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56th ABU General Assembly & Associated Meetings



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from The Editor

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Cover: ABU Tokyo 2019

Wishing all our members and readers a very happy new year for 2020. Looking back, we had a very successful year in 2019 with a number of activities and services implemented and delivered to our members.

This issue of the TR is focused mainly on our annual meetings which was held in Tokyo, last November. A detailed report of the proceedings of the Technical Committee meeting and the decisions from the Technical Bureau are included. We would like to extend our thanks and appreciation to the designated rapporteurs for their contributions. You will also find the details of this year's winners of the Engineering Awards and the Technical Review Prizes. We would like to extend our congratulations again to all the winners. A special thanks to NHK for being a wonderful host for the meetings and the arrangements made for the members. We have allocated a few pages to appreciate the NHK showcase "2020 and Beyond", which was arranged for the delegates to experience the advanced technologies and content ideas implemented and developed by NHK.

Two articles related to technology development and applications contributed by our members B-SAT and IRIB are featured inside. The first one by B-SAT shares studies related to Broadcasting-Satellite Service titled "Effectiveness of Frequency Sharing Criteria in the Broadcasting Satellite Link". The article discusses two frequency sharing criteria (pfd and EPM), comparing studies from the viewpoint of effectiveness to the sharing cases between Broadcasting Services. The second article titled "Transition of SDI to Audio/Video signals over IP", contributed by colleagues from IRIB R&D department, discusses the move from SDI to IP infrastructure. It highlights the key areas of concern a broadcaster should look into when they are planning to move ahead with such an implementation specially highlighting the available standards and transition strategies.

Highlights from some of our key activities and services to members are included for information. As usual we conclude with our selection from the key Industry news, digital updates and the latest in equipment trends from the media industry. We hope the selection of articles and the information included will be useful for all our readers.

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Effectiveness of Frequency Sharing Criteria in the Broadcasting Satellite Link

SUMMARY: Two frequency sharing criteria for BSS (Broadcasting-Satellite Service) are enacted in Section 1 of Annex 1 to Appendix 30 to Radio Regulations. These two criteria are pfd (power flux-density) and EPM (Equivalent Protection Margin) values. In this paper, the two criteria are compared and studied from the view point of effectiveness to the sharing cases between BSS and BSS. In particular, it is shown that in some cases, the EPM criterion contributes to alleviate the problem of “sensitive satellite network”, i.e., one that has relatively low transmission power and is very weak against interference and blocks the new satellite to enter. Therefore, the EPM criterion should be maintained in the future in order for the efficient use of the geostationary-satellite orbit.

Disclaimer: The views and positions expressed by the authors are strictly personal and do not constitute, nor can be interpreted as, the position of the International Telecommunication Union on the topics addressed in this paper.

Key words: Broadcasting-satellite service, Frequency sharing criteria, Equivalent protection margin, Power flux-density.

1. Introduction

This paper shows the effectiveness of the two frequency sharing criteria between BSS (Broadcasting-Satellite Service) networks. In Section 1 of Annex 1 to Appendix 30 to RR (Radio Regulations), two types of threshold value triggering coordination are given: a) pfd (power flux-density) and b) EPM (Equivalent Protection Margin). According to the provision in RR as cited below [1], a proposed satellite network does not need to coordinate with others if either the pfd criterion or the EPM criterion is met.

..., an administration in Region 1 or 3 is considered as not being affected if either of the following two conditions is met:

- ..., the power flux-density at any test point within the service area..., does not exceed the following values: (WRC-15)...
- ... the equivalent downlink protection margin corresponding to a test point of its assignment... does not fall more

than 0.45 dB below 0 dB or, if already negative, more than 0.45 dB.

For the allocation of frequencies the world has been divided into three Regions. Region 1 is Europe including countries belonging to the former Soviet Union and Africa; Region 2 is America and Region 3 is Asia and Oceania. The pfd criterion was introduced in addition to the EPM criterion by WRC-2000 (World Radiocommunication Conference in 2000) for BSS only in Region 1 and Region 3, but not for BSS in Region 2. In Regions 1 and 3, since a new satellite only needs to meet one of the two criteria, it is easier for the new satellite to be successfully coordinated than in case of Region 2. In this paper, the comparison between the two criteria and their effectiveness are studied, thus focusing only on Regions 1 and 3.

From the regulation aspect, it was not clear concerning the features and merits of the two criteria. In this paper due consideration is given, and in particular it is shown that the EPM criterion contributes to alleviate the problem of “sensitive satellite network” that has a low transmitting power and is very weak against interference, resulting in the irrational blockage of a newcomer. It means the EPM criterion contributes to the efficient use of orbit/spectrum resources. More detailed description is given in [3].

2. pfd criterion

This section explains the pfd criterion and its features. The pfd value is derived as e.i.r.p. (Equivalent Isotropically Radiated Power) divided by $4\pi d^2$, where d is the distance between the satellite and the receiving point on the Earth where the pfd value will be calculated. The pfd criterion is easily calculated and understood. Therefore, it was proposed in WRC-2000 to suppress the EPM criterion and only the pfd criterion was introduced for the BSS and BSS sharing in Regions 1 and 3.

The threshold pfd value triggering coordination is shown below in italics (cited from RR [1]), as a function of orbital separation angle θ between two BSS satellites.

$$\begin{aligned} & -147 \text{ dB(W/(m}^2\cdot 27 \text{ MHz)) for } 0^\circ \leq \theta < 0.23^\circ \\ & -135.7 + 17.74 \log(\theta) \text{ dB(W/(m}^2\cdot 27 \text{ MHz))} \\ & \quad \text{for } 0.23^\circ \leq \theta < 2.0^\circ \\ & -136.7 + 1.66 \theta^2 \text{ dB(W/(m}^2\cdot 27 \text{ MHz)) for } \\ & \quad 2.0^\circ \leq \theta < 3.59^\circ \\ & -129.2 + 25 \log(\theta) \text{ dB(W/(m}^2\cdot 27 \text{ MHz)) for } \\ & \quad 3.59^\circ \leq \theta < 9.0^\circ \end{aligned} \quad (1)$$

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies.

Regarding the satellite station-keeping above, RR requires that space stations in BSS must be maintained in position with

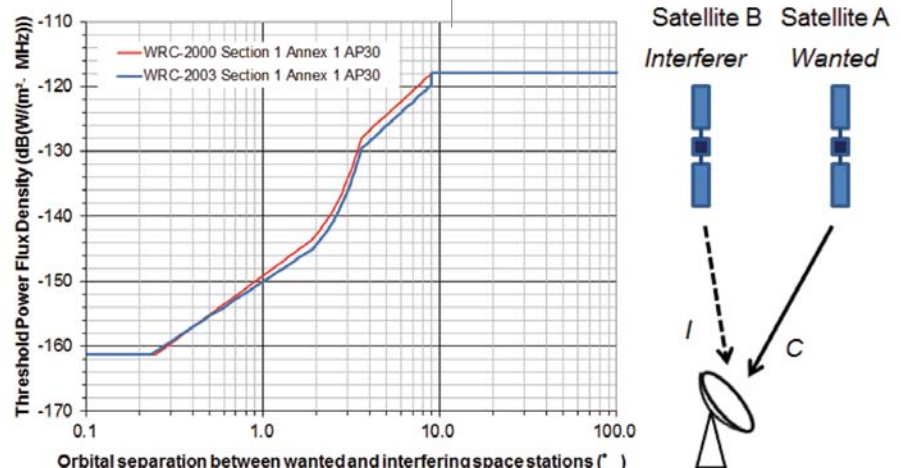


Fig. 1 Comparison of WRC-2000 and WRC-2003 pfd masks in Section 1, Annex 1, AP30

an accuracy equal to or better than ± 0.1 degrees in the East - West directions.

The threshold pfd value above is depicted in **Fig.1** (WRC-2003, Blue line). Note that the pfd value in **Fig.1** is expressed per 1 MHz bandwidth, instead of 27 MHz, in order to be consistent with other sharing cases. The threshold pfd value is the single - entry interference level as indicated "I" of an interfering satellite (newcomer) in **Fig.1**. It is an absolute value regardless of the wanted level as indicated "C" of an interfered-with satellite (existing) in **Fig.1**.

The receiving earth station is assumed throughout this paper to be located at a latitude of 33 degrees North and the difference between its longitude and the satellite orbital position is 13 degrees.

Since the threshold pfd value is an absolute interference power expressed in terms of pfd, it can be converted to $\Delta T/T$ (the increase of noise temperature caused by the interference and the system noise temperature ratio), $\Delta C/N$ (the degradation of C/N , Carrier to Noise ratio) defined as $(C/N) - (C/(N+I))$, where $C/(N+I) = -10\log(10^{-C/N/10} + 10^{-I/N/10})$, and I/N (Interference to Noise ratio). Note that the $\Delta T/T$, I/N and $\Delta C/N$ are equivalent and can be converted from one to another [2].

In the conversion of the pfd value to $\Delta T/T$ etc., the total link noise temperature of the earth station is assumed to be 174 K (Section 2, Annex 6, AP30). Then the system noise N is given as follows.

$$N = kTB = -228.6 \text{ (dBW/Hz/K)} + 10\log(174) \text{ (dBK)} + 10\log(106) \text{ (dB)} = -146.2 \text{ (dBW/MHz)} \quad (2)$$

The interference power I to the receiver of the earth station is derived by using the antenna discrimination D (dB) and the effective antenna area A_e (m²) as follows.

$$I = \text{pfd} + D + 10\log(A_e) \text{ (dBW/MHz)} \quad (3)$$

The antenna efficiency is assumed to be 61.4%, which gives the absolute maximum antenna gain of 35.5 dBi at 12.1GHz (See Fig.7bis, Section 3.7.2, Annex 5, AP30).

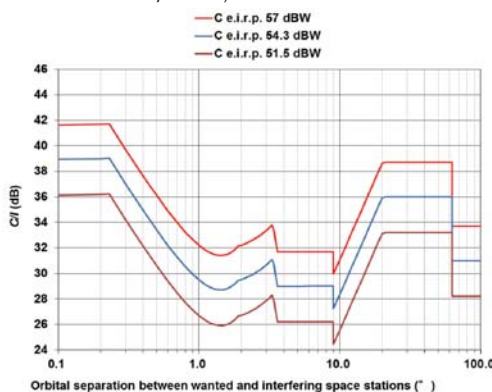


Fig. 2 C/I corresponding to pfd mask (WRC-2003)

The C/I (Carrier to Interference ratio) value corresponding to the pfd value is a function of the wanted level (C) (See **Fig.2**). Note that the C/I value corresponds to a single-entry interference.

3. EPM criterion

This section explains the EPM criterion and its features. The EPM, referred to as M in this paper, is defined in Section 3.4 of Annex 5 to Appendix 30 to RR, as follows.

$$M = -10\log(10^{-M_1/10} + 10^{-M_2/10} + 10^{-M_3/10}) \quad (4)$$

where M_1 is the value (dB) of the protection margin for the same channel (co-channel). This is defined in the following expression where the powers are evaluated at the receiver input:

$$M_1 = \frac{\text{wanted power}}{\text{sum of the co-channel interfering powers}} \text{ (dB)} - (\text{co-channel protection ration}) \text{ (dB)} \quad (5)$$

where co-channel protection ratio is the required value of the aggregate C/I used in the BSS Plan and is given in Annex 5 to Appendix 30 to RR.

M_2 and M_3 are the values (dB) of the upper and lower adjacent-channel protection margins respectively. The co-channel protection ratios (PR) in Regions 1 and 3 are as follows.

- 31 dB for 1977 BSS Plan.
- 24 dB for WRC-97 revision of BSS Plan for downlink.
- 21 dB for WRC-2000 digital BSS Plan.

While the EPM in Eq. (4) is expressed from the view point of frequency assignments, it is expressed as the ratio of carrier to aggregate interference by the next equation (See also **Fig. 3**).

$$M = \frac{C}{I_{aggr}} - PR = \frac{C}{\sum_{i=1}^n I_i} - PR \quad (6)$$

A certain amount of spectrum in the BSS band is assigned equally to all countries for future use in order to guarantee equitable access to the geostationary-satellite orbit and spectrum among countries, which constitutes a BSS Plan. For example, in the Regions 1 and 3 BSS Plan, 12 channels in the 11.7 - 12.2 GHz band are assigned to all Region 3 countries. In addition, the BSS band in Regions 1 and 3 is used through the coordination procedure and such spectrum is registered in the List, which are additional uses of satellites beyond the Plan (i.e. use of assignments with characteristics different from those appearing in the Regions 1 and 3 Plan and which are capable of causing more interference than the corresponding entries in the Plan or use of assignments in addition to those appearing in the Plan). For an assignment, Reference EPM

(Ref. EPM) is defined in ITU-R to be the EPM when all the interfering assignments in the Plan and the List located within 9 degrees coordination arc of that assignment are considered. Note that the Ref. EPM is updated by ITU-R every time a new assignment is entered in the Plan or the List or an assignment in the List is cancelled.

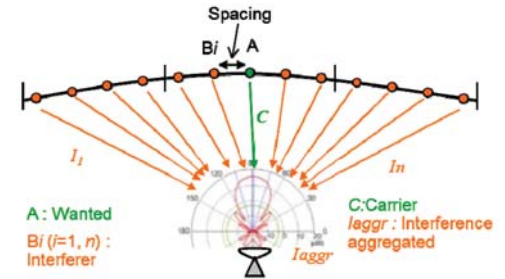


Fig. 3 Mechanism of EPM

The EPM criterion is hard to be calculated and understood, but it considers all interference sources coming from other BSS networks. In Regions 1 and 3, according to RR, only other BSS networks located within ± 9 degrees are taken into account in calculating EPM. It is useful to recognize the total amount of interference in terms of aggregate interference because the BSS Plan is for future use. The EPM criterion was adopted since the development of the BSS Plan back in 1977 and in WRC-2000 the EPM criterion was kept despite proposals to suppress it.

The EPM criterion giving the threshold value for coordination is described in Section 1, Annex 1 of Appendix 30 to RR (See **1. Introduction** of this paper). Table 1 shows an example of the relation among transmitting power, Ref. EPM, threshold C/Inew, etc., in particular it shows how much interference is allowed for a newcomer depending on the Ref. EPM of an existing network so that the existing network is not considered as being affected by the newcomer. The colours of the numbers in Table 1 correspond to **Fig. 4** and **Fig. 5**, respectively.

In Table 1, the items are as follows.

Ce.i.r.p. is e.i.r.p. of the wanted satellite.

Ref. EPM is the current EPM value without taking into account the interference from the newcomer.

C/Iaggr is the current value and derived by $PR + \text{Ref. EPM}$. The C as well as I_{aggr} should be, by definition, wanted and aggregate interference powers, respectively, at the output of the interfered-with receiving earth station antenna. However, in this paper, C is expressed as the same as Ce.i.r.p. and I_{aggr} is expressed as the sum of (interfering e.i.r.p. + the discrimination (≤ 0) of the interfered-with receiving

earth station antenna). This expression does not change the conclusion of this study.

$laggr$ is derived by $Ce.i.r.p. - C/laggr$. As mentioned above, the value of $laggr$ (equivalent interfering e.i.r.p value) has been taken into account the discrimination of the interfered-with receiving earth station antenna between the wanted and the interfering satellites.

$C/lnew$ is mathematically derived by $-10\log(10^{-(C/(laggr+Inew))/10} \cdot 10^{-(C/laggr)/10})$. However, in **Table 1**, it is derived so that the $Inew$ meets the EPM criterion (See **Fig. 5** and b) from **1. Introduction** as cited from RR). This is the lowest $C/lnew$ of the existing network due to interference from the newcomer so that the existing network is not considered as being affected by the newcomer.

$Inew$ is derived by $Ce.i.r.p. - C/lnew$. It indicates the maximum allowable interference power. $Inew$ should be, by definition, interference power at the output of interfered-with earth station antenna. However, in this paper, $Inew$ is expressed as the interfering e.i.r.p + the discrimination of the interfered-with receiving earth station antenna. This expression does not change the conclusion of this study.

$C/(laggr + Inew)$ is the resulting value and derived by $-10\log(10^{-(C/laggr)/10} + 10^{-(C/Inew)/10})$ or $PR + EPM(laggr + Inew)$.

$EPM(laggr + Inew)$ is the new EPM value taking into account the maximum allowable interference from the newcomer. According to RR, an existing network is not considered as affected by the newcomer if the *Ref. EPM* is not degraded more than 0.45 dB below zero if the *Ref. EPM* value is not negative or more than 0.45 dB if the *Ref. EPM* value is already negative (See **Fig. 4**). Thus, it is derived:

- If *Ref. EPM* ≥ 0 , $EPM(laggr + Inew) = -0.45$
- If *Ref. EPM* < 0 , $EPM(laggr + Inew) = Ref. EPM - 0.45$

Degradation is the difference between *Ref. EPM* and $EPM(laggr + Inew)$.

As same as above with the pfd criterion, it is assumed that the antenna is 60 cm in diameter, the earth station antenna locates at a latitude of 33 degrees North and the difference between its longitude and the satellite orbital position is 13 degrees.

The EPM criterion in terms of EPM degradation is depicted in **Fig. 4**. It shows the resulting EPM (*New EPM*) when the 0.45 dB degradation principle is applied.

<i>Ce.i.r.p.</i> (dBW)	54.30	54.30	54.30	54.30	54.30
<i>PR</i> (dB)	21.0	21.0	21.0	21.0	21.0
<i>C/laggr</i> (dB)	36.0	26.0	21.0	16.0	6.0
<i>laggr</i> (dBW)	18.3	28.3	33.3	38.3	48.3
<i>Ref. EPM</i> (dB)	15.0	5.0	0.0	-5.0	-15.0
<i>C/lnew</i> (dB)	20.7	22.0	30.6	25.6	15.6
<i>Inew</i> (dBW)	33.6	32.3	23.7	28.7	38.7
<i>C/(laggr+Inew)</i> (dB)	20.55	20.55	20.55	15.55	5.55
<i>EPM(laggr+Inew)</i> (dB)	-0.45	-0.45	-0.45	-5.45	-15.45
Degradation (dB)	-15.45	-5.45	-0.45	-0.45	-0.45

Table 1 Example of the relation among transmitting power, *Ref. EPM*, threshold $C/lnew$, etc.

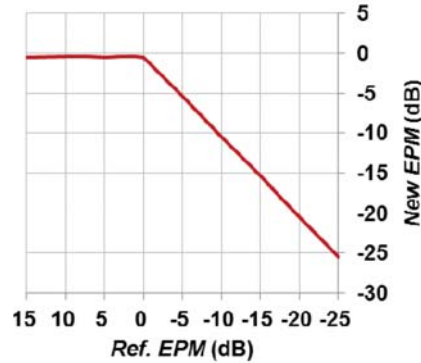


Fig. 4 EPM criterion in terms of EPM degradation

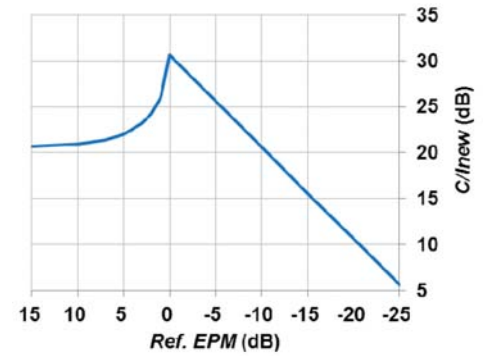


Fig. 5 EPM criterion in terms of $C/lnew$

The EPM criterion in terms of $C/lnew$ is shown in **Fig. 5**. The $C/lnew$ gives a threshold value, or a permissible value of the interference $Inew$ when the 0.45 dB degradation principle is applied. Note that the $C/lnew$ is independent of the value of $Ce.i.r.p.$.

Table 2 below indicates minimum orbital separations for a new network to co-exist with an existing network based on the EPM criterion assuming both networks have the same characteristics (60 cm diameter of receiving antenna, same transmitting power, etc.). The earth station antenna is assumed to locate at a latitude of 33 degrees North and the difference between the longitude and the satellite orbital position is 13 degrees.

From **Tables 1, 2, Fig. 4** and **Fig. 5**, the following items are observed.

- (1) For an assignment with a high (positive) *Ref. EPM*, it allows relatively high interference caused by the newcomer, while ensuring a good level of protection to the existing assignment, up to such a level corresponding to the EPM of -0.45 dB. For example, when the *Ref. EPM* is 15 dB, the $Inew$ (maximum allowable interference) is 33.6 dBW, which is higher than 23.7 dBW of $Inew$ when the *Ref. EPM* is 0 dB.
- (2) For an assignment with a *Ref. EPM* around 0 dB, it allows relatively low interference to give a further

Table 2 Minimum orbital separation based on EPM criterion

<i>Ref. EPM</i> (dB)	C/I (dB)	Minimum orbital separation (deg.)	Minimum topocentric angle (deg.)
10	20.96	3.33	3.78
5	22.01	3.68	4.18
0	30.62	8.10	9.22
-2	28.62	6.75	7.67
-4	26.62	5.61	6.38
-6	24.62	4.67	5.31
-8	22.62	3.88	4.11
-10	20.62	3.30	3.75
-15	15.62	2.88	3.27
-20	10.62	2.37	2.69
-25	5.62	1.73	1.96
-30	0.62	0.57	0.65
-30.6	0	0	0

degradation of EPM by -0.45 dB. Note that at 0 dB of *Ref. EPM*, the C/I_{new} is maximum and I_{new} is minimum (23.7 dBW in **Table 1**), which means the assignment is most sensitive when the *Ref. EPM* is 0 dB.

- (3) For an assignment with a very low *Ref. EPM* less than -10 dB, it allows relatively high interference caused by the newcomer to give a further degradation of EPM by -0.45 dB, which means that the assignment will not be identified by ITU-R as being affected if a newcomer does not produce up to such a high interference. In other words, it is easier for a newcomer to meet the sharing criterion. For example, when the *Ref. EPM* is -15 dB, the I_{new} is 38.7 dBW, which is higher than 23.7 dBW of I_{new} when the *Ref. EPM* is 0 dB.

4. Effectiveness of pfd and EPM criteria

In this section, the relation and effectiveness of pfd and EPM criteria are investigated. In order to compare the EPM criterion with the pfd criterion, the EPM criterion is converted into the threshold pfd values. **Fig. 6** shows an example of the characteristics of *Ref. EPM* vs threshold pfd values for the pfd and EPM criteria in order to clarify the effectiveness of the two criteria. In other words, it clarifies which criterion should be used so that a newcomer can transmit more power and at the same time does not affect an existing network.

In **Fig. 6**, the I_{new} values in **Table 1** derived under the EPM criterion are converted into the threshold pfd values at the receiving earth station.

The following explains how the conversion of I_{new} to threshold pfd ($\text{dB(W/(m}^2\text{MHz))}$) was done for a case of *Ce.i.r.p.* of 54.3 dBW, *Ref. EPM* of 0 dB and orbital separation of 3 degrees and 6 degrees.

I_{new} in 27MHz: 23.7 dB(W/27MHz)
 I_{new} in 1 MHz: 9.4 dB(W/MHz) i.e. $(23.7 - 10\log(27))$
 pfd toward boresight: -153.8 dB(W/(m^2MHz)) i.e. $(9.4 - 162.4 (d = 37187\text{km}))$

Off axis angle of the receiving earth station antenna on the Earth (topo-centric angle toward the interfering satellite): 3.4 deg. for 3deg. spacing, 6.7deg. for 6deg. spacing.

Discrimination of 60 cm receiving earth station antenna on the Earth at 3.4 deg: -17 dB, at 6.7 deg.: -27 dB

pfd produced by the newcomer: -136.0 dB(W/(m^2MHz)) (-153.8 + 17) for 3 deg. spacing, -126.0 dB(W/(m^2MHz)) (-153.8 + 27) for 6 deg. spacing.

It is interesting to know that, in this case, the threshold pfd value (-136.1 dB(W/(m^2MHz))) derived from the EPM criterion with 0 dB of *Ref. EPM* for *Ce.i.r.p.* of 54.3 dBW coincides to the one derived from the pfd criterion for the 3 deg. spacing between the wanted and interfering satellites.

It can be seen from **Fig. 6** that in a range of *Ref. EPM* about from 0 dB to -5 dB, the pfd criterion is effective for low *Ce.i.r.p.* like 51.5 dBW.

It is also interesting to know that, when the *Ref. EPM* is very low (less than about -10 dB to -15 dB), the EPM criterion is effective and it allows relatively high interference caused by the newcomer. The BSS Plan is developed generally assuming *Ce.i.r.p.* of 59 dBW in a 27 MHz bandwidth at the peak and 56 dBW at the edge of coverage. The assignment with a low transmitting power, e.g., *Ce.i.r.p.* of 51.5 dBW, is possible, but if there are Plan assignments and/or List assignments near such a satellite with co-coverage/co-frequency, the low power satellite suffers from high interference and results in a very low *Ref. EPM* (Part "C" in **Fig. 6**), then it can never get a value of about 0 dB of *Ref. EPM* (Part "B" in **Fig. 6**).

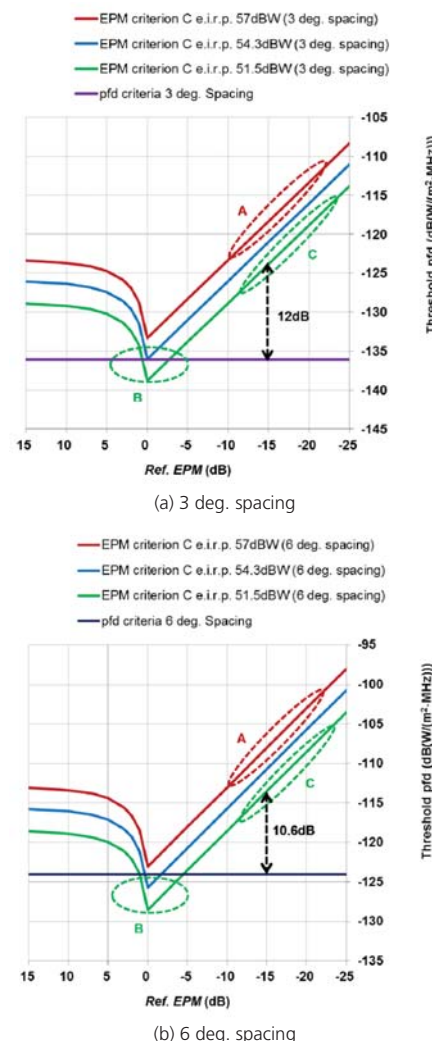


Fig. 6 Example of EPM and pfd criteria in terms of threshold pfd

For example, for the *Ref. EPM* of -15 dB, the difference between the threshold pfd's of the EPM criterion (-124.1 dB(W/(m^2MHz))) and the pfd criterion with 3 deg. separation (-136.1 dB(W/(m^2MHz))) is about 12 dB. The relaxation of 12 dB under the EPM criterion makes the coordination much easier for a newcomer than under the pfd criterion. In other words, by using the EPM criterion, a newcomer can transmit 12 dB more power than using the pfd criterion while that sensitive network is not affected. The more negative the *Ref. EPM* is, the larger difference between the two criteria becomes. Therefore, it can be said that the EPM criterion contributes to alleviate the problem of "sensitive satellite network", which has a low transmitting power and permits a low interference power under the pfd criterion.

On the contrary, in Part "A" in **Fig. 6**, both of the interfered-with satellite and the interfering satellite have a high *Ce.i.r.p.* In this case, the two satellites give detrimental interference to each other and suffer a very low EPM value. This situation should be avoided since both satellite services become destructive.

5. Conclusion

In this paper, two frequency sharing criteria (pfd and EPM) for BSS in Regions 1 and 3 are compared and studied from the view point of effectiveness to the sharing cases between BSS and BSS, which was not clear before. This study is useful for satellite broadcasting system designs including the selection of an orbital position. From the aspect of regulations, the mechanism for the alleviation of a problem of "sensitive satellite network" is clarified.

It was assumed in this paper that the receiving earth station antenna is 60 cm in diameter and locates at a latitude of 33 degrees North and the difference between its longitude and the satellite orbital position is 13 degrees.

The following conclusions are obtained.

- (1) For an assignment with a high (positive) *Ref. EPM*, it allows relatively high interference levels from a newcomer while maintaining a high level of aggregate C/I ratio.
- (2) For an assignment with a *Ref. EPM* around 0 dB, it allows relatively low interference. At 0 dB of *Ref. EPM*, the C/I_{new} is maximum therefore I_{new} is minimum, which means the assignment is most protective (most sensitive).
- (3) For an assignment with a very low *Ref. EPM* less than -10 dB, it allows relatively high interference and the

assignment will not be identified by ITU-R as being affected if a newcomer does not produce up to such a high interference. In other words, it is easier for a newcomer to meet the sharing criteria.

- (4) It is shown the effectiveness of the pfd and EPM criteria with respect to the *Ref. EPM*. The EPM criterion is mostly dominant, and the pfd criterion is dominant in a range of *Ref. EPM* about from 0 dB to -5 dB for low *Ce.i.r.p.*.
- (5) The low power satellite suffers from high interference and results in a very low *Ref. EPM*. The EPM criterion contributes to the alleviation of the problem of "sensitive satellite network", i.e., one that has relatively low transmission power and is very weak against interference and blocks the new satellite to enter under the pfd criterion when the orbital separation is small.

Therefore the EPM criterion should be maintained in the future in order for the efficient use of the geostationary-satellite orbit.

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Thong Pham Viet, Radiocommunication Bureau, ITU-R, received his B.E. and M.E. from the Hanoi University of Technology in 1997 and 2001, respectively. His major was telecommunication and he stayed at the University as a teaching assistant for 2 years after his graduation. At the same time, he was employed by the Vietnamese Administration from 1997 to 2008 to carry out frequency coordination and studies on the feasibility and payload for Vietnam's first communication satellite project. He joined the ITU in November 2008. Since then, he has worked in the Space Notification and Plans Division, which is responsible for managing the BSS and FSS Plans.



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Transition of SDI to Audio/Video signals over IP

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Abstract: Operators and broadcasters who have invested heavily in the generation and transmission of the SDI signal will face technical and financial challenges in moving to IP based topologies. There are a lot of practical solutions and recommendations for these operators, system designers and manufacturers. Some of the most important methods and standards are described in this article. In these methods, as well as the proposed solutions, the emphasis is on maintaining the current infrastructure and SDI is the dominant topology. The key issues raised in this article are SMPTE standards for how to encapsulate and correct audio, video signals and data errors, SDI to IP conversion, and the challenges of transmitting 12G SDI signals and higher bit rates. Also, the transition strategy for the transmission of audio, video and data over IP is indicated.

Keywords: SMPTE 2022, SMPTE 2110, SDI, IP, Interoperability and Interworking, SDI and IP hybrid structure, Transition to IP

I. Introduction

The diverse capabilities that streaming through the IP network provide compared to the traditional way, have driven content providers and TV network owners to take advantage of this technology. The reasons and requirements for moving toward IP as a platform for transmitting audio and video signals, especially in the contribution, include flexibility, scalability, and the ability for the business model to respond quickly in accordance with the changes. At this stage, the goal is to replace the SDI with the IP infrastructure, but the ultimate goal is virtualisation, with software replacing dedicated hardware. In fact, moving to IP is a prerequisite for transferring and passing hardware to software. In the context of IP contribution and distribution, there are challenges and constraints such as synchronisation, bandwidth, service quality, network architecture, security, integrated switching and network management, which is important.

The transition from SDI to IP uncompressed video and audio has led to the presentation and development of several methods over the last few years.

Different methods and standards, such as SMPTE 2022-6, TR-03 and TR-04, SMPTE 2110, are converging. There are also other suggestions like ASPEN and NDI.

By identifying details of IP solutions, operators need to consider how to manage the infrastructure, production and distribution functions in a completely new environment, including cables and new connectors. The question is, 'how do operators drive this new technology and implement IP in the current SDI workflow that works well?' This paper describes and presents practical ways and means for this transitional stage, which is the broadcast of uncompressed video and audio over the IP platform.

II. SDI formats

The traditional SDI solution lacks operational and maintenance efficiency, scalability, and production efficiency, which limits the capabilities of broadcasters to rapidly develop new format content for broadcasting and television systems. In fact, IP is no longer a choice, it is the only option.

Mostly the SDI formats used are SD-SDI (270Mbps), HD-SDI (1.5Gbps) and 3G-SDI (3Gbps). When converted to an uncompressed IP format, in transmitting signals, 10 GB/s routing lines in the switches of the current IT infrastructure are used. Since the use of higher resolutions, UHD-1 and UHD-2, is particularly prevalent among operators and outside broadcasters (OBs), it is not clear at present how it transmits the signal at high bit rates, because the payloads are higher than the conventional 10Gb/s backbone standard.

As UHD-1 and UHD-2 appear, new 25Gb/s and 100Gb/s ports have been introduced [1]. Also light compressions like JPEG2000 (Evertz), TICO (IntoPix), LLVC (Sony), NDI (NewTek) are presented in signal transmissions.

Most equipment support SDI interface, while few manufacturers supply equipment for uncompressed video over IP interfaces. Recently some equipment has been implemented with different IP standards, incompatible with each other, because the type and standard of IP was not clear on the broadcast equipment.

In accordance with industry standards such as the Society of Motion Picture and

Television Engineers (SMPTE)-2022 suite and 2110, AMWA's Networked Media Open Specifications (NMOS) IS-04, IS-05, IS-06, Video Services Forum (VSF), and the European Broadcasting Union (EBU), all components of the system produced by different vendors can be compatible with each other, but pioneers have noticed that providing the equipment compliant with the standard is complicated.

III. IP standards and solutions

Different methods and standards for encapsulating video signals, including SDI, are provided for transport over IP networks. The most important of these, the SMPTE 2022 and 2110 suite of standards, provides the frame work for encapsulation of video, audio and data [2].

SMPTE 2022

Introduced for the first time in 2007, the SMPTE 2022 standard covers several types of IP video transport. The first two sections of the standard cover IP protocols for compressed, constant bit-rate video signals in MPEG-2 transport streams. Newer sections of the standard cover two different kinds of variable-rate compressed video signals, as well as methods for carrying uncompressed video and hitless protection switching. Each section of 2022 is described below.

ST 2022-1: Forward Error Correction for Real-Time Video/Audio Transport over IP Networks, defines row/column FEC (Forward Error Correction) for IP video streams.

ST 2022-2: Unidirectional Transport of Constant Bit Rate MPEG-2 Transport Streams on IP Networks, specifies how constant bit rate compressed video signals that are encoded within MPEG-2 transport streams are encapsulated into IP packets. This standard covers the transport layer, RTP and UDP, as well as comments about timing and buffer sizes.

ST 2022-3: Unidirectional Transport of Variable Bit Rate MPEG-2 Transport Streams on IP Networks, defines IP packets for variable bit-rate MPEG-2 TS streams that are constrained to have a constant bit rate between PCR messages (Piecewise-constant).

ST 2022-4: Unidirectional Transport of Non-Piecewise Constant Variable Bit Rate MPEG-2 Streams on IP Networks,

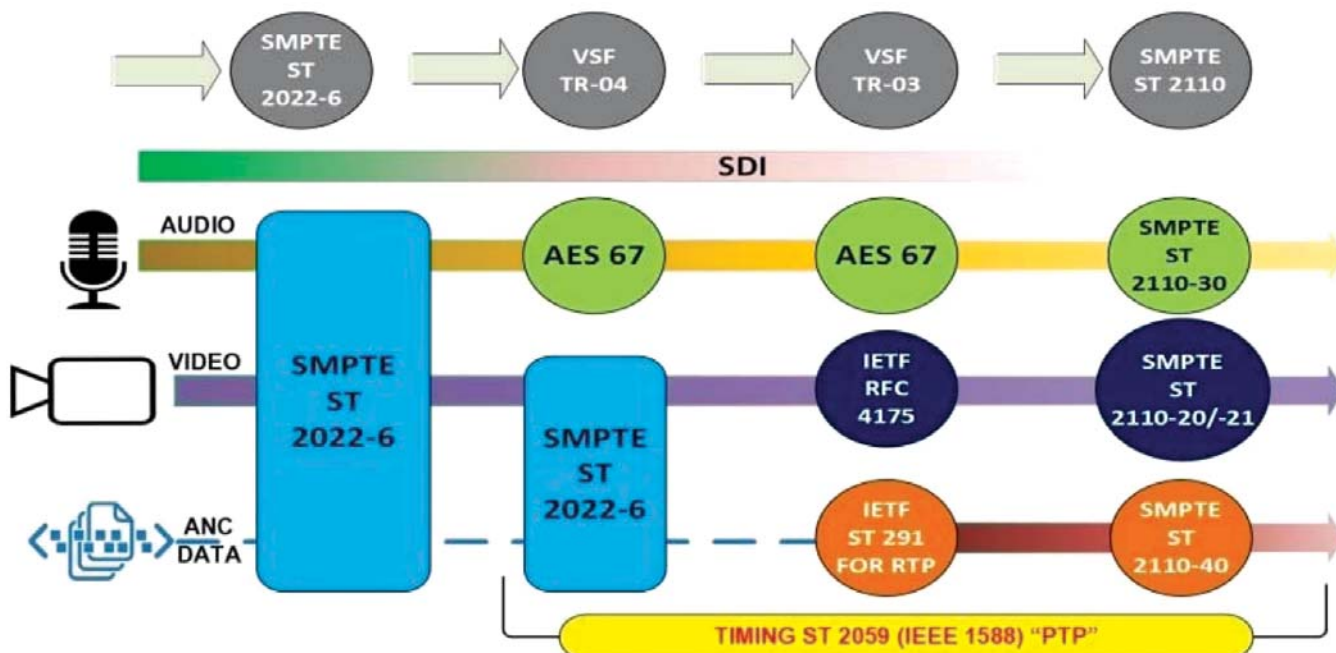


Figure 1: Minimum user requirements to build and manage an IP-based media facility [15]

is similar to Section 3, except that it removes the constraint on bit rates.

ST 2022-5: Forward Error Correction for High Bit Rate Media Transport over IP Networks, expands on Section 1 to allow larger row/column FEC combinations to support signals with bit rates up to 3 Gbps and beyond.

ST 2022-6: Transport of High Bit Rate Media Signals over IP Networks, specifies a way to transport high bit-rate signals including uncompressed 3 Gbps 1080p video that are not encapsulated in MPEG-2 transport streams.

ST 2022-7: Seamless Protection Switching of SMPTE ST 2022 IP Datagrams, describes a way to send two matching streams of packets from a source to a destination over different paths, and have the receiver switch automatically between them.

ST 2022-8: Integration with ST 2022-6
This standard is under consideration for inclusion, dealing with interworking between ST 2022 and ST 2110 standards. It is not yet approved and under development.

SMPTE 2110

The 2110 series of standards is comprised of several sections. According to this standard, Broadcast media is transferred to managed-IP networks. In this suite, voice and video streams and data are carried separately and in real time with synchronization information, and the individual streams are fully synchronous.

It is worth noting that the 2110 standards will support UHD, HDR video and other emerging formats.

ST 2110-10: System timing and definitions

The ST 2059 is used to distribute time and timebase to each device within

the system by giving timestamps to the separate streams. It specifies the various system clocks and how the RTP timestamps are calculated for Video, Audio and ANC signals. This enables each component, audio, video, metadata, to be synchronized, while the streams are independent.

ST 2110-20: Uncompressed active video

This standard specifies the real-time, RTP-based transport of uncompressed active video essence over IP networks. It supports resolutions up to 32k x 32k, so it can well cover new formats like UHD, HDR and HFR content.

ST 2110-21: Traffic shaping and delivery timing for video

This Part defines a timing model for SMPTE 2110-10 video RTP streams, as measured leaving the RTP sender, and defines the sender SDP parameters used to convey the timing features of these streams.

ST 2110-22: Compressed video

Now the SMPTE 2110 specifies how to transport uncompressed video over IP. With the introduction of Part 22 to be released in the future, the SMPTE 2110 will define a standardised way for transporting compressed video over IP workflows such as TICO or JPEG2K.

The introduction of compressed video to ST 2110 allowing users to transport high-bandwidth video, such as 4K and 8K, over affordable 1GbE/10GbE networks using COTS IP switches.

ST 2110-23: Single Video Essence Transport over Multiple 2110-20 Streams

This defines how to split high-bandwidth signals into several lower-bandwidth 2110-20 streams. It is not yet approved and is in development.

ST 2110-30: Uncompressed PCM digital audio

This part specifies real-time, RTP-based transport of PCM digital audio streams over IP networks. The SMPTE standard references AES67 for audio transport. Also defines an SDP-based signaling method for metadata necessary to receive and interpret the stream.

ST 2110-31: AES3 transparent transport

This standard is considering audio RTP-based transport in AES3 frames, which are suitable for non-PCM audio. It can handle compressed audio formats like Dolby, MPEG or AAC. This standard is not approved yet and is still in the development stage.

ST 2110-40: Transport of SMPTE ancillary data

This standard defines RTP payload format for SDI ancillary data and defines how to use the IETF RFC 8331 with 2110. It maps ancillary data packets (caption information, timestamps, active format description, dynamic range information as defined by SMPTE ST 291-1) into RTP packets and enables those packets to be transmitted synchronously over IP networks with related video and audio essence streams.

Other key standards:

For establishing connections and working system properly, there is also need another standards which are not covered by SMPTE 2110. "We realized that, in a serious deployment, ST 2110 alone requires a huge amount of manual configuration work", said Félix Poulin, Director of Engineering Lab Services at CBC/Radio Canada, one of the leading organizations in IP infrastructure deployments [3].

AMWA (Advanced Media Workflow Association) is developing the NMOS (Network Media Open Specification),

which is a family of specifications which are related to networked media for professional applications. Complementary with industry specifications like ST2110 [4].
 AMWA IS-04: Discovery & Registration
 AMWA IS-05: Connection Management
 AMWA IS-06: Network Control
 AMWA IS-07: Event & Tally
 AMWA IS-08: Audio Channel Mapping
 AMWA IS-xy: Flow Grouping, ID & Timing, Scalability, Security & more (Work In Progress)

IV. The technology pyramid for Media Nodes

The EBU recommended additions to IP-based systems of the future that would complement the SMPTE ST 2110 transport protocols as minimum user requirements to build and manage an

IP-Based Media Facility [5], [6].

The EBU Technical Committee is asking manufacturers and vendors to implement this ensemble of technologies in their equipment and including them in their product roadmaps. The purpose is to help accelerate the maturation of products and to support the continued growth of the market around IP-based devices used in broadcast workflows.

The JT-NM work group, partner with vendors and users in order to provide information that helps the transition to IP. The JT-NM test different IP-based equipment and evaluate the interoperability between them, as well as how vendor equipment conforms to the standards [7].

V. SDI and IP hybrid structure as the transition strategy

Broadcast workflows have traditionally been created using specific hardware, which offered the best performance and efficiency for real-time baseband video and audio signals. IP solutions for broadcast and media industries, improve efficiency, but the mission-critical reliability in SDI broadcast workflows is also essential in IP networks and must be provided. When it comes to the selection of SDI or IP workflows, all aspects must be considered and the advantages and disadvantages of each one taken into account. In the following table we compare two technologies based on various important parameters in the broadcast workflows.

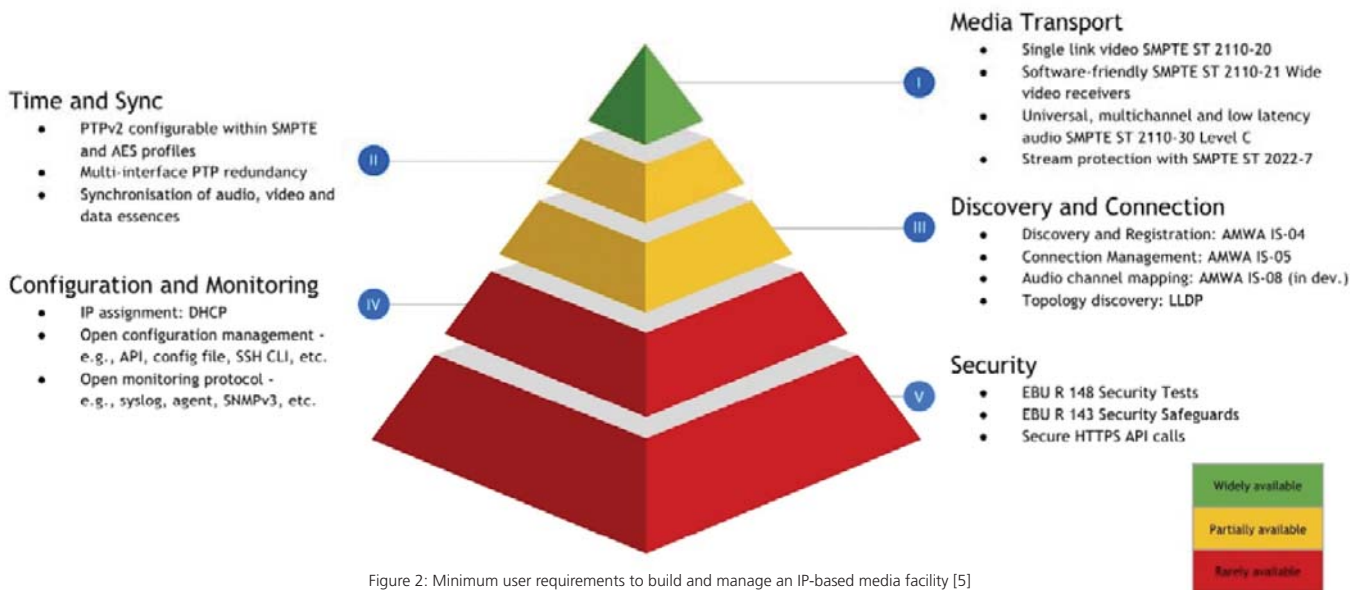


Figure 2: Minimum user requirements to build and manage an IP-based media facility [5]

	Traditional Broadcast	IP Network
Multi-vendor equipment	Broadcast specific proprietary	COTS IT hardware, many vendors
Support & ideal for various digital broadcast standards such as HD1,UHD2	It is impractical, or even impossible, to accomplish this with traditional broadcast SDI router designs	Using commercial off the shelf (COTS) hardware. 10 GigE, 25 GigE, 40 GigE and 100 GigE switches
Capacity and bandwidth management	dedicated bandwidth	dynamic bandwidth allocation
Virtualization and cloud	Limited, requires specific baseband I/O interfaces	Moving to IP will ultimately allow a shift from dedicated broadcast hardware to virtualized and cloud-based infrastructures
Reliability	Not fully redundant systems	MPTE 2022-7 provides hitless or seamless switching
Efficiency	Processing an audio stream or metadata from an SDI-based signal requires a de-embedding process, which consume significant amounts of computing capacity.	SMPTE 2110, does not require audio or data streams to be de-embedded and decreases computational overhead.
Cost	Proprietary hardware, very little changes in cost over time.	SMPTE 2110 may be too expensive with all-new IT infrastructure, new IP products, and additional human resources/ COTS IT hardware provides significant savings over time

evaluation and feasibility assessment of production and transmission, both contribution and distribution, over IP platform. Transition to IP with the set of SMPTE ST 2110 standards requires careful planning and market evaluation. The research and study phase is ongoing. It has now been decided to launch a small-scale pilot in the early stages and conduct test on equipment and networks. We also are going to use the open source EBU Live IP Software Toolkit, LIST [12], [13], to analyze captured network streams.

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Senior Engineer, IRIB Research and Development, Iran

Sepideh Ghandali works as a Researcher at IRIB R&D. She received Master of Science degree electrical (Communication) engineering from Amirkabir University of Technology in 2011. In 2012, she joined IRIB R&D and her field of expertise is contribution, distribution and signal transmission. Her professional work activity is telecommunication engineer with responsibility of broadcast engineer in the technical research and development department. She specializes in new contribution solutions for transmission of high bitrate videos such as IP which is lead to practical trials and pilots.



Afshin Yadollahi

Senior engineer, Terrestrial Communications Department of IRIB, Iran

Afshin Yadollahi works as a telecommunications engineer at IRIB. He received Master of Science in electrical communication engineering from Amirkabir University of Technology in 2013. In 2012, he joined Terrestrial Communications Department of IRIB and his responsibilities include head of the test and development laboratory, comprehensive monitoring and management of microwave radio links, member of IP committee and instructor of CISCO courses. Since 2014, he has focused on the IP protocol and its capabilities and features which makes it a suitable solution for the future of signal contribution and transmission.



IRIB R&D has made major advances in applying basic research and innovation in media technology. It develops innovative new products and technologies in broadcast/broadband industry that leads the development of future technologies in IRIB. Core research themes at IRIB R&D include deep learning and AI based services, intelligent OTT services, Internet of Things, HbbTV, development of transmission via terrestrial and satellite systems, cloud-enabled networking, IP-based content production and contribution. Our R&D projects often involve collaborations with public or private entities, including universities, government laboratories, technology start-ups and incubators, research institutes and partner companies. IRIB R&D scientists also partner with local universities to share expertise and resources.

IRIB R&D in collaboration with Iranian knowledge-based companies, has started developing IP based products related to chain of IP production, contribution and distribution.

IP Gateway

IP gateway with 10G IP Trunk for the provision of various services including ASI, SDI, AES, based on SMPTE 2022 and SMPTE 2110 family of standards, with bandwidth optimization and maximum flexibility, support point-to-point and point-to-multipoint and can be used in production and transmission over IP workflow. The main cards of this modular product:

- IPG-1000-SDI (SDI/IP Gateway)
- IPG-1000-ASI (ASI/IP Gateway)
- IPG-1000-AES (AES/IP Gateway)



IP Intercom

IP Intercom is an integrated audio communication system that employs digital audio technology over the IP network to achieve accurate communications with optimal security and reliability.

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Technical Bureau looks at **key broadcasting issues**

The ABU Technical Bureau met at NHK Headquarters in Shibuya, Tokyo, on 17 November, a day before the Technical Committee Meeting.

Bureau members discussed important issues affecting broadcasters, including the transition to digital broadcasting.

Participants were also taken on a tour of NHK facilities.

The Bureau consists of 18 members elected from among the members of the Technical Committee.

It meets twice annually, once in mid-year and once in conjunction with the General Assembly.

The meeting was chaired by the Technical Committee Chairman, Mr Hamid D Nayeri of IRIB-Iran.

The Bureau proposed two recommendations to the Committee, one on 'Supporting the Review of the Regulation of Ku-band Broadcasting Satellites' and the second on 'Supporting WBU Position on EBU's Technology Pyramid for Media Nodes'. ■



ABU Technical Committee Meeting

The ABU Technical Committee Meeting was held on 18-19 November 2019 in Tokyo.



OPENING SESSION

The Chairman of the Technical Committee, **Mr Hamid Dehghan Nayeri**, welcomed the delegates to Tokyo and said it was the opportunity of a lifetime to witness first-hand the latest developments within the NHK laboratories. He thanked NHK for its wonderful hospitality and arrangements made for the meetings, and for organising the special showcases for members to see and experience the advance solutions that NHK has developed including 8K.

Mr Nayeri then briefly highlighted the fruitful session of the Technical Bureau meeting the previous day. He said a complete review of the tasks and action items from the mid-year meeting had been carried out. He said broadcasters in the region faced multiple challenges as the growing popularity of broadband content delivery and the emerging new media players had put the traditional broadcasters in a difficult situation. Broadcasters need to carefully assess the situation and work together to take decisive action to be relevant in the current market.

Mr Nayeri also noted that the industry is moving ahead with advanced technologies such as UHD 4K and 8K services with HDR, HFR and next-generation audio. These technologies provide huge improvements in picture and sound quality providing a much-enhanced

experience for the audience. Many advanced members are either testing these technologies or have already started these services, like 8K by NHK.



In his welcome address, **Mr Keiji Kodama**, Director of the NHK's Engineering Administration Department, expressed his gratitude to the ABU Secretary General, Dr Javad Mottaghi, who he said had been strongly and proactively driving ABU activities for these past years. He also thanked the Director of the Technology and Innovation and his team for their continuous dedication to ABU's technical activities.

Mr Kodama also thanked the Chairman of the Technical Committee, Mr Hamid Dehghan Nayeri, and the Technical Bureau members for their sincere contribution to this ABU Technical Meeting in Tokyo.

He further said that with the theme of this year's General Assembly, "Building Trust: Enriching Audience Experience", broadcasters were in the era where the media landscape was drastically changing with audiences seeking more diverse and higher quality experiences through multiple platforms.

Mr Kodama said that in Japan, television services had drastically evolved during the past two decades. Digital satellite broadcasting started in the year 2000, and the analogue service was terminated in 2011. Also, digital terrestrial broadcasting

started in the year 2003, and the analogue service was terminated in 2011. Furthermore, 4K and 8K satellite broadcasting was launched last December.

However, the environment of content distribution has drastically changed due to the spread of smartphones and the growth of video delivery via the internet. As a result, consuming video-on-demand by personal devices had become the major style, especially among the younger generation.

In NHK's Three-Year Corporate Plan, we announced to proceed from 'Public Broadcaster' toward 'Public Media' to continuously fulfill as a major component of social infrastructure. In 2013, NHK launched a service called Hybrid cast, which integrated broadcast and broadband. Now, we are preparing to launch simulcast live-streaming service to deliver terrestrial channels over the internet.

Mr Kodama concluded that in order to face these challenges, we believe it would be extremely vital to share our experiences and solutions among ABU members. We will also exhibit our latest technologies at 'NHK Technical Showcase' in the room Tempo. Our hope is to make the most of this opportunity to bring constructive discussions and aggressive opinion sharing to reduce the 'digital divergence'.

In his opening address, the ABU Secretary-General, **Dr Javad Mottaghi**, said he was delighted to



be in the vibrant city of Tokyo and it was wonderful to be back since NHK last hosted the meetings in 2010.

Dr Mottaghi said that with the support and guidance of the Technical Bureau, ABU Technology was continually implementing positive changes in its approach and its programmes.

He was happy to note that ABU Technology's flagship event the Digital Broadcasting Symposium had celebrated its 15th year anniversary earlier this year. It was a proud moment for the members of the Technical Committee and the Bureau that it was an idea initiated by their colleagues and taken forward by them. With the support of our members and industry partners, the symposium was going from strength to strength. It was now a well-recognised event that the industry looks forward to every year. He said the ABU would like to see more members getting involved in the event more actively rather than just attending as delegates.

The ABU was proud that some of the early trendsetters within the industry were among its members. For example, technologies like Ultra-High Definition 4K and 8K were led by ABU members. Some of the cutting-edge research and advanced studies were carried out within the research facilities of its members.

Dr Mottaghi said the broadcasting industry was going through a lot of changes. New technologies and advanced solutions were changing the way broadcasters operated. Media consumption was becoming more and more personal and the use of the digital technologies to understand the preference of audience was key to developing an edge over one's competition.

Technologies such as cloud computing, virtual reality, artificial intelligence and the move towards all IP-based infrastructures were helping organisations to completely transform their operations and enhance existing workflows. Many advanced broadcasters were exploring the use of 5G Technology which had become a buzz word in the industry.



Mr Ahmed Nadeem

ABU TECHNOLOGY ACTIVITY REPORT

Mr Nadeem introduced the ABU Technology's activity report for the 2018-2019 period and presented all the activities organised by the department. He also commended the support received from international organisations like BES India, KOBA, BroadcastAsia, IBC, InterBEE and also thanked the World Broadcasting Unions, the EBU, WorldDAB, DRM, ITU and ASBU. He ended by thanking his team at the ABU for their tireless efforts in producing the events successfully.

BUREAU PROPOSALS

The Director, ABU Technology, **Mr Ahmed Nadeem**, briefed the meeting on the Technical Bureau's recommendations and asked for input from the delegates:

RECOMMENDATION 1/2019

Supporting the Review of the Regulation of Ku-band Broadcasting Satellites

This is for the ABU members to work closely with satellite operators, service providers and government regulators to support appropriate review of the regulation of the Ku-band broadcasting satellites to provide UHDTV programmes.

RECOMMENDATION 2/2019

Supporting WBU Position on EBU's Technology Pyramid for Media Nodes

This is for ABU members to support and take the EBU's "Technology Pyramid for Media Nodes" document (EBU TECH 3371) as a reference in implementing IP-based infrastructure within their organisations. Basically for members to use the guidelines and requirements detailed in the document to engage manufacturers and ascertain the degree of compliance necessary to effectively design, build, secure and maintain IP-based facilities. It also recommended that ABU members further study and explore the SMPTE's ST-2110 standards and consider taking the necessary steps to move to new IP-based facilities for Television or Radio in their future projects.

The meeting adopted the two recommendations without any changes.

KEYNOTE PRESENTATIONS

There were two keynote presentations.

Mr Kazutaka Ogata, Director, Broadcast Engineering Department, NHK, spoke on TV Production Technologies beyond 2020. Mr Ogata explained and presented some of this year's 4K & 8K TV programmes and portable on-the-field 4K & 8K cameras and drones.

He also spoke about 4K & 8K studio cameras, the coverage of the 2019 Rugby World Cup in Japan, and plans for the coverage of the 2020 Olympics.



Mr Kazutaka Ogata

Dr Kohji Mitani, Director, NHK Science & Technology Research Laboratories, gave a presentation on "Future Media – "Diverse Vision".

He introduced delegates to the NHK Science & Technology Research Laboratories, which were leading the evolution of broadcast technology in Japan and the world. Their work includes research on emergency warning broadcast system, satellite broadcasting, and 8K UHDTV.



Mr Kohji Mitani

FUTURE STRATEGIES



Dr Kong Bin

Chaired by the Technical Committee Vice-Chairman, **Dr Kong Bin** of NRTA, this session featured presentations Dr Hans Hoffmann, EBU/SMPTE, Dr Xie Wei, NRTA-China, Mr Shin Jongseob, KBS-Korea, Mr Lindsay Cornell, BBC-United Kingdom and Mr Yoshi Tsurimaki of T-NET Japan.

Dr Hans Hoffmann of the EBU spoke on 5G Media Applications. He described the EBU's interest in 5G because of the flexibility, increased reach and cost efficiency.



Mr Shin Jongseob

Dr Xie Wei's presentation was on the application of 4K UHD in China. He spoke on the planning and standardisation, and content production and distribution, among other aspects,

Mr Shin Jongseob's presentation was on KBS' IP-Based UHD Live Broadcast System. He gave an overview of the system design and some of the technology being used.



Mr Lindsay Cornell

Mr Lindsay Cornell spoke on 'Standards Stack for IP Production'. He looked at the challenges for traditional broadcasters and explained why the BBC has gone for IP production.

Mr Yoshi Tsurimaki spoke on 'Expansion and Interoperability of Hybridcast Services'. He gave details of the ASEAN Japan Workshop and the topics covered, including Hybridcast.



Mr Yoshi Tsurimaki



Dr Hans Hoffmann



Dr Xie Wei



ADVANCED TECHNOLOGIES



Mr Masashi Kamei

The Technical Committee Vice-Chairman, **Mr Masashi Kamei** of NHK, chaired the Advanced Technologies session. The speakers were Mr Yoichi Kondo of TBS-Japan, Dr Zhang Yu of NRTA-China, Mr Toni Fiedler of Fraunhofer IIS, Mr Yim Zung Kon of KBS-Korea and Mr Zhou Gang of NRTA-China.



Mr Yoichi Kondo

Mr Yochi Kondo presented on Development of Live Multi Viewing by first introducing the TBS Company (Tokyo Broadcasting System), which launched radio in 1951 and TV in 1955. He explained that Live Multi-viewing allows audience to select any video cameras wanted on their smartphone while watching Sports or Concerts on live TV.

The first trial was at the Kirin Challenge Cup, a football game – Main Screen for TV broadcasting and sub screen for Live Multi Viewing (e.g. select different angle of video). The demonstration was illustrated by Mr Kondo and the timing comparison was also illustrated. Regarding the background of project development, sub-screen contents for smartphones and tablet device provided by TV stations became more and more popular. TBS started to develop low-latency and scalable distribution system (e.g. scalable CDN and HLS).

With the solving of video processing and transmission delay, video delivery with a delay of 0.1 sec was achieved. Therefore, it is possible to sync the timing of broadcasting and distribution. The project also received much positive feedback from social media such as Twitter and enabled the real-time analysis of the viewer needs. The overall outcome figure was very good – total viewing time increase 7-fold. TBS concluded the project to be successful in developing a new platform by a broadcasting station.



Dr Zhang Yu

Dr Zhang Yu's presentation was on The Evaluation of 5G Broadcast. He first introduced different standards for 5G broadcasts. In 3GPP Release 13 LTE eMBMS (Evolved Multimedia Broadcast Multicast Service), the performance was not good. In 3GPP Release 14 LTE FeMBMS (Further Evolved Multimedia Broadcast Multicast Service) it was much better and became a competitor for traditional broadcast method.

3GPP Release 16 LTE-based 5G terrestrial broadcast was to ensure the technology fulfills the requirements defined in the "Broadcast" section of the "3GPP 5G Radio Requirements" (TS 38.913). 3GPP Release 17 Broadcast related item included (1) 5G New Radio (NR) and (2) 5G Core Network.

Dr Zhang also summarised the 5G Broadcast Roadmap. For advanced Interactive Broadcasting (AIB), various types of contents & services can be delivered to users through 5G networks. The AIB Work Group was established on 20 April 2018 to develop standards and organise trials and evaluations. AIB has 48 members from NRTA, the mobile industry, the broadcast industry and research entities.



Mr Toni Fiedler

Mr Toni Fiedler presented Next Generation Audio and its Application in Broadcasting and started by introducing his organisation, Fraunhofer IIS. He spoke on MPEG-H Audio (Immersive Sound, Interactive Audio & Universal Delivery). Today's experience shows that broadcast audio is not about the Codec. Broadcast audio needs compelling audio system features to attract customers with reasonable bitrate (9.1 + objects @384kbps). It also needs to be a robust system (safe broadcasting including OTT & 5G transmission). There are MPEG-H 3D audio system trials in Asia in countries

including China, Japan and Korea. The audio systems also need to control the metadata distribution, storage and interoperability effectively.



Mr Yim Zung Kon

Mr Yim Zung Kon of KBS made a presentation on The Progress of Terrestrial 4K UHD Broadcasting in KBS and Korea and began by first introducing KBS and gave a brief history of UHD development in South Korea. There are four major terrestrial broadcasters in Korea. Until 2020, 4K coverage is expected to be about 90%. Korea is using the ATSC3.0 System for UHD. UHD has three big services – 4K TV service, 4K UHD on OTT and mobile service for mobile reception. KBS is also working on UHD mobile and beyond. The UHD broadcast will be used for international sports big events. KBS believes in new technology, new user experience, and new content creation.



Mr Zhou Gang

Mr Zhou Gang of NRTA presented on The Application of Broadcasting Earthquake Warning Technology and began by introducing Sichuan Cable TV Network Co Ltd. The EEW (Earthquake Early Warning) was established in 2011 and has been serving the public for more than 8 years. The EEWS contains Sensors, EEW Center and Receiver. Characteristics of EEWS include system response time, countdown function, etc. The effect of EEW on society is significant. EEWS was used in the Changning Earthquake and sent out warnings efficiently. A demonstration video was presented. The role of EEWS improved society's awareness of the earthquake. Three modes of transmissions include Radio, CATV and internet and private network. For terminal devices of EB EEWS, it can be TV, STB, Radio or loudspeaker. The Next step is to further optimise and improve response time, safety and location accuracy, etc. Mr Zou stated that the goal is to let all countries to have access to EB EEWS.

TOPIC AREA REPORTS



The Production Topic Chair, **Mr Kazim Pektas**, Chief Engineer at TRT-Turkey, introduced the session and spoke of some important developments. Among them was the development of Ultra High Definition TV by NHK, for transmission and display technology and developing production equipment for full features 8K. NHK has developed an ongoing project to create a system for people with special needs for weather forecasts and sports. This programme was developed for people with Photosensitive Epilepsy. NHK has also developed an IT-based production system and file-based workflow. It has also developed a system with Artificial Intelligence, Machine Learning and Deep Learning, followed by a transcript system for Programme Production that recognises speech in video footage that is sent from press conference sites and also Automatic Colourisation Technology for Monochrome Video.

The Transmission Topic Area Chair, **Mr Kenichi Murayama**, Senior Manager Planning & Management Division, Engineering Administration Department at NHK, updated the meeting on the following projects topics. The Frequency Planning for Digital Broadcasting which covers ASO in the regions as well as new ITU-R text related to DTTB coverage with the frequency planning. The Next Generation Terrestrial Broadcasting investigates efforts and studies that have been done toward the realisation of next generation terrestrial broadcast solutions with reports from Japan and Korea. The Integrated Broadcast Broadband and OTT which covers the standardisation of Multimedia Coding for UHD TV and Integration Broadcast Broadband System in Japan as well as Cyber Security.



SPECIAL PRESENTATION

Mr Lindsay Cornell of BBC-UK gave a special presentation on BBC's 5G Broadcast Trial. He described how the BBC is trialing 5G in Stronsay on the Orkney Islands. By trialing 5G as a mode of broadcast delivery with mobile broadband, it was able to broadcast 13 live radio stations using a dedicated broadcast radio application.



MEMBERS' UPDATES

Members present presented their status reports which covered ongoing developments in their organisation.



TECHNOLOGY PANEL



Mr Masakazu Iwaki



Dr Kong Bin



Mr Akira Negishi



Dr Hans Hoffmann



Mr Terence Yiu



Mr Nigel Fry



Ms Hong Young-Kyung

The theme for the panel was the Future of Linear Broadcasting. Moderated by **Mr Masakazu Iwaki** of NHK-Japan, the panel featured **Dr Kong Bin**, NRTA-China, **Mr Akira Negishi**, NHK-Japan, **Ms Hong Young Kyung**, KBS-Korea, **Dr Hans Hoffmann**, EBU, **Mr Terence Yiu**, Phoenix-TV Hong Kong, **Mr Nigel Fry**, BBC-UK and **Dr Fares Lubadeh** of SpaceTech Jordan. The panel highlighted the need to collaborate and innovate, and the need to be agile in adapting to the changes in the market to stay relevant and continue to educate, inform and entertain audiences.



Dr Fares Lubadeh



THE HOST PRESENTS | NHK-JAPAN

The Host Presents session was chaired by the TC Vice-Chairman, Mr Masashi Kamei. The presenters were Mr Kohei Kambara, Senior Research Engineer, Advanced Transmission System Research Division, NHK-STRL, Mr Kazuyuki Arai, Engineer, Technical Planning & Management Division, Broadcast Engineering Department, NHK, Mr Yuki Kawamura, Engineer, Advanced Transmission System Research Division, NHK-STRL and Dr Hisayuki Sasaki, Engineer, Spatial Imaging Research Division, NHK-STRL.

Mr Kohei Kambara spoke on a study on the transmission system of an advanced ISDB-T. The study was to develop ISDB-T (phase 2) for 4K/8K UHDTV, to evaluate the basic performance and for improvement of various functions.



Mr Kohei Kambara



Mr Kazuyuki Arai

Mr Kazuyuki Arai made a presentation on IP Live Production and Upcoming Workflow Redesign. He said more production studios were switching from SDI to IP to increase efficiency of power, space, cooling facility, enhance programme quality with optimal operation environment.

Mr Yuki Kawamura spoke on New Viewing Experience with Free Viewpoint Augmented Reality Synchronised with Broadcast Video. This is a combination of UHDTV broadcast technology and AR technology, making sure the AR while presented is precisely synchronised with the video of the main broadcast.



Dr Hisayuki Sasaki

Dr Hisayuki Sasaki presented on Integral 3D Video Technology, describing NHK's research work on creating 3D without glasses. A Lens array is used to create 3D TV based spatial imaging. The system tracks the viewer's eyes to reduce the angular spread needed for the lenses. The system was on display in the showcase and delegates were encouraged to try it.



Mr Yuki Kawamura

UPCOMING MEETINGS:

Mr Nadeem provided details on DBS 2020 and showed a promotional video encouraging members to save the date and attend the event. Mr Warren Robert of VBTC-Vanuatu showed a short video on Vanuatu, which will be the location for PMPC 2020 hosted by VBTC.

Mr Akira Negishi made an announcement on the NHK Broadcasting Technology Research programme for ABU 2020.

The TC meeting was then informed of the appointment of the Honorary Vice-Chairman from VOV-Vietnam, the host of the 2020 ABU General Assembly.



TC Honorary Vice-Chairman named

The Honorary Vice-Chairman of the Technical Committee for 2020 is Mr Nguyen Nang Khang of the Voice of Vietnam, VOV.

VOV will host the 2020 ABU General Assembly and associated meetings, including the Technical Committee meeting. Each year a senior representative of the host organisation takes up the role of Honorary Vice-Chairman.

Mr Nguyen Nang Khang is Deputy Director of the VOV Production and Archive Centre, a position he has held since 2012.

He is responsible for technical management, planning for upgrading the system, and reviewing broadcasting technologies. ■



CLOSING REMARKS BY TC CHAIRMAN

The Chairman thanked NHK for their excellent hosting, magnificent hospitality and organisation of the meetings.

Tokens of appreciation were then presented to the Honorary Chairman for 2019, Mr Kenichi Murayama, TC Vice-Chairman, Mr Masashi Kamei and to the ABU Technical Liaison Officer, Mr Akira Negishi.

THANK YOU TO THE RAPPORTEURS ■



Mr Warren Robert, VBTC-Vanuatu



Mr Solomon Finau, TBC-Tonga



Mr Terence Yiu,
Phoenix-TV Hong Kong -China



Mr Paul Treleaven, IABM



Past Winners Welcomed

The Technical Committee welcomed Mr Taiji Nishizawa and Mr Takao Shimizu to the meeting as Distinguished Observers.

Mr Taiji Nishizawa, formerly from NHK-Japan, won the inaugural ABU Broadcast Engineering Excellence Award in 2003. Mr Takao Shimizu is formerly from TBS-Japan and he won the 2008 ABU Broadcast Engineering Excellence Award.

The TC was pleased to have Mr Nishizawa and Mr Shimizu join the meeting.



MR TAIJI NISHIZAWA

NHK in the spotlight



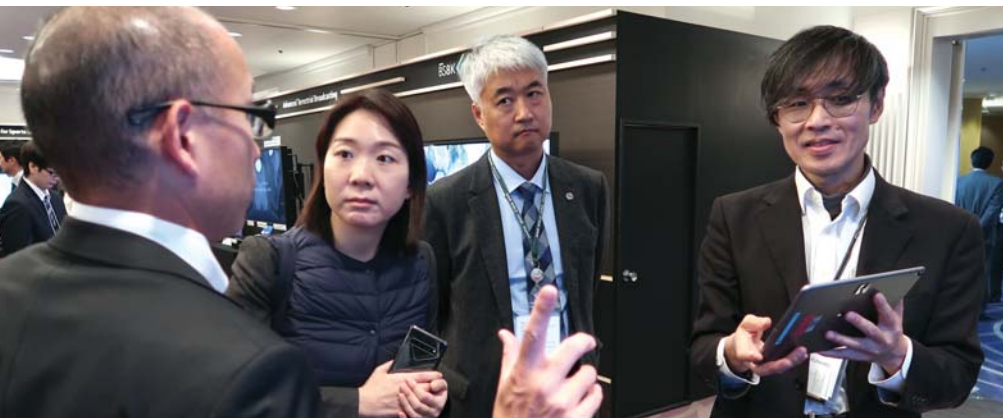
A highlight of the 2019 ABU annual meetings was the NHK Showcase which opened on 17 November and was held alongside the meetings for five days. The main aim of the showcase was to introduce ABU members to NHK's content and technology. On the opening day it featured two special events in addition to the daylong exhibition.

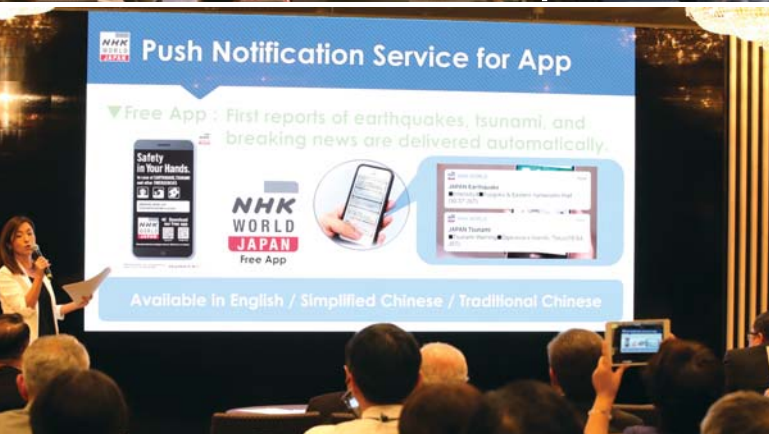
One was a presentation on "A Stranger in Shanghai", a drama based on a journal by famous Japanese writer Ryunosuke Akutagawa. The other was a look at how 1,500 young Japanese from different organisations have worked together to find a new approach for policy-making to solve social issues.

The showcase introduced the latest technology developed by NHK. The "8K Living Room" allowed delegates to experience 8K ultra-high definition video and 22.2 advanced audio, as well as presentations of many other cutting-edge technologies such as AI, AR, and VR. ■









2019 ABU Engineering Awards

ABU
ENGINEERING AWARDS
2019



The Engineering Awards consist of the ABU Broadcast Engineering Excellence Award, the ABU Engineering Industry Excellence Award, the ABU Green Broadcast Engineering Award and the ABU Developing Broadcasters' Excellence Award.

In 2019, the ABU received a total of 15 nominations for the awards.

The ABU Engineering Awards were judged by two panels of judges.

Mr Hamid D Nayeri chaired the Broadcast Engineering and Developing Broadcasters' awards panel and Dr Kong Bin chaired the Engineering Industry and Green Broadcast awards panel. The panel members are Mr Sunil, DD-India, Mr Masashi Kamei, NHK-Japan, Ms Hong, Young-Kyung, KBS-Korea, Dr Fintan Mc Kiernan, Ideal Systems, Mr Charles Sevier, Dell EMC, Mr Asaad Sameer Bagharib, Thinking Tub Media, Mr Jamel bin Seman, RTM-Malaysia, Mr Naoki Kashimura, Ikegami-Japan, Mr Peter Bruce, IABM, APAC and Mr Alexander Zink, Fraunhofer-Germany.

The sponsor of the 2019 ABU Green Broadcast Engineering Award is KOBA. We highly appreciate their support. Our thanks also to KBS for initiating the sponsorship.

KOBA

The ABU Green Broadcast Engineering Award recognises outstanding contributions in developing, implementing and/or promoting green technology in the broadcasting industry.

In 2019 there were three joint winners of the ABU Green Broadcast Engineering Award namely DRFT-NRTA China, All India Radio and NBT-Thailand.

The Radio, Film & TV Design & Research Institute (DRFT) NRTA-China won the award for the environmental protection measures taken in the Lotus TV Tower project in Colombo, Sri Lanka.

All India Radio won the award for adopting green technologies throughout its digitalisation programmes and promoting

awareness of climate change.

The National Broadcasting Services of Thailand (NBT) won the award for promoting the protection of the environment throughout its digital transition.

Mr CHANG Hyung Jun, Executive Director of TV Production Technology, KBS who represented KOBA presented the Green award to Mr Zhang Hongyin of DRFT-China. Mr Chang also presented the award to Ms. Anuradha Agarwal, ADG (Engg) of All India Radio and to Mr Kachan Kannika of NBT-Thailand.

The ABU Engineering Industry Excellence Award, which recognizes the most outstanding engineering contribution made by an individual to the broadcasting industry in the region, was awarded to Dr Reza Alidadi, Technical Vice President of the Islamic Republic of Iran Broadcasting for his outstanding leadership and innovative contributions in the development of the radio and television industry in Iran.

Mr Keiji KODAMA, Director of Engineering Administration, NHK-Japan presented the award and we invite Dr Reza Alidadi/rep who is accepting on behalf of Dr Reza Alidadi.

The ABU Broadcast Engineering Excellence Award, which recognises contributions of an outstanding nature in



broadcast engineering made by an individual in a broadcasting organization was awarded to Mr Lee Chang Hyung, Technology Executive Managing Director, Korean Broadcasting System for his outstanding leadership in establishing the digital broadcasting technology plan and his contributions in the digital transition in Korea.

Mr Hamid Nayeri, ABU TC Chairman, presented the award to Mr CHANG Hyung Jun who accepted the award on behalf of Mr Lee Chang Hyung.

The ABU Developing Broadcasters' Excellence Award which is for contributions of an outstanding nature in broadcast engineering made by an individual in a developing broadcasting organization was awarded to Mr Wali Ahmad Kabir, Head of TV, Technical Department of Radio & Television Afghanistan for successfully overcoming many challenges in RTA's ongoing



transition to digital broadcasting. Dr Kong Bin, Vice-Chairman Technical Committee presented the award to Mr Wali Ahmad Kabir.

ABU Technical Review Prizes 2019

The ABU Technical Review Prizes were awarded for articles contributed to the Technical Review from October 2018 to September 2019. The prizes were judged by the ABU Technical Committee Chairman and Vice-Chairmen.

Three prizes were presented each from the categories of Practical Implementation, Research and Case Studies.

The winner for the Best Article on Practical Implementation was Kim Hae Jung of KBS-Korea for the article titled Administrating IP-Based UHD Studio which appeared in the April-June 2019 issue.



The Best Article on Research was awarded to Mohammad Paknahad, Mahmoud Kiani and Dr Mohieddin Moradi of IRIB-Iran for the article titled A Novel Approach for Upgrading TV Studios to HDR Technology which appeared in the July-September issue.

The winner of the Best Article on Case Studies is Mr M S Duhan of DD-India for the article titled Anatomy of RF Amplifiers – Failure Mechanics and Maintenance Strategies. The article appeared in the October-December 2018 issue.

Mr Masashi Kamei, Vice Chairman ABU Technical Committee and Senior Research Engineer, Science and Technology Research Laboratories, NHK, presented the certificates to Mr CHANG Hyung Jun of KBS-Korea, to Mr Hamid Nayeri of IRIB-Iran and to Ms Anuradha Agarwal, ADG (Engg) of DD-India respectively. ■





Award is a team honour, says **Atsushi Haruguchi**

A senior NHK engineer, **Mr Atsushi Haruguchi**, has said the Distinguished Service Award conferred on him by the ABU was an honour for the broadcaster's entire engineering team.

Mr Haruguchi was speaking after receiving the award at the ABU Technical Committee Meeting in Tokyo on 18 November.

The award was bestowed on him in recognition of his important contributions to the development of television broadcasting, including the launch of 8K television.

He told the Technical Committee he believed all his NHK colleagues were being honoured for their work in developing broadcasting technology.

"In this sense, I am here as a representative of the entire engineering team of NHK."

Mr Haruguchi is the former Deputy Chief of Engineering and Director of the Engineering Administration Department at NHK. Since June 2019, he has been the Senior Executive Officer of NHK Technologies, Inc.

He contributed greatly to the development and installation of the play-out system for radio, terrestrial and satellite television broadcasting at NHK's Engineering Administration Department.

Mr Haruguchi told the meeting he felt fortunate to have been involved in assisting the digitalization of terrestrial television broadcasting in several Asian and Central American countries by applying the ISDB-T system.

He said he had spent 38 years as a broadcast engineer, during which time the industry had seen dramatic changes, from analogue to digital, tape system to server system, SDTV to HDTV, and HDTV to UHDTV.

"We faced various difficulties at these changes, but we managed to overcome the obstacles.

"Then we accomplished the digitalization and the analogue switch off in terrestrial and satellite television broadcasting, and the launch of the world's first 8K broadcasting last December."

Mr Haruguchi pledged to continue working to help advance broadcasting technologies in the Asia-Pacific region. ■



Mr Atsushi Haruguchi
Senior Executive Officer,
NHK Technologies, Inc



IBC 2019 Report

from **Nepal Television Corporation**

First of all, I would like to extend Special thanks to the Asia-Pacific Broadcasting Union (ABU) and Nepal Television for giving me such a wonderful opportunity to enhance my knowledge and experience in the latest broadcast technology, effective and efficient use of TV technology and the future technology of TV broadcasting.



Bishnu Ram Neupane
Acting DGM, Nepal Television

The International Broadcasting Convention (IBC) is an annual trade show happening in every year in Amsterdam, Netherlands at the RAI exhibition centre. Usually, IBC starts in the month of September. The five-day trade show kicked off on 13 September and concluded on 17 September 2019. IBC is one of the world's most influential media entertainment and technology shows and is focuingsed on broadcasters, content creators and providers, equipment manufacturers, professionals, engineers, researchers, and other participants in the broadcasting, entertainment and technology industry. IBC 2019 had more than fifty-Six thousand attendees from 150 countries around the world. More than 1700 of the world's key technology suppliers were exhibiting, alongside a leading conference.

At the five-day conference, different parallel conferences were conducted in the Keynotes and Global Gamechangers, Lounge talks, Owners and associations,

Big Screen, Esports at different venues. Altogether, 109 sessions on different topics were presented by the speakers.

In the Keynotes and Global Gamechangers conference, The most influential leaders transforming the industry delivered agenda-setting keynotes giving exclusive insight of their products. On the topics, "Can public broadcasters stay relevant?" and "Creative challenges and digital giants" At "Global Content Gamechangers" Ms. Forbes and Ms Lisa Opie presented the current status among Global Gamechangers.

Likewise, on the Big Screen Auditorium World, leading film makers from BBC Studios National History Unit showed clips and shared insight into latest technical advances. In Rocketman: 'The story of the music and the story of the edit' Elton John and Oscar winning editor Chris Dickens shared their experience on the Big Screen.





Similarly, Future Zone was another major attraction to the visitors and delegates at IBC. The future Zone, featured the latest ideas, innovation and proof-of-concept technologies from industry and academia. Mainly, Future Zone provided practical answers to questions like; 'How do 3D virtual Studios operate?' What are the quality limits for UHD media?' 'What effect will the new 5G mobile standard have on production, contribution and distribution?' and 'How will we consume media in the future as interactive and immersive entertainment experiences achieve greater traction?'

NHK showcased virtual da Vinci, BBC Research and Development, convergence TV, AMD Radeon Pro for wireless VR, Vision III Imaging Inc VR together showed their products in the Future Zone.

Based on my interest and experience I always had one question in my mind during this exhibition, 'Is this the end of traditional Satellite and terrestrial broadcasting?' They are delivering content efficiently but why are they falling behind the needs of viewers?

There were interesting findings from CenturyLink 'Television 2.0 Report', 67 percent indicated that they would accept a trade off in quality when watching onmobile and more than 80 percent people say that they are watching more content now than ever before. Another interesting topic was, 'What is the IP Transition

Impact on Broadcast? Likewise, 'What is the impact of the move to OTT (Over-the-Top) delivery on traditional platforms?

Many channels have deployed IP for their delivery platforms such as KBS, Arena, Fox Network, CCTV, Sky and emerging in the market. Sooner and later, IP migration is inevitable.

Cyber security was another of the hottest topics in the conference. US\$2.7 Billion damages were reported in 2018." According to Microsoft, the potential cost of Cyber-Crime to the global community is a mind boggling US\$500 billion and data breaches will cost the average company about US\$3.8 million".

This exhibition visit was a good experience and a great exposure for me. I visited many booths and had meetings with different experts and professionals. As a representative of our National Broadcaster, I focused on the new technology available for efficient and effective use in my organisation.

In conclusion, it was good experience and benefit to me, indeed for my organisation. The conference and Exhibition gave me different ideas and knowledge and built more confidence towards decision making for our future needs. ■

IBC 2019 Report

Report by

Mr Hamid Dehghan Nayeri, Chairman ABU Technical Committee, Director, International Technical Affairs & ABU Technical Liaison Officer, Islamic Republic of Iran Broadcasting (IRIB-Iran)



This year we had a chance to visit IBC in Amsterdam and participate in several conferences and visit stands. In brief, IBC (International Broadcasting Convention exhibition and conference) is the second largest broadcast and media exhibition, following the National Association of Broadcasters (NAB) show held in Las Vegas, USA. This year, the NAB exhibition attracted approximately 91,000 visitors and the IBC exhibition attracted approximately 56,000 visitors around the globe from 13-17 September to see the latest technologies and products.

We can say the IBC event is “the premier annual event for professionals engaged in the creation, management and delivery of entertainment”. IBC is operated by a partnership of six leading international broadcast bodies: IABM, the IEEE Broadcast Technology Society, the Institute of Engineering and Technology, the Royal Television Society, the Society for Broadcast Professionals, and SMPTE.

In addition to its huge exhibition area, IBC this year organised a comprehensive conference program encompassing everything from the technical side of broadcast technology to cinema screenings with different panels of senior experts all around the world.

Broadcast and Media Industry Trends at IBC 2019:

One of the useful publications for IBC published by IABM (International Association of Broadcast and Media) a member of ABU, which published a special report for this IBC on new technology trends across the broadcast / media industry.

Regarding the direction to lead the change of the industry, the IABM report summarises the major issues of competition among global companies such as Netflix, Apple, and Disney, increased investment in content and platforms, and rapid response to changing markets.

The following technical trends were also identified at IBC as major trends for this year's event.

from IRIB-Iran

Recently in the broadcasting and media industry, as with other industries, the introduction of cloud-based services is the most important topic. Almost half the companies are already using the cloud, and more companies are expected to introduce it in various areas in the future.

In addition to technologies such as cloud, remote production, and IP-based content creation, the following new technologies were also key issues.

AI: AI and data-driven solutions are quickly entering the media content industry, forcing many companies to offer optimised and personalised services. Artificial Intelligence (AI) offers a wide range of functionalities, from achieving efficiency in editorial, automating workflows to tagging metadata.

AI is currently being employed to monitor regulatory compliance, the application of AI to enhance media workflows, aid editors and producers in image selection, video encoding and delivery over IP as well as overlaying metadata for quality assurance in the ever-converging ecosystem.

For the news AI will take away human job functions, and is “massively important” for organisational adoption to save costs, with the advantage of job shuffle responsibilities and enhancing editorial and creative storytelling.

AI changes regulation control checks and enables us to spend more time telling the story better and giving greater impact to audience on the news.”

UHD: Many content services have begun offering 4K / UHD content, but the addition of high dynamic range (HDR) technology to FHD content has attracted attention as an alternative. IBC 2019 highlighted that the general public are buying 4K/Ultra HD displays at an enormous rate. Indeed, it is difficult to go into a retailer and find a set that is not equipped for UHD. Analysis at IHS, says that globally more than half of all TVs shipped in Q4 last year were 4K. In Western Europe 63% of shipments were 4K.

Falling prices are helping sales, and buyers are opting for ever-larger screen sizes. Next year's global sales will easily top 130 million units, and 55” now seems to be the ‘sweet spot’ in terms of screen size.

The other fact is the growing number of UHD channels and programming now available and several broadcasters

are pushing 4K content, in particular in Sport and Drama. These broadcasters are investing in new 4K episodic drama productions.

Satellite operators say there are now many Ultra HD channels (or feeds) available around the world; up an impressive 24% over the past year. Some markets have an significant number of 4K channels available.

VR: While the popularity of VR headsets is an obstacle, the development of various VR-related technologies is progressing, along with the utilisation of VR in the content creation stage. There were many relevant booths featuring VR. Some of them caught our attention. This year a company developed cutting-edge technologies to create a unique experience placing the spectator in the middle of the action: the Free Viewpoint Video System. With this technology we can view the same scene from various angles, changing to the perspective of an athlete on the field or any number of alternate viewpoints. Additionally, viewers can control both viewpoint and game time at will. This revolutionary technology dramatically changes how sports will be viewed. The world's first implementation of the upcoming MPEG standard for video-based point cloud compression (V-PCC) on today's mobile hardware was also presented at IBC.

Blockchain: The Blockchain industry has matured past the 'blockchain as a feature' mindset, meaning a lot of companies have moved on to the next trend. But the introduction of blockchain technology in the media content industry is not yet a hot subject in IBC and few companies focused on it.

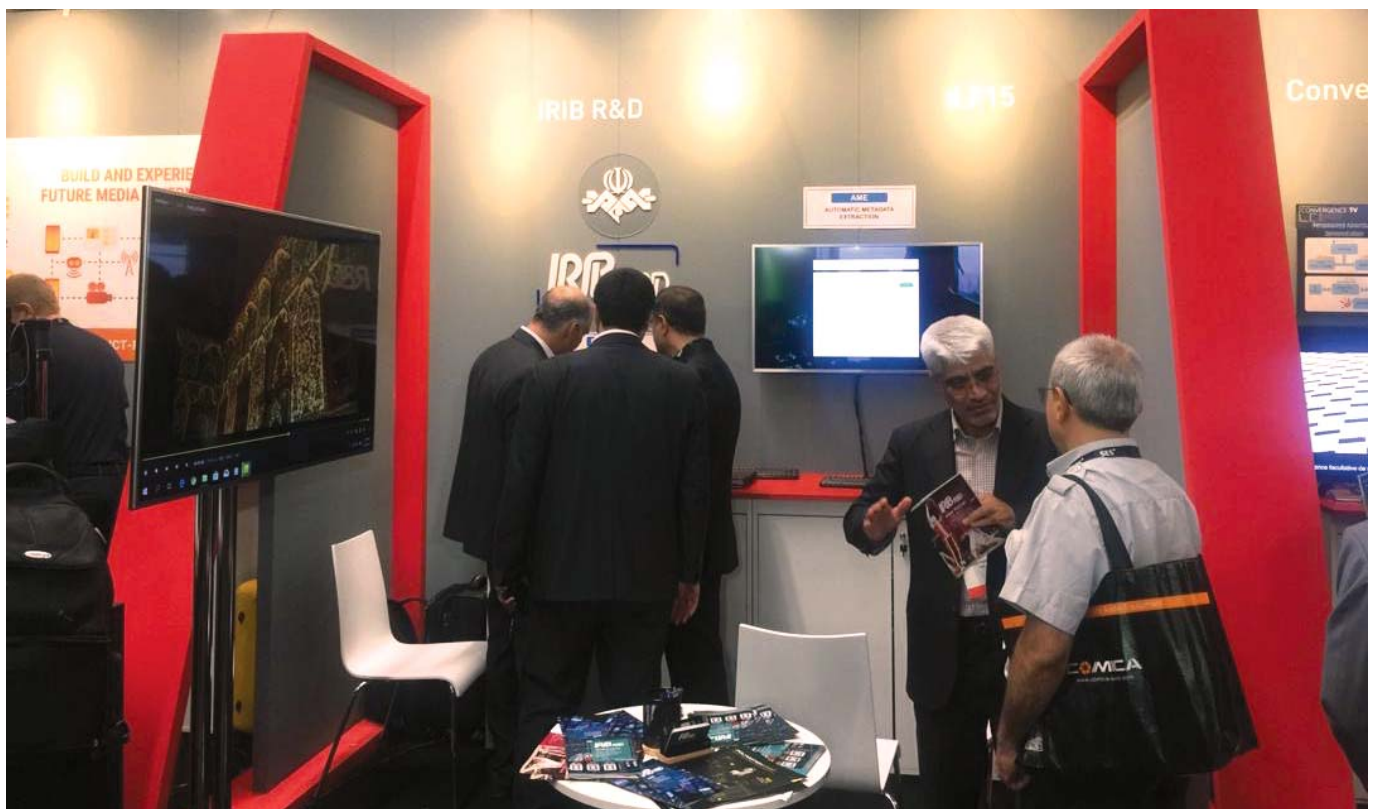
Future Zone at IBC 2019:

This year at IBC the **Future Zone** brought together the

very latest ideas, innovations and concept technologies from international industry and academia, and showcased them in a single specially curated area where innovators could meet. Along with booths, this zone offered an open access to the IABM Future Trends Theatre which had an **interesting program**. A key competent of IBC's Future Zone footprint was this Theatre. The packed programme of 60, 20-minute, presentations explored up-and-coming technology and business trends and how they will segue from today's environment. Executives from companies including Hexaglobe, video menthe, Prime Focus Technologies and Blue Lucy presented on a range of topics including AI, cloud business models, new-age content supply chains, and blockchain.

Major trends this year included 8K, 5G, and immersive media (VR/AR/XR). The VR booth was located in the center of the Zone and high visibility, generating a lot of attention. Also from ABU region, NHK Japan and also IRIB Iran booths had many visitors and a lot of attention.

The Islamic Republic of Iran Broadcasting (IRIB) R&D had collaborated with Sharif University of Technology on some exciting projects, highlighting here Visual Quality Assessment (VQA) using Deep Learning to accurately predict human mean opinion score (MOS) values. Other projects include Low-Cost Motion Capturing with Deep Neural Network for 3D Animations, and Semantic Metadata Extraction for Audio-Visual Content using Deep Learning Methods. NHK of Japan introduced the world's first 8K satellite broadcasting system plus 8K content showcase, and the next-gen 8K terrestrial broadcasting system with Versatile Video Coding (VVC) technologies. Fascinating glimpses of future media consumption, glasses-free 3D-TV for mobile devices and future TV viewing using AR glasses, could also be experienced in booth 8.F01. ■



InterBEE 2019

by Nguyen Duc Tue,
Deputy Director General
Technical Production Center,
Vietnam Television



“What will you do next”, was the InterBEE 2019 slogan, I wondered what meant. It seems that those who use broadcast technology now have to make several decisions; stay with HD or move on to UHD; traditional SDI or IP based infrastructure; how to deliver content to audiences and how to enrich user experiences...

InterBEE is a broadcast technology show that focus on the Japanese market only, it is not easy to visit and navigate the show without understanding Japanese. However, within just the three days of the show, it was not difficult to learn what is going on in broadcast technology today.

4K and 8K technologies are everywhere: The Tokyo Olympics 2020 will be covered in 8K and the first 8K channel was aired in Japan last year. So, all the Japanese big names demonstrated their product here, with 8K video content, huge 8K screens with 22.2 audio etc. I was interested in the demonstrations of 8K and AI technology. They used only one 8K camera to shoot a baseball match, and the system automatically generated HD shots from that 8K picture, with auto-tracking of the movements of the ball, or of specific players. That was impressive.

The InterBEE IP Pavilion showed the full range IP based products, including cameras, routers, mixers, monitors, timing devices etc. ...with the main vendors involved. It seemed that the ST2110 standard was almost market ready.





InterBEE also showed that 5G also promises a big change in broadcast technology, and a demonstration of live multi-venue video production, connected by 5G, including video, audio, tally and intercom were shown. Production using 5G wireless connection could happen in the near future.

Cloud-based services and broadband internet is again a big trend and some service providers offer everything for us to easily create a TV channel or deliver content to audiences: With the new techniques of ingest, transcode, catalogue, management, playout, VOD, auto subtitling etc., traditional TV now faces a big challenge. Anyone can produce and broadcast video over the internet with a lot more features and new user experiences.

Besides showing the bigger trends in broadcast technology, of course InterBEE featured many

smaller vendors, whose products help freelancers, amateur video makers or small production houses to improve their output. Video shooting, editing, finishing, delivery etc. have never been easier.

Thank you to the InterBEE organisers and to the ABU for arranging my visit to the event. Your sponsorship has been very valuable to me. ■





Regional Workshop

on DRM Digital Radio Implementation and Rollout

9-10 October 2019 Kuala Lumpur

The Asia-Pacific Broadcasting Union (ABU) in partnership with the Digital Radio Mondiale (DRM) Consortium organised a regional workshop on DRM Digital Radio Implementation and Rollout. The workshop was held in Kuala Lumpur, Malaysia from 9 to 10 October.

The main objective of the workshop was to provide broadcasters, regulators, and other stakeholders with a clear understanding of the technology and features of DRM digital radio broadcasting standard. Industry professionals and the DRM consortium members shared expert knowledge and up-to-date information on DRM digital radio implementation and rollout. The topics ranged from DRM network design and planning considerations for local and large area coverage to the latest DRM developments around the world, including DRM receiver status.

More than twenty-five participants from broadcasters and regulators in the Asia-Pacific region benefitted from the event. Participants were acquainted with real world case-studies on how broadcasters could plan to move from analogue to digital radio for a full-scale countrywide rollout. One of the highlights for the participants was a live demonstration on setting up a DRM content server and configuring a transmission system as a hands-on exercise.

The two day event commenced with an introductory session on DRM standards, and its features & benefits. The Digital Radio Mondiale (DRM) is an open digital radio standard that it works in all frequency bands from LW, MW, SW to FM. Some of its salient features are that it

offers more choice, excellent audio quality and multimedia applications for listeners. Furthermore, its robust signal gives wider coverage with SFN networks and tuning by station name is possible in addition to its emergency warning and alert functions. Participants heard different audio samples and were able to compare them with conventional AM signals and digital audio signals of different codec choices.

The use of DRM for local coverage in the FM Band was one of the key discussions in addition to Band I and Band III. The open ITU standard with 96kHz bandwidth, for varying bit rates, suits flexible configuration with respect to capacity, coverage, and transmission power. The trade-off allows DRM to be deployed in two modulation modes and four code rates in the VHF band. Network design and planning considerations are important

steps to migrate to DRM for local coverage. Different migration scenarios are possible including the ability to simulcast within an existing FM services with no disruption to those services. DRM is also capable to operate in SFN networks for improved coverage, gap filling and better resource management.

Participants were exposed to hardware setup, infrastructure and cost considerations. The DRM transmission chain was presented including setting up of device interfaces using audio, data, and Journaline services. The content server could be set as standalone unit at a studio or integrated into the transmitter in addition to using it separately as the interface device for content archiving. The use of digital STL equipment for programme distribution and receivers for monitoring & logging purposes were also





Radu Obreja, DRM

considered in the infrastructure set-up. Typical cost scenario of migration costs, with respect to CAPEX and OPEX, were also illustrated.

'Round the Globe,' case studies on DRM deployment in the FM band was also presented at the workshop. The delegates were informed about how the digital radio system was being adopted in South Africa, Indonesia and Russia. When the DRM trial was started by the public broadcaster in March 2017 in Johannesburg South Africa, it was seen that DRM signal inserted between two FM signals did not cause any interference. Likewise, both adjacent high power FM stations had no impact on the DRM signal. The trials in Indonesia on both MW band and FM Band were also presented, including simulcast operation in FM with DRM services. No disturbance to neighboring FM stations were noted and mobile and indoor reception results were excellent as showed. Short Wave trials at three sites in North Russia and at two SFN sites in Moscow and another VHF trial in St Petersburg were examples showcased from Russian DRM deployment.

The Indian case study was comprehensively discussed and analysed at the workshop. Now, All India Radio (AIR) has 35 DRM transmitters on MW and four transmitters on SW, making the country one of the world's largest digital radio deployments so far. AIR has upgraded five transmitters with latest xHE-AAC codecs and it serves with improved audio signals, Journaline, text messages



Alexander Zink, DRM

and service logos. The regulator, TRAI, issued recommendations on Digital Radio Broadcasting in India on 1 February 2018.

Participants enjoyed a remarkable session on the second day with hands-on exercise and demonstrations. The participants were given the chance to configure a DRM service of their choice and capability. The configuration was done on a demo content server which would be linked through internet to respective radio stations. The audio, data, text and Journaline services could be modified & set-up as per the service channels and bandwidth available and codec choices the DRM radio offers. Different modes and sets of configuration were tested during the live demonstrations. Earlier, participants had familiarised themselves with different receiver sets, devices and importantly the emergency alert triggering feature of the DRM digital radio set-up.

DRM digital Radio in AM bands is widely deployed for large area coverage. The conventional LW, MW and SW bands are being reused to deliver exciting new digital radio. It offers FM like sound quality with no more fading, crackling and distortions. Bandwidth options are available for 9 or 10 kHz and 18 or 20 kHz with flexible configuration as a trade-off between robustness, coverage and transmission power. For energy consumption, examples were shown that, for the same coverage, a 100kW MW transmitter can be replaced with a 40 kW DRM transmitter. A conservative calculation by the ITU suggests that even

20 kW DRM Tx may achieve the same coverage.

DRM's emergency warning functionality was also showcased as part of the demo. DRM radio has built-in tools required for a quick and complete mass-notification in case of disasters. The CAP protocol is used for sending EWF Journaline, text messages, associated audio and alarm to receivers. Participants got to know from use cases and trials by All India Radio and others that disaster information is displayed on the receivers in English and other languages.

Countries that are rolling out DRM digital radio services include India, Indonesia, China, New Zealand, Bangladesh, Russia, South Africa and Brazil among others. In 2016, China started SW digital broadcasting with multiple transmitters installed throughout the country. Bangladesh has also acquired few transmitters for digital radio rollout. In Brazil DRM tests have been carried over the last few years using AM and VHF bands. Germany has also used DRM services for on-board infotainment service on a ship.

Up-to-date information was shared on DRM receiver status and developments worldwide. India alone has around two million cars with DRM receivers on the road. The receiver brands are mostly Avion, Gossell, Titus II and with other new brands like Innot, starwaves and RF2digital coming to the market. Starwaves is on mass production with cheaper radio of prices down to US 29 Dollars. Titus II has multimedia player radio app on android that supports DRM, DAB+, FM and AM reception. Fraunhofer IIS has a DRM receiver for mobile phone with a built in WiFi hotspot to serve tablets and mobiles.

The experts jointly discussed about meeting the broadcasters' needs to migrate to DRM, especially in the Asia-Pacific countries. They highlighted that regional and national roll-out for large area coverage could be deployed using SFN and upgrading existing services to slowly to DRM. In big cities with crowded spectrum use, stations could ease the FM spectrum by inserting DRM transmissions for local coverage in simulcast mode. Likewise, in villages and hills with few FM services, these may be digitised to reduce the overall transmission cost. Key message from the workshop was that relevant national authorities should start communicating with all stakeholders to get them involved and set a realistic roadmap with a launch date. Also holding public campaigns to create awareness for a successful national rollout. The workshop was presented by experts from the DRM Consortium. ■



News from The ABU Region



MEASAT WINS APSCC 2019 YOUNG TALENT AWARD

Vinothan Nadarajah, Assistant Manager, Business Development and Strategic Planning, at MEASAT Satellite Systems Sdn Bhd, has won the 2019 Asia-Pacific Satellite Communications Council Young Talent Award.

Vinothan, who has 11 years of experience in the satellite communications industry, was acknowledged at APSCC's third Young Talent Award at the Intercontinental Hotel, in Bangkok, Thailand.

This is the second year in a row that MEASAT was recognized in developing some of the brightest talent for the development of future technology leaders.

The award, presented by Gregg Daffner, President of APSCC, on 21 November 2019, recognises Vinothan's achievements in leading the initiatives of Malaysia's first satellite-based consumer broadband service, which enabled thousands of unserved Malaysian to receive broadband connectivity for the first time.

The APSCC Young Talent Award is part of the APSCC efforts to ensure a healthy future for the satellite industry and to attract and retain young talent.

The award is presented to give the best of the young staff encouragement and public recognition of their contributions to the Asia-Pacific satellite and space community.

MEDIACORP DEPLOYS MULTI-PLATFORM STRATEGY TO COVER 30TH SEA GAMES

Mediacorp, Singapore's leading transmedia broadcaster, has been actively growing its audiences with a combined digital and linear platform strategy. The company provided coverage of the 30th SEA Games in real time across multiple platforms, which included three dedicated channels on Toggle, selected sports and daily highlights on Channel 5, and curated content on Toggle's YouTube channel. The 30th SEA Games was held in the Philippines from 30 November - 11 December 2019. Two segments of the coverage captured the most spectacular competitive moments. As part of the social media initiatives, Mediacorp artiste brought audiences the sights, sounds and cuisines happening on the sidelines of the SEA Games, as well as highlights new sports added, short clips content was shown on free-to-air, digital and social media platforms.

Mediacorp's multi-platform approach in covering the SEA Games will indeed engage fans anytime and anywhere. The station will also be the olympics network for Singapore serving as the home for Tokyo 2020 for fans in the republic. [\[APB News\]](#)

RADIO VANUATU CAPITAL DEVELOPMENT WORK BEGINS

With the support of the Government of Vanuatu, the Vanuatu Broadcasting and Television Corporation (VBTC) has begun work on a VT942 million (US\$8.1m) infrastructure upgrade to improve radio and free-to-air television service throughout Vanuatu.

The first phase involves the design, installation and commissioning of a new shortwave (HF) and medium wave (MF) service for Radio Vanuatu, the country's public radio service. Costing for phase one will be in excess of VT242 million (US\$2.2m) and is funded by the Government of Vanuatu. Following the improvements to shortwave and medium wave services, VBTC will also undertake technical work to strengthen the coverage and reliability of its FM services. A 10kW MF Nautel transmitter and a 10kW HF transmitter manufactured by Hanjin Electronics of South Korea will be installed at VBTC's major public service transmission site at Emtan Lagoon on Efate.

The second phase, beginning early 2020, will reopen Radio Vanuatu's medium wave radio transmission facilities at St Michelle in Luganville on the island of Santo. This will provide AM service to provinces in the top half of Vanuatu at a cost in excess of VT300 million (US\$2.5m). The third phase will expand the national television free-to-air service, Television Blong Vanuatu, along with a new digital television service. This final phase will cost an estimated VT400 million (US\$3.5m).

The Government of Australia funded the scoping study for the radio upgrade project and is providing funding support to implement the strategic reform programme. Meanwhile Kordia New Zealand Limited has been awarded the contract to project manage, design, install and commission the new radio transmission facilities beginning with the facilities at Emtan Lagoon outside Port Vila. Alongside the infrastructure upgrade, is an extensive programme to strengthen the technical capacity of Vanuatu's broadcast technicians along with a long-term maintenance regime to expand the life of the equipment. [\[dailypost.vu\]](#)

SUCCESSFUL 8K LIVE DISTRIBUTION VIA 5G NETWORK

NHK Technologies, Inc. in collaboration with Rakuten Mobile was successful in live transmission of 8K video using Rakuten Mobile's 5G network. The live transmission experiment makes use of Rakuten Mobile's 5G network in order to stream 8K video content from NT's 8K Cloud Distribution System. The use of the public 5G wireless network frees the user from fiber-optic network constraints, and greatly enhances the user's freedom of location in content production.

NT believes there will be increased demand for 8K live transmission of sporting events, as seen from the popularity of 8K public viewings of the 2019 Rugby World Cup games. NT strives to bring a better media experience in areas such as sports, entertainment, education, and medical applications, through the use of 5G network infrastructure, in collaboration with network providers such as Rakuten Mobile. The transmission was demonstrated at InterBEE 2019 during November 13 – 15 at Chiba Japan.

NHK Integrated Technology and NHK Media Technologies merged in April 2019 to form NHK Technologies, Inc. The merger of NHK's two technical subsidiaries has enabled NT to provide one-stop services for the entire range of broadcast-related services. NT continues the two companies' mission

of contributing to a better media society through the development of related technologies. [\[InterBEE.com\]](#)

CHINESE BROADCASTERS NRTA COLLABORATE WITH FRAUNHOFER IIS

Fraunhofer IIS has signed a memorandum of understanding with Administrative Bureau of Radio Stations of the Chinese National Radio and Television Administration (NRTA) to strengthen the cooperation for the advancement of Digital Radio Mondiale in mainland China.

According to Fraunhofer IIS, the MoU, which was signed at its headquarters in Germany, is based on long-term mutual trust established in previous collaborations, and aims to further develop the cooperation with regard to the open terrestrial DRM standard, including technologies substantially developed by Fraunhofer IIS, such as the xHE-AAC audio codec and the Journaline text service. In addition, it says, the two parties will intensify their exchange of information on DRM technology, work on jointly promoting DRM technology, hold workshops on DRM technology, and conduct field trials to successfully drive the deployment of DRM in China. [\[RadioWorld\]](#)

JAPAN'S TBS TV BUILDS NEWS STREAMING WORKFLOW WITH ATEM SWITCHERS

Japan's TBS television broadcast station has built a news streaming workflow with Blackmagic's ATEM 2 M/E Production Studio 4K, ATEM 1 M/E Production Studio 4Ks and ATEM 1 M/E Advanced Panels. This new facility is used for streaming daily news as well to provide extensive streaming news content covering Japan's upcoming election campaign.

TBS, one of Japan's top commercial broadcasters, has grown their streaming programming as the demand for providing up to the minute news to non TV devices like smartphones and computers has grown. The channel now includes a YouTube channel for breaking news, a 24-hours news streaming channel for satellite broadcast and news streaming for social media such as twitter and Facebook. All of these will include content created with the Blackmagic Design ATEM switchers, which were installed at TBS's main Tokyo locations.

Each ATEM switcher receives pictures from television relay, VTRs and subtitles. Taking advantage of the ATEM 2 M/E Production Studio 4K's 20 inputs, TBS sends camera feeds to the switcher while using additional inputs for subtitles. Each ATEM switcher is also connected to an

ATEM 1 M/E Advanced Panel via LAN for more intuitive operation. Tallies are used for two VTR inputs with the ATEM 2 M/E Production Studio 4K and one VTR input for the ATEM 1 M/E Production Studio 4K. Audio from camera feeds on the ATEM 2 M/E Production Studio 4K are sent to an audio mixer via Blackmagic's Mini Converter SDI to Audio. Then all video and audio are sent to a matrix router and each program is streamed via an encoder. [\[Content+Technology\]](#)

GATES AIR'S EXCLUSIVE TV TRANSMISSION DEAL WITH DOORDARSHAN EXPANDS TO NORTHERN INDIA

India's national broadcaster plans to deploy six GatesAir Maxiva liquid-cooled, digital-ready UHF transmitters to equip three greenfield sites in the Jammu region. GatesAir, a global leader in wireless, over-the-air content delivery solutions for TV and radio broadcasters, has received a new TV transmission order from Doordarshan, India's national broadcaster, to strengthen analog UHF television coverage in the Jammu region. GatesAir, Doordarshan's exclusive TV transmission supplier since 2012, delivers six digital-ready Maxiva ULX liquid-cooled transmitters by the end of 2019. The transmitters integrate GatesAir's APEX M2X multi-standard Exciter, allowing Doordarshan to convert the transmitters to DVB-T2 or DVB-T2-Lite at any time.

GatesAir has delivered more than 30 digital-ready Maxiva TV transmitters to Doordarshan over the past seven years. The six new 10kW transmitters is deployed in redundant 1+1 configurations at three sites in Jammu, Srinagar and Leh, and especially to improve coverage along India's northwest border.

Doordarshan selected GatesAir due to the continued reliability of its existing transmitter fleet, which is particularly important in the Jammu region due to its dynamic climate and mountainous terrain. GatesAir was also the only vendor able to meet Doordarshan's exacting technical requirements outlined in the tender document. The broadcaster's testing and evaluation standards were met with compliance upon a recent visit of Doordarshan executives to GatesAir's Quincy, Illinois manufacturing center. [\[GatesAir\]](#)

OTT TAKES CENTRAL STAGE AT BROADCAST INDIA 2019

India's media consumption has grown at a CAGR of 9% for the period 2012-18, almost nine times that of the US and twice that of China. Furthermore, the media industry employs more than

3.5 million people, including both direct and indirect employment in 2017. The 29th edition of the Broadcast India has drawn even more crowd. From content creation to delivery, the broadcast show in Mumbai, India, showcased advanced innovations in broadcast and media technologies, as well as emerging trends to help broadcasters thrive in the digital age.

The event, held on 17 - 19 October 2019, was supported by global exhibitors such as Sony, Avid, Red Digital, Canon, Panasonic, VTI, Datavideo, Ross Video, For-A, Grass Valley, ARRI, Carl Zeiss, Panther, Seagate, AJA Video Systems, IHSE, Primestream, Ikegami, Netweb Technologies, Sennheiser, Octopus and many others eyeing the growing media industry in India.

To fully engage the attendees, the event was packed with activities, workshops and seminars, zones, partner programmes and networking receptions. As OTT took central stage, Next-Gen Technologies in Broadcast Media & Entertainment Industry formed the core key theme of the conference sessions. Indeed, the entire broadcast ecosystem is witnessing a major transition in traditional broadcasting with the OTT and social media services gaining increasing acceptance across multiple platforms, including smartphones, in the land of over two billion eyeballs. [\[APB News\]](#)

INTER BEE 2019 ENDS SUCCESSFULLY

The Japan Electronics and Information Technology Industries Association (JEITA) announced the successful end of Inter BEE 2019.

The 55th International Broadcasting Equipment Exhibition 2019 had 1,158 exhibiting companies/organizations in 2,125 booths and 40,375 visitors. The exhibition included 632 companies/organizations from 37 countries/regions overseas. This was an event held in Makuhari Messe, Japan over three days from November 13 to 15 that brought together under one roof the latest innovations in video, broadcasting, communication, audio, lighting and the media business.

Inter BEE aims to further develop as a comprehensive event for media communications and entertainment that covers the areas of creating (production), sending (transmission) and receiving (experiences) with content at the core of this. The organiser plans to hold InterBEE 2020 in Makuhari Messe over three days from November 18 to 20, 2020. [\[InterBEE\]](#) ■

DIGITAL BROADCASTING Updates

FIRST DVB-I SPECIFICATION APPROVED AND PUBLISHED

The DVB-I specification was approved at the meeting of the DVB Steering Board in Geneva. It has been published as DVB BlueBook A177. The specification aims to ensure that linear television delivered over the internet is as user-friendly and robust as a traditional broadcast television experience. It offers the possibility for linear television services to be delivered to any device with a suitable internet connection and media player, including TV sets, smartphones, tablets and media streaming devices.

The DVB-I specification defines DVB-I Service Lists, a means for internet-connected devices to find curated sets of linear television services that may be delivered through broadband or broadcast mechanisms. It also defines the methods to retrieve electronic programme data for those services, which can be integrated into a single coherent offering that is accessed through a consistent user interface.

With the publication of the DVB BlueBook, implementers can proceed with the development of DVB-I-enabled clients, while broadcasters and other content providers can take the necessary steps to make their services available via DVB-I. [DVB]

TRADITIONAL BROADCASTERS EYE CONTENT ON SOCIAL MEDIA PLATFORMS, AMPERE SAYS

"Made-for-social" video content is rising in popularity, especially among younger viewers, and that demand is being met by many social platforms with the commissioning of projects. But traditional broadcasters are also attempting to get in on the action, often in a funding role, according to Ampere Analysis. Based on research into the strategies of digital studios, Ampere has found that digital studio groups are diving further into video specifically aimed at social platforms. Since the middle of 2018, YouTube, Facebook and Snapchat have commissioned more than 200 digital originals, scripted and unscripted. 2020 will see the launch of another platform, Quibi, which has more than 80 projects of its own in development.

However, while digital studios are interested in creating content specifically for these platforms, there's an ebb and flow to their ability to produce them. Following 44 projects commissioned in Q4 2018, only 10 titles were commissioned by the social players in Q1 2019; it would rise to 68 in Q3 2019. Digital studios are working with broadcasters, discovering talent and create or license IP to commercial and public broadcast groups. [tvtechnology.com]

EXPANDED CLOUD MEDIA WORKFLOW FOR LIVE STREAMING FROM SPACE SUCCESSFULLY TESTED

At SMPTE 2019, the National Aeronautics and Space Administration (NASA) and Amazon Web Services (AWS) successfully tested a workflow that marks the first use of cloud resources for data storage and video origination for streaming from space. The proof-of-concept expands on the workflow NASA and AWS co-

produced in 2017 to enable the first-ever live 4K UHD stream from space, and now includes cloud-based media services for high-quality and secure live video transport, video origination and packaging, broadcast-grade live video processing, and content delivery networks. The test took place during a special SMPTE program honoring the 50th anniversary of the Apollo 11 moon landing, and supported a special live interview with NASA Astronauts Christina Koch, Jessica Meir, and Andrew Morgan located 250 miles above Earth aboard the International Space Station and two NASA colleagues presenting at SMPTE 2019 in Los Angeles.

NASA is seeking innovative ways to reduce the cost and complexity of live streaming from space as it prepares to send the first woman and next man to the lunar face by 2024 through its Artemis architecture. By shifting 90% of the workload into the cloud instead of using traditional ground-based broadcast video processing, satellite long-haul transport, and content delivery infrastructures, the workflow helps reduce the cost and complexity of streaming video from space to scientists and viewers on Earth. The proof-of-concept test at SMPTE 2019 included AWS Elemental MediaConnect for long-haul transit of content from Johnson Space Center, AWS Elemental MediaLive for live transcoding, AWS Elemental MediaPackage for content origin and packaging, and Amazon CloudFront for content delivery. [SMPTE]

ITU WRC-19 AGREES KEY PARAMETERS FOR FUTURE COMMUNICATION TECHNOLOGIES

The World Radiocommunication Conference 2019 (WRC-19) concluded on 22nd November as agreements signed by some 3400 delegates from around 165 Member States were enshrined in the Final Acts of the Radio Regulations, the international treaty governing the global use of radio-frequency spectrum and satellite orbits.

WRC-19 identified additional globally harmonized (millimeter wave) frequency bands for International Mobile Telecommunications (IMT), including IMT-2020 (otherwise known as 5G mobile), facilitating diverse usage scenarios for enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications. This will unlock a host of applications facilitating Intelligent Transport Systems, creating smart cities and making communities more sustainable while allowing for effective climate action, improved health care, sustainable agricultural practices, and greater energy efficiency.



At the same time, protections were accorded to the Earth-exploration satellite service (EESS) as well as meteorological and other passive services in adjacent bands, such as the space research service (SRS) to ensure that space-based monitoring of the earth and its atmosphere remain unhindered. Satellite services supporting meteorology and climatology that aim to safeguard human life and natural resources will be protected from harmful radio-frequency interference, as will systems used by radio astronomers for deep space exploration. Steps were also taken to ensure that radio astronomy stations would be protected from any harmful radio interference from other space stations or satellite systems in orbit.

Furthermore, protections were accorded to the Broadcasting-satellite service (BSS) of frequency assignments, providing a priority mechanism for developing countries to regain access to spectrum orbit resources. [ITU News]

LOW COMPLEXITY ENHANCEMENT VIDEO CODING (LCEVC) PROMOTED TO COMMITTEE DRAFT

At its 128th meeting, WG11 (MPEG) promoted ISO/IEC 23094-2 Low Complexity Enhancement Video Coding (MPEG-5 Part 2 LCEVC) to Committee Draft (CD). The goal of MPEG-5 Part 2 LCEVC is to provide a standardised video coding solution that leverages other video codecs in a manner that improves video compression efficiency while maintaining or lowering the overall encoding and decoding complexity. The MPEG-5 Part-2 LCEVC standard uses a lightweight video codec to add up to two layers of encoded residuals. The aim of these layers is correcting artefacts produced by the base video codec and adding detail and sharpness for the final output video.

The target of this standard comprises software or hardware codecs with extra processing capabilities, e.g., mobile devices, Set Top Boxes (STBs), and PC-based decoders. Additional benefits are the reduction in implementation complexity or a corresponding expansion in spatial resolution. [MPEG]

SAMSUNG CREATES AI CODEC TO SUPPORT 8K CONTENT

Samsung has announced that it has developed a new artificial intelligence codec, AI ScaleNet, that will aid the delivery of 8K content to consumers. It supports the delivery of 8K content on 4K networks without additional infrastructure, according to Samsung. Created by Samsung Research, the R&D hub of Samsung Electronics' SET Business, AI ScaleNet enables the delivery

of 8K content on networks that are typically only able to support 4K speeds. It does this by utilizing deep learning technology to minimise data loss during compression, allowing for the 8K content to be streamed on networks with lower bandwidth capabilities. Samsung says that the process is done by compressing the 8K content to 4K quality through an AI downscaler and transmitted to the user's TV, which uses AI to upscale the content back to 8K quality.

In addition, AI ScaleNet deals with bandwidth limitations within modern network infrastructures with an adaptive AI codec, which can adapt to various bandwidths and adjust the resolution for seamless streaming, according to a researcher on Samsung Research's Visual Technology team. Samsung claims that the AI ScaleNet codec is best suited to work with OTT services. [tvtechnology.com]

ATSC 3.0 STANDARD DOCUMENT PUBLISHED

The Advanced Television Systems Committee, Inc. publishes the A/300:2019 standard that describes the ATSC 3.0 digital television system. ATSC 3.0 is a suite of voluntary Technical Standards and Recommended Practices that is fundamentally different from predecessor ATSC systems and is therefore largely incompatible with them.

This divergence from earlier design is intended to allow substantial improvements in performance, functionality, and efficiency sufficient to warrant implementation of a non-backwards-compatible system. With higher capacity to deliver Ultra High-Definition services, robust reception on a wide range of devices, improved efficiency, IP transport, advanced emergency alerting, personalization features, and interactive capability, the ATSC 3.0 Standard provides much more capability than previous generations of terrestrial broadcasting.

This document describes the complete ATSC 3.0 Standard, which encompasses a set of individual standards documents, the interworking of which is described therein. The document can be accessed at <https://www.atsc.org/standards/> [ATSC]

RADIO NOW AND IN THE FUTURE

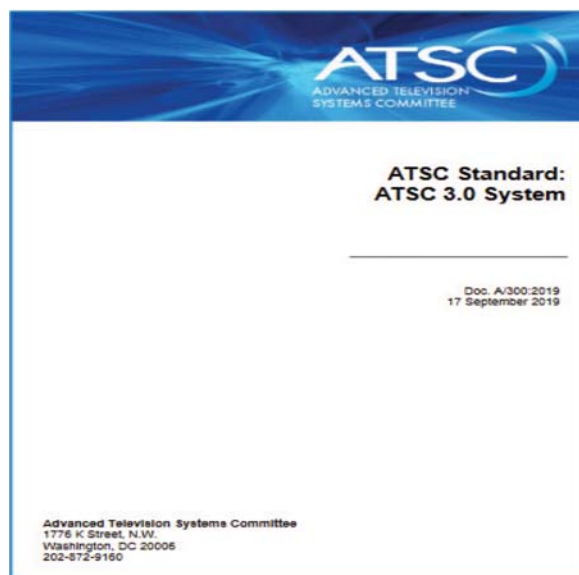
At a wider research project involving radio and audio consumers, Xtra Insights sought the views of radio

and music programmers from around the world by posing a series of questions regarding the current state of radio, as well as their perceptions of the future of music and radio. The past few years have seen a change in the audio consumption landscape. While music continues to be intrinsic to radio, for many listeners, it's the content provided by radio that sets it apart from alternatives.

When asked, programmers agreed that music is still as important as ever to radio. In some instances, the programmers' responses echoed the sentiments identified by radio listeners. While the importance of music hasn't gone unnoticed, the degree of its importance is often dependent on the strength of the other elements.

Although programmers tended to agree on the importance of music to radio, when asked "can an algorithm replace a Music Director?" the responses returned various opinions both for and against Artificial Intelligence. Ultimately, the consensus was that while an algorithm can assist in the curation of playlists, by itself, it could not replace an MD.

As it stands, AI doesn't have the ability to respond emotionally to music. While it may be able to predict some hit songs, it will likely miss others that could go on to change the course of popular music. For many stations, well researched music can be a source of diversification from not only competitors within the market, but also streaming services and other audio options. Often, listeners turn to radio for curated playlists as trying to pick from a streaming service can be overwhelming and inconvenient. For Music Directors, AI may be of some assistance when building a playlist, but ultimately music curation is about getting the balance of art versus science right. [Asia Radio Today] ■



Equipment Trends

AJA REVEALS 8K HDR IMAGE ANALYZER 12G

AJA Video Systems, Inc. recently revealed HDR Image Analyzer 12G. The equipment delivers a comprehensive array of tools for the effective analysis of the latest 4K/ UltraHD HDR standards, over a single cable with 12G-SDI (including HLG, PQ, Rec.2020 and Rec.709) from 8K/ UltraHD2/ 4K/ UltraHD/ 2K/ HD content in a convenient real time 1RU device. Developed in partnership with Colorfront, AJA HDR Image Analyzer 12G supports a wealth of inputs from camera LOG formats to SDR (REC 709), PQ (ST 2084) and HLG and offers colour gamut support for BT.2020 alongside traditional BT.709. AJA hardware prowess ensures high reliability and performance, with 4x 12G-SDI bidirectional I/O, and DisplayPort connections.

Specifically designed to be used wherever needed, the 1RU form factor fits into a range of environments, providing the confidence needed for consistent and predictable HDR production and mastering.

Its features are:

- Advanced 8K/UltraHD2 HDR and SDR production monitoring and analysis workflows
- Powerful monitoring and analysis for Live Production, DIT Pipelines, Broadcast Monitoring, Postproduction, QC (Quality Control), Final HDR Mastering
- Input support for both leading camera LOG formats as well as SDR, HLG and PQ
- Video I/Os: 4x 12G-SDI Bidirectional I/O up to 8K/UltraHD2 60p, SDI Auto Signal Detection, DisplayPort for UI, up to UltraHD 60p. [AJA.com]

functions, the congestion on the cellular network is reduced and video delivery is optimised. A demonstration conducted with Sat5G, a consortium of satellite and terrestrial networks for 5G, affirmed the concept. The demonstration showcased over-the-air satellite multicast technology for the delivery of live channels using a multi-access edge computing (MEC) platform for CDN integration with efficient edge content delivery. It also highlighted the benefits in terms of bandwidth efficiency and delivery cost of using a satellite-enabled link for provisioning live content in a 5G system.

As mobile consumption is on the rise, Broadpeak is offering clients options to personalise user experience (UX) with contextual ad insertion on mobile devices and grow subscriber base with content prioritisation for premium subscribers. Broadpeak also offers 5G network slicing for video delivery; for instance, the 5G network could be sliced for IoT, web delivery, and content delivery. In addition, the native multi-tenant functions include monitoring, quota management, billing and reporting. [APB News]

NEW DIGITAL AUDIO CONSOLE FOR ON AIR AND PRODUCTION APPLICATIONS FROM AEQ

ATRIUM is the new digital audio mixer specially designed for on-air audio production for Radio and Television with high demand operational requirements and workflows. ATRIUM can manage up to 1000 audio channels of local content or AoIP controllable through one or several control surfaces, each with up to more than 90 motorised faders with pages for snapshots or memories.

Developed with the user in mind, it has a great simplicity of operation through a powerful set of touch screens, encoders, indicators and keys, which can be pre-configured, and dynamically adapt their function to the context, avoiding

unnecessary steps, and maintaining the precise information always visible, so the operation is simple and safe.

AEQ ATRIUM has been designed taking advantage of the possibilities that technology provides in this day and age: AoIP systems allow the signal inputs and outputs, and the process or control elements, to be distributed in different equipment, sometimes physically very distant. This new mixer incorporates tools with the capacity to develop redundancy at all levels, the storage and instant recovery of snapshots, the convergence of physical and virtual control elements, the automatic mixing and level adjustments, the transport of control inputs and outputs to the different equipment in a system, etc. All these possibilities that the ATRIUM state-of-the-art technology offers, generate a new concept in which the sum of the different components develops a combined functionality far superior to that of each component separately.

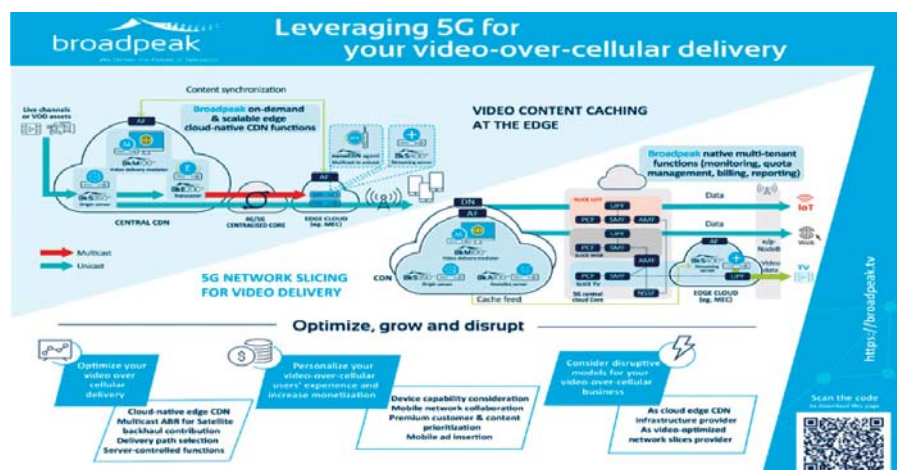
Each ATRIUM control surface and its individual controls can be customised for any operation. Thus, classic workflows can be implemented, for example: each fader can have A / B configuration, or each channel has direct access to sending to pre-defined buses, or the two-way multiplex channels can be defined so that each user is allocated a mix-minus or N-1 channel. User can also configure mixed or very special workflows with flexible programming of keys to act on the routing of the console, maybe controlling external equipment such as routers, audiocodes, telephony broadcasting systems, broadcast automation, or perhaps intercom systems; in definitive, adapting the console to each possible operational scenario.

Finally, ATRIUM's great simplicity of configuration and integration within a system as already covered, is not only restricted to the local production centre, but reaches outside. It allows connecting with external events and remote production centres, enabling the creation of a multi-channel audio network as extensive as the user application may require. [AEQ] ■



BROADPEAK: OPTIMISE, GROW AND DISRUPT

With the advent of direct-to-consumer delivery over cellular network, 5G and cloud technologies continue to steal the show at IBC. Broadpeak was advising clients to optimise, grow and disrupt so as to stay ahead of the competition. Through content caching on the edge of the cloud with content delivery network (CDN)



Personalities & Posts

Dr Veysel Binbay joins ABU Technology



Dr Veysel Binbay, a senior engineer at TRT-Turkey, has been seconded to ABU Technology.

Dr Binbay has over 20 years' experience as a broadcast engineer, a network administrator and IT Director at TRT. He was most recently Chief Engineer at the TRT Directorate in Diyarbakir, in south-eastern Turkey.

His experience includes designing, setting up and operating analogue/hybrid/digital radio and TV broadcast systems including IT Systems.

Dr Binbay holds a PhD from the Institute of Science at Dicle University in Turkey, an MSc from Dicle University and a B. Eng degree from Gazi University, also in Turkey. ■

2019 ABU Staff of the Year



Nadzim Zainal, Multimedia Designer, photographer extraordinaire, is the 2019 ABU Staff of the Year.

Nadzim joined the ABU in June of 2011 and is the sole designer/webmaster/photographer at the ABU where his scope of work spans designing collaterals for events, designing and laying out publications and internal magazines, designing sub-events and partnered events landing pages, and maintaining the official website.

Nadzim is also the ABU's official photographer, never failing to capture events well.

ABU colleagues are thrilled for Nadzim on his award. ■

Nargiza Numanova joins ABU Secretariat



Ms Nargiza Numanova joined the ABU Secretariat in October 2019 as Personal Assistant to the Secretary-General.

Ms Numanova was Head of International Relations of MRTK-Uzbekistan, an ABU member.

She was instrumental in organising many ABU meetings including the Central Asia Media Forum in 2015, 2017 and 2018, and the Administrative Council Meeting in Tashkent in 2018.

Ms Numanova was a member of ABU Planning and Strategy Group for several years. She also represented MRTK on the Administrative Council for three years.

She graduated from the Uzbek State World Languages University and Tashkent Finance Institute. ■

Fiji's FBC unveils new logo

The Fijian Broadcasting Corporation, FBC, has introduced a new logo. It coincides with the renaming of the broadcaster, formerly known as the Fiji Broadcasting Corporation.

Designed in-house, the logo is designed to symbolise FBC's core operations, its reach to all Fijians and its role as a progressive national broadcaster.

The triangle represents the universal symbol for broadcast towers. The circle around it symbolises FBC's reach to all corners of Fiji. And the coconut tree, the tree of life, represents its connection to Fijians of all walks of life.

The various shades of blue represent FBC's connection to the Pacific ecosystem and symbolises all the Fijian communities. ■



**FIJIAN
BROADCASTING
CORPORATION**

New MEMBERS



New Affiliate Member

ADINNO Inc. has businesses in China, Africa, USA, Europe, and is the leading 5G+ 4K, 8K, cloud XR end to end solution provider with a unique position. ADINNO has combined both broadcasting services and technical solutions for worldwide Mobile/Fixed operators & Cable TV/ IPTV. ADINNO offers 4K UHD based Contents and Production and OTT/ IPTV platform, together to develop its unique offering to the market. ■



Ms Chua Laynar, former ABU Administrative Assistant

Ms Chua Laynar, former Administrative Assistant to the Secretary-General, passed away on 1 January after a short illness. Laynar worked for the ABU from 1981 and retired after 29 years of service. Laynar had the distinction of working for four Secretaries-General: Mr Roku Ito, Mr Hugh Leonard, Mr David Astley and Dr Javad Mottaghi. Laynar always had a smile for her colleagues and was meticulous and helpful in her work. She leaves behind her husband and two sons. ■

CALENDAR of Events

JANUARY

6-19 Regional Workshop on Engineering Fundamentals for Broadcasters, Kuala Lumpur

FEBRUARY

13-15 26th BES Conference and Expo, New Delhi, India

MARCH

2-5 ABU DBS 2020, Kuala Lumpur

TBC ABU-ASBU DTV Training, Tunis

TBC Regional Workshop on Radio Studio Automation, TBA

MAY

13-15 KOBA Show, Seoul

JUNE

9-11 BroadcastAsia2020, Singapore

TBC ABU Technical Bureau Mid-Year Meeting, Singapore

JULY

TBC Workshop on Satellite Technologies for Broadcasters, TBA

TBC ABU-ASBU WorldDAB Digital Radio Workshop, TBA

AUGUST

17-18 Pacific Media Partnership Conference, Vanuatu

AUGUST-SEPTEMBER

TBC ABU Technology Webinar Series, Online

SEPTEMBER

11-15 International Broadcasting Convention 2020, Amsterdam

TBC Workshop on IP Infrastructure for Broadcasters, TBA

OCTOBER

22 ABU Technical Bureau Annual Meeting, Hanoi

23-24 ABU Technical Committee Meeting, Hanoi

26-27 ABU General Assembly, Hanoi

NOVEMBER

TBC ABU-DRM Regional Workshop on Digital Radio 2020, Kuala Lumpur

13-15 InterBEE 2020, Japan

TBC 17th Iran Media Technology Conference & IRIB Annual Technical Assembly, Tehran

DECEMBER

TBC ABU Training Course on Engineering Fundamentals for Broadcasters 2020, Kuala Lumpur

KOBA 2020



30th KOREA INTERNATIONAL BROADCAST
AUDIO & LIGHTING EQUIPMENT SHOW

13-15 MAY 2020
COEX, KOREA

ORGANIZERS

Korea E & Ex Inc. | Korea Broadcasting Engineers & Technicians Association

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