Contributors:**
3.	**to consider, in accordance with Resolution 247 (WRC-19), the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level;** **(WRC-23 AI 1.4)**	1. Follow developments of studies in WP 5D to identify and possible impact on Broadcasting Services. 2. Possible impact on broadcasting service in Asia-Pacific Area.	1. From time to time, circulate among ABU members, relevant information on sharing studies. 2. Preparation of ABU contributions to the relevant SGs and WPs of ITU-R, APT and others. **Reports: As required.** **Time Period: Oct 2024**	**Project Manager** **Co-Project Managers:** **Mr. Rajendra Kumar** rkumar@prasarbharati.gov.in **Contributors:**
4.	**to review the spectrum use and spectrum needs of existing services in the frequency band 470-960MHz in Region1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review, in accordance with Resolution 235 (WRC-15);** **(WRC-23 AI 1.5)**	1. Follow developments of study results on WRC-23 AI 1.5 conducted in ITU-R TG 6/1 2. Possible impact on broadcasting service in Asia-Pacific Area.	1. From time to time, circulate among ABU members, relevant information on sharing studies. 2. Preparation of ABU contributions to the relevant SGs and WPs of ITU-R, APT and others. **Reports: As required.** **Time Period: Oct 2024**	**Project Manager** **Co-Project Managers:** **Mr. Rajeev Kumar** rajeev00kumar@yahoo.com **Contributors:**

	WRC-23 ISSUES			
	PROJECT TOPIC	**TASKS**	**DELIVERABLES**	**PROJECT MANAGER**
9	**To consider a new primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2,while protecting existing primary services in the band, in accordance with Resolution 174 (WRC-23 AI 1.19)**	1. Follow developments of study results on WRC-23 AI 1.19 conducted in ITU-R WP 4A 2. Possible impact on broadcasting services.	**Time Period: Oct 2024**	**Project Manager:** **Dr. Li Leilei** **lileilei@abp2003.cn** **Co-Project Managers:**

Technical Committee Meeting
28.10.2023 - 13:30-17:00 & 29.10.2023 - 9:00-17:00
ABU 2023 SEOUL
함께한 50년 여러분의 KBS
KBS

Doc T-23/20

STATUS REPORTS

Doc T-23/20-1

STATUS REPORT

Organisation:	TONGA BROADCASTING COMMISSION		
Period:	1 year	Date of Report:	06/10/2023

PART A

Technical Developments during the past year:
• System upgrades/changes to practices for improved quality/efficiency Upgrade Studio equipment and network connectivity
• New Services/new projects initiated SRT services from main headquarter to outer Island for TV link via fiber optic cable and new project being commissioned "EARLY WARNING SYSTEM PROJECT"
• Research projects OTT Project still under research for options
• Internet and Mobile Broadcasting Services Streaming FB services and Youtube plus SRT services

			Radio	Television
Coverage %			100%	90%
Programme Channels			2	2
Studios (Production)	File-based Set-up	R/N/D	N	
	SDTV	R/N/D		D
	HDTV	R/N/D		R
	UHDTV			
	IP Based Set-up	R/N/D		R
Transmission & Delivery	HF	R/N/D		
	MF	R/N/D	R	
	FM	R/N/D	R	
	TV	R/N/D	R	
	OTT/IBB/Internet Services	R/N/D		
	Mobile Services	R/N/D		

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	Area	Brief Details: 1. Objectives 2. Progress to date	Challenges/Problems Faced: 1. Lack of resources 2. Lack of know-how 3. Others (e.g. up-skilling)	Solutions Implemented/Type of assistance requirement from ABU
1.	**Development projects/Upgrading facilities/Training**	Early Warning System	1. Trigger Siren all over Tonga using AM signal	Need Up-skilling	Need IT sort of Training
		IT	1. Up-skilling	Lack of training and resources	Need training and resoures
2.	**Participation in ABU Activities**	**Area**	**Level of Participation**	**Reasons for not participating (though interested)**	
		Technical Meeting & activities	High	Lack of funding available to attend meeting	
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform**	**Activity 1** **Study**	Needs to understand technologies and how it will be adapted and relevant to us in our regions	Challenges is that we are too far behind compare to developing countries and its resources	Need more assistance in terms of training, workshops and projects
		Activity 2 **Projects**	We need to implement some projects to help us onboard on technologies	Challenges we are too far and small organizations to attract any donor's attentions	We need ABU to help us intiate projects that will upgrade our services on TV like OTT project
		Activity 3			

Doc T-23/20-2

STATUS REPORT

Organisation:	Television Broadcasts Limited		
Period:	September 2022 to October 2023	Date of Report:	October 9, 2023

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency
  1. The Generic Code of Practice on Television Technical Standards has been revised. The major change is removal of Analogue television system standard and adoption of international technical standards on the loudness control for digital television services. TVB will follow up accordingly.
  2. Continue the improvement of security measures for content delivery, contribution, and distribution.
  3. Continue Central Transcoding Farm facilities enhancement to support and 4K/UHD files conversion.
  4. Deep archive medium migration from LTO-5 to LTO-9 due to EOL.
  5. Enhancement of Sobey HDNLE Media Asset Management to a DOCKER platform.
  6. Adoption of Face Recognition Technology to streamline data exchange during Production.
  7. Continue SCTE customization for 3rd parties' advertisement systems to insert advertisement for OTT platform.
  8. Continue the research of low latency solution for OTT platform.

- New Services/new projects initiated.
  1. Research on adoption of A.I. technology to do video de-noising during up-version of SD files to HD.
  2. Developing a Production Rundown System to streamline data exchange during Production workflow.
  3. Launch of an in-house developed Programmes Preview System for Production colleagues.
  4. Adoption of Mini Workgroup editing environment for different editing needs.
  5. Planning to deploy Cesium grade time and frequency reference for SFN network and MCR.

- Research projects
  1. Continue the study of transcoding and cross conversion between SDR and HDR materials.
  2. Continue SD HDR and 4K/UHD HDR study.

- Internet and Mobile Broadcasting Services
  1. New DTTB technology study
  2. 5G HPHT TV study

			Radio	Television
Coverage %			NA	99%
Programme Channels			NA	5 HD
Studios (Production)	File-based Set-up	R/N/D		
	SDTV	R/N/D		
	HDTV	R/N/D		
	UHDTV			
	IP Based Set-up	R/N/D	NA	
Transmission & Delivery	HF	R/N/D	NA	
	MF	R/N/D	NA	
	FM	R/N/D	NA	
	TV	R/N/D	NA	29 sites
	OTT/IBB/Internet Services	R/N/D	NA	
	Mobile Services	R/N/D	NA	

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	**Area**	**Brief Details:** **1. Objectives** **2. Progress to date**	**Challenges/Problems Faced:** **1. Lack of resources** **2. Lack of know-how** **3. Others (e.g. up-skilling)**	**Solutions Implemented/Type of assistance requirement from ABU**
1.	**Development projects/Upgrading facilities/Training**				
2.	**Participation in ABU Activities**	**Area**	**Level of Participation**	**Reasons for not participating (though interested)**	
		HDR vivid and Audio vivid Standards and Application 4K UHD live video broadcasting over 5G wireless transmission network	Engineer, update and acquire knowledge (On-line)		
		Immersive Video in China	Executives in Engineering, acquire knowledge on TV Industrial in China		
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform**	**Activity 1**			
		Activity 2			

	Activities	**Area**	**Brief Details:** **1. Objectives** **2. Progress to date**	**Challenges/Problems Faced:** **1. Lack of resources** **2. Lack of know-how** **3. Others (e.g. up-skilling)**	**Solutions Implemented/Type of assistance requirement from ABU**
		Activity 3			

Doc T-23/20-3

STATUS REPORT

Organisation:	National Broadcasting Services of Thailand (NBT-Thailand)		
Period:	2022 - 2023	Date of Report:	October 10th 2023

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency
  - In 2021, Replacement and upgrades all of the radio equipment for 8 radio frequencies.
  - In 2022, Replacement and upgrades all of the radio equipment for 10 radio frequencies and Established a backup station for digital television transmitters to services coverage Bangkok area.
  - Next year (2024) Plan to replace and upgrades all of the radio equipment for 3 radio frequencies is in progress.

- New Services/new projects initiated
  - NBT-Thailand is in the process of purchasing the equipment of a 1,000 m^2 Studio (large size), MCR, CAR and social media for the PRD Media Operation Centre.
  - Currently, the PRD Media Operation Centre is in the process of requesting budget allocation for purchasing the equipment (phase two), the details include equipment of 150 m^2 (small size) studio, 400 m^2 (medium size) studio and new media equipment.
  - Allocating equipment for live streaming via social media using the 5G network for provincial public relations departments in every province across the country. and for radio stations in the department's network

- Research projects
  - NBT-Thailand is researching on Radio Data System (RDS) for sending the text or picture to emergency disaster notification and advertisements.

- Internet and Mobile Broadcasting Services

			Radio	Television
Coverage %				95.1% of household
Programme Channels			79 FM / 25 AM	1 Nationwide. (NBT2 HD) 4 Regional Programs (NBT 11)
Studios (Production)	File-based Set-up	R/N/D		
	SDTV	R/N/D		
	HDTV	R/N/D		11 Studio Stations (R) 1 Studio Station (N)

	UHDTV			
	IP Based Set-up	R/N/D		
Transmission & Delivery	HF	R/N/D		
	MF	R/N/D		
	FM	R/N/D	R	
	TV	R/N/D		1 Backup main station coverage for Bangkok and peripheral
	OTT/IBB/Internet Services	R/N/D	N	
	Mobile Services	R/N/D	N	

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	Area	Brief Details: 1. Objectives 2. Progress to date	Challenges/Problems Faced: 1. Lack of resources 2. Lack of know-how 3. Others (e.g. up-skilling)	Solutions Implemented/Type of assistance requirement from ABU
1.	Development projects/Upgrading facilities/Training				
2.	Participation in ABU Activities	Area	Level of Participation	Reasons for not participating (though interested)	
3.	Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform	Activity 1			
		Activity 2			
		Activity 3			

Doc T-23/20-4

STATUS REPORT

Organisation:	Radio Television Hong Kong (RTHK)		
Period:	Nov 2022 to Sep 2023	Date of Report:	13 Oct 2023

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency

1. Establishment of a new DTT broadcast network at 29 transmitting stations for providing one additional DTT frequency channel and one additional DTT system headend to carry additional DTT programme channels
2. Expansion of the population coverage of the new FM channel (CNR "The Greater Bay") to 50%
3. Replacement of aged power systems and lightning protection systems at 4 DTT/AM/FM transmitting stations
4. Deployment of Unreal engine on Augmented Reality and Virtual Set system with object tracking system to enhance picture quality in TV studio production
5. Completion of the upgrade of the lightings in the largest TV studio to LED lightings for quality improvement and energy saving
6. Completion of a new broadcast centre including 2 TV studios, 5 editing rooms and 1 audio post production room
7. Deployment of Artificial Intelligence (AI) applications for virtual TV presenters and subtitle production
8. Adoption of internet communication protocol (RTMP/SRT) to support live video transmission among broadcasters and content providers
9. Completion of the upgrade of the radio studio in town centre with video production capability and hybrid audio mixing system for live broadcast
10. Deployment of 4K UHD video streaming encoder for radio programme with visual output
11. Deployment of analogue audio mixing system, 24-bit 96-kHz high-res digital audio production system and acoustic re-design for fine music production in radio studio
12. Deployment of cloud gateway for secured and scalable production media content exchange and ingestion with external parties
13. Replacement of the core network switches for Radio production
14. Replacement of aged network intrusion detection and prevention appliances to protect against cyber-attacks
15. Replacement of storage and backup system for RTHK online multimedia contents

- New Services/new projects initiated

1. Migration of DTT transmission service from old equipment room to new DTT building at Lamma Island transmitting station
2. Replacement of Outside Broadcast vehicle for TV live production
3. Replacement of Outside Broadcast microware links
4. Deployment of LED wall and Extended Reality for TV production
5. Deployment of IP technologies for video and audio production systems in TV/Radio studios and Outside Broadcast systems
6. Adoption of cloud service for video transmission between RTHK and broadcasters in other regions
7. Replacement of aged server farms and storage nodes
8. Webcast of new DTT programme channels (RTHK TV33 – "CCTV-1", RTHK TV34 – CCTV "CGTN Documentary", RTHK TV35 –"CGTN") on RTHK website and mobile applications
9. Deployment of RTHK mobile applications to Huawei platform
10. Production of 8K/4K UHD programmes for distribution in webcast and SmartTV platforms

- Research projects

1. Application of AI and cloud technology for intelligent editing and anywhere editing
2. Application of AI for analysis of video/audio archive contents
3. Adoption of Cloud technology for disaster recovery for master control systems of DTT services

- Internet and Mobile Broadcasting Services

1. Enhancement of RTHK website and mobile applications to incorporate new DTT programme channels
2. Setup of live streaming service of new DTT programme channels on RTHK website and mobile applications
3. Enablement of closed caption service and audio tracks selection on RTHK TV 31 and 32 online streaming services on RTHK website and mobile applications

			Radio	Television
Coverage %			99% (AM/FM)	99% (DTT)
Programme Channels			4 (FM) 4 (AM)	5 (DTT, High Definition)
Studios (Production)	File-based Set-up	R/N/D	R	
	SDTV	R/N/D		N/A
	HDTV	R/N/D		R
	UHDTV			N
	IP Based Set-up	R/N/D		N
Transmission & Delivery	HF	R/N/D	N/A	
	MF	R/N/D	R	
	FM	R/N/D	R and N	
	TV	R/N/D	N/A	R and N
	OTT/IBB/Internet	R/N/D	R	R and N

	Services			
	Mobile Services	R/N/D	R	R and N

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	**Area**	**Brief Details:** **1. Objectives** **2. Progress to date**	**Challenges/Problems Faced:** **1. Lack of resources** **2. Lack of know-how** **3. Others (e.g. up-skilling)**	**Solutions Implemented/Type of assistance requirement from ABU**
1.	**Development projects/Upgrading facilities/Training**	Deploy cloud service for broadcast grade video content transmission across regions	• Upload/download video content between RTHK and other broadcasters outside Hong Kong through broadband/5G mobile connections to cloud platform • Technical trial in progress	Interoperability issues between RTHK's video encoders/decoders and cloud service providers	Line up equipment vendors with cloud service providers to resolve compatibility issues
		Develop cloud solution for anywhere editing and sharing of common footages and music contents	Enhance operational efficiency for post production	Insufficient knowledge for cloud applications	Collaborate with cloud service providers to conduct sessions for proof of concept and technical trial
		Apply AI technology to editing and archiving	Improve efficiency in editing and analysis of video/audio archive contents	• Insufficient know-how to fully leverage the benefits of the AI editing tools • Lack of manpower to train the analysis model for archive contents	• Arrange trainings and participation in AI industry events to enhance the AI knowledge of internal staff • Closely cooperated with suppliers and contractors in knowledge sharing on AI technologies • Appreciate ABU to conduct sharing forums for case studies of AI deployment among broadcasters

	Activities	Area	Brief Details: 1. Objectives 2. Progress to date	Challenges/Problems Faced: 1. Lack of resources 2. Lack of know-how 3. Others (e.g. up-skilling)	Solutions Implemented/Type of assistance requirement from ABU
2.	**Participation in ABU Activities**	**Area**	**Level of Participation**	**Reasons for not participating (though interested)**	
		ABU Digital Broadcasting Symposium 2023	Attendance and sharing		
		ABU Technical Committee Meetings 2023	Attendance and sharing		
		ABU webinar series on different technology topics	Audience		
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform**	1. Provide webinars/on-line demonstration to introduce the application of Artificial Intelligence in broadcasting			
		2. Provide sharing/forum/workshop for deployment of cloud technologies for TV post production and disaster recovery service			
		3. Provide technology sharing/forum/workshop to evaluate the technical feasibility and business case for applying 5G technology in TV			

	Activities	Area	Brief Details: 1. Objectives 2. Progress to date	Challenges/Problems Faced: 1. Lack of resources 2. Lack of know-how 3. Others (e.g. up-skilling)	Solutions Implemented/Type of assistance requirement from ABU
		broadcasting			

Doc T-23/20-5

STATUS REPORT

Organization:	NEPAL TELEVISION CORPORATION		
Period:	OCT 2022- SEP 2023	Date of Report:	15TH OCT 2023

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency
  I. STUDIO GRAPHIC SYSTEM
  II. OB VAN UPGRADATION
  III. NEWS GATHERING SYSTEM

- New Services/new projects initiated
  I. NTV WORLD CHANNEL PROJECTS
  II. PROVINCIAL BUREAU SETUP
  III. DIGITAL ARCHIVING
  IV. ONLINE GRAPHIC SYSTEM FOR NEWS CHANNEL
  V. SATELLITE COVERAGE THROUGH DTH IN GEOGRAPHICALLY CONSTRAIN AREA
  VI. OB VAN

- Research projects
  I. TERRESTRIAL NETWORK EXPANSION AND OPTIMIZATION
  II. IMPLEMENTATION OF IP NETWORK

- Internet and Mobile Broadcasting Services
  I. 3G/4G DEVICES FOR MNGS
  II. MOBILE JOURNALIST (MOJO), MOBILE APPS

			Radio	Television
Coverage %				I. TERRESTRIAL NETWORK: GEOGRAPHICALLY 52% ANDBY POPULATION 75%
Programme Channels				FIVE (NTV, NTV NEWS, NTV PLUS, NTV ITAHARI, NTV KOHALPUR0
Studios (Production)	File-based Set-up	R/N/D		REPLACEMENT
	SDTV	R/N/D		DISCONTINUED

	HDTV	R/N/D		REPALCEMENT
	UHDTV			
	IP Based Set-up	R/N/D		
Transmission & Delivery	HF	R/N/D		
	MF	R/N/D		
	FM	R/N/D		
	TV	R/N/D		
	OTT/IBB/Internet Services	R/N/D		OTT
	Mobile Services	R/N/D		NEW

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	**Area**	**Brief Details:** **1. Objectives** **2. Progress to date**	**Challenges/Problems Faced:** **1. Lack of resources** **2. Lack of know-how** **3. Others (e.g. up-skilling)**	**Solutions Implemented/Type of assistance requirement from ABU**
1.	**Development projects/Upgrading facilities/Training**	NTV WORLD CHANNEL	I. NEPAL'S PERSPECTIVE TO THE WORLD IN ENGLISH LANGUAGE. II. FIRST INTIATED LAUNCHING IN DIGITAL PALTFORM.	I.LACK OF RESOURCES AND SUSTAIBILTY ISSUES II. CAPACITY BUILDING IN DIFFERENT DYNAMICS	ABU CAN ASSIST IN CAPACITY BUILDING.
		DIGITAL ARCHIVING	TO PRESERVE AND PROTECT VALUABLE VISUAL ASSETS TO THE NEXT GENRATION.	I.FINANCIAL CONSTRAIN AND AN EFFECTIVE TECHNOLOGY TRANSFORMATION	EFFICIENT AND EFFECTIVE TECHNOLFY TRANSFORMATION WITH CAPACITY BUILDING
		TRANSMISSION NETWORK	OPTIMIZATION OF TERRESTIRAL NETWORK	LACK OF RESOURCES AND EXPERTISE	KNOWLEDGE SHARING AND CAPACITY DEVELOPMENT
2.	**Participation in ABU Activities**	**Area**	**Level of Participation**	**Reasons for not participating (though interested)**	
		GENERAL ASSEMBLY	HEAD OF ORGANIZATION OR DEPUTY		
		TECHNICAL MEETING	DEPUTY GENERAL MANAGER	LACK OF FINANCIAL RESOURCES	
		SYMPHOSIUM/ EXHIBITION	SENIOR TECHNICAL HEAD	LACK OF RESOURCES	
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform**	**Activity 1**	IP NETWORK FOR EFFICIENT CONTRIBUTION, DISTRIBUTION AND TRANSMSSION		
		Activity 2	LATEST TREND IN TV TECHNOLOGY AND FUTURE PERSPECTIVE		
		Activity 3	TERRESTRIAL TRANSMISSION TECHNOLGY ATSC 3.0		

Doc T-23/20-6

STATUS REPORT

Organization:	Radio broadcasting service, Radio Nepal		
Period:	2022 to 2023	**Date of Report:**	15. Oct.2023

PART A

Technical Developments during the past year :

- **System upgrades/ changes to practices for improved quality/efficiency**

  There are no major changed in technologies in last year.

- **New Services/ new projects initiated :**

- Started mobile app
- Studying on an analogue to digital switchover
- Studying digital plate form for SW/ FM simulcast broadcasting
- FM relay stations in different provinces
- Planning to broadcast in new languages

- **Research Projects: NA**

- **Internet and mobile broadcasting Services:**
  Web portal upgrade/ Audio streaming / Mobile App

S.N.				RADIO	TELEVISION
1.	**Coverage%**	90% approx. by population			
2.	**Programme Channels**	Central channel with province channels			
3.	**Studio (Production)**	File- based Setup	R/N/D	Replacement/ Upgrade	
		SDTV	R/N/D	NA	

		HDTV	R/N/D	NA	
		UHDTV	R/N/D	NA	
		IP based set-up	R/N/D	New	
4.	**Transmission and Delivery**	HF	R/N/D	Discontinued	
		MF	R/N/D	Discontinued in several Tx. places	
		FM	R/N/D	Planning to add new stations	
		TV	R/N/D	NA	
		OTT/IBB/Internet Services	R/N/D	New	
		Mobile Services	R/N/D	Replacement/ Upgrade OB VAN and Suitcase Radio	

Note:

R: Replacement/ Upgrade
N: New
D: Discontinued
NA: Not Applicable

PART B

CURRENT ACTIVITIES

S.N.	Activities	Area	Brief Details: 1. Objectives 2. Progress to date	Challenges/ Problems Faced: 1. Lack of resources 2. Lack of know- how 3. Others (e.g. up –skilling)	Solutions Implemented / Type of assistance requirement from ABU
1.	**Development Projects/ upgrading facilities / training**	Content	• Operation and upgrading digitization of audio contents and archiving system		
		Policy	• PSB		
		Technology	• Study on digital switchover		
		Expansion	• FM relay stations		
2.	**Participation in ABU activities**	Area	**Level of Participation**	**Reasons for not participating (through interested)**	
	Webinars		Fine		
	Work shop/ seminar/ conference		Few	Due to lack of organization annual budget	
	GA meetings		Few	Due to lack of organization annual budget	
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform**	Activity 1	Apps/ connectivity		
		Activity 2	New technologies		
		Activity 3	• Access of RNE into technical study group • TAS for digital switchover for RADIO NEPAL • Technical training as well as IT training • Support for technical research activies		

PLANNING ACTIVITIES OF RNE 2023- 2024 year:

- Essential programs under the policy are carried out for conversion of public broadcasting (PSB). Inform the related person along with the study, interaction regarding the digital switchover.
- Conducting activities including training within the Radio Nepal related to broadcasting, e-library, Radio library.
- A new policy on Business development management in OTT platform.
- In accordance with the aim of making Radio Nepal's service information technology friendly, the reporting, accounting, administration, inventory and engineering services will be gradually strengthened based on digital technologies to make service delivery and performance fast, simple, effective and transparent.
- Study on employee skills development with new technologies.
- The content delivery network will be expanded by this year for systematic transmission and secure archiving.
- In order to introduce the digital transmission capacity through AM/FM, it will be proposed to the Government of Nepal for the necessary budget on digital technologies.
- Up gradation of transmission link optical fiber, STL, AOIP system
- To purchase necessary software to make Radio Nepal information technology friendly.
- Other major initiatives taken to facilitate better coverage, reach and improve the RNE content are as follows.
    1. Construction of new studio and office building in outside of Kathmandu
    2. Installation FM relay stations
    3. Purchase of broadcast and IT equipments.

Date: 15th/October/2023

Prepared by:

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Chief of engineering department
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Doc T-23/20-7

STATUS REPORT

Organisation:	**KBS**		
Period:	Nov 2023	Date of Report:	2023.10.16.

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency

UHD Facilities Investment & Service Activation

We continued to invest in our facilities to deliver quality UHD programming to our viewers. We built two new UHD studios and promoted the construction of a UHD general editing room and reinforcement of facilities. Starting with KBS Jeju's broadcast of UHD programs in January 2022, we expanded the UHD broadcasting area by building UHD transmission facilities at KBS Jeonju and KBS Cheongju. We held a demonstration and seminar on direct reception of terrestrial UHD on smartphones, and conducted verification of mobile reception of UHD mobile channels and location-based services in vehicles on the road. To improve reception, we also developed a converged transmission technology for broadcasting (ATSC3.0) and telecommunications (5G) networks.

Strengthening Network Stability & Effective Facilities

Management KBS improved the direct terrestrial reception environment for TV, Radio and DMB broadcasts by replacing the head office and local network's worn-out DTV (14 stations including Changwon, Gwangju, Jeonju etc.), FM (10 stations including Daejeon, Busan etc.) and DMB (Chuncheon) relay transmitters in various areas across the nation, and conducting maintenance in three regions (Gangneung, Jeju and Daegu) for 1R AM's main medium wave transmission wave facilities. We also worked to make our broadcasting network more efficient and made transitions to more stable transmission facilities in line with national policies. A case in point is replacing our fixed M/W (124 devices in 20 locations) following the government's plan to reassign the 6 GHz frequency band, and closing and consolidating transmission facilities due to the construction of Ulleung Airport (Closure and consolidation of Gadubong TVR with Ulleung TVR).

Fulfilling the Role of Primary Disaster Broadcaster

Through regular disaster broadcasting simulation drills, we strengthened the disaster broadcasting response capabilities of our employees and strived to fulfill our role as the nation's primary disaster broadcaster. We quickly and accurately produced and delivered special reports on major national disasters. Disaster broadcasts began within seven minutes of the Goesan earthquake in North Chungcheong Province, fulfilling our role as the primary disaster broadcaster. We aired 33 hours of continuous live broadcasting for Typhoon Hinnamnor, and reported on the mountain fires in Gyeongnam, Uljin and Milryang. In addition, our live broadcast area by helicopter, which was limited to the Seoul Metropolitan region, was expanded with new M/W to the Chungcheong Provinces, and the replacement of old broadcast equipment in the helicopter was also successfully completed. Through this process, we are now able to provide detailed location information for disaster areas to viewers using AR video synthesized from UHD aerial imagery and map data.

- New Services/new projects initiated

Strengthening Competitiveness for Program Production

To reduce production time and streamline file management for programs that use multiple cameras, we configured a system that can batch record/transfer up to 16 camera channel output to improve production workflow. Not only did we develop our own object recognition auto-tracking camera system using AI technology and use it for the launch of Nuri, but we also applied new and diverse technologies to our programs such as program cloud transmission, to improve broadcast production efficiency.We built and operated UHD production facilities to comply with the UHD content programming ratio. Two existing HD studios and one comprehensive editing room were converted to accommodate UHD, and the editing system was enhanced to improve the UHD production workflow and lay the foundation for stable broadcast production.

- Research projects

AI Transformation in Multicam Production

The AI-based multicam production solution, 'VVERTIGO', enables low-cost and highly efficient multi-cam production by automatically tracking multiple subjects and producing individual videos with a single 8K high-resolution camera. Since its launch in 2019, it has been utilized for making official fancams for <Music Bank>, presented by KBS K-pop, its YouTube channel boasting 8 million global subscribers. In December 2022, 'VVERTIGO Live' was introduced to support live production, enabling real-time interation with UHD cameras and simulating a multi-cam video production environment without a director. KBS has remarkably enhanced AI performance to enable real-time processing, and its goal is to further develop 'VVERTIGO Live' for various contents such as sports, concerts, and live commerce. The technology has been showcased globally and business opportunities in overseas markets have been explored at NAB Show 2023 and IBC2023.

AI Transformation in Color Restoration

KBS, which holds Korea's most extensive video archives dating back to 1961, has effectively utilized AI to restore heritage videos, including some black and white films. This AI application has proven to be significantly time-efficient and quality-effective in color-restoring historically significant videos. In 2022, the technology was used to produce the Liberation Day special "Our Faces in Color," restoring 50,000 black-and-white frames to color, with only 365 frames being manually colorized. With ongoing research and development, the applications of AI are progressively expanding. This year, we are restoring the legendary 1972 drama "Yeoro" in color.

AI Transformation in Large-Scale Viewing Data Analysis

KBS R&D provides insights by analyzing content viewing data across various distribution channels. As TV program viewership through OTT platforms increases, viewers' content consumption is leaving a vast digital footprint. Analyzing this can offer valuable information to producers and broadcasters. The innovation in AI technology is spearheading the development of sophisticated tools to analyze these massive amounts of viewing data. This includes the creation of models that can describe the content consumption patterns of segmented audiences, as well as the development of models that analyze and group content relationships based on viewing data.

Content search service models for KBS open archive BADA

KBS "BADA," introduced in 2022, represents an open archival service designed to facilitate unrestricted access for all Korean citizens to downloadable video materials, available for creative use. The term "BADA," translating to "sea" in Korean, aptly conveys the concept of an expansive and limitless content repository. Within this platform, advanced artificial intelligence (AI) engines undertake the intricate task of content analysis for video materials that pose challenges in manual tagging for search purposes. These AI engines adeptly extract pertinent intelligent content keywords, thereby enhancing the effectiveness of the search

process. The intended outcome is to empower content creators with the ability to precisely locate the specific scenes or elements they require, thanks to the wealth of material video information made accessible through this platform. It is important to note that this research initiative receives funding from governmental sources.

Cloud-IP based Studio Systems

KBS R&D is conducting researches on IP based production systems and its extension to virtualization and cloud technologies to cope with the ongoing paradigm shift of broadcast technologies. The cloud-IP based technology enables the creation and management of high-quality live media content from anywhere, at any time. At its core, this technology includes the development of software-based broadcast-grade low-latency IP media gateways and high-quality, low-latency mobile applications for mobility media production. With these innovations, we're poised to redefine the landscape of remote media production and bring unparalleled convenience and quality to the industry.

Character Generator Development

KBS R&D has a long history in developing and innovating character generators to meet domestic broadcasters demanding requirements. Due to their excellence and versatility, they are prevailing in production sites covering from daily programs to world class events like the Olympic Games. KBS R&D is devoting to developing the best value IP character generator to meet demanding domestic requirements again.

Smart Contents Production Research

Through the development of a new concept production platform based on AR/VR technology, KBS R&D conducts research to showcase new next-generation content production technology to viewers and to utilize it for differentiated program production.

Digital Convergence Networks Research

The digital convergence network can connect the advantages of ATSC3.0 (TV broadcast) and 5G mobile network to provide viewers with content with optimal quality and seamlessly. By automatically connecting to the 5G network in a fringe area where reception is poor, it is possible to use UHD/FHD/disaster broadcasting/additional services without interruption anywhere.

UHD Single Frequency Network Optimization Research

UHD single-frequency broadcasting network optimization research is researching and developing media service technology to fulfill KBS' public responsibility. KBS R&D conducts optimization research on UHD single frequency broadcasting network to solve the problem of coverage loss in UHD broadcasting and to increase the efficiency of transmission infrastructure.

Viewer Participation Service Development

KBS R&D develops a digital service that allows TV viewers to conveniently participate in voting, quizzes, surveys and commenting on the program using smartphone apps while watching TV. And the reaction results of TV viewers are displayed on the on-air screen.

Audio/Subtitle Research

KBS R&D conducts subtitle synchronization and voice recognition technology research to provide subtitles for hearing-impaired viewers in real-time broadcasting as well as Internet and VOD services

Emergency Alert Broadcasting Research

Research on UHD disaster warning service is being conducted to rapidly deliver disaster warning signals not only to TV but also to public places such as outdoor display boards, buses, and subways when emergencies occur.

Broadcast Network-Based Additional Data Services – Traffic and Positioning

This research focuses on developing technology to implement various additional services, such as traffic information and precise positioning, through next-generation broadcast networks. It also involves designing optimal data transmission methods suitable for the transmission process.

- Internet and Mobile Broadcasting Services

Strengthening Convenience of Digital Platform Use & Role of Public Media

2022 was a year of high-profile events, including the presidential election, the Beijing Olympics, and the FIFA World Cup in Qatar. To accommodate, KBS launched a variety of digital services to ensure viewers' right to know and free universal viewing. First, we delivered election-related information such as ballot counts both digitally and through terrestrial broadcasts fairly and transparently. In order to cover the various events of the Olympics and the World Cup, we operated five separate onlineonly channels to broadcast less popular events, Paralympic events, stadium multicam footage, and stadium ASMR footage free of charge. In addition, to provide diverse entertainment for World Cup matches, we introduced the first terrestrial "match analysis AI service" allowing viewers to predict the match results for fun. We also revamped our KONG app, which is considered to be the original internet radio, and overhauled the VOD service to make it easier to find and view KBS' various VODs. We have also continued to produce VOD subtitles for the disabled and people with viewing disadvantages, and we have done our best to fulfill our role as a public media through the "Old Radio Service," which discovers and releases classic radio content for free, and online quiz-type events aimed at correctly learning and using the Korean language.

Launching of Open Archive for Public Interest Content

In celebration of our 49th anniversary on March 3, 2022, KBS made its content freely available to the public, a first for a domestic terrestrial broadcaster, through KBS Bada (bada.kbs.co.kr). KBS Bada is an open archive for public interest content that contains 11,875 items ranging from video, audio and images. Through the service, we aim to actively fulfill our public responsibility as a public services media by sharing the value of our recorded assets with the public. Also, we plan to respond to the needs of viewers and the trend of the times by returning the copyright of KBS content for public purposes through KBS Bada. We hope that all the content we release will be utilized in education, research, and creative fields and help to promote a freer creative environment.

			Radio	Television
Coverage %				
Programme Channels				
Studios (Production)	File-based Set-up	R/N/D		
	SDTV	R/N/D		
	HDTV	R/N/D		
	UHDTV			
	IP Based Set-up	R/N/D		
Transmission & Delivery	HF	R/N/D		
	MF	R/N/D		
	FM	R/N/D		
	TV	R/N/D		
	OTT/IBB/Internet Services	R/N/D		
	Mobile Services	R/N/D		

R = Replacement/upgrade
N = New D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	Area	Brief Details: 1. Objectives 2. Progress to date	Challenges/Problems Faced: 1. Lack of resources 2. Lack of know-how 3. Others (e.g. up-skilling)	Solutions Implemented/Type of assistance requirement from ABU
1.	Development projects/Upgrading facilities/Training				
2.	Participation in ABU Activities	Area	Level of Participation	Reasons for not participating (though interested)	
3.	Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform	Activity 1			
		Activity 2			
		Activity 3			

Doc T-23/20-8

STATUS REPORT

Organisation:	Voice of Viet Nam (VOV)		
Period:	11/2022 – 10/2023	Date of Report:	16 Oct 2023

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency
  - Added two 200kW AM transmitters to Tay Nguyen station.
  - Added some new FM transmitters.
- New Services/new projects initiated
- Research projects
  - National digital radio platform.
  - National radio transmission over IP network.
  - VOV digital network infrastructure.
  - VOV digital transformation in TV production.
- Internet and Mobile Broadcasting Services

			Radio	Television
Coverage %			~ 98%	N/A
Programme Channels			8 channels	16 channels
Studios (Production)	File-based Set-up	R/N/D		
	SDTV	R/N/D		
	HDTV	R/N/D		
	UHDTV			
	IP Based Set-up	R/N/D		
Transmission & Delivery	HF	R/N/D	R/D	
	MF	R/N/D	R/N/D	
	FM	R/N/D	N	
	TV	R/N/D		
	OTT/IBB/Internet Services	R/N/D		
	Mobile Services	R/N/D		

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	**Area**	**Brief Details:** **1. Objectives** **2. Progress to date**	**Challenges/Problems Faced:** **1. Lack of resources** **2. Lack of know-how** **3. Others (e.g. up-skilling)**	**Solutions Implemented/Type of assistance requirement from ABU**
1.	**Development projects/Upgrading facilities/Training**	IT network infrastructure	Upgrade computer IT network infrastructure in Ha Noi – In progress	- Lack of financial and human resources - Lack of engineers with good network administration skills	- Consult and learn experiences from others broadcasting organisations about IT network infrastructures. - Support and advise on methods to build good IP network infrastructure
		OTT/Internet Services	Building a national online radio platform, based on the existing platform of Voice of Vietnam – In progress	Lack of financial and human resources	Research and review on online radio models and solutions
		Digital Transformation	Planning VOV Digital Transformation – In progress	Lack of resources and know-how	Consult and learn experiences from others broadcasting organisations
2.	**Participation in ABU Activities**	**Area**	**Level of Participation**	**Reasons for not participating (though interested)**	
		Digital Broadcasting Symposium 2023	In person		
		Webinar Series on Member Innovations	Virtual		
		ABU Technical Bureau Mid-Year Meeting	Virtual		
		Workshop on Archiving and Media Management	In person		
		ABU General Assembly	In person		
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform**	**Activity 1**	IT network infrastructure for broadcaster		
		Activity 2	National online radio platform		

	Activities	**Area**	**Brief Details:** **1. Objectives** **2. Progress to date**	**Challenges/Problems Faced:** **1. Lack of resources** **2. Lack of know-how** **3. Others (e.g. up-skilling)**	**Solutions Implemented/Type of assistance requirement from ABU**
		Activity 3	Digital transformation in media		

Technical Committee Meeting
28.10.2023 - 13:30-17:00 & 29.10.2023 - 9:00-17:00 | KBS Conference Place 1
ABU 2023 SEOUL
함께한 50년 여러분의 KBS

Doc T-23/20-9

STATUS REPORT

Organisation:	NRTA-CHINA		
Period:	2023.01-2023.10	Date of Report:	2023-10-11

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency

（1） Managed the complexity of TV operating and"matryoshka dolls" charging.

（2） Promoted the implementation of emergency broadcasting projects in underdeveloped areas, strengthen cooperation with the China Earthquake Administration and the China Meteorological Administration, jointly carry out pilot experiments on earthquake and meteorological early warning and emergency broadcasting, and carry out research and experiments on fast transmission channels for emergency broadcasting based on directly broadcasting satellite.

（3） Released TVOS 4.0 with EAL3 assessment, enabling seamless integration of 8K+AI services. Completed the research and development of TVOS5.0, achieved integration with the open source Open-Harmony OS, supported audio and video standards such as AVS3, HDR Vivid, and Audio Vivid, and supported the TV-Link protocol for multi view collaborative viewing. 5 international standards and 7 industry standards have been published, and 6 national standards have been established.

（4） Established DRM standards system for video audio content distribution, issued six DRM technical specifications, support content protection in scenarios such as cable, IPTV, OTT TV, and Internet video services. Developed DRM client SDK, which has been preinstalled in more than 100 million client devices including smart TV sets, mobile devices, car entertainment systems. Established digital certificate management system of DRM, providing key and certificates for the media industry. Seven service providers have deployed DRM system meeting industry standards, supporting protection of high-commercial value HD/UHD content; Designed DRM service certification rules and organized DRM service certification, continuously improving content protection of the whole industry.

- New Services/new projects initiated

（5） Carried out pilot work on "Future Television" in different fields.

（6） Carried out demonstration work on the application of virtual reality production technology in broadcasting, television, and online audiovisual applications.

（7） Solicited for the formulation and revision of standards for the broadcasting, television, and online audiovisual industries.

- Research projects

（1） Studied cutting-edge technologies in large videos, continuously create the next generation AVS UHDTV coding standard, and achieve a "fully immersive interactive experience" with multi-modality, diverse heterogeneous objects, and multiple interactive forms.

（2） Built high-level laboratories and national level projects and innovation platforms with industry influence.

(3) Strengthened the efficient collaboration among partners in various links of the ecological chain, and continue to promote the industrialization and internationalization of domestic audio and video encoding and decoding standards.

(4) Participated in 3GPP for the standardization of 5G Broadcast, researched on the evolution of 5G Broadcast technology, made technical report on "Technology and Plan of 5G Radio and Television System", formulated the 5G Broadcast standard system composed of 12 standards, constructed a trail network and conducted test in Chengdu, Sichuan Province, promoted this technology to the industry.

(5) Developed standard systems for ultra-high-definition video, VR video, and cloud gaming, resulting in the formulation of 15 industry standards. Played a pivotal role in completing the cloud broadcast technology test for the "Meet in Beijing" Winter Olympics test match. Played a key role in supporting the integrated media development and participated in the scheme design of the integrated production and broadcasting cloud platform of Guangdong Radio and Television Station and China Media Group. Formulated the "TV Series Master Production Specification", and developed a prototype for standard compliance testing to support the establishment of a national TV series version storage system.

(6) Conducted research on deepfake governance of audiovisual content, released technical requirements for prevention of audiovisual deepfake. Developed deepfake detection dataset, support the industry to carry out research and optimize deepfake detection technologies. Developed deepfake detection SDK for the improving of media industry deepfake governance.

- Internet and Mobile Broadcasting Services

(1) Deeply grasped the four levels of broadcasting and television networks, IPTV (Interactive Network Television), OTT (Internet Television), and the Internet that provide broadcasting and television services, and systematically research and promote broadcasting and television and network audiovisual work.

(2) China Broadcasting Network Group Corporation Ltd.(CBN) actively promotes the evolution of 3GPP Release18 MBS and participates in the development of technical specifications for RAN sharing, inactive multicast, simultaneous reception of unicast and broadcast. For the evolution of 3GPP Release 19, CBN continues to promote 5G NR MBS evolution and continuously improve relevant technical functions at 3GPP plenary and workshop. At the same time, according to the 3GPP Release17 specifications, CBN promotes the industry to support for 5G NR MBS feature, and organizes end-to-end pilot experiments to test the whole industrial parts including networks, terminals, chips and App. It also verifies that commercial terminals do not need to modify the hardware and can support FTA broadcasting.

			Radio	Television
Coverage %			99.65%	99.75%
Programme Channels			2527	
Studios (Production)	File-based Set-up	R/N/D		
	SDTV	R/N/D		
	HDTV	R/N/D		1082
	UHDTV			10
	IP Based Set-up	R/N/D		2974
Transmission & Delivery	HF	R/N/D		
	MF	R/N/D		
	FM	R/N/D		
	TV	R/N/D		
	OTT/IBB/Internet Services	R/N/D		
	Mobile Services	R/N/D		

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	Area	Brief Details: 1. Objectives 2. Progress to date	Challenges/Problems Faced: 1. Lack of resources 2. Lack of know-how 3. Others (e.g. up-skilling)	Solutions Implemented/Type of assistance requirement from ABU
1.	**Development projects/Upgrading facilities/Training**				
2.	**Participation in ABU Activities**	**Area**	**Level of Participation**	**Reasons for not participating (though interested)**	
		Cooperate with ABU-TD	ABP in NRTA to explore ways to collaborate with ABU-TD. Lieku.cn has provided links to ABU-TD.		
		Production	Organize relevant experts from NRTA to attend research project and Webinar.		
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform**	**Activity 1**			
		Activity 2			
		Activity 3			

Doc T-23/20-10

STATUS REPORT

Organisation:	TRT		
Period:	01.11.2022-18.10.2023	Date of Report:	19.10.2023

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency
  - İstanbul TV and some Radio studios renewal
  - TRT External Broadcasts Radio's new studio installation
  - The Digital Archive System upgrade project of TRT. (The contract was signed, and hardware installations completed, software adaptations with new functional capacities are ongoing. 4PB of media and related metadata will be migrated during the project)

- New Services/new projects initiated
  - PAM-Production Asset Management System implementation process has begun (completion is expected next year)
  - 5G-compatible broadcasting transmission devices procurement (and their testing over 5G networks)
  - Tape library technology and the storage capacity of the HSM system for TRT World / TRT Arabi channel will be renewed and increased. (ongoing)
  - DAB+ trial broadcast (ongoing)
  - DVB-T2 trial broadcast (ongoing)

- Research projects

- Internet and Mobile Broadcasting Services

			Radio	Television
Coverage %			TRT FM: %99.7 TRTRadio1: %93.6 TRTNagme: %90.6 TRTTurku: %92.1 TRTRadioNews: %75.7 TRTRadio3: %75.2 TRTRadioKurdi: %16.2 TRTRadioWorld: %30.59	TRT 1 : %98.4 TRT News: %98.1 TRT Sport : %96.8 TRT Kinds : %92 TRT-Kurdi : %16.1

			TRTRadioArabia: %21.4	
Programme Channels			TRT FM TRT Radio 1 TRT Nagme TRT Turku TRT Radio News TRT Radio 3 TRT Radio Kurdi TRT Radio World TRT Arabia	TRT 1 TRT News TRT Sport TRT Kinds TRT-Kurdi
Studios (Production)	File-based Set-up	R/N/D		
	SDTV	R/N/D		
	HDTV	R/N/D		
	UHDTV			
	IP Based Set-up	R/N/D		
Transmission & Delivery	HF	R/N/D	R	
	MF	R/N/D	R	
	FM	R/N/D	R	
	TV	R/N/D		R
	OTT/IBB/Internet Services	R/N/D		
	Mobile Services	R/N/D		

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	**Area**	**Brief Details:** **1. Objectives** **2. Progress to date**	**Challenges/Problems Faced:** **1. Lack of resources** **2. Lack of know-how** **3. Others (e.g. up-skilling)**	**Solutions Implemented/Type of assistance requirement from ABU**
1.	**Development projects/Upgrading facilities/Training**	Digital Radio (DAB+)	In trial	Waiting the final frequency planning form RTUK. 8 radio programmes in Ankara, Istanbul, Izmit and Bursa broadcasting via DAB+.	Having enough knowledge and experience. No technical assistance is needed at this time.
		Digital TV (DVB-T2)	In trial	Waiting the final frequency planning form RTUK. 6 SD/3 HD TV programmes and 14 Radio prorammes in Ankara, Istanbul, Izmir, Adana and Bursa broadcasting via DVB-T2.	Having enough knowledge and experience. No technical assistance is needed at this time.
2.	**Participation in ABU Activities**	**Area**	**Level of Participation**	**Reasons for not participating (though interested)**	
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange**	**Activity 1**			
		Activity 2			

	Activities	Area	Brief Details: 1. Objectives 2. Progress to date	Challenges/Problems Faced: 1. Lack of resources 2. Lack of know-how 3. Others (e.g. up-skilling)	Solutions Implemented/Type of assistance requirement from ABU
	platform				
		Activity 3			

Technical Committee Meeting
28.10.2023 - 13:30-17:00 & 29.10.2023 - 9:00-17:00 | KBS Conference Place 1
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Doc T-23/20-11

STATUS REPORT

Organisation:	NHK（Japan Broadcasting Corporation）		
Period:	Aug.2022-Sep2023	Date of Report:	16 October 2023

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency

Digital Flip: Real Time CG System Using AR Markers

An AR technology method enables an image recognition of specific two-dimensional code "AR markers" from camera images and real-time composition of digital materials at appropriate positions, angles, and sizes. Flipboards are typical props used in program production, such as for live broadcasts and studio programs. We have developed a system called "Digital Flip," which synthesizes CG images on a realistic flipboard printed with AR markers.

This system can be installed inexpensively and compactly by using a notebook PC, ensuring convenience at the shooting location. In addition to still and moving images, 3D characters can be used as digital materials displayed on the flip to expand the range of program production. Users have commented that "it is easy for the performers to use the flip, as they do not have to change the flip," "it is easy to produce moving images," and "it is less affected by weather and lighting." The effectiveness of AR technology in program production is expected to continue.

- New Services/new projects initiated

Sign Language CG for Weather/Disaster Prevention Info

In October 2022, NHK began offering a trial version of "Sign Language CG for Weather/Disaster Prevention Info" in order to provide information on disasters such as earthquakes and heavy rainfall in sign language as quickly as possible in its efforts to report disaster prevention and disaster mitigation as a public media. Based on data released by the Japan Meteorological Agency, the system automatically generates sign language CG and calls for evacuation and precautions. Although it is difficult to secure a sign language interpreter in an emergency, the automatic sign language CG generation system aims to promptly provide information to those who need it 24 hours a day, 365 days a year.

Currently, the system can only handle limited information such as weather and disaster information, but by applying this sign language CG technology, it will become a useful tool in a wide range of daily life situations, such as providing information on train and passenger aircraft operations. In the future, we aim to use AI to develop sign language CG for news bulletins of any genre, especially those with a high degree of urgency. Furthermore, we hope to develop not only Japanese Sign Language but also International Sign Language.

- Research projects

Real Time Audio Encoder/Decoder Based on MPEG-H 3D Audio

NHK is studying next-generation audio services that use object-based audio to improve the quality and functionality. Object-based audio is a scheme in which audio objects together with audio metadata are transmitted and reproduced by a renderer in the receiver. In order to transmit programs produced with object-based audio, we have adopted MPEG-H 3D Audio, an audio coding standard that supports object-based audio and developed an audio encoder and audio decoder that enable real-time transmission. The developed audio decoder has functions for audio format conversion, audio object replacement, audio object level adjustment, and output for a second device; viewers can customize the reproduced sound as they prefer.

Development of 400-Mbps-class millimetre-wave wireless transmission technology for content production that realizes wireless relay for ultra-high definition 360-degree video

NHK has been conducting research and development into wireless transmission technology that makes it possible to transmit ultra-high-definition 360-degree video from various locations with the aim of providing a new experience and emotion that exceeds the bounds of conventional TV. By removing the cable from ultra-high-definition 360-degree cameras that capture their entire periphery and making them wireless, it becomes possible to perform live relay of 360-degree video that has a high sense of presence for festivals and similar events with high concentrations of people, for giving the feeling of being surrounded by the ocean, and for sports competitions.

In order to transmit ultra-high-definition 360-degree video, it is necessary to have an even larger transmission capacity than 4K and 8K video. NHK has worked to reduce the size of the transmitter by using millimetre waves in the 42 GHz band, which have a broad signal bandwidth, and by applying single carrier modulation, which can be used with higher output from the power amplifier than even OFDM. In this work, NHK presents 400-Mbps-class wireless transmission, which is approximately double that of conventional single-transmitter systems, using technology developed for spatially multiplexing a single carrier modulation signal (MIMO-SC-FDE) using a MIMO structure with two transmitters and four receivers.

- Internet and Mobile Broadcasting Services

Video Summarization and Extraction of Thumbnail Images Using AI

In this era in which an enormous number of videos are accessible, broadcast stations have recognized the importance of producing Internet-content such as program summary videos for social networking services (SNS) and program websites that will let viewers comprehend the story of a program in a short time. Here, NHK has developed systems for automatically generating news and program summary videos. Our systems incorporate a video summarization artificial intelligence (AI) that has learned the image composition and camerawork typical of important scenes, with which it is possible to automatically generate summary videos with a quality close to that of videos edited by actual program production staff. These systems have been on trial or in practical use at many NHK broadcasting stations. The generated summary videos are posted daily on SNS. Furthermore, considering that a program website also holds important content that could boost viewer contact rates, we have developed a support system for creating program websites by using an AI to extract thumbnails automatically. Program websites can be created with minimal effort by using thumbnail candidate images extracted automatically by the AI which has learned the unique features of a program’s representative images. These technologies can streamline the production of Internet-content such as summary videos and program websites. Moreover, they will greatly boost Internet deployments of various broadcasting programs.

			Radio	Television
Coverage %			MF Radio1:99.9% Radio2:99.9% FM:98.0%	Digital Terrestrial:98.2%
Programme Channels			AM Radio:2 FM Radio:1	Digital terrestrial:2 Digital Satellite (HD):2 Digital Satellite (UHD):2
Studios (Production)	File-based Set-up	R/N/D		
	SDTV	R/N/D		
	HDTV	R/N/D		
	UHDTV			
	IP Based Set-up	R/N/D		
Transmission & Delivery	HF	~~R/N/D~~	3	
	MF	~~R/N/D~~	Radio1 :281 Radio2 :146	
	FM	~~R/N/D~~	532	
	TV	~~R/N/D~~		Digital :2,214
	OTT/IBB/Internet Services	~~R/N/D~~		
	Mobile Services	~~R/N/D~~		

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	**Area**	**Brief Details:** **1. Objectives** **2. Progress to date**	**Challenges/Problems Faced:** **1. Lack of resources** **2. Lack of know-how** **3. Others (e.g. up-skilling)**	**Solutions Implemented/Type of assistance requirement from ABU**
1.	**Development projects/Upgrading facilities/Training**				
2.	**Participation in ABU Activities**	**Area**	**Level of Participation**	**Reasons for not participating (though interested)**	
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform**	**Activity 1**			
		Activity 2			
		Activity 3			

Doc T-23/20-12

STATUS REPORT

Organization:	KIRIBATI HOPE RADIO		
Period:	1/11/2022 – 1/11/2023	Date of Report:	24th October, 2023

PART A

Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency

  Entire broadcasting system and equipment earthed for complete protection

- New Services/new projects initiated

Television – Kiribati Hope Channel to be up and running early next year, 2024

FM Radio Expansion to the outer Kiribati Islands in mid-2024 with trial on four islands, Abemama in the Central, Kiritimati in the East, Marakei in the North, and Tab North in the South.

- Research projects

  Direct To Mobile (D2M) Broadcast Roll out in TARAWA ISLAND with Saankhya Labs Pvt. Ltd. Working together on the project with another ABU member from Kiribati, Kiri-1 TV and is still in the preparatory stage.

- Internet and Mobile Broadcasting Services

Please refer to the D2M project above.

			Radio	Television
Coverage %			80+%	5%
Programme Channels			24-hour service FB Live	
Studios (Production)	File-based Set-up	R/N/D	D	
	SDTV	R/N/D		
	HDTV	R/N/D		
	UHDTV			
	IP Based Set-up	R/N/D		
Transmission & Delivery	HF	R/N/D		
	MF	R/N/D		
	FM	R/N/D	R	
	TV	R/N/D	N	
	OTT/IBB/Internet Services	R/N/D		

	Mobile Services	R/N/D	N	

R = Replacement/upgrade
N = New
D = Discontinued

PART B
CURRENT ACTIVITIES

	Activities	**Area**	**Brief Details:** **1. Objectives** **2. Progress to date**	**Challenges/Problems Faced:** **1. Lack of resources** **2. Lack of know-how** **3. Others (e.g. up-skilling)**	**Solutions Implemented/Type of assistance requirement from ABU**
1.	**Development projects/Upgrading facilities/Training**	Television	1.Set up and operate a new television service 2.Hope Channel International is on already, however local contents awaits completion of new TV studio, Service is expected to be up and running early next year, 2024	Funds are slow as well as communication between media officers responsible to speed up the process of acquiring the necessary equipment required for a new TV studio production. Training of new TV staff is a challenge and we rely on people from Australia and Fiji to come and help in the installation and training.	We need ABU to provide factories to acquire equipment for TV which include quality TV cameras (with autocues, etc) for production and for OB assignments PLUS other needed equipment in a simple TV set up.,
		Radio Expansion to 20 islands of Kiribati	1.To expand current FM radio broadcasting service to the rest of the uncovered islands of Kiribati. 2. Four islands have been designated for trial phase in 2024. A broadcast engineer in Australia has been assigned to prepare all the list of the equipment required for repeater stations. Mapping and satellite survey of Kiribati has been completed. Funding has been sought out as well and when the two are completed, then work on the first four islands is expected to kick off in the middle of 2024.	It's a real challenge trying to get our current services to the outer islands due to distance. Funds also is a challenge and we are appealing to a number of sources.	Our Australian engineer will be coming up with the list of equipment needed for substations to be built in the outer islands and on the 4 islands for trial. Once the list and total costs of the entire set up is received, we can send the final project proposal to our funding bodies. Again, we need ABU technical assistance where possible to identify places and equipment needed for repeater substations. We want to upload our current radio service to satellite or using internet where possible. Please advise on the best solution available.

	Activities	Area	Brief Details: 1. Objectives 2. Progress to date	Challenges/Problems Faced: 1. Lack of resources 2. Lack of know-how 3. Others (e.g. up-skilling)	Solutions Implemented/Type of assistance requirement from ABU
2.	**Participation in ABU Activities**	**Area**	**Level of Participation**	**Reasons for not participating (though interested)**	
		ABU GA Meetings, etc	We fully engage in this important event every year since we joined ABU		
		PACIFIC MEDIA PARTNERSHIP CONFERENCE	We fully support ABU program designed for its members in the Pacific region.		
		ONLINE Webinars, training etc	We avail ourselves to such opportunities	However, there are times when we did not participate due to internet issues in the islands.	
3.	**Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform**	**Activity 1**	Implement an exchange program where ABU members can learn from each other. This is very important for journalists, radio producers, etc in the Pacific to be able to get exposed to an environment of professional broadcasting and news reporting, etc		
		Activity 2	Provide more avenues for funded training for broadcasters, news reporters, program makers. Money is the issue for broadcasters in the Pacific.		
		Activity 3	Organise one PACIFIC DANCE FESTIVAL AND SONG FESTIVAL during the next PMPC. You haven't seen what Pacific dancers and singers can do to make ABU look brighter and more interesting and attractive.		

Doc T-23/21

INFORMATION DOCUMENTS

Technical Committee Meeting
28.10.2023 - 13:30-17:00 & 29.10.2023 - 9:00-17:00
ABU 2023 SEOUL
Doc T-23/21-1

Introduction of 5G Channel Technology White Paper, Guo Changxiong, Suzhou Broadcasting System

Abstract：

5G Channel Technology White Paper, released by NRTA (National Radio and TV Administration) in December 2022, is one of the key technologies for future TV evolution. 5G Channel can be considered as the 5th Generation Radio and Television Channel. Based on 5G and other information technology, 5G Channel Technology White Paper provide a mechanism to aggregate radio and television resources of China, to create individualized radio and television channel, to improve the terminal presentation capabilities by intelligent recommendation, intelligent arrangement of programs and Interactive Audiovisual Communication. More specifications for different application scenarios, functions, and tests are under construction and making rapid progress.

Key Words:

5G Channel, Intelligent Arrangement, Customization Channel, Future TV

1、Introduction

With the development of 5G technologies and the improvement of terminal presentation capabilities and Artificial Intelligence, the era of future TV evolution has arrived. Future TV which can provide intelligent recommendation, intelligent arrangement of programs, Interactive Audiovisual Communication and Immersive Audiovisual experience is gaining more and more attention these years.

There are thousands of radio and television stations in China. Each with a large number of program contents and users, but they cannot form a joint force. With the development of technology, they get a new chance to build future TV, in order to converge national content and user resources, so as to better serve users and enhance the overall competitiveness of radio and television institutions.

Since 2022, the NRTA organized several leading TV stations and enterprises to develop new solutions for future TV, one of them namely 5G Channel. 5G Channel can aggregate radio and television resources of China, create individualized channel, display Interactive Audiovisual Communication, and provide Immersive Audiovisual experience. It was originally released as an industrial white paper in 2022, and then with the guidance from the NRTA, has been adopted in the pilot construction of 5G

Channel.

2、Overall Architecture

The technical support for 5G Channel comes from master platform and local platforms. Local media organizations build local platforms. The master platform which will be built by the NRTA or the enterprise designated by the NRTA, has a close cooperation with local platforms.

The master platform unifies user accounts, registration, and management, provides intelligent recommendation, intelligent arrangement, recommendation link, provide an unified APK for smart TV screen, provide an unified SDK for local media organizations to embed their existing media APPs.

The 5G channel has both a TV screen and a mobile terminal screen. If the mobile terminal screen releases a new APP, it is difficult to accumulate a large number of users in a short time. The new APP will also grab users with original APP of TV stations. The SDK is embedded in the local media APP so as to quickly import a large number of users for the master platform, without changing the original name and functions of the existing media APP. The 5G Channel can also use the high-quality resources of the master platform to increase its user stickiness, improve the daily access of the APP, and achieve a win-win situation between the master platform and the local platform.

Local media institutions can add 5G channel modules to the existing media APPs, access 5G Channel by the SDK provided by the master platform, register local information and content to the master platform, also provide CDN traffic. APPs of local media institutions still retain their original names and functions.

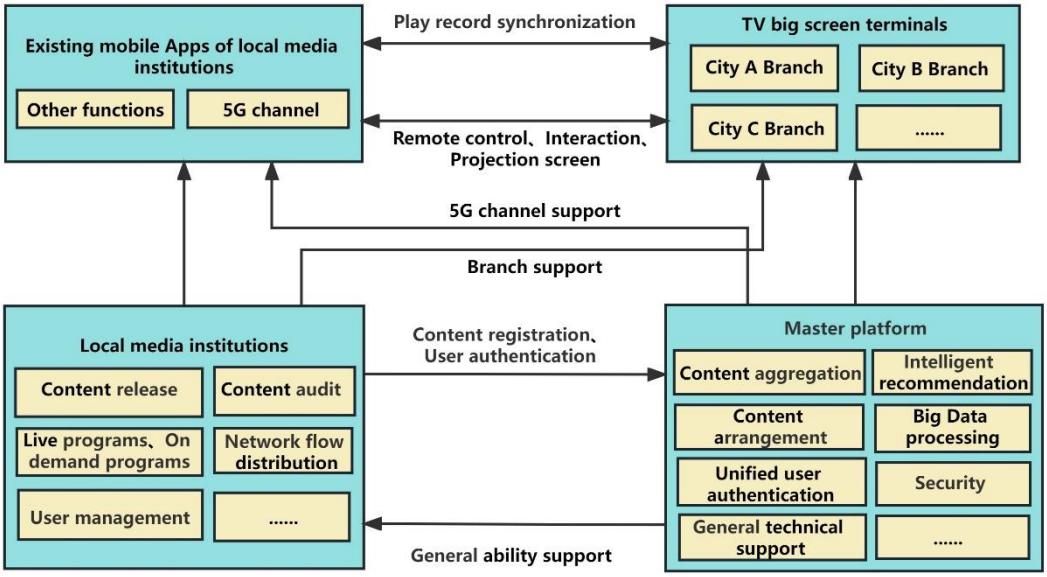


Figure1 Overall Architecture

The local platform is the content provider, editor and promulgator, and service provider of 5G Channel contents. After the contents are audited, they will be provided to the master platform and aggregated into an unified resource library. The master

platform converges contents, provides users with personalized content recommendation services by intelligent analysis, customization channel services by intelligent arrangement. The content access support is provided by local platforms.

3、Core Functions of 5G Channel

3.1 User Identity Mutual Authentication

The users of each local platform are managed by each local platform. The master platform generates an unified identity for data processing within the master platform.

3.2 Platform Association

The local media APP is used as the entrance of 5G channel through the master platform SDK, and its services are supported by the master platform.

The local platform is connected with the master platform to realize the functions of user data interoperability, content aggregation and sharing, platform services, authorization link management and so on. It supports User Portrait, intelligent recommendation, intelligent arrangement, Big Data Processing Service, and realizes the global release and intelligent touch of regional contents.

Figure2 5G Channel Access schematic diagram

3.3 Aggregation Home Page

The master platform provides the aggregation home page service. After gathering the content registration information of each local platform, the Big Data analysis system and the content recommendation system provide the content recommendation links and channel customization functions on the TV and mobile screens, and recommend links as live, on-demand, interactive live and other pages to users by the mobile terminal.

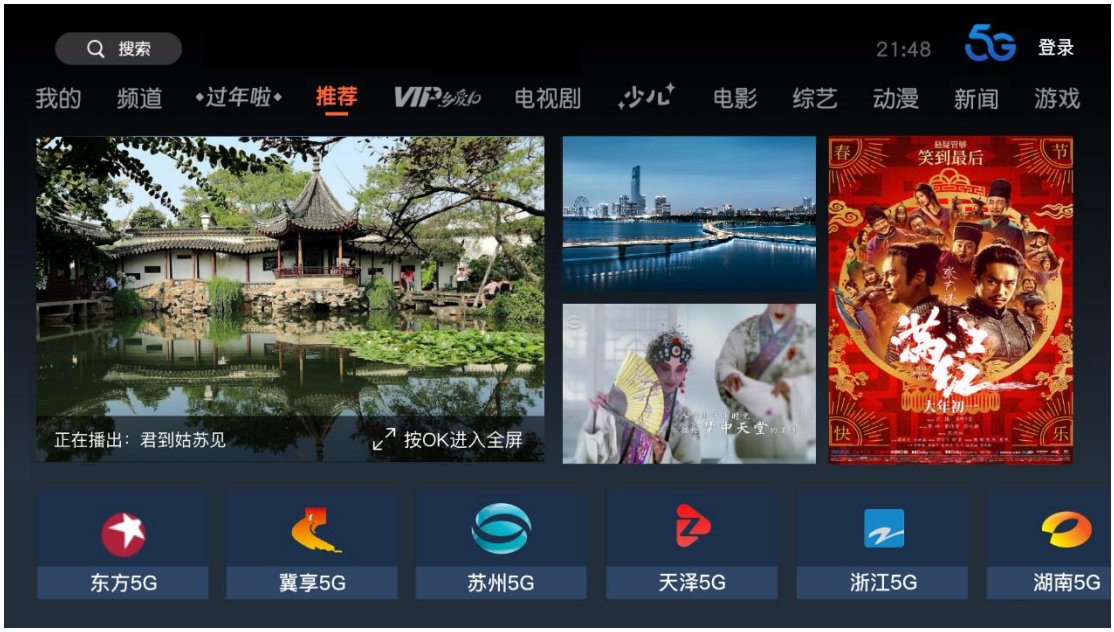


Figure3 5G Channel Aggregation Home Page schematic diagram

3.4 TV and Mobile Screen Co-presentation

The master platform and each local platform meet the needs of multi-terminal linkage play and control. Based on the mobile phone small screen and a variety of terminal linkage release, the seamless connection between multiple scenes is realized. In addition to providing contents and application services, the mobile phone also provides functions such as a remote control, a camera, a microphone, a gyroscope, and a game operation handle, and realizes collaborative connectivity with the TV screen.

3.5 Intelligent Arrangement and Channel Customization

The 5G channel not only has the traditional linear broadcast mode, but also provides a personalized ' quasi-linear ' broadcast mode arranged by AI intelligent arrangement of programs according to user characteristics, program characteristics, time, location and other information.

3.6 Platform Operation and Flow Settlement

The platform is operated through CDN traffic settlement, advertising and other methods. The operating income is divided into three parts: the master platform, the local platforms and the content creation teams. The master platform income is used for the construction, operation and development of the master platform. The local platform income is dominated by the local platforms, and the creation team income is used to encourage content creation.

4、Construction Requirements

The construction of 5G channel follows the principle of overall planning, and provides a cooperative guide for all media institutions to build and share 5G channels through an unified overall architecture design.

The overall architecture of 5G channel is the organic interconnection of the master platform and multiple local platforms, and the content polymorphic release and multi-screen collaboration of TV big screen and mobile small screen are achieved in coordination.

The master platform construction of 5G channel is a gradual and progressive process, which can be modularized as necessary parts and advanced parts, according to the actual needs.

Local platform construction is carried out in two stages.

The first stage: Before the completion of the master platform, local media institutions can build local platforms first, or optimizes the current platform of China Broadnet.

The second stage: After the completion of the master platform, the local platform implants the SDK provided by the master platform to generate 5G channels, which improves the richness of the contents of the local platform and improves the accuracy of the contents of the customized channel.

5、Conclusion

As a new force in the field of future TV standards, 5G Channel Technology White Paper is dedicated to building 5G Channel by different steps, and providing a better and more comfortable audiovisual experience on various display devices.

Now there are several top TV stations and institutions in China, organized by the NRTA, follow the guidance of the white paper to carry out the construction and operation practice of 5G channels. At the same time, some TV stations, which have strong research and development abilities, with the support of the NRTA, are actively carrying out the research, construction and trial operation of the master platform stipulated in the second stage of the white paper, so as to contribute to build 5G channels fast.

The white paper will create greater value for the development of the 5G Channel industry and bring infinitely wonderful audio-visual feasts to the industry and consumers.

6DoF VR video content production, distribution and multi-platform real-time interaction, Wei Na, Academy of Broadcasting Science, NRTA

Abstract:

This project provides a full-chain solution for 6DoF VR multi-modal video content production, distribution and experience, which has achieved the effects of significantly reducing production complexity and production time, reducing the amount of distributed data, cross-platform terminal access, real-time interaction in multi-person virtual space, and strong immersion interaction.

Key words:

6DoF (Degree of freedom), Virtual Reality, Content Production, Multi-platform, Real-time Interaction

1. Introduction

6DoF VR video content generally has problems such as high production difficulty, low scene richness, large amount of data, immature interactive patten, and limited large-scale application. This project has developed 6DoF VR video content production and distribution technology based on multi-modal data intelligent conversion, immersive interaction technology based on fixation and distance guidance, real-time rendering technology of digital image animation based on reverse dynamics and multi-platform VR video interactive technology. The 6DoF VR multi-modal video content production, distribution and multi-platform real-time interaction system was built to solve the above problems.

On the content production end, in the past, it was necessary to use 3D engines such as Unity for individual scene design and production, which was highly professional and difficult. This system can reduce the dimension and template processing of complex 3D scene content production, reduce the production difficulty

and time, and reduce the amount of data required for transmission, also can carry out intelligent conversion of multi-modal material content. It improves the richness of scene content. On the content experience end, through multi-modal content fusion and multi-sensory guided interaction, enhanced users' cognition of the virtual environment. Local motion capture, global physical inference and other technologies are used to generate and render accurate digital images and actions in real time, combined with multi-user, low-latency interaction technologies enriched the interactive patten and enhance the natural and immersive sense of interaction. The system is compatible with OpenXR standard, suitable for multiple platforms, also can support large-scale dissemination and application of 6DoF VR video content.

2. Architecture Solution and Key Technologies

2.1 End-to-end Solution

This project has developed a 6DoF VR multi-modal video content production, distribution, and multi-platform real-time interaction system, which is divided into three parts: content production, content data distribution and content experience/interaction. The end-to-end system solution is shown in Figure 1.

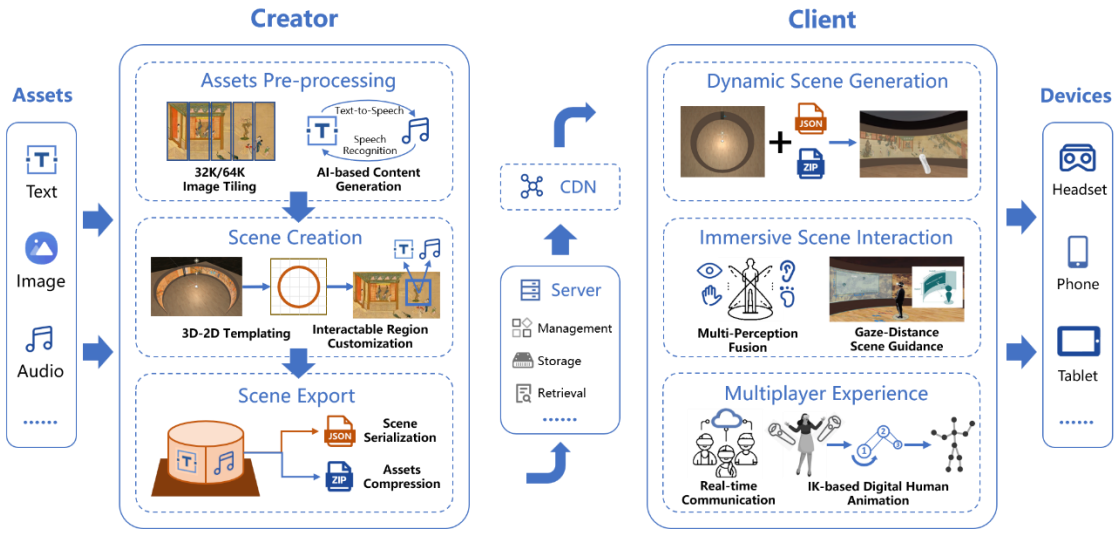


Figure 1 End-to-end system solution diagram

2.2 Content production end

The content production end is responsible for organizing, converting, positioning and editing the imported scene materials, generating 6DoF VR video scene description files, packaging the resources, and uniformly uploading them to the content data distribution end. The contend production end screenshot shown in figure 2.

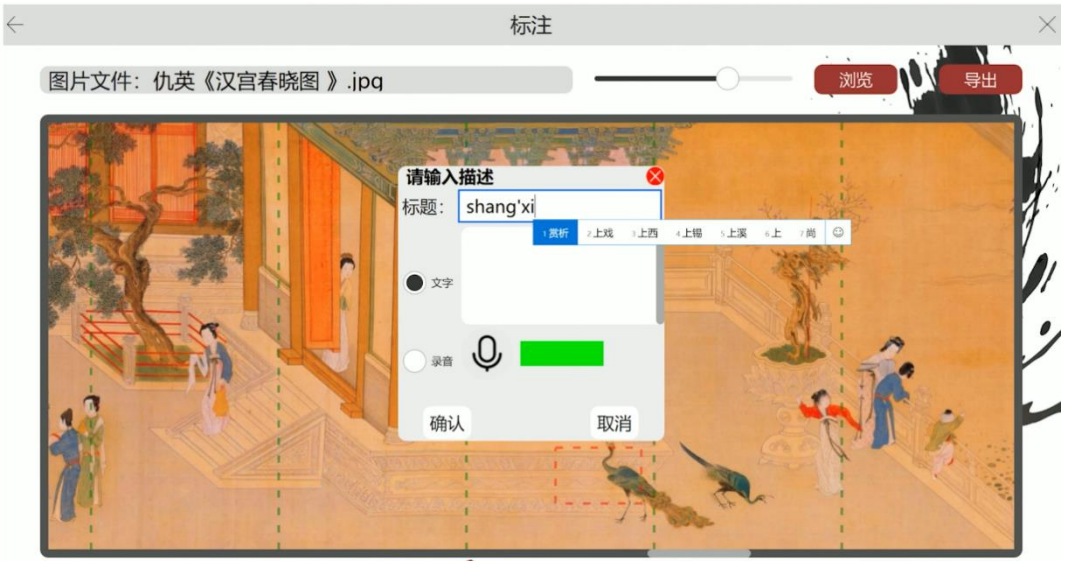


Figure 2 Screenshot of the content production end

The key technologies of the content production end are as follows:

a) The typical three-dimensional scenes in the actual application requirements are templated and presented in two-dimensional form, which reduces the complexity of scene design, understanding and production;

b) Images, texts, audio and other multi-modal materials can imported, VR image support 64K and above ultra-high resolution. By dividing the original image into several block images with lower resolution, can avoid decoding and rendering failure, maintain high fidelity and high definition;

c) Can set user interaction points and place material content at different locations in a scene, and the system can automatically generates multi-sensory guided interaction areas in three-dimensional space;

d) Though AI technology can convert text to audio, audio to text, to achieve multi-modal content conversion, so that the scene content can be selected by the user in the most appropriate mode of presentation;

e) When the content is completed, the content location and interactive information can be text serialized, the scene description file is generated, and only the original material and part of the generated content are compressed and packaged, avoiding the direct transmission of three-dimensional scene and object data, which greatly reduces the amount of data required for distribution.

2.3 Content data distribution end

The content distributor receives the produced scene content file through the network server, and with the optional content distribution network (CDN), provides the access, retrieval, addition, deletion and other capabilities of the scene description file and resource file, to achieve the rapid distribution of the produced content in many places.

2.4 Content experience and interaction end

After the content experience end obtains the scene description file and resource file from the content distribution end, it generates the 6DoF VR video scene conforming to the description in real time, dynamically and asynchronously. Users can enter the scene through different terminals, experience the scene in six degrees of freedom, and communicate and interact with other users in the same scene in real time with low delay. The screenshot of museum scene shown in figure 3.

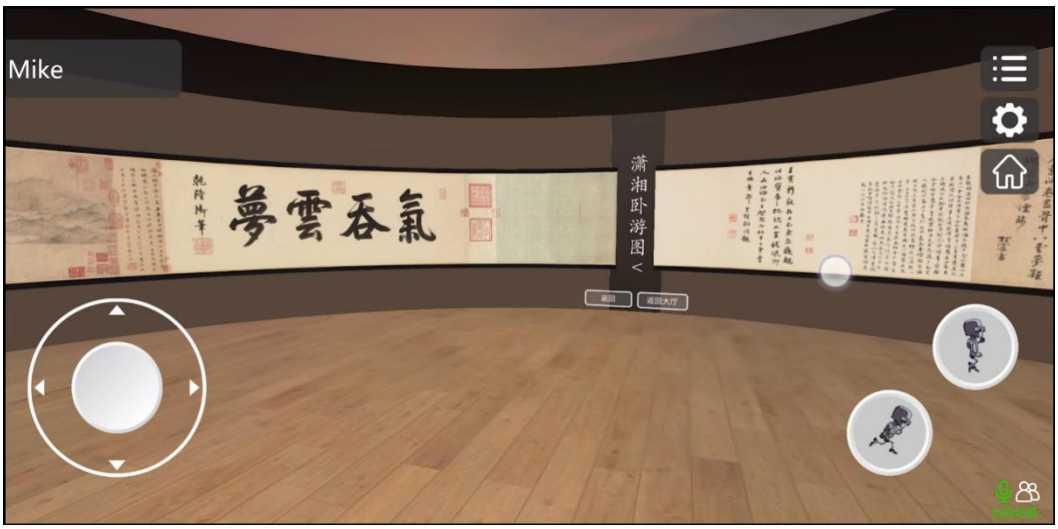


Figure 3 Screenshot of the museum scene

The key technologies of the content experience end are as follows:

a) Users can browse, retrieve, and access all the scenes stored on the server. After selecting a scene, the system automatically downloads and decompresses the corresponding resource file to load the scene template (shown in Figure 4);

b) The experiential software can asynchronously and dynamically fill the material, set the location and various properties, add interactive areas and behaviors, then generate 6DoF VR video scenes in real time (shown in Figure 4);

Figure 4 Users choose the scene and viewing area

c) The sensor of VR headset display and other devices can capture the user's gaze angle and spatial position information in real time, and then dynamically match and display/hide the interaction area inside/outside the current field of view, guide the user's scene, and improve the concentration of its experience;

d) The experience end supports multi-sensory integration of multi-modal content, and enhances the user's immersion experience and the awareness of scene information through ultra-high-definition image rendering and spatial audio playback;

e) Through real-time network data exchange, support multiple users to experience the same scene at the same time, and through voice and other low-latency interaction;

f) Use the sensor of VR headset display and other devices to obtain the key point pose of the user's part bone, deduce the parent bone pose based on reverse dynamics, and then adjust the whole bone chain data to generate natural digital image action animation (shown in Figure 5);

Figure 5 Generate natural digital image motion based on reverse dynamics

g) Compatible with the OpenXR standard, generate content experience terminals running on different devices and system platforms, adaptive adjustment of interaction interface, interaction mode, operation parameters, etc., to achieve multi-user, cross-platform real-time interactive experience of 6DoF VR video content, so that the wide range of 6DoF VR video content promotion and application is no longer limited to VR hardware equipment.

3. High-light features (Data based on actual tests)

a) The equivalent video resolution is more than 64,000 ×3840, and the spatial audio effect is equivalent to 32 channels;

b) The 6DoF VR video frame rate reaches 120fps, the number of scene vertices exceeds 11000, and the number of triangular pieces exceeds 14500;

c) Compared with the ordinary 6DoF VR system, the user's memory ability, understanding ability and immersion score of the 6DoF scene are improved by 12%, 27% and 13% on average;

d) The server is configured with 16GB memory, which can support 300 users online in the same scene at the same time. The delay of multi-user voice interaction is less than 200ms;

e) The system supports real-time calculation of 144 skeletal pose animations with a frame rate of 75fps;

f) Terminal type supports computer, mobile phone, tablet, VR headset and so on.

4. Application Scenarios

In the 6DoF VR video content production, the complex and time-consuming 3D scene production is converted to 2D graphic design and editing, which greatly reduces the difficulty of 6DoF video content production and saves production time and cost. At the same time, the generated scene content data can be described by text serialization, avoiding the direct transmission of 3D scene data, also reduced the amount of data required for distribution.

In terms of 6DoF VR video content experience, it supports multi-modal data multi-sensory experience, multi-user real-time experience, and low-latency interaction, and supports cross-platform experience of VR headsets, mobile phones, tablets, computers, and other devices.

The system can be applied to a variety of pattens such as VR+ cultural travel, VR+ education, VR+ training, VR+ entertainment and so on. At present, the system has been applied to some offline teaching points of Peking University Golden Autumn Education Group (shown in Figure 6), Migu Virtual Museum project, etc., and is promoting the application with Henan Museum, Bohua Ultra-HD Innovation Center, Shanghai Jing Qing Hui Vision Technology Co., LTD.

Figure 6 Application case of Peking University Golden Autumn Education Group

Automatic AI-based Sports Events Production Revolution, Yan Kaihua, China Broadcasting Network Chongqing Co., Ltd

Abstract:

AI live streaming system of China Broadcasting Network Chongqing Co., Ltd (CBNCC) combines leading AI live streaming technology with existing 5G and cloud platform businesses to shoot, stream and analyze long-tail sport events (sub-professional, mass and campus events) that account for 99.5% of total sports events. The system consists of three main modules: AI camera, cloud platform for sport events live broadcast, and mini program for sport events live broadcast.

Key words:

AI live streaming, 5G, Cloud platform, 8/12K Panoramic video

1. Background

Judging from the high frequency of various types of sport events held in markets across the country after the easing of the epidemic, long-tail sports events have huge numbers of events, low barriers to live streaming participation, and broad market prospects. In 2021, the total output value of sports media and information services was 104.5 billion CNY, an increase of 19.9%. However, sports live streaming is still mainly limited to professional events, while long-tail events (sub-professional events, mass events, campus events) that account for 99.5% of total sports events are still a blue ocean market. Long-tail sports events include sub-professional events, mass events, and campus events, organized by local sports bureaus and associations, various civilian sports operation partners, the Ministry of Education, schools, etc. Mass sports live broadcasting has the characteristics of huge number of events, low barriers to live streaming, relaxed policies, and strong user willingness to pay, and the market is promising.

The traditional sports broadcasting industry is mature, but due to cost constraints, 99.5% of sporting events have not been able to be presented to the public in the form of live streaming or professional broadcasting. After thorough analysis and research, CBNCC believes there is still room to tap into the long tail sports events market.

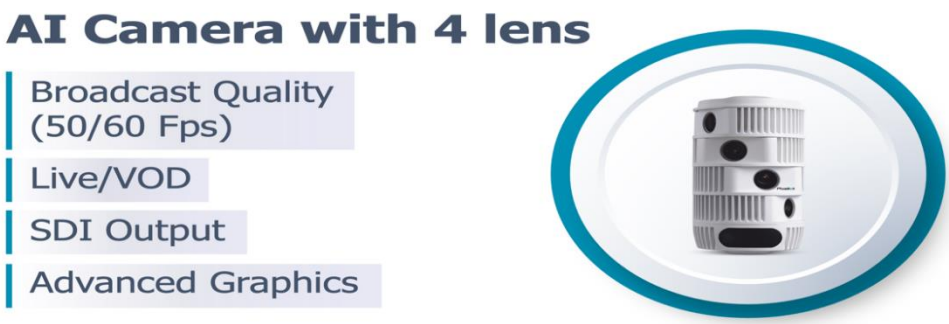
Based on CBNCC's self-built cloud platform and 5G services, combined with the AI-based live broadcast system for sports events, CBNCC will build a platform for capturing, production, live broadcasting, and data analysis of sports game. This will create new economic growth points for the company.

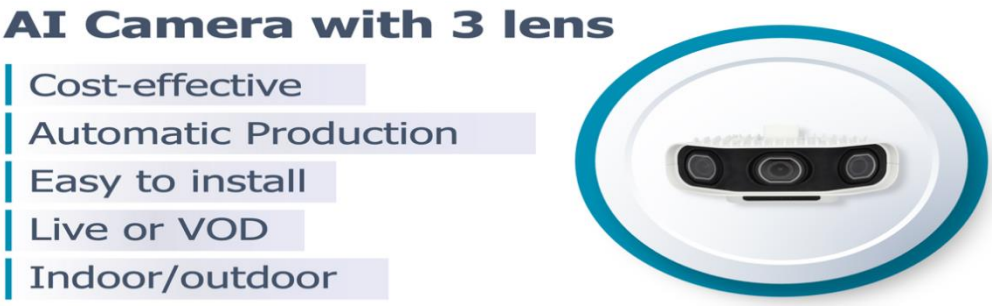
2. Solution Introduction

Based on the above requirements analysis and product program R&D, focusing on mass live streaming of sports events, CBNCC has innovatively launched the "AI Live Streaming + 5G + Cloud Platform" full-stack integrated solution. The entire innovative application mainly consists of the following three core modules and has connected and docked a unified technical architecture for commercial operation promotion, so that the sponsorship of event live streaming can be directly reached, and efficiency improved through the internet advertising and marketing system.

2.1 AI Camera

Live image stitching: 3/4-lens AI camera achieves panoramic image shooting; edge workstation realizes image stitching and splicing.





Automatic cropping and tracking: Based on live broadcast techniques, automatically crop the footage to follow the players and the ball, with camera pans, zooms, tilts, and tracks. Automatically analyze and track all the iconic objects in the footage (such as the backboard, hoop), the ball, and the players.

Lightweight and easy to deploy: Supports mobile installation, IP66 protection rating, can be used indoors and outdoors.

2.2 Cloud platform for Sports Event Live Broadcast

CBNCC realized the widespread demand in the market for live broadcasts of major sports events. They launched the "CBNCC Live Sports Broadcast PaaS Service Platform". This platform has the capabilities of connecting to diverse live broadcasting devices, stadium management, event management, media storage and distribution, and AI model invocation. It also provides rich APIs to frontend SaaS partners, meeting the diverse needs of connecting devices, media distribution, and data analytics on the frontend business side. This live sports broadcast PaaS service platform provides end-to-end capabilities including automated event filming, cloud-based intelligent playout and distribution, graphic and text ad insertion, player data statistics and analytics. The sports content is broadcasted live over the internet, mobile devices, reaching a wider consumer base.

2.3 Mini Program for Sports Event Live Broadcast

The main functions include event information, event initiation, event registration and fee collection, competition schedule arrangement, competition results display, picture live broadcast, video live broadcast and a series of other functions. For C-end users, there are functions like registration management, event

sign-up, score inquiry, recruiting players and teams, online check-in, one-click sharing, etc., providing convenience for users.

Based on the unified front-end App/WeChat mini program architecture and functional modules, the data summary of events has more accurate statistical sources, and it is also easier to precisely reach advertising and marketing resources.

3. Market Analysis

According to the 2022 statistics from the General Administration of Sport of China, there are currently 2,626,600 sports venues across the country. Among them, venues for football, basketball and volleyball, the "three major balls", account for 1,339,900, taking up 51.01%; venues for table tennis and badminton account for 1,181,400, taking up 44.98%; venues for other ball sports account for 105,300, taking up 4.01%. Compared with the large population, national venue resources still have great potential for development. Relying on various types of sports venues to host mass sports events, while satisfying people's basic needs for physical health, also stimulates consumption for the entire sports industry.

A rough estimate shows that just the three major ball games in Chongqing (excluding informal pick-up games) involve hosting 100,000 games per year. Estimating based on 105 Type II megacities nationwide, the annual total number of hosted and undertaken major ball games is 5-8 million, involving 1 million participating teams, 20 million direct participants, and up to 100 million indirect participants.

4. Conclusions

If intelligent, high-quality, low-cost, automated sports live broadcasting solutions without manual participation can be adopted for mass sports events across the country, it will present more wonderful events to consumers, enabling mass sports events around people to receive intelligent and high-quality broadcasting.

This solution can not only create value for CBNCC through device sales and complementary cloud resource sales, but also fully leverage CBNCC's advantages to draw more social attention to sport events, attract more business sponsorship and advertising, and facilitate the virtuous business cycle of event operation.

Moreover, the unified sports live streaming cloud platform can assist in

providing objective and authentic mass sports statistics. It can help professional and semi-professional sports clubs improve their performance, also assist the government in generating data reports and decision-making basis regarding sports industry development.

Technical Committee Meeting
28.10.2023 - 13:30-17:00 & 29.10.2023 - 9:00-17:00
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Introduction of 5G New Radio Multicast Broadcast, Xue Kaixin China Broadcasting Network Group Corporation Ltd

Abstract： As a new generation of mobile communication technology, 5G is believed by the industry to continue to change future economic development and social life in the further deepening transformation of the digital economy. 5G NR multicast broadcast technology (hereinafter referred to as"5G NR Broadcast") can fully leverage its broadcast advantages to provide public service scenarios such as public safety, mission critical emergency communication, and emergency broadcasting, exploring new application fields in industries such as V2X, IoT, XR, and multimedia.

Key Word: 5G, Multicast, Broadcast

1. Introduction

Against the backdrop of the booming development of mobile internet, users have formed a habit of mobile, interactive, and fragmented video viewing. Using a full range of intelligent terminal devices such as mobile phones, televisions, tablets, and wearable devices, watching videos and live streaming anytime and anywhere based on mobile networks has become the new norm in all scenarios such as urban buildings, high-speed transportation, and remote outdoor environments. In order to meet the new demands of users for video and information services in the new situation, the broadcasting industry urgently needs to accelerate technological innovation and complete the reconstruction of mobile, interactive, and ubiquitous service forms.

5G NR broadcast utilizes 5G's existing communication technology and does not require modifications to the base station and terminal hardware, allowing users to receive broadcast services anytime and anywhere. The existing unicast services transmit data content through point-to-point methods, while 5G NR Broadcast uses point-to-point transmission, which can effectively save network resources and improve transmission efficiency. 5G NR Broadcast is widely applicable to various types of 5G universal terminals, and can also receive broadcast services without SIM card. It not only solves the long-standing problem of high bit rate and high-quality multimedia business concurrent transmission in broadcast networks and communication networks, but also supports dynamic seamless switching between unicast and multicast broadcast services, providing new interactive video services.

2. System Overview

5G NR Broadcast multiplexed 5G core network and cellular base station resources, to unicast, multicast, broadcast dynamic intelligent switching, adapted to standard 5G general terminals, to achieve access and non-access terminal service synchronous reception.

Technical specification of 5G NR Broadcast access network, including the overall architecture of wireless system, network interface, basic functions of physical layer, multicast broadcast service protocol architecture, group scheduling, QoS and multicast broadcast processing process, etc.

2.1 Transmission Mechanisms

Broadcast service data is distributed to the NG-RAN base station by 5GS and then broadcast to UE through the air interface which can provide efficient network resource utilization, especially on the wireless air interface with the following characteristics:

1. Only downlink broadcast; UEs in all RRC states are supported.

2. Data is delivered over a broadcast channel over the wireless. Unlike UE unicast, there is no air interface data feedback or retransmission.

3. Start / stop broadcast session based on MBS area (cell list and / or TA list).

MBS session creation: MBS session creation is used by AF(Application Function) to create a 5GC-oriented MBS session. MBS session creation takes place in several steps (such as TMGI assignment, providing information about the MBS session, requesting the activation of the MBS session). The last step of MBS session creation triggers resource establishment for downlink broadcast data transmission between 5GC and NG-RAN. For broadcast communication, after MBS session creation and session establishment, the established resources exist not only between 5GC and NG-RAN, but also between AF and 5GC.

Service announcement: A service announcement is used to distribute information to a UE about the service receiving the needed service (for example, an IP multicast address (es)) and possibly other service-related parameters (such as service start time). This step can be done in parallel with MBS session creation or later. Service bulletin information can be pre-configured on the UE side.

Data transmission: The stage at which broadcast data is transmitted over an air interface. The broadcast data is transmitted to the gNB in the broadcast area, and the gNB delivers the broadcast service in the form of a public channel. All terminals with the broadcast APP enabled can receive the broadcast data. The UE in the same channel and region receives the same data.

Session release and delete: A session is released whenever there is no longer any need to transmit broadcast data. The resources in the 5GS are released and the broadcast session is

deleted.

2.2 Transport Stream specification

Broadcast transmission MTCH sends broadcast PDSCH based on PDCCH scheduling. RNTI for broadcast is G-RNTI, DCI format is 4-0, and its value space is configured in the same space as C-RNTI. Broadcast transmission without HARQ retransmission and feedback.

Broadcast MAC layer scheduling is performed according to TS 38.321.

The RLC layer adopts UM mode.

The broadcast layer PDCP window sets the window location based on the first data packet received.

2.3 Applications

In November 2021, based on 5G NR Broadcast, CBN completed the verification of new broadcast services such as multi-angle viewing and panoramic VR video live broadcasting in the Beijing Winter Olympics test events. This is the world's first system capability verification of 5G NR MBS in commercial scenarios, which is of great significance to the subsequent acceleration of the industry chain maturity and full-scenario business innovation.

With 5G NR Broadcast, audiences in the stadium can freely choose to watch live content such as multi-angle and VR panoramas on 5G terminals including mobile phones and VR wearable devices, without video jams caused by high concurrency. 5G NR Broadcast realizes the high-concurrency transmission of high-bitrate multimedia content on consumer mobile phones, which cannot be achieved by traditional broadcast technologies. 5G NR Broadcast deployment integrating VR/XR and other new multimedia formats will create innovative services for broadcasting industry.

3. Field trial

In 2021, based on 5G NR Broadcast, the technology was tested in Beijing TV Tower, Shanghai Oriental Pearl TV Tower and Nanjing TV Tower respectively. Information about the tests has been submitted separately to ITU-R SG6 in the form of information notes.

4. Conclusions

5G NR Broadcast takes the existing 5G communication technology and adopts point-to-multipoint transmission mode, which can effectively save network resources and improve transmission efficiency. 5G NR Broadcast is widely applicable to all types of 5G general terminals. It not only solves the problem of concurrent transmission of high bit rate and high-quality services in broadcast networks and communication networks for a long time, but also supports dynamic

seamless switching between unicast and multicast broadcast services and provides new interactive video services and converged information broadcast services.

5G NR Broadcast can meet the needs of users with diversified content, ubiquitous terminals and bi-direction interactive services, and realize the service reconstruction and innovation of broadcasting and TV services from one-way to interactive, from linear TV channels to all kinds of content services, from home fixed scenes to all kinds of scenes, and from TV sets to all kinds of intelligent terminals. It is of great significance to promote the transformation and development of the radio and television industry.

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Research and Application Demonstration of Intelligent Recommended Channels for Cable TV,

Dong Yuan，YaoMiaohua，Cao Yali Beijing Gehua CATV Network Co.,Ltd.，Wasu Media & Network Co., Ltd.,BesTV NetTV Technology Development Co., Ltd.

Abstract

The Cable TV Intelligent Recommendation Channel Research and Application Demonstration Project is a collaborative research and application initiative aimed at enhancing the viewing experience of cable TV users in Beijing, Shanghai, and Zhejiang. The project innovatively collected massive data, organically integrating live TV resources with on-demand columns, researched and utilized autonomous and controllable intelligent recommendation algorithms tailored for the broadcasting industry, following the design idea of "short with long, convergence of business", designed a user-friendly and concise interface, analyzing the behavioral patterns and interests of each viewer, and realizes the intelligent channel recommendation under manual intervention while ensuring safety. Under the premise of ensuring security, the project achieved a manageable, controllable, and user personalized intelligent channel recommendation application through intelligent assisted scheduling with manual intervention. Currently, the project has covered over 3.1 million terminals, with a cumulative user base exceeding 1.1 million, and the cumulative number of users has exceeded 1.1 million, demonstrating significant social and economic benefits.

KeyWords Self-recommendation algorithm, Innovative user experience design

1. Introduction

With the popularity of video applications such as IP network short videos and online live streaming, users gradually preferred new network audiovisual content forms. Traditional live TV lacks intelligent recommendation services, and the viewing pattern is predetermined by TV stations and operators, with programs played in fixed sequences. With the continuous increase in live TV programs, users need to constantly switch among hundreds of TV channels to choose the programs they like to watch. The traditional user interface for program selection is a uniform layout, and the TV interfaces adopts content tiling page design with deep hierarchical levels, making it inconvenient for users to

operate with a remote control. In order to improve the viewing experience of cable TV users, intelligent recommended channel application technology solution is designed based on four aspects: data aggregation, independent and controllable recommendation algorithms, user experience design, and security solutions

2. Technical solution

We mainly embodied the cable TV intelligent recommended channel technology solution in the data layer, algorithm layer and business layer of the related technology system.

2.1 Data aggregation

The user data for the intelligent recommendation channels on cable TV is based on the 'end-to-end data collection system' of the cable TV network operator, serving as the big data foundation. has collected log information from dozens of systems in the cable TV operator's cloud platform, such as live viewing hours, network status, box status, peripheral information and other data collected by TVOS-based smart terminals. It also gathered usage data for replay and on-demand services for both QAM VOD system and IPTV VOD system. Taking Beijing Gehua Cable TV Network Co., Ltd. as an example, the big data infrastructure platform has gained log information of 39 systems, and the daily data volume has reached 1.09 billion entries, with a daily capacity of 400G. The hot data for three months has gathered over 80 billion entries, with a storage capacity of more than 55TB, while the cold data has been retained for the long term, and with an accumulation of data of nearly 400TB after compression and processing.

2.2 Self-recommendation Algorithm

Based on data collection, Cable TV Intelligent Channel Recommendation Project combines various usage scenarios and demands to research and select the most suitable recommendation algorithm to maximize the association between users and TV programs. The recommendation algorithms for the Cable TV Intelligent Recommendation Channel also consider the algorithm's runtime and recommend different content under different interfaces while ensuring algorithm accuracy. Users do not need to see the algorithm's execution process, everything will be provided as feedback through the personalized interface displayed to each individual user. The recommendation algorithm for the Cable TV Intelligent Recommendation Channel is an independent and controllable intelligent recommendation algorithm with the characteristics of broadcasting and television, compared the functionalities of leading internet companies, referring to the mature algorithms of the Internet's big data platforms, absorbing and converging on the user profiles and data characteristics accumulated by Internet companies.

The recommendation algorithm for the Cable TV Intelligent Recommendation Channel primarily utilizes content-based algorithms and collaborative filtering algorithms, which could integrate live TV and interactive on-demand content recommendations based on

each user's personalized behavioral characteristics and interests, based on the convergence of live TV and interactive VOD content recommendation, reconfiguring the recommendation process, and achieves intelligent assisted scheduling with manual intervention, providing a manageable and controllable personalized intelligent channel recommendation application for users.

2.3 Innovation design of User experience

At the beginning design stage, the intelligent recommendation channel followed the design concept of "short with long, convergence of business." By recommending content through short videos on the intelligent recommendation channels and providing user prompts through interactive interfaces (such as 'long press "OK" to watch the full video'), users can be directed to interfaces for consuming longer content.

The user interface of the intelligent recommendation channel contains “Daily Recommendations,” “Live Broadcast,” “Children,” “Movies,” “Military,” “TV Dramas,” “Variety Shows,” and other columns It also features interfaces for viewing history, favorites, additional operations and more. Eliminate the existing cumbersome and complex interaction design mode, following the design philosophy of "Great Truth in Simple Words", it offers users with a full-screen "immersive" viewing experience, reducing the need for excessive operations. Users can navigate and access content swiftly using the remote control's “Up,” “Down, ” “Left, ” “Right, ” and “OK” buttons.

The Intelligent Recommendation Channel transforms the original set-top box user profile into different family members such as “Family,” “Grandfather,” “Grandmother,” “Dad,” “Mom,” “Boy,” and “Girl.” Each family member can customize their viewing columns, track viewing data, and independently generate personalized intelligent recommendations.

At the same time, the cable TV intelligent recommendation channel unified TV screen and mobile screen content label system, it simultaneous launched the "GehuaCloudTV" WeChat mini-program. This mini-program allows users to watch live, replay, and on-demand TV programs on their smartphones. It offers features such as synchronized screen projection between mobile and large screens, smartphone remote control, search functionality, intelligent recommendations, and social sharing. This allows users to select and play live and on-demand programs through their smartphones and control the set-top box's large screen via smartphone remote control. This solution effectively addresses the user-unfriendly and poor experience issues associated with operating the set-top box TV on a large screen. It fully demonstrates the complementary and synergistic relationship between large and small screens, as well as the user experience advantages of integrated fixed-mobile applications.

2.4 Security Solutions

The various applications of Cable TV Intelligent Recommendation Channel are cross-platform, cross-network, and fixed-mobile convergence products, which have high requirements for network security and data security. Relying on the existing network security structure of Cable TV Network Corporation, it targeted the network security

program of Cable TV Intelligent Recommendation Channel to strengthen the deployment of network security system protection to ensure that it meets the high security protection standard of "Level 3". In terms of data security, the user data processing related links to strengthen data service control, introducing the technical concept of privacy computing to strengthen the user data security protection and output, docking and other work.

It enables multiple non-trusted data sources (various departments, affiliated companies, third-party organizations) to share data securely among themselves and with end-users, ensuring both data sharing and safe data transmission. Additionally, it ensures that the shared data remains protected, and the use and dosage of the data are stipulated. So that multiple users can carry out multi-dimensional, multi-featured analyses and refinement of the use of the data under the prerequisite of obtaining the specific right to use the data only. In the event of data anomalies and other problems, it also equipped the Cable TV Intelligent Recommendation Channel with emergency handling and one-click offline functions for content and services to ensure security and control.

3. Evaluation and data results

Cable TV Intelligent Recommendation Channel has been running stably for a long time, covering over 3.1 million terminals. After dozens of iterations and optimization, the app has been running stably for 8 months (so far). The WeChat mini-program "GehuaCloudTV" as an example, has added 12,000 new users since September 2022. Based on the experience of the current mature application, Cable TV Intelligent Recommendation Channel will gradually expand the application coverage and the number of terminals nationwide.

Indicators (2022.9 to present)	BEIJING	SAHNGHAI	HANGZHOU	statisticians
User coverage (million)	205	55	50	310
Cumulative number of users (million)	77.09	20.3	19	116.39
Average daily active users (persons)	16900	8200	5096	30196
Average daily activity rate	2.36%	4.23%	3.03%	3.2%(average value)
Average daily content plays (million)	1.7	8.7-13.4	4.9	15.3-20
Average household hours of use (minutes)	26.3	95.47	66.6	188.37
Average number of plays per household (times)	5.8	14.14	14.5	34.44

The Cable TV Intelligent Recommendation Channel has significantly enhanced the user viewing experience, increased daily engagement on large TV screens, and improved user retention. Its exploration into various forms of television products in different scenarios for future products has shown notable results. Taking Beijing's recent statistics as an example, set-top boxes with the Cable TV Intelligent Recommendation Channel have shown significant improvements: the daily activity rate increased by 2.78%. On average, households increased their monthly usage duration on large screens by 313 minutes, a 5.25% improvement. In terms of on-demand services, the average monthly on-demand content playbacks per household increased by 18.09%, and the monthly viewing duration of on-demand content per household increased by 29.76%. Additionally, there was an 18.94% increase in active user numbers, and the average daily on-demand content playbacks per household rose by 30.98%. In January 2023, after expanding the coverage of the Intelligent Recommendation Channel, the subscription data for Beijing's 'Kuai Dian' premium on-demand product package increased by 56% compared to the daily average in December 2022, fully demonstrating the effectiveness of the application.

4. Conclusion

The Cable TV Intelligent Recommendation Channel has enabled a more precise understanding of users' personalized needs and trends, promote the iterative upgrading of traditional cable TV services to Intelligent Recommendation TV services, serve the national cultural digitalization strategy guideline, pragmatically promote the development of deep integration of broadcasting and television media, achieve high-quality development of broadcasting and television, further merge the cable TV communication position, innovate and expand the mainstream ideology of the main position.

Promote the sale of long content through the "short to long" approach. With a better understanding of subscriber behavioral data, the cable TV industry can provide advertisers with more accurate advertisement placement services and improve the conversion rate and ROI of advertisements.

The cable TV intelligent recommendation channel requires extensive data support. Through the application of the intelligent recommendation channel, the cable TV industry is aggregating huge amounts of content data, getting richer and more diversified data resources, and establishing a collaborative working mechanism of jointly contributing and benefits-sharing. At the same time, it is providing more application scenarios and business opportunities for the data industry.

Technical Committee Meeting
28.10.2023 - 13:30-17:00 & 29.10.2023 - 9:00-17:00
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Introduction of a Smart TV Operating System,

Sheng Zhifan, Academy of Broadcasting Science, NRTA

Abstract: TVOS (Smart TV operating system) is a set of intelligent operating system independently developed by China, which is specifically designed for TV terminals. The research and development of TVOS conforms to the trend of technological and industrial development, and builds an open operating system architecture that is secure, controllable, cross-hardware platform, layered decoupling, tailorable and splicable, and has multiple application frameworks. It is a smart operating system tailored for the new generation of smart TV terminals, which not only achieves security and controllability in the industry, but also integrates the world's best open source achievements.

Key words: Smart TV terminal, TVOS, Safe and controllable, All media processing

1. Introduction

In 2010, with the development of new-generation information technologies like mobile internet, the smartification of TV terminals became an inevitable trend and a crucial goal in the broadcast television industry. At that time, China lacked a domestically controlled smart TV operating system, and the development of smart TV terminals was at risk of being dominated by foreign smart operating systems and constrained by foreign technologies. Therefore, it is urgent to develop an autonomous and controllable smart TV operating system to safeguard Chinese cultural security and ensure industrial dominance.

Furthermore, due to the severe fragmentation of cable television network terminals in China, meaning that a cable television set-top box used in one region couldn't be deployed in another, addressing this fragmentation was essential alongside the development of smart broadcast and television terminals. This would provide the technical support needed to integrate the entire cable television network into a single network in China.

Under the guidance and deployment of the NRTA (National Radio and Television Administration), more than 120 organizations were organized by the ABS (Academy of Broadcasting Science) to successfully develop the TVOS, an smart TV operating system with independent intellectual property rights. Currently, TVOS supports 13 chipsets from five domestic companies, and there are over a hundred terminal products. The total TVOS terminals count in the fields of cable television, satellite broadcast, and internet TV exceeds 38 million units. It effectively replaces foreign smart TV operating systems, resolves the issue of fragmentation in cable television terminals, lays the technical foundation for the integration of China's cable television network, and prepares China for the accelerated development towards ultra-high definition television.

2. Technical characteristics

The television operating system (TVOS) consists of the rich execution environment (REE) and trusted execution environment (TEE). The TVOS REE employs a hierarchical and modular software architecture and consists of five functional software layers, kernel, hardware abstraction layer (HAL), functional component, execution environment and application framework in a loose-coupling mode. Each functional software layer consists of multiple software modules in a loose-coupling mode. The TVOS TEE consists of the secure OS, TEE HAL, and trusted application (TApp). The TVOS software architecture is illustrated in Figure 1.

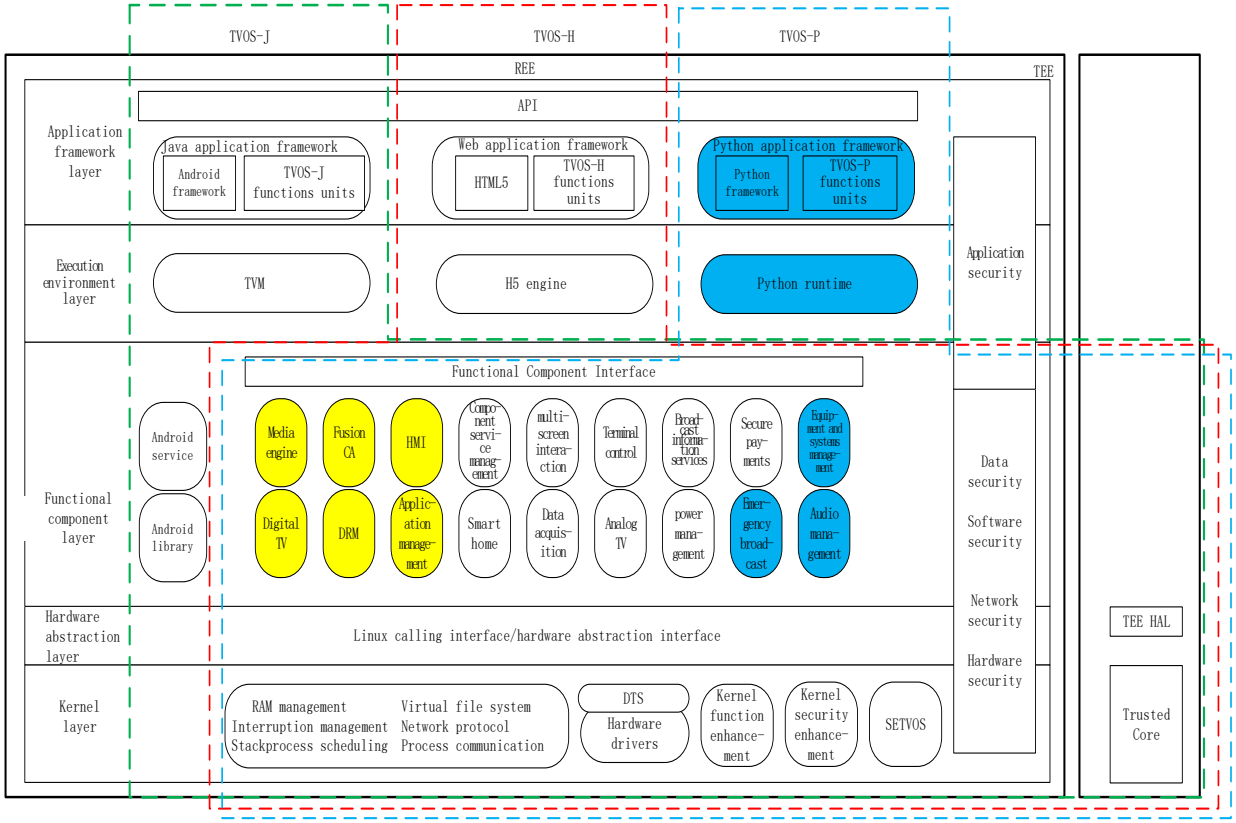

Figure 1 TVOS software architecture

2.1 Highly cohesive, loosely coupled software architecture that supports parallel multi-application environments

The TVOS software architecture exhibits characteristics of high cohesion, loose coupling, and supports concurrent operation in multiple application environments.

High cohesion in this architecture is manifested in two ways: firstly, it allows various functions to be aggregated into a super functional component in a flexible and extensible manner, providing services to other software modules or applications through standardized interfaces. Secondly, it enables multiple functional components to aggregate into a super-aggregated software module with a specific business function through a component calling mechanism. The functional components initiating and performing the aggregation provide specific business support capabilities to applications.

The loose coupling feature of this architecture is evident in two ways: firstly, there is loose coupling between different software layers, such as the Linux kernel layer, hardware abstraction layer, functional component layer, execution environment layer, and application framework layer, such that changes in one layer do not significantly impact other software layers. Secondly, there is loose coupling between various functional components within the functional component layer, meaning that changes

to one component do not have a significant impact on other components. Each functional component can be independently extended, upgraded, replaced, or trimmed.

This architecture supports concurrent operation in multiple application environments. TVOS versions can independently run Web applications, denoted as TVOS-H. It can also independently run Java applications, referred to as TVOS-J, or Python applications, known as TVOS-P. Furthermore, TVOS can simultaneously support the parallel operation of Web and Java application environments, known as TVOS-C, and Web and Python application environments, termed TVOS-HP. It can even support the simultaneous operation of Web, Java, and Python application environments, referred to as the full TVOS version.

2.2 Efficient, flexible and open all-media processing technology based on hardware security

TVOS is built on the GStreamer framework, forming a media engine component. It enhances the processing capability for various media scenarios, including AVS2/3 audio-video codecs, standard-definition/high-definition/4K/8K resolutions, and HLS/HTTP/UDP network video protocols. It accomplishes audio and video parsing, playback, recording, and forwarding for diverse media scenarios, such as digital TV broadcasting, on-demand TV, 3D/VR videos, local video playback, internet TV, emergency broadcasting, visual communication, cloud video gaming, and more. This architecture addresses the static and rigid nature of media processing functions and protocol/format interpretation while implementing an adaptive audio-video synchronization mechanism for various scenarios. Additionally, TVOS's media framework supports secure video pathways based on the Trusted Execution Environment (TEE), with the ability to adhere to various digital rights management content protection standards and conditional access systems. It optimizes user experiences during channel switching, on-demand playback, low-latency playback, and makes notable technological advancements. Furthermore, TVOS resolves the issue of insufficient bandwidth for transmitting 8K ultra-high-definition video streams through broadcasting multiple channels reception and demultiplexing technology, supporting 8K ultra-high-definition live television.

2.3 All-round layered security defense system based on hardware security

TVOS has designed a comprehensive hierarchical security defense system based on hardware security, providing all-encompassing security protection from hardware security, software security, data security, network security, to application security. Leveraging the security computation mechanisms under the Trusted Execution Environment (TEE), digital certificate security trust mechanisms, and security trust chain verification mechanisms, TVOS achieves security protection for both the system itself and the applications it hosts, capable of resisting security risks such as

unauthorized firmware flashing and the installation of illicit applications. Additionally, TVOS employs a secure video path mechanism to secure media video content, effectively mitigating issues related to tampering and illicit recording, thus ensuring the safety of video content. TVOS utilizes open digital television conditional access multi-terminal processing technology, which supports the dynamic download of conditional access terminal applications (App) and trusted applications (TApp), effectively addressing the problem of smart TV terminals being tightly bound to specific conditional access service provider products. Furthermore, TVOS incorporates open video digital rights management multi-terminal processing technology, supporting the dynamic download of digital rights management terminal applications (App) and TApp. This resolves the issue of smart operating systems needing pre-integrated digital rights management terminals to support corresponding digital rights management systems, enabling intelligent security management of video content rights.

2.4 Multi-Screen Interaction Technology Across Local and Wide Area Networks

TVOS has introduced device discovery and connection technologies in heterogeneous network environments and designed multi-screen interaction protocols across local and wide area networks. This innovation transcends the limitations of local area networks, enabling smart interaction and cross-screen interaction and transmission between smartphones and other intelligent devices, such as TV with TVOS, even when they are located in home Wi-Fi local area networks and 5G or other wide area network environments. TVOS's multi-screen interaction protocols primarily include discovery protocols, link establishment protocols, control protocols, and transmission protocols. Among these, the discovery protocol accomplishes Bluetooth discovery, local area network discovery, and wide area network discovery. The link establishment protocol facilitates direct connections within local area networks, direct connections across wide area networks, wide area network relay connections, and link selection. The control protocol enables local resource playback, online resource playback, command control, and coordinated control, while the transmission protocol supports HTTP data transmission, RTP/RTSP data transmission, and HLS data transmission."

2.5 Open Digital TV Conditional Access Multi-Terminal Processing Technology Supporting Dynamic Downloads

TVOS has designed a dynamic download open digital TV conditional access multi-terminal processing technology, which manages various conditional access terminal applications implemented in different forms, such as applications based on the Rich Execution Environment (REE) and trusted applications (TApp) based on the Trusted Execution Environment (TEE). It also supports the collaboration of corresponding App and TApp, providing comprehensive support for conditional access technology. TVOS

further enables the dynamic download, on-demand loading, and simultaneous execution of the respective App and TApp for multiple conditional access terminals. Following TVOS's REE and TEE architecture, the REE and TEE security communication mechanisms, as well as the hardware security protection mechanisms based on hardware security chips at the TEE side, the security-critical components of conditional access terminals are implemented within the TApp, while the less security-critical components are implemented within the App of the conditional access terminal. Any product from a conditional access service provider can run on TVOS as long as it adheres to the architecture defined by TVOS and the supported API interfaces. Through this approach, TVOS resolves the issue of close coupling between broadcast smart TV receiving devices and specific conditional access service provider products.

3. Technical Advantages

Operating systems similar to TVOS primarily include Android for TV, hereafter referred to as “Android TV.” In comparison to Android TV, TVOS holds the following advantages:

1) **Support for Live Television:** TVOS inherently possesses the 'genetics' to support live digital television. It comes with digital TV feature component software modules, effectively overcoming the challenge that Android TV faces, which cannot support live digital television.

2) **Media Processing Capability:** TVOS excels in its ability to efficiently and securely process various media formats, multiple protocols, encapsulation formats, and encoding standards (such as AVS2/3). In contrast, Android TV has a fixed media player that can only handle specific media protocols, encapsulation formats, and encoding standards. Enabling support for different protocols and formats in Android TV demands significant effort, involving the development of an end-to-end media processing workflow, including hardware drivers.

3) **Support for Multiple Application Platforms:** TVOS supports the independent execution of web applications and simultaneous execution of web, Java, and Python applications. In contrast, Android TV lacks support for Python applications, and web applications are dependent on the Java runtime environment to function correctly.

4) **Media Security and Protection:** TVOS boasts comprehensive, hardware-based security capabilities, including secure video paths and a unified media resource control mechanism. This ensures the security of media content. Android TV, on the other hand, relies on user permissions for controlling media content, potentially introducing the security risk of excessive media service permissions.

5) **Support for Conditional Access, Digital Rights Management, Emergency Broadcasting, and Live Satellite Services:** TVOS includes integrated support for conditional access capabilities and open digital rights management. It supports domestic technologies like ChinaDRM and national encryption algorithms, as well as features for emergency broadcasting and live satellite services. Android TV lacks these capabilities.

6) **Security and Control:** TVOS development and management are led by the TVOS working group, providing control over source code and development direction. In contrast, Android TV is primarily led by foreign companies, which may introduce the risk of external technology control."

4. Industry Ecosystem

TVOS has established a comprehensive industry ecosystem encompassing chip manufacturers, content and service providers, cable TV network operators, terminal solution providers, and terminal hardware manufacturers.

In terms of chip manufacturers, chip platforms like Hisilicon, Goke Microelectronics, Shanghai Gaoqing, NationalChip, and Megacore have implemented support for TVOS. Regarding content and services, TVOS effectively supports a wide range of digital TV services, including cable, wireless, and satellite broadcasting. It also extends support to IPTV and OTT video-on-demand content. On the terminal side, TVOS has become the preferred solution for leading domestic terminal solution providers and major set-top box manufacturers. TVOS-based terminal products are available in various forms, such as set-top boxes, televisions, media gateways, smart speakers, and more. The product lineup comprises over 100 models, with support for nearly 200 different service applications.

5. Conclusion

TVOS has filled a void in the field of smart television operating systems within the Chinese cable TV industry. It has played a pivotal role in driving the industry's transition to smarter, more intelligent broadcasting solutions. In addition to this, TVOS has achieved several technological breakthroughs and innovations in areas like software architecture, all-in-one media processing, security provisions, and cross-screen interaction. Moreover, it has fostered the growth of an independent industry ecosystem around TVOS, which has effectively addressed the issue of fragmentation among cable TV terminals in China, thereby laying a solid technological foundation for the seamless integration of cable TV networks across the entire country.

Upgrade and Application of Beijing Radio & Television Station 8K Ultra HD Technology System, Zhang Xiaodan, Wang Lidong Beijing Radio and Television Station

Abstract: The Upgrade and Application of Beijing Radio & Television Station 8K Ultra HD Technology System project continues to carry out the project construction based on the existing Ultra HD production and broadcasting technology system. It have established a comprehensive chain of pre-shooting, on-site production, post-production, broadcast and transmission. By innovating the business model ,it has enhanced the broadcast transmission system and business efficiency.The "Peking 8K" APP business operation functions have been enriched, with optimized the function interface and strengthening user stickiness. Through CATV, IPTV, public large screen and "Peking 8K" APP high-tech video mobile application transmission and distribution, It establishied an end-to-end communication chain. This project provides a long-term and stable supply of 8K content from its source, while creating basic technical conditions for upstream and downstream industrial chain related to

housing exhibition of 8K technology application such as chip research and development, equipment manufacturing, system integration, terminal consumption.Furthermore,it promotes the research and development of artificial intelligence video enhancement equipment and domestic 8K cameras, and enhances the quality presentation in both of 4K/8K formats along with multi-scene business adaptation capability of mobile terminals.

Key Word: 8K Ultra HD, Pre-shooting, On-site production, Post-production, Broadcast and Transmission

The existing 8K Ultra HD system of Beijing Radio & Television Station primarily consists of a cluster of shooting equipment, Apple Production Island, 8K broadcast transmission system, and the "Peking 8K" APP. With the official launch of the Beijing Radio & Television 8K Ultra HD experimental channel and the official launch of the "Peking 8K" APP, there has been a continuous increase in business volume. However, the current 8K system has exhibited certain shortcomings in terms of business

efficiency, production scale, capacity efficiency, and diverse presentation ability. To adress these issues while building upon the existing 8K technology system, an on-site production system, and post-production processes network have been established to enhance a large-scale production capacity and improve multi-modal presentation capabilitis.

During the combined with the 8K construction process, several technological innovations have been achieved. Firstly, by leveraging a unified technology architecture along with hierarchical encoding techniques, compatibility between HD / 4K / 8K depth has been realized to supports for multi-format mixed production and broadcasting services. Secondly, research and development efforts for domestic 8K cameras have been promoted alongside upgrading existing 4K broadcasting vehicle for used with the 8K EFP in order to facilitate agile expansion of 8K on-site production capability based on innovative application modes. Thirdly, collaboration between production and broadcast teams through an for generating subtitles in an 8k environment enables easier content revision and generation of multiple versions without incurring additional resource costs due to repeated outputting of slices.Fourthly, it utilizes the artificial intelligence technology to target the amplitude dimensions and performance parameters of mobile terminal, enabling the implementation of video enhancement processing that significantly improve the presentation effect of 4K / 8K Ultra HD on mobile phones and tablets. Fifthly, the 8K + XR virtual site production process improves the business efficiency and shooting effect by putting post-production forward. Throughout this project's development, six patents have been filed and accepted while additional three software copyrights have been authorized.

The 8K Ultra HD technology system provides robust support for the operation aspects of 8K channels, improves the supply of 8K Ultra HD and high-tech video content from the source, and plays a pivotal role in Beijing's 8K content production and industrial developmen.

1. On-site production

The on-site production system mainly consists of a small-scale 8K EFP system, XR immersive studio, and a 360° free perspective VR system. This system enables fast 8K capacity output through live recording, while also focusing on enhancing the ability of diversified presentation.

The small-scale EFP system adopts low-cost, lightweight and modular design approach. It is equipped three standard 8K channels that can be connected to our upgraded OB-Van 's second production area to produce 8K and 4K content. The switcher includes frame synchronization function inside, eliminating the need for

additional synchronous equipment and significantly reducing the peripheral cards. The recording equipment supports various video coding / file packaging formats, and imports materials to the post-production network via the high-speed data interface.

The XR immersive studio system features curved screen and rectangular ground screen. It utilizes rendering servers and virtual extension servers to generate virtual scenes pixel by pixel. The virtual tracking device can be flexibly combined with rocker camera, track camera or Stanicom device to provide camera location information for the rendering server. In real time, the rendering server adjusts the perspective of virtual object lighting to achieve immersive shooting effect.

The 360° free perspective VR system deploys circular camera array and connects to an IP network. The synthetic playback equipment provides camera calibration, acquisition and recording, live broadcast control. It captures key frames from camera video stream, generates bullet time video and achieves degraded playback / inversion effects.

2. Post-production

The post-production network is positioned within the large-scale production system, adopting a platform + application architecture, and integrates with the existing cloud platform for program production and broadcasting. It expands the number of storage nodes and network devices in the basic resource pool and capability service layer, putting them into the cloud management platform. It introduces distributed, micro-service and loose coupling design to achieve dynamic scaling of media processing capacity combined with the container scheduling engine. In the business application layer, it uses the hierarchical coding technology to manage the video files with differently coding / packaging way according to the performance of the later site, enabling compatibility with 8K / 4K / HD content. By integrating "foolproof" color tuning tools and surround sound production tools, usability is improved while simplifying production processes. Leveraging the advantages of cloud platforms enables efficient data exchange between various business domains to achieve large-scale, procedural, and fully formatted content production capabilities, and form a unified architecture compatible with ultra-high definition/high-definition production and broadcasting system.

3. Broadcast and Transmission

The broadcast transmission system has enhanced its functions and innovated its modes bassd on the original system. Firstly, it has upgraded the 8K subtitle packaging production mode for facilitate collaboration between production and broadcast

domains. The production domain outputs a pure version of 8K film without packaging along with Sub Rip Text (SRT) documents. The 8K subtitle packaging system matches video files with SRT files based on program names, analyzes the time-sharing data and subtitle packaging content in the SRT file, then generates 8K channel packaging program lists using pre-set templates. The subtitle packaging content is accurately overlaid onto program screens to achieve separation of subtitle packaging productions and broadcasting, forming a collaborative production mode that improvs the efficiency in 8K production and broadcasting business. Secondly, the number of coding equipment has been expanded while improving its functions.The system provides live-streaming signals for the "Peking 8K" APP and supports conversion from Hybrid Log-Gamma (HLG) format to High Dynamic Range (HDR) Vivid format in order to adapt the presentation requirements of mobile terminal small screens. Thirdly, 8K Ultra HD recording function has been upgraded to include multiple signal formats such as JPEG-XS and 4×12G SDI, as well as multiple file / encoding formats such as ProRes and JPEG-XS.

4. Mobile Applications

The "Peking 8K" APP focuses on supplementary operation functions. Firstly, it has built an intelligent operation platform that established a oneID user system by associating mobile phone number, WeChat IDs, device numbers. It combined with labeling function to distinguish different user groups. Secondly, it has established a membership rewards points platform and implemented VIP level management function that can configure member upgrade rules based on consumption in order to achieve unified and orderly promotion of ordinary members, gold members and diamond members while granting various physical rights and virtual rights accordingly. Thirdly, it has improved operational service functions including advertising realization, digital collection release, AI creative marketing, etc.

The upgrading and application of 8K Ultra HD technology system have further stimulated the strong momentum of the Ultra HD industry providing broad space for comprehensive upgrades in chips, equipment, systems and terminals, and playing a demonstrative leading role for the subsequent development within this industry. On this basis, a cross-platform communication mode was built which expands business application scenarios, explores market operation modes, improves operating efficiency, reduced production costs effectively expanding scale supply of 8K high definition content, which will eventually create more commercial value.

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Introduction of the Third Generation AVS Video Coding Standard（AVS3),

Zhou Yun Academy of Broadcasting Science, NRTA

Abstract:

AVS3 is the third-generation video coding standard developed by Audio and Video Coding Standard (AVS) Workgroup of China and is published as GY/T 368 by NRTA in 2023. Meanwhile, AVS3 has also become the DVB's next-generation UHD video coding standard. AVS3 is established for higher resolution video especially 8K ultra-high-definition（UHD）video. Compared with its predecessor, AVS2, which is used in 4K UHDTV channels in China, AVS3 has 50% bitrate savings. AVS3 has been used in China's 8K UHDTV channels and will have more applications worldwide in the future.

Key words: AVS3, Video coding, UHDTV

1. Introduction

In recent years, China has rapid development in UHD video industry. With higher resolution, framerate, bit depth, dynamic range and wider color gamut, the data amount of UHD video has increased largely. In order to meet the demand of 4K UHD video services, NRTA published the second generation AVS video coding standard（AVS2）in 2016. AVS2 has similar coding efficiency with H.265 and is adopted for 4K UHD video coding in China with the bitrate of 36Mbps under the configuration of 3840×2160@50p, 10bit and HDR. However, 8K UHD video brings more challenges and it is necessary to develop new video coding standard to further improve the coding efficiency.

AVS3's standardization process is started in December 2017. The gold of AVS3 is to have 50% bitrate savings with AVS2 under the premise of ensuring video quality. In order to promote industrial application, the development of AVS3 is divided into two phases: In the first phase, the primary consideration for the selection of coding tools is the limited decoder complexity, and it is finalized in July 2019 with two year's efforts. In the second phase, it is aimed to future improve coding efficiency on the basis of the first stage. Finally, AVS3 is finalized in 2022. Through the comprehensive evaluation and testing procedure, AVS3 is adopted as industry standard and published by NRTA in March this year.

2. Key coding tools of AVS3

AVS3 adopts the traditional block-based hybrid video coding framework, and proposed novel coding techniques including block partition structure, prediction, transform, quantization, entropy coding and in-loop filtering.

2.1 Flexible block partition structure

AVS3 designs a more flexible block partition structure to adapt for different video resolutions. The coding picture is firstly divided into patches and then are divided into largest coding unit（LCU）, the largest size for LCU is 128x128 which is more applicable for UHD video. LCU can be recursively split into coding units（CU）based on partition tree structure. AVS3 adopts quad-tree (QT), binary tree (BT) and extended quad-tree (EQT) partition to decide the final size of CU as shown in Fig.1.

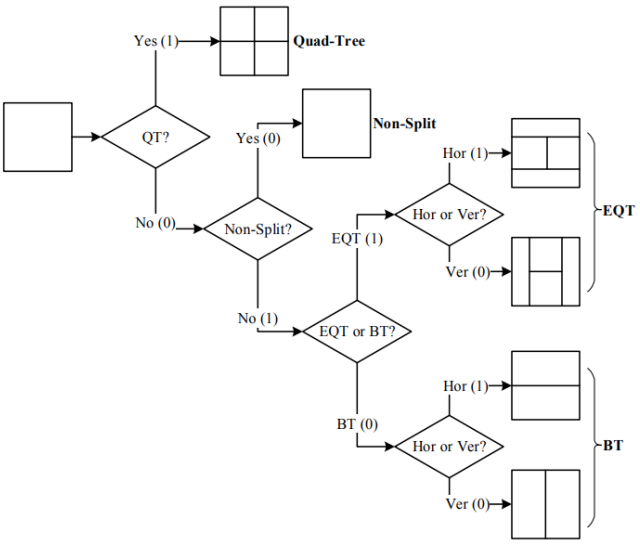

Fig. 1 illustration of block partition in AVS3

For each LCU, one bit is first used to indicate whether the LCU is divided into QT or not. If not, one more bit is then used to represent whether the LCU is divided into EQT or BT. Through this flexible partition process, CU can be non-square.

2.2 Intra prediction

AVS3 adopts 66 luma intra prediction including 63 angles prediction modes, DC mode， planar mode and bilinear mode. AVS3 introduces Intra Derived Tree (Intra-DT, intra prediction filter (IPF) and two step cross-component prediction mode (TSCPM) to improve intra prediction.

Intra Derived Tree defines intra coding unit partitioning mechanism vertically or horizontally. The current CU is divided into two or four prediction units (PU) when the current CU apply to intra-DT. Intra-DT has 6 split types.

IPF is a coding tool to improve the accuracy of the intra predicted pixels. The predicted value near the top and left boundary of current CU is filtered to enhance the prediction accuracy.

TSCPM is designed for intra chroma coding, which assumes the linear correlation between the prediction results of luma and chroma components. The linear regression function is first applied to the originally reconstructed luma block to get an internal prediction block. Second, the internal prediction block is down-sampled to generate the final chroma prediction block.

2.3 Inter prediction

In AVS3, Affine prediction mode considers more complex motion instead of translational motion. There are two types of affine motion prediction, one is affine direct mode while the other is affine inter mode. In affine direct mode, an affine candidate list including at most 5 affine models is derived from the motion information of neighboring blocks, an affine model candidate is a 4-parameter affine model or 6-parameter affine model, represented by 2 or 3 motion vectors. When the CU is affine inter mode, it is 4-parameter affine motion model.

Adaptive Motion Vector Resolution (AMVR) is adopted to reduce the coding bits for the motion vector difference (MVD) coding. The MVD is usually coded with 1/4-pel precision. While AMVR allows various resolutions for MVD coding. For instance, 1/4–pel, 1/2–pel, 1–pel, 2–pel and 4–pel resolution are supported.

Ultimate motion vector expression (UMVE) technology is an effective way to express motion vector for skip and direct modes in AVS3. According to the base motion vectors derived from the information of spatial or temporal neighboring candidates, this technique offsets these motion vectors to obtain the motion vectors that are more suitable for the current coding blocks.

Based on the above HMVP and AMVR, an enhanced motion vector resolution (EMVR) mode is carefully designed to avoid the shortcoming of one motion vector prediction (MVP) compared to multiple MVP. EMVR is proposed to bind the AMVR and HMVP, which corresponds the existing AMVR index of current CU with the motion information in HMVP table, and then conducted inter-frame prediction.

Symmetry motion vector difference (SMVD) is used for motion vector difference in inter Bi-directional prediction mode. One bit is used to indicate whether SMVD is adopted when the prediction mode of current CU is Bi-directional prediction mode. When SMVD is used, the motion information in List1 is symmetrical with respect to List0.

2.4 Transform

Position based transform (PBT) is introduced in AVS3, DST-VII and DCT-VIII are added to transform module. The selection between DCT-II, DCT-VIII and DST-VII are depended on signaling bit and intra block's position. AVS3 introduces a new transform method which uses pre-designed transform sets for four sub-blocks according to their positions. A new CU-level syntax element, PBT flag, is introduced. When PBT flag is 0, the traditional DCT-II transform is used for current CU. When PBT flag is 1, PBT splits the CU into four sub-blocks, and use pre-designed transform set according to their position. In each sub-block, its position number is connected with a pre-designed transform set.

2.5 In-loop filtering

Enhanced sample adaptive offset (ESAO) is applied to consider the textural and edge directional features. There are two feature descriptors in the sample classification process. The first one is calculated based on local binary patterns by comparing the intensities of the current sample with its 8 neighboring samples. The second descriptor is derived based on the amplitudes of the current reconstructed samples.

Cross-component sample adaptive offset (CCSAO) is only applied for chroma components. There are two feature descriptors in CCSAO classification process. The first one is based on the difference between the corresponding luma sample and its neighboring samples. The second descriptor is based on the amplitude of the current sample or its corresponding luma sample.

Besides, AVS3 improves adaptive loop filter (ALF), a larger filter shape is enabled with 15 coefficients and 29 taps. To make the filter more adaptive, the reconstructed frame is divided into 16 or 64 categories.

3. Advantages of AVS3

1) **High coding efficiency:** AVS3 achieves significant bit-rate saving than any other preceding AVS standards while maintaining better complexity performance trade-off to facilitate diverse use cases.

2) **Tailored for UHD video coding:** AVS3 introduces many novel technologies to adapt to higher resolution video encoding, and shows significant performance for UHD video coding.

3) **One-stop patent pool solution:** The AVS licensing mode is set prior to standard formulation, helping avoid potentially complex and stringent patent licensing challenges in advance, that might occur during the industrialization process.

4. Industry Ecosystem

AVS3 has attracted tremendous attention from industry ever since the finalization of AVS3 Main Profile in March, 2019.The designation and performance-complexity trade-off naturally fulfill the demands and requirements of different use cases. AVS3 has deployed from industrial-grade 8K real-time software codecs to 8K decoder chip for smart-phone, from 8K UHD TV broadcasting service to worldwide large-scale events support.

Based on the Intel scalable video technology (SVT) architecture, a novel AVS3 8K real-time software encoder has been presented, namely SVT-AVS3. The SVT-AVS3 encoder achieves an optimal trade-off among coding performance, encoding speed, and perceptual visual quality.

AVS3 all-platform open-source decoder "MERAK" has been released. The decoder was developed by the team of Peking University Shenzhen Graduate School, code-named uavs3d, and supports up to 8K/60P real-time video decoding.

In September 2019, Hisilicon Inc. has officially released a new end-to-end solution for 8K contents based on the world’s first AVS3 8K decoder chip Hi3796CV300 in International Broadcasting Convention (IBC), which greatly promotes the 8K applications of AVS3.

On February 1, 2021, the China Media Group launched an 8K UHD test channel using the AVS3 video standard. On January 1, 2022, the Beijing TV Winter Olympics Documentary Channel was broadcast using the AVS3 video standard. On January 25, 2022, the 8K UHD channel of China Media Group as broadcast using the AVS3 video standard.

In July 2022, AVS3 officially became one of the next-generation video codec standards in the DVB standard system, which means that AVS3 video standard, as an option of video encoding of international organizations, will be of great significance to supporting the future development of the global UHD video industry.

5. Conclusion

AVS3 is now opening a new era for 8K UHD video coding in which end-to-end solutions and commercial-level AVS3 codecs have been incorporated and established. Several directions are currently under investigation for future research and applications, including neural-network based video coding technology and machine-vision oriented video coding.

China V Chain: Digital Copyright Protection and Transaction Application in The Radio and Television Industry Based on Blockchain Technology,

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Abstract

With the rapid development of information technology, the dissemination of digital media complicates copyright protection, and piracy and illegal dissemination bring losses to media industry. The video copyright trading market has evolved from simple transactions between broadcasting stations and production companies to including short video live-streaming platforms and even covering massive ordinary users. The complex issues of copyright ownership determination and rights protection have been troubling the entire radio and television industry. Leveraging the characteristics of blockchain technology, China V Chain accurately, timely, and comprehensively records the entire process of digital copyright production, application, transactions, authorization, and transfers. It effectively solves the problems of digital copyright right confirmation and transactions, providing robust support for tracking infringement acts. The digital asset protection and transaction application developed by China V Chain constructs a comprehensive digital copyright management system based on blockchain technology. It explores and implements an integrated management model for copyright certification, transactions, and protection, opening up new paths for copyright management in the broadcasting and television industry.

Background

As the main force of content production in the era of all-media, the broadcasting and television industry has a large amount of stock resources and new content, but the ownership relationship of most of the content has not been effectively confirmed. The development and openness of the internet have made acquiring content easier, leading to widespread unauthorized practices such as clipping and piracy,greatly violating the interests of copyright owners in the broadcasting and television system, copyright holders struggle to promptly identify instances of copyright infringement and efficiently protect their rights.

In terms of copyright utilization, despite the production of approximately 8 million hours of broadcast programs annually nationwide, the industry still heavily relies on revenue from production and advertisements. Less than one-fifth of the content, which could potentially generate incremental profits through copyright transactions, is utilized for such purposes.

To address these challenges, China V Chain is committed to empowering the copyright management industry through technological innovation. It focuses on developing and promoting platforms for "copyright confirmation," "copyright protection," and "copyright transactions" based on blockchain technology. China V Chain is a subsidiary corporation of Changsha Media Group and it grows by deep integration of "culture + technology". As a pioneer in the fusion development of China's broadcasting and television industry, it leverages the extensive experience in copyright operation of China Radio and Television Corporation's subsidiary, TVZONE and collaborates with Hunan Malanshan Video Cultural and Creative Industrial Park to establish "Hunan MalanShan Tianze Weilian Technology Co., Ltd." The company is responsible for the comprehensive development and operation of the China V Chain platform. The platform focuses on copyright confirmation, protection, and application, providing the industry with a complete lifecycle of copyright services.

Blockchain base

Blockchain is a distributed technology that harnesses the "self-supervision" capabilities of each node to ensure data validity and reduce copyright management costs. Its decentralized model guarantees the immutability of information stored in data blocks. Meanwhile, its transparency makes the entire transaction process more secure under supervision. In addition, the blockchain system enables the sorting of every transaction with timestamps and records it in the blockchain, facilitating providing evidence during copyright authorization and infringement disputes.

Decentralized Self-Supervision

Blockchain acts as a decentralized distributed system maintained by numerous nodes. Once the content of the work is recorded in the blockchain, each node will copy the ledger and preserve complete data copies. When the system is attacked, the data can be restored through copies to ensure the authenticity and accuracy,the fault tolerance rate of the information system is strengthened, and the cost of digital copyright management can be reduced.

Immutability and Traceability

The characteristics of distributed accounting of the blockchain protect the registration confirmation information, making sure the relevant information not be tampered with, be transparent and open. Once all data is entered into the blockchain,

it will be shared by all nodes of the system to ensure the data from being tampering. The application of the blockchain technology can provide an immutable evidence chain to help rights protection. At the same time, any transaction information can be queried and tracked through the blockchain technology to protect the interests of the copyright holders.

Transparent, Open, Secure, and Reliable Data

Copyright information registered on the blockchain can be easily accessed using keys. Transaction data is transparent and open, enabling direct contact between transaction parties. According to the accurate calculation algorithm, copyright tax can be deducted during transaction to complete and simplify copyright trading and royalty settlement services, being beneficial to the spread of copyright and use. Blockchain utilizes "asymmetric encryption" technology for encryption, automatically completes reviews and supervision through algorithms, reduces the frequency of fraudulent activities and ensuring the accuracy of transaction data and user privacy.

Innovation mechanism

Blockchain technology has brought an innovative path for digital copyright protection. The registered content is classified and labeled through the system. In the release, use or transaction of copyright content, the system requires real-name identity authentication, and the smart contract ensures the legitimacy of copyright usage or transaction of the copyright owner. Once an infringement is found, the system will check all the operations of each node on the blockchain to provide evidence to the copyright owner to safeguard his rights and protect all content within the system.

Digital copyright certification

The whole process of production and creation is recorded on the blockchain, and accurate records are provided for each creation, protecting the rights and interests of copyright owners. Digital copyright holders only need to upload relevant information about the content to the blockchain, and the system will add a time stamp, embed a password, calculate the hash value, write the data into the blockchain, and complete the confirmation and registration of digital works. This point-to-point certification method gives each work a unique hash value to ensure that the data is true and accurate. Through the direct connection with China Copyright Protection Center and the provincial official copyright registration, blockchain certification endorsements are resolved, the efficiency of right confirmation has been improved, and artificial intelligence and plagiarism check mechanisms address copyright validity issues.

Digital copyright protection

Decentralized supervision is provided in the point-to-point management mode of blockchain. Every transaction information is linked up, and copyright owners can track the use of digital copyright timely to prevent piracy and infringement. Once the infringement occurs, the information on blockchain can be traced and queried, providing effective evidence and providing better conditions for the rights holders to protect their rights. The immutability of blockchain guarantees the reliability of evidence, avoids the waste of judicial resources, and reduces the cost of rights protection.

Digital copyright transaction

The decentralized nature of blockchain technology enables direct transactions between the two parties, avoids the restrictions of third-party platforms, improves the transaction efficiency and reduces the cost. All transaction details are recorded on the blockchain, and smart contracts make transactions more transparent and convenient. Smart contracts not only facilitate transactions, but can also function in standardizing licensing terms for protected works for different uses and jurisdictions, providing immediate and transparent remuneration to copyright holders.

Technological characteristics and service capabilities

1. Blockchain infrastructure:

Based on the Consortium Blockchain China's V Chain blockchain focuses on building an industrial application chain, which integrates P2P network, consensus algorithm, virtual machine, smart contract, cryptography and data storage and other key technologies, forming a stable, efficient and secure smart contract execution environment. The main features include:

- Smart Contract support:
  Supports a variety of smart contract types (EVM, Native, MYVM, Precompiled), offers multi-language programming support (Solidity and C + +), and covers all aspects of the contract lifecycle (writing, compiling, deploying, calling, upgrading and freezing).

- Expansion capabilities:
  It provides a variety of contract expansion capabilities, including privacy protection, RSA signature verification, Base64 codec, context retrieval, JSON and XML parsing, to meet the needs of different application scenarios.

- Consensus technology:
  The consensus algorithm based on PBFT, highly available Byzantine fault tolerance, supports automatic recovery of consensus state and automatic data

storage equalization, and realizes the automatic routing of node services to ensure the consistency of data in the distributed system.

- Security measures:
  It strengthens security, including TLS two-way authentication, communication traffic encryption, user private key signature transaction, and multi-node data storage, etc., and supports the national secret algorithm and privacy model, ensures the security and integrity of on-chain data.

- Cross-chain service:
  Based on the cross-chain data connection service ODATS, it achieves the trusted communication between homogeneous / heterogeneous blockchain, and develops a standardized blockchain UDAG full-stack cross-chain protocol to ensure the security, scalability and reliability of cross-chain transactions, and provide basic capabilities for global copyright cross-chain interaction.

2. Application service layer:

The three major problems of copyright, "difficult right confirmation, difficult rights protection and difficult circulation", are dismantled and relevant products are created, and the whole chain service system that can be dismantled and grouped is developed with the integration concept of "copyright + science and technology". The multi-dimensional application of standardized products can better serve the whole industry. It provides a variety of operations and access channels to meet the diverse needs of industry users, and achieve a complete closed loop system.

- Copyright certification application:
  Blockchain technology is used to provide copyright certification and on-chain approval services, ensuring data immutability. It achieves information exchange between the China Copyright Protection Center and provincial official copyright registration, gradually realizing copyright sorting and connection work for various levels of television stations. It defines copyright content clearly, establishing the foundation for content copyright at all levels of television stations, and achieving comprehensive online content, sharing, and collective management.

- Copyright protection application:
  Based on blockchain technology rights services and copyright content characteristics of the value information, it monitors copyright content usage across the entire network. Combining machine learning algorithms and big data analysis, it enhances the recognition rate and accuracy of identifying copyright infringement. It automates evidence collection for rights protection and automatically distributes rights protection leads to the judicial process. It supports multiple dispute resolutions and is currently connected to authoritative notary institutions, working on cross-chain mutual trust among provincial judicial nodes, helping broadcasting

media reduce the cost of rights protection and improve its effectiveness.

- Multi-category transaction scenario:
  Provides full-path copyright hosting services, including batch upload, content analysis and sampling, feature code extraction, preview video generation and other automated processes. Intelligent tags and algorithms are utilized to recommend resources suitable for purchasing users to improve transaction accuracy and repurchase rate. The system realizes a convenient online transaction process, and automatically completes the settlement of copyright revenue sharing. It includes copyright authorization, copyright transfer, copyright evaluation and other multi-category transaction scenarios, combined with the application of big data and artificial intelligence in copyright value evaluation and transaction, copyright infringement evaluation mechanism, intangible asset value evaluation system, digital copyright and transfer standards. It also provides copyright content trading services for nearly one thousand TV stations and program copyright owners nationwide, and realizes the sharing and reuse of content resources and the incremental value of copyright.

Future and Prospect

China V Chain will continuously optimize its technical architecture to address future challenges in digital copyright protection. On this basis, we will expand broader cooperation with international partners to jointly study the innovation of the underlying technology of blockchain, promote the content exchange between different cultures and enrich the digital copyright ecosystem through the cooperation with international copyright agencies, content providers and the digital media companies. We look forward to achieving mutual benefits in international cooperation and jointly promoting the prosperity of the radio and television industry in the digital era.

Virtual Digital Human, Guxiaoyu Fang Chencen
Zhejiang Satellite TV& Tencent Interactive Entertainment

Profile:

Guxiaoyu is China's first high-precision photorealistic virtual human, with over 2 million polygons, using Unreal Engine to achieve real-time rendering for radio and television AR real-time stages. She boasts the real-time dynamic simulation of intricate details such as twist braids, 300,000 individual hair strands, and interactively computing five layers of high-poly fabric. Guxiaoyu is capable of real-time rendering and regular broadcast, with enhanced AIGC capabilities for motion and facial expression generation, AI vocal synthesis, music and dance generation, as well as AI outfit and hairstyle changes. When it comes to real-world use, Guxiaoyu has appeared in the Hangzhou Asian Games closing ceremony, CCTV's China Farmers' Harvest Festival Gala, the "Ideas Shine Over China" program, and major variety shows. She has also appeared offline on interactive screens at the World Internet Conference, China International Cartoon & Animation Festival, as well as the Deshou Palace Site Museum, and Hangzhou National Archives of Publications and Culture. Meanwhile, Guxiaoyu is helping promote Chinese culture abroad; her Chinese Language Day promotional video was praised by UN and she has participated in cultural exchange events such as the Mid-Autumn Festival Gala for Overseas Chinese. In "Most Memorable is Hangzhou", a video clip played at the Hangzhou Asian Games closing ceremony, Guxiaoyu made a stunning appearance, waving goodbye to the audience.Guxiaoyu has also won commendations from mainstream media outlets, such as People's Daily Overseas Edition and Guang Ming Daily, and boasts over 300,000 fans on Weibo, having generated over 300 million views in total.

Key Word:

Virtual Human;Chinese Culture；World-Wide Influnece ;Technological Innovations

Application Scenario:

As a blend of culture and technology, Guxiaoyu is characterized by "intelligence". Focused on the Song Dynasty culture that is a distinctive cultural identity of China's Jiangzhe region, Guxiaoyu is a virtual digital human that was introduced by Zhejiang TV and Zhi Ji of Tencent Interactive Entertainment under the guidance of the Publicity Department of the CPC Zhejiang Provincial Committee and Zhejiang Media Group. Inspired by Guyu or "grain rain", one of the Chinese lunar calendar's 24 solar terms,

Guxiaoyu is identified as a virtual promoter of the Song Dynasty's culture. Her name not only highlights her unique identity as a dedicated promoter of traditional culture, but also embodies the beautiful cultural connotation of "rain bringing the growth of grain in hundreds of valleys along with prosperity".

When it comes to character design, the team has meticulously reproduced the appearance of Song Dynasty figures: Guxiaoyu wears a modified dress and Song-style upper body camisole, featuring sleeve cuffs inspired by West Lake's lotus leaves. Her lower body is dressed in a long skirt with ink painting. Her makeup imitates the pearl cosmetics popular among noble Southern Song ladies and is paired with twist braids and a sophisticated hair accessory to recreate a lady from the Southern Song Dynasty's capital city.

Guxiaoyu also embodies an innovative way of inheriting and developing traditional Chinese culture and, as a promoter of Song Dynasty culture, Guxiaoyu mostly appears in cultural activities. For instance, she hosted the 2023 Song Yun Cultural Festival opening ceremony. She's also the "AI Digital Guide" that appears on the Deshou Palace and Hangzhou National Archives of Publications and Culture interactive screens providing guidance to visitors. "Timeless Beauty", her promotional video, perfectly integrates watercolor woodblock printing, a national intangible cultural heritage, with digital technology. This production was awarded the accolade of "Outstanding Original Internet Visual & Audio Program" by the National Radio and Television Administration in August, 2023.

April 20 of this year marked Guxiaoyu's first birthday and the UN Chinese Language Day, a promotional video of the Chinese language was launched. It focused on the use of "rain" imagery in poetry, helping share the beauty of Chinese characters with domestic and global audiences while earning praise from the UN and UNESCO. In "Most Memorable is Hangzhou", a video clip played at the Hangzhou Asian Games closing ceremony, Guxiaoyu made a stunning appearance, waving goodbye to the audience.

Technological Innovation:

1. Photorealism: Leveraging the game engine's real-time rendering technology, Guxiaoyu is a high-precision virtual human composed of over 2 million polygons. Her twist braids are made of 300,000 individual hair strands and she wears five layers of clothes, each made of a different fabric. All the intricate details are generated by the game engine's real-time interactive simulation, ensuring a high degree of realism under a wide variety of lighting and movement.

2. Facial expressions: 1) A real-time SDK was developed for facial keypoint detection, able to render at 200FPS using 106 keypoints and at 50FPS using

240 keypoints. 2) A consumer-level driver system rivaling Apple's ARKit has been developed, along with a high-precision facial expression driver system able to output over 200 facial expression control parameters to control photorealistic CG characters.

3. Lip sync: 1) The team has achieved SOTA results in Chinese speech recognition and understanding. 2) Dozens of hours of parallel data of speech and lip animation have been collected for lip sync, encompassing controller and BS parameters of multiple characters and six emotion types. The implementation supports early project experiments, the construction of model frameworks, and experiments comparing various baseline models.

4. Speech comprehension: 1) Analysis of the semantic context and the emotions of speech has substantially improved the fluidity and subtlety of lip and motion animation in generating Guxiaoyu's voice content. 2) A cross-modal intent recognition method based on voice-to-text matching has been proposed, based on a two-stage training method (multimodal pre-training plus fine-tuning) and speech-to-text transcriptions from a generic domain. Meanwhile, a multi-objective optimization scheme has been proposed for learning the semantic information of speech.

The above-mentioned technological innovations enable Guxiaoyu to display natural facial expressions and enjoy smooth interactions with human guests during a variety of programs.

Technical Committee Meeting
28.10.2023 - 13:30-17:00 & 29.10.2023 - 9:00-17:00
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Introduction of key technologies of audiovisual media microservices,

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Abstract: With the continuous development of media convergence, in order to solve the problem that traditional technical architecture and business architecture are not suitable for new services, we propose a media microservice architecture (MMA) and cloud-native microservice key technologies, and plans seven business domains suitable for audiovisual media. Through MMA, media organizations can improve deployment and iteration efficiency, reduce costs and increase efficiency, optimize media production processes, and expand converged media coverage. MMA has been applied in audiovisual organizations such as Hunan broadcasting system, iQiyi, and Mango TV in China.

Keywords: Audiovisual Media, Micro Service, Architecture

1. Introduction

Nowadays, there is a problem that the traditional technical architecture in the field of audiovisual media cannot meet the requirements of new services in the trend of media converage, and the current radio or television media cannot meet the development needs of rapid iteration of Internet-based content and diversified service. Radio, television organizations and Internet audiovisual media enterprises are generally exploring the technical architecture system that meets the need of media transformation. The microservice technology used and self-developed by audiovisual media organizations both domestic and abroad is independent, and the interconnection is not realized. The microservice component cannot be shared with resources, forming a resource island.

In order to solve the above problems, this paper starts from the overall status quo and adaptation scope of the audiovisual media industry, and proposes a new model for building business support software system, namely the audiovisual media microservice architecture (MMA) technology, which will be introduced from the aspects of audiovisual media microservice architecture and key technologies, audiovisual media microservice component resource pool and its application in the audiovisual industry.

2. Audiovisual Media Microservice Architecture and Key Technologies

2.1. Audiovisual media microservices architecture

Audiovisual media microservice architecture is a general software architecture specially designed for the media industry and used to cope with development needs of rapid iteration of audiovisual media content and diversified service. MMA is designed to incorporate all kinds of important businesses in the industry into the corresponding microservice layer. MMA covers five layers: infrastructure adaptation layer, microservice governance capability layer, media business service layer, platform service layer, and application integration layer, Fig.1. shows the complete architecture diagram.

Infrastructure adaptation layer includes the system resource adaptation functional area and the data resource adaptation functional area, and the system resource adaptation layer supports the adaptation of VM systems, container orchestration systems, and cloud and marginal resources. The data resource adaptation function supports the adaptation of distributed and cloud databases, lakehouse systems, and big data systems.

Microservice governance capability is the core ability of MMA, which includes microservice components such as service governance, service communication, and load balancing. Microservices implement self-governance to make application management relatively easy, so service governance is an indispensable part of microservices architecture. Each microservice or microservice component can have some metadata to describe its operational or scheduling capabilities, primarily to identify their special features such as service level agreement, permission levels, and so on.

The microservices API gateway is a key role in the microservices architecture to protect, enhance and control access to microservices, a system that precedes the application or service to manage authorization, access control, traffic restrictions, etc., so that the microservices are protected by the microservice gateway and transparent to all callers. As a result, business systems hidden behind a microservice gateway can focus more on the business itself. As a middleware system connecting the consumers and service providers of services, the microservice gateway naturally isolates the evolution and development of their respective business systems, making the business system more focused on the business service itself, and the microservice gateway can also provide and precipitate more additional functions for services.

Media business service layer can be divided into media commonality support function area and special media business function area. There are many microservices with clear functions and could be reused and shared in the underlying technology of audiovisual media. Dividing and defining their APIs will play a positive and effective role in promoting the business ecology of the whole industry to mature, robust, agile

and flexible. The microservice component of media commonality support function area is a common basic function with media characteristics extracted from the business of the audiovisual media industry, such as media file management, audio and video content processing, interactive management services, user attribute management, media AI service, etc. The microservice component of the media special business function area is a collection of services provided by the functional subdomains of the platform. API management platform can be seen for the combination and arrangement of platform business services, and can also be used as the basic unit of superior business process arrangement. This layer will show the rich industry attributes of the audiovisual media industry: hundreds of microservices related to business capabilities are defined and standardized here.

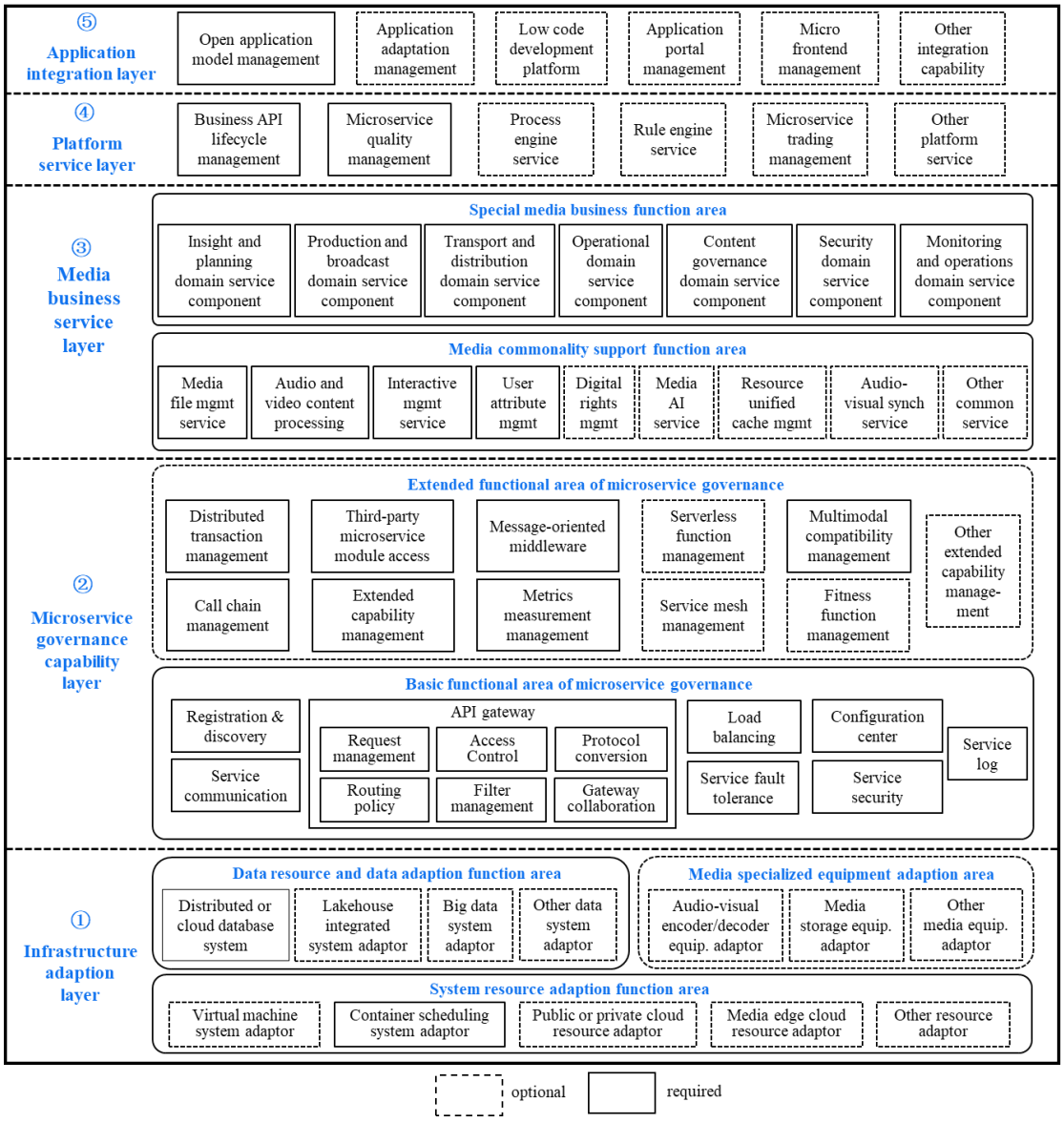

Fig. 1. Overall architecture of audio-visual media microservice

Platform service layer is a highly modular business function unit, which is composed and orchestrated by the microservice combination of different types of media-specific business domains, and the important objects of this layer are platform application management (that is, software applications composed of underlying microservice aggregation): business API lifecycle management, microservice quality management, process engine services, rule engine services, etc.

Application integration layer focuses on the construction of audiovisual media software applications. The microservice components in the media business service layer are used as the basic business pool. Through the integration capabilities of the application integration layer, the platform service capability layer is relied on to achieve collaborative application assembly.

2.2 Key technologies of audiovisual media microservices

1) Efficient docking technology

Aiming at the characteristics of high resources and high cost of transaction processing resources and large fluctuations in computing volume in audiovisual media scenarios, an efficient microservice docking technology suitable for audiovisual media is proposed, which specifically includes two aspects: microservice application traffic scheduling and microservice operation resource scheduling. At the microservice application traffic scheduling level, the microservice routing technology is proposed, which is based on the common single-data center registration discovery and multi-data center registration discovery technologies. It provides a unified and flexible global registration discovery policy adjustment mechanism, and solves the problem of reasonable access and dynamic allocation of traffic according to service capabilities in multiple data centers under the condition that the amount of local resources or costs are limited. At the level of microservice operation resource scheduling, based on the general single-data center scaling technology, a large-scale elastic scaling technology for multi-data centers and multiple types of resources is proposed, which solves the efficiency and cost problems of audiovisual media microservice component expansion.

2) Dynamic collaboration technology

The microservice component is usually not designed and developed for a special scenario, which brings great challenges to the dynamic collaboration of audiovisual media microservices. In addition, the cost of computing amount, storage volume, and network transmission volume of task types represented by video codecs far exceeds that of ordinary IT fields. Dynamic collaboration still focuses on efficiency. In view of operation, the audiovisual media microservice API gateway access layer technology is proposed, which provides unified and flexible microservice traffic access and collaborative configuration capabilities, decouples the application (refers to the collection of multiple microservice components working together) operation

configuration with the microservice itself, and solves the problem of microservice collaborative work under complex operational environment. Aiming at video codec microservices, a task sharding strategy is proposed to solve the problem of microservice collaboration efficiency in typical scenarios.

3) Traceability technology

In the field of audiovisual media, the processing time of some tasks (such as encoding and decoding, image quality enhancement, etc.) in a single microservice instance far exceeds that of common microservices. Audiovisual media also have high requirements for the timeliness of task processing, and if the task fails only by exceeding the expected processing time (ordinary microservices in milliseconds, and complex tasks such as encoding and decoding in minutes and hours) to initiate a retry, regardless of whether it really fails, it will cause a great waste of resources and time. Aiming at the observability problem of audiovisual media microservices, based on the general monitoring, logging and call chain tracking technologies of microservices, a real-time tracking technology of audiovisual media microservices is proposed, which provides the ability to find and locate abnormal states in a single task link of the microservice system as soon as possible, and solves the practical application problems such as long single task time, real-time monitoring and manual intervention unique to the audiovisual media field.

3. Audiovisual Media Microservices Resource Pool

In the media business service layer of MMA, we have planned the domain microservice business layouts of the whole media industry chain, forming a special business function area for media, covering seven domains such as insight and planning domain, production and broadcast domain, transmission and distribution domain, operation domain, content supervision domain, security domain, monitoring, operation and maintenance domain, etc., and a total of more than 200 microservice components have been developed and completed. The seven domain microservice components form an audiovisual media microservice resource pool. It could provide agile and efficient microservice access capabilities for audiovisual media national, provincial, municipal and county organizations and we media, and quickly realize the content planning, production, dissemination, security, operation, supervision, etc.

Through the comprehensive collection of online, offline and third-party data, the insight and planning domain microservice components explore market opportunities, locates customer pain points, clarifies the competitive situation, and customer portraits. The production and broadcast domain microservice components could provide content production capabilities such as pre-on-site and post-processing to meet the production requirements of various business scenarios. It could provide multi-channel and multi-terminal integrated publishing capabilities for TV channels, IPTV, OTT video, etc. The transmission and distribution domain microservice components meet the transmission

requirements of traditional audio and video signals and IP signals, and supports the transmission of various audio and video signals and files through various wired, wireless, and Internet sources, covering the transmission requirements. The operation domain microservice components meet the operational functions such as user data collection, business operation statistics, advertising delivery, business marketing, online interaction, and customer management. The security domain include client, network entrance, virtualized network and host security, application-level security, data security, security management, and security maintenance microservices. The content supervision domain includes microservices such as scraping, preprocessing, content supervision, and supervision and disposal. The monitoring and operations domain include media application monitoring, basic resource monitoring, and automated monitoring and operations microservices.

4. Audiovisual Media Microservice Industry Application

4.1. Audiovisual media content resource service platform

Based on MMA, an audiovisual media content resource service platform has been built in Hunan broadcasting system, China. The platform has multiple application service sub-platforms, including intelligent media assets, broadcast file preparation, transmission scheduling, virtual production and intelligent cloud editing, cloud transcoding and content distribution, operation, content supervision, monitoring and operation and maintenance and other sub-platforms. The multi-modal intelligent recommendation service system and Intelligent Ad review system for multiple terminals are typical microservice architecture application systems of operation sub-platforms and content supervision sub-platforms, respectively.

1) Multi-modal intelligent recommendation service system for multiple terminals

The system serves the video platform with multi-terminal and diversified recommendation business scenarios, such as video recommendation on large and small screens, advertising recommendation, e-commerce recommendation, community content recommendation, etc., simplifying labor operating costs, and improving content distribution efficiency.

The intelligent recommendation service system opens up multi-service converged data flow, accesses the unified log collection and analysis platform, designs and develops distributed machine learning ordering services, designs and develops high-performance general recommendation engines, designs and develops visual analysis platforms, designs and develops flexible and efficient algorithm platforms, continuously accumulates basic feature operator libraries and general algorithm component libraries, deeply customizes and optimizes model algorithms such as user preference matching, recall, sorting, and service rearrangement by deeply mining the behavioral characteristics and content attribute data of each business. The architecture diagram

of the intelligent recommendation service system is shown in Fig. 2.

The system has supported online recommendation scenarios such as platform (both web and mobile) video recommendation, intelligent message push, e-commerce search recommendation, advertising effect optimization, and member community recommendation. The conversion rate of the recommendation module of the large-screen unified recommendation framework of the intelligent recommendation system was 10% in 2020 and 13% in 2021, so the conversion rate increased by 30%. The recommended conversion rate of short video was 3.5% in 2020 and 4.8% in 2021, so the recommendation conversion rate also increased by 30%.

2) Intelligent Ad review system

The system enables ad review by artificial intelligence technology. Deep learning based on large-scale sample training and traditional machine learning technology realizes system automated, intelligent and real-time content review. The scope of review not only covers the conventional review of material content but also innovatively adds functions such as remote advertising inspection, induced material identification, material tonality and industry identification, and material aesthetic evaluation.

The intelligent Ad review system product has been put into operation on Mango TV, and by splitting and building the original review system of the enterprise as a microservice, and deploying it to the public cloud environment, the remote deployment and remote synchronous inspection of the intelligent review system have been realized, which greatly improves the system function efficiency of the product, and the agile development characteristics of microservices also help to improve the development and maintenance efficiency of the product. The system has been in stable service for more than 600 days, independently completed the review of Mango TV's internal advertising exchange, demand-side platform, supply-side platform and other advertising platforms, greatly improved the review efficiency, after the launch, successfully reduced 90% of the review team members, only relied on 5 reviewers to complete a small number of manual review and AI mis-divided sample reflow work, an average of thousands of problem materials successfully blocked a week. After the remote inspection system of creative intelligent review is deployed through the microservice architecture, the review efficiency, audit quality, audit coverage, and annual audit volume have been greatly improved.The average review time of images, text, voice, video, etc. is 10 seconds for images and 2 hours for videos in 2020, and 0.1 seconds for pictures and 60 seconds for videos in 2021, increasing the review efficiency by more than 100 times. The recall rate of audit quality in 2020 was 70%, the accuracy rate was 60%, and the recall rate reached 95% in 2021, the accuracy rate reached

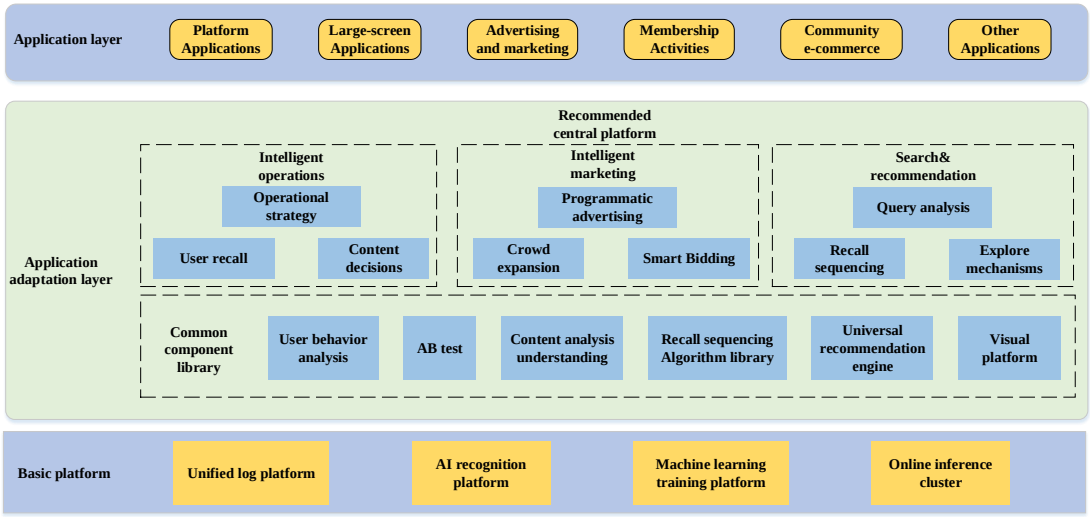

Fig.2. Block diagram of multi-modal intelligent recommendation service system for multi-terminal

85%, improving the audit quality by more than 30%; The audit coverage will cover 40% of the business volume of business parties in 2020 and about 60% in 2021, increasing the audit coverage rate by more than 50%. In terms of annual audit volume, about 50% of media assets were audited in 2020 and 70% in 2021, an increase of more than 40% in annual audit volume.

4.2. Content production prototype system based on microservices architecture

iQiyi built a content production prototype system based on MMA, which mainly includes microservice governance and business functions. Through the containerized hybrid cloud platform elastic scheduling system, task scheduling center, microservice governance system, etc., it can realize efficient docking of resources, scheduling decisions of microservices, and platform-based management of corresponding infrastructure configurations. The production process dynamic orchestration engine realizes parametric workflow orchestration, and in terms of microservice functional components, audiovisual media microservice components such as encoding, image enhancement, distribution, AI special effects, video cutting, and video merging are constructed. The content production prototype system based on microservice architecture realizes efficient docking, dynamic collaboration and traceability of microservices, the scale of the actual application system has reached nearly 100,000 cores, the number of professional service users exceeds 1,000, and 20 million medium and long video production transactions can be processed every day in actual operation, and the integration of new function R&D has been shortened from 2 months to 1 week for each application module, shortening the R&D cycle by about 90%. In addition to being suitable for content production scenarios, the system also provides infrastructure for microservice transformation in other business scenarios of iQiyi, such as mobile app background system, membership rights system, transaction payment system,

overseas website background system, search system, advertising system, etc., and more than 70% of application scenarios in iQiyi have achieved microservice transformation.

5. Conclusion

MMA has been popularized and applied in audiovisual media industry, education, cultural creativity, medical and other fields with its advantages of strong compatibility and excellent evolution. In the future, through the standardization of MMA, the construction of MMA componet store, the establishment of MMA sharing consortiums or ecological communities, we hope MMA could be further applied in TV stations, online audiovisual platforms, newspapers and education systems so as to serve and standardize the development of media industry.