



Radiocommunication Bureau (BR)

Administrative Circular
CACE/936

7 November 2019

To Administrations of Member States of the ITU, Radiocommunication Sector Members, ITU-R Associates participating in the work of the Radiocommunication Study Group 6 and ITU Academia

Subject: **Radiocommunication Study Group 6 (Broadcasting service)**

- **Approval of 1 new ITU-R Question and 8 revised ITU-R Questions**
- **Suppression of 7 ITU-R Questions**

By Administrative Circular CACE/914 of 20 August 2019, 1 draft new ITU-R Question and 8 draft revised ITU-R Questions were submitted for approval by correspondence in accordance with Resolution ITU-R 1-8 (§ A2.5.2.3). In addition, the Study Group proposed the suppression of 7 ITU-R Questions.

The conditions governing this procedure were met on 20 October 2019.

The texts of the approved Questions are attached for your reference in Annexes 1 to 9 and will be published by the ITU. The suppressed ITU-R Questions are indicated in Annex 10.

Mario Maniewicz
Director

Annexes: 10

Distribution:

- Administrations of Member States of the ITU and Radiocommunication Sector Members participating in the work of Radiocommunication Study Group 6
- ITU-R Associates participating in the work of Radiocommunication Study Group 6
- ITU Academia
- Chairmen and Vice-Chairmen of Radiocommunication Study Groups
- Chairman and Vice-Chairmen of the Conference Preparatory Meeting
- Members of the Radio Regulations Board
- Secretary-General of the ITU, Director of the Telecommunication Standardization Bureau, Director of the Telecommunication Development Bureau

Annex 1

QUESTION ITU-R 146/6

Spectrum requirements for terrestrial broadcasting

(2019)

The ITU Radiocommunication Assembly,

considering

- a) that terrestrial broadcasting undergoes the transition from analogue to digital emission;
- b) that digital technology provides for greater total information capacity than its analogue counterpart within a given bandwidth;
- c) that digital emission formats have different protection requirements to those determined for analogue emission;
- d) that digital emission can provide opportunities for new forms of broadcasting, including:
 - high quality sound and video services;
 - portable, mobile and fixed reception;
 - data broadcasting services;
 - multimedia broadcasting services;
 - interactive broadcasting services;
- e) that there is considerable interest in maximizing the efficient use of the broadcasting spectrum;
- f) that during the transition from analogue to digital and then from digital to a new generation of broadcasting, sufficient amount of spectrum may be required to implement full duplication of the incumbent broadcasting services,

decides that the following Questions be studied

- 1 What is the anticipated demand for spectrum for terrestrial broadcasting applications during and following the transition to digital and a new generation of broadcasting, taking into account both the current and new forms of service?
- 2 What protection requirements are needed for terrestrial broadcasting services from other potential radiocommunication services that might be considered for shared use of the bands?

further decides

- 1 that the results of the above studies should be included in (a) Recommendation(s);
- 2 that the above studies should be completed by 2021.

Category: S1

Annex 2

QUESTION ITU-R 135-2/6

System parameters for and management of digital sound systems with and without accompanying picture

(2010-2014-2019)

The ITU Radiocommunication Assembly,

considering

- a) that the improvements in picture quality associated with high-definition, ultra-high definition and three-dimensional television systems may warrant continued study of the sound systems that should be used in order to keep in step with the higher level of realism available in the picture;
- b) that Recommendation ITU-R BS.646 – Source encoding for digital sound signals in broadcasting studios, specifies sampling frequency and bit resolution per sample for the digital coding of sound signals;
- c) that Recommendation ITU-R BS.775 specifies hierarchic multichannel sound systems up to 3/2 multichannel sound system for broadcasting;
- d) that Recommendation ITU-R BS.2051 specifies an advanced sound system with and without accompanying picture, beyond the sound systems specified in Recommendation ITU-R BS.775, that can support channel-based, object-based and a scene-based audio, or a combination of these, with the use of metadata to fully describe the audio contents of the sound production;
- e) that Recommendations ITU-R BS.2076, ITU-R BS.2094 and ITU-R BS.2125 provide a set of audio-related metadata called Audio Definition Model (ADM) and related specifications for advanced sound systems;
- f) that Recommendation ITU-R BS.2127-0 specifies reference rendering method for the ADM metadata specified in Recommendation ITU-R BS.2076-1;
- g) that it will be necessary to tailor sound programmes produced in advanced sound system in order to deliver them through 2-channel stereo and 3/2 multichannel sound delivery systems;
- h) that the audience awareness of, and interest in advanced sound system could be boosted if the benefits of those systems in terms of an enhanced listening experience could be at least partly preserved when they are tailored for 2-channel stereo or 3/2 multichannel sound presentation;
- i) that Recommendation ITU-R BS.1909 specifies as typical viewing/listening environments public environments, home environments and mobile environments, and further states that the coincidence of position between sound images and video images should be maintained over a wide image and listening area;
- j) that the angular width of the screen at the listening/viewing positions in the production and reproduction environments will not always be equal, and so consequently there will be a benefit to adapting the reproduction of the audio content in a way that audio-visual coherence is maintained to a sufficient level across various screen environments;

k) that listeners desire audio programmes to be uniform in subjective loudness for different sources and programme types even if broadcast programmes are provided to the other media including Internet delivery services;

l) that Recommendation ITU-R BS.1770 specifies a loudness measurement algorithm for channel-based audio programmes,

decides that the following Questions should be studied

1 What are the optimum arrangements for monitoring multichannel sound during production, such as:

- loudspeakers/room responses;
- suitable methods for aligning the reproduction levels of the monitor loudspeakers;
- suitable methods for visual monitoring of multichannel sound signal parameters such as level, phase, delay, etc.?

2 What are the requirements for allocation of channels on channel interfaces, when multichannel operation is envisaged?

3 What are the optimum methods to ensure appropriate system compatibility, such as:

- backward compatibility of higher order multichannel sound systems specified in Recommendation ITU-R BS.2051 with lower order sound systems already specified in Recommendation ITU-R BS.775 while retaining at least part of the enhanced listening experience inherent in the use of advanced sound systems, in terms of greater impression of presence and sound depth, without providing a sub-optimal experience if the sound reproduction system differs from that envisioned by the method employed;
- forward compatibility of lower order sound systems already specified in Recommendation ITU-R BS.775 with higher order multichannel sound systems;

4 Which methods may be employed in order to scale audio programmes for different screen sizes using channel-based, object-based or scene-based paradigms in order to maintain audio-visual coherence for screens varying in size, including from personal/mobile consumption to large screen representations?

5 Which methods may be employed for the conversion between advanced sound programmes with different metadata sets?

6 What audio metering characteristics should be used to provide accurate indication of subjective loudness of programmes produced in the object-based and scene-based sound systems?

7 What operational practices can be established on a globally harmonised basis for achieving consistency in the sound quality?

8 What sound parameters, including loudness characteristics should be used to ensure accurate and consistent sound quality?

9 What considerations should be made by the broadcaster for end user listening conditions in a number of environments?

10 How should user interactivity be considered in the methods being studied in this Question?

11 What forms of user interactivity are most beneficial to broadcast application?

further decides

- 1 that the results of the above studies should be included in (a) Recommendation(s) or (a) Report(s);
- 2 that the above studies should be completed by 2023.

Category: S2

Annex 3

QUESTION ITU-R 139-2/6

Methods for rendering of advanced audio formats

(2015-2018-2019)

The ITU Radiocommunication Assembly,

considering

- a) that there is an increasing interest in the production of sound and television programmes in advanced sound systems, which can provide a listening experience that matches the enhanced viewing experience provided by image production in HDTV (see Recommendation ITU-R BT.709) and UHD TV (see Recommendation ITU-R BT.2020);
- b) that Recommendation ITU-R BS.2051 specifies advanced sound systems that can provide an enhanced listening experience to a properly equipped radio or television audience;
- c) that Recommendation ITU-R BS.1909 specifies as typical viewing environments theatre and large theatre environments as well as large-to-average size room environments, and mobile such as in-car or personal environments;
- d) that consistency in sound production requires consistency in the sound reproduction system that is employed in the production environment and that this implies the need for consistency in the reproduction of the advanced sound system in the production chain;
- e) that the rendering system that creates the loudspeaker signals from the advanced sound system signals is a critical component to provide the needed consistency in reproduction;
- f) that Recommendation ITU-R BS.2076 specifies a set of metadata used in broadcasting sound production and its common definition is specified in Recommendation ITU-R BS.2094, and its serial presentation form is specified in Recommendation ITU-R BS.2125;
- g) that Recommendation ITU-R BS.2127-0 specifies a reference rendering method for the ADM metadata specified in Recommendation ITU-R BS.2076-1,

further considering

- a) that a description of a renderer¹ should be complete and self-contained. Ideally it abstracts from implementation details and provides those by using a reference implementation;
- b) that the description should clearly describe the operations and signal processing to be carried out, based on the incoming audio data, metadata and the local metadata which configure the rendering process and not contain any ambiguities;

¹ A renderer converts a set of audio signals with associated metadata to a different configuration of audio signals and metadata, based on the provided content metadata, and local environmental metadata. It may be used for quality evaluation purposes or in the programme production process.

c) that if a file format does exist, this can be referred to in terms of parameters and storage, but in general the specification should not be linked to specific implementations of such parameters in aforementioned file format;

d) that a renderer should be able to support all loudspeaker setups as proposed in Recommendation ITU-R BS.2051,

decides that the following Questions should be studied

1 What are the requirements for renderers for use in the production and monitoring of advanced sound programmes?

2 What are the requirements for renderers for use in quality evaluation?

3 What are the specifications of renderers that are satisfactory for use in the production and monitoring of advanced sound programmes?

4 What are the specifications for renderers that are satisfactory for use in quality evaluation?

5 What signal processing and metadata inputs (environmental metadata, content related metadata) are needed for required operation of a renderer?

6 What algorithms should be used to derive the loudspeaker signals based on all possible input formats (object-based, channel-based, scene-based and combinations thereof) according to Recommendation ITU-R BS.2051?

further decides

1 that the results of the above studies should be included in Recommendation ITU-R BS.2127 or other ITU-R texts;

2 that the above studies should be completed by 2023.

Category: S2

Annex 4

QUESTION ITU-R 102-4/6

Methodologies for subjective assessment of audio and video quality

(1999-2011-2014-2015-2019)

The ITU Radiocommunication Assembly,

considering

- a) that it is highly desirable to have standard methods of measuring picture and sound quality in broadcasting, in a subjective way, permitting an appropriate comparison of the results obtained in different places;
- b) that, while methods for the subjective assessments of the quality of pictures and sound have been established in a number of ITU-R Recommendations, new image and sound systems and technologies may require extensions to these methods;
- c) that the perceptual interaction between the audio and visual modalities can affect their mutual qualities and the overall perceived quality;
- d) that a wide range of broadcasting systems and audio-visual presentations in different viewing and listening environments needs to be supported by subjective assessment methods for audio and video quality,

decides that the following Questions should be studied

- 1 What are the quality attributes including small, medium and large impairments for audio and/or visual perception?
- 2 What are the subjective test methodologies¹ required for different applications and quality levels for:
 - visual presentation without associated audio presentation?
 - visual presentation with associated audio presentation?
 - audio presentation without associated visual presentation?
 - audio presentation with associated visual presentation?
- 3 How could such methodologies be used as criteria to identify quality attributes that are important for different application areas of audio and/or visual presentation?
- 4 How could they be used to express quality requirements for audio and/or visual modalities for different application areas and to assess their optimization?
- 5 What methods and criteria are required to assess if the “Quality of Experience” expectations of the intended audience of advanced immersive audio-visual content, are being met?

¹ This should include, for example, the harmonization of grading scales employed in audio and visual testing at present (refer to present ITU-R BS and BT, and ITU-T Recommendations), test environments, viewing and listening distances, training procedures, etc.

6 How the context dependent quality balance between audio and visual presentation should be considered?

further decides

1 that the results of the above studies should be included in (a) Recommendation(s) and/or Report(s);

2 that the above studies should be completed by 2023.

Category: S2

Annex 5

QUESTION ITU-R 143-1/6

Advanced Immersive Audio-Visual Systems for Programme Production and Exchange for Broadcasting

(2017-2019)

The ITU Radiocommunication Assembly,

considering

- a)* that Virtual Reality, 360° video, three-dimensional (3D) video and sound and other immersive media technologies have caught the attention of the content providers, audiences, and the associated consumer technology vendors;
- b)* that television and radio programme makers and others are exploring advanced immersive systems to enhance the audiences experience of their content;
- c)* that currently immersive media content is usually acquired and produced to the requirements of specific delivery or distribution technologies;
- d)* that there are no agreed measures or means to assess the quality of the images and associated audio of advanced immersive audio-visual content;
- e)* that there are no criteria for assessing if the “Quality of Experience” expectations of the intended audience of advanced immersive audio-visual content, are being met;
- f)* that broadcasters are distributing programme content to audiences via an increasing number of interactive delivery platforms;
- g)* that viewers have documented an experience of eye fatigue, dizziness, or nausea in viewing of some Virtual Reality or Augmented Reality content, and device performance parameters, viewing time, and content type may all influence these undesired reactions,

decides that the following Questions should be studied

- 1 What are the appropriate parameters for production and international exchange of advanced immersive audio-visual content?
- 2 What audio, video, data, and metadata are required for representing immersive scenes from any viewpoints?
- 3 What common sound and video systems should be used for the production and exchange of advanced immersive audio-visual content to maximize interoperability?
- 4 What viewing and listening conditions including audio-visual displays should be assumed for viewing of advanced immersive audio-visual content in production and consumer viewing?
- 5 What metadata is required to allow accurate exchange and reproduction of advanced immersive audio-visual content?

6 How do device performance parameters interact with production decisions to avoid or minimize eye fatigue, dizziness, or nausea in audiences when viewing advanced immersive audio-visual content?

further decides

1 that the results of the above studies should be included in Recommendation(s) and/or Report(s);

2 that the above studies should be completed by 2023.

Category: S2

Annex 6

QUESTION ITU-R 34-3/6¹

File formats and transport for the exchange of audio, video, data and metadata materials in the professional broadcast environments

(2002-2007-2009-2019)

The ITU Radiocommunication Assembly,

considering

- a)* that storage systems based on information technology, including data disks and data tapes have already started to penetrate all areas of the professional television environment; production, non-linear editing, play-out, post-production, distributed production, archiving, contribution and distribution;
- b)* that future TV production environments will increasingly incorporate systems from the Information Technology (IT) world such as networks, and server systems;
- c)* that applications for professional TV and sound broadcasting are being increasingly based on software which generally handle content in file form;
- d)* that file exchange does not introduce additional picture and sound quality degradation if, for example, the compressed audio and video accommodated in the file body is transferred in its original, compressed form;
- e)* that file exchange can be adapted easily to the available channel bandwidth so that user can trade-off transfer-bandwidth versus transfer-time;
- f)* that audio, video, data and metadata can be stored and transferred in a common file;
- g)* that audio, video, data and metadata can also be stored and transferred as independent files with provision for later synchronization;
- h)* that the technology of file formats and file exchange offers significant advantages in a workflow in professional broadcast environments;
- i)* that the interoperability within and between content management systems is an essential user requirement for the exchange of content and assets;
- j)* that the application of metadata exchange in TV and sound production requires support of existing specifications on metadata;
- k)* that compatibility with both binary and XML metadata transport protocols needs to be considered;

¹ This Question should be brought to the attention of ITU-T Study Group 9 and the ISO/IEC JTC1 SC29 Working Group 11.

- l) that the adoption of a small number of interoperable file formats for the exchange of broadcast content would greatly simplify the design and operation of equipment and facilities;
- m) that interoperability and conformance testing can be simplified when a single coding method is specified;
- n) that many broadcasters have already deployed systems based on file formats;
- o) that many applications provided by multiple vendors rely on interoperable file formats;
- p) that it is desirable that file formats meet future user requirements,

recognizing

- a) that Recommendation ITU-R BT.1775 defines the editable file format and the generic container for the exchange of metadata, audio, video and data;
- b) that Recommendations ITU-R BS.1352 and ITU-R BS.2088 specify file formats for the exchange of audio programme materials with metadata,

decides that the following Questions should be studied

- 1 What are the user requirements and potential category of requirements for carrying programme and programme genres for the exchange of audio, video, data and metadata encapsulated in a file format in the professional television and sound broadcasting environments?
- 2 What structure of file formats will best serve the future needs of users, while desirably maintaining interoperability with existing deployments?
- 3 What degree of extensibility can be achieved while maintaining backward compatibility?
- 4 What will be the design of the encoders and decoders which would be utilized for interchange of audio, video, data and metadata?
- 5 What digital interfaces should be specified for transport of the file format(s) for interchange of audio, video, data and metadata?
- 6 What independent video/audio search capability will be required to assist asset management during and following interchange of the file?
- 7 What operational considerations will be required by broadcasting organizations for the interchange of audio, video, data and metadata?

further decides

- 1 that ITU-R Study Group 6 should continue to monitor the standardization work of other organizations with regard to file formats and transport mechanisms, and that appropriate existing and future file formats should be proposed for adoption by the ITU-R;
- 2 that the study should also include a consideration of integration and migration strategies for legacy, established and future file formats;
- 3 that the results of the above studies should be included in Report(s) and/or Recommendation(s);
- 4 that the above studies should be completed by 2023.

Category: S2

Annex 7

QUESTION ITU-R 56-4/6

Characteristics of terrestrial digital sound/multimedia broadcasting systems for reception by vehicular, portable and fixed receivers

(1993-2006-2016-2017-2019)

The ITU Radiocommunication Assembly,

considering

- a)* that there is an increasing requirement by some countries for suitable means of broadcasting high quality stereo/multi-channel sound and multimedia content to vehicular, portable and fixed receivers;
- b)* that significant progress has been made in technical studies on digital sound/multimedia broadcasting systems and that some systems have been widely implemented with good success;
- c)* that it has been demonstrated that advanced digital sound/multimedia broadcasting systems can lead to improved spectrum and power efficiency and immunity to multipath compared with conventional analogue sound broadcasting systems;
- d)* that digital sound/multimedia broadcasting systems can be designed to allow common signal processing in receivers for various broadcasting bands;
- e)* that digital sound/multimedia broadcasting systems can be used for national, regional and local terrestrial services;
- f)* that it would be advantageous for a digital sound/multimedia broadcasting system if a common receiver, capable of receiving terrestrial and satellite services, could be designed;
- g)* that digital sound/multimedia broadcasting systems may be configured to broadcast programmes with lower or higher bit rates in order to trade quality against the number of channels;
- h)* that digital sound/multimedia broadcasting systems are able to provide additional facilities to deliver programme-related and non-programme-related data;
- i)* that some radiofrequency bands are still used for emissions of analogue sound broadcasting services;
- j)* that ITU-R has already studied various aspects of digital sound/multimedia broadcasting, e.g.: in Recommendations ITU-R BS.774, ITU-R BS.1114, ITU-R BS.1348, ITU-R BS.1349, ITU-R BS.1514, ITU-R BT.1833 and ITU-R BT.2016;
- k)* that some Administrations are considering switching off their analogue sound broadcasting services,

noting

that studies on the use of various radiofrequency bands for emission of digital sound broadcasting services are reported in the Final Acts of the CEPT Wiesbaden 1995 planning meeting,

recognizing

a) that the World Administrative Radio Conference (Malaga-Torremolinos, 1992) (WARC-92) asked the former CCIR to undertake as a matter of urgency the technical studies associated with terrestrial digital audio broadcasting;

b) that the Regional Radiocommunication Conference (GE-06) has planned some parts of band III in Region 1 and Islamic Republic of Iran for digital sound broadcasting,

decides that the following questions should be studied

1 What are the technical characteristics of digital sound/multimedia broadcasting systems for reception by vehicular, portable and fixed receivers?

2 What are the most suitable VHF/UHF bands, technically, economically and from a sharing and programme capacity point of view, for the implementation of a terrestrial digital sound/multimedia broadcasting service?

3 What are the system and service requirements for a digital sound/multimedia broadcasting service?

4 What are the most appropriate channel coding, multiplexing and modulation methods for a digital sound/multimedia broadcasting service, taking into account the properties of the source coding applied?

5 Which approaches can meet the needs of local, regional and national broadcasting in terms of service area and multiplexing?

6 What are the benefits which can be achieved by using hierarchically modulated signals?

7 What are the effects of normal, abnormal and very abnormal propagation, including multipath on digital sound and multimedia broadcasting systems?

8 What protection ratios are required to prevent mutual interference between different digital sound/multimedia broadcasting services and other services using the same or adjacent frequency bands?

9 What steps need to be taken to mitigate any issues in the transition from analogue sound to digital sound/multimedia broadcasting?

10 What are the necessary planning criteria for national, regional and local area coverage for vehicular, portable and fixed reception?

11 What advantages can be obtained by the combined use of satellite and terrestrial services operating in the same frequency band?

12 What would be the advantages in the use of diversity reception?

13 What, in the light of *considering g*), would be the tradeoff in terms of the quality and capacity between the digital sound broadcasting systems and the analogue systems being replaced?

further decides

- 1 that the results of the above studies should be included in (a) Report(s) and/or (a) Recommendation(s);
- 2 that the above studies should be completed by 2023.

Category: S2

Annex 8

QUESTION ITU-R 132-5/6

Digital terrestrial television broadcasting planning

(2010-2011-2011-2015-2017-2019)

The ITU Radiocommunication Assembly,

considering

- a)* that many administrations have already introduced, and others are introducing, Digital Terrestrial Television Broadcasting (DTTB) services in VHF (Band III) and/or UHF (Bands IV/V) bands;
- b)* that experience gained through the implementation of DTTB services will be useful in refining the assumptions and techniques to be applied in the planning and implementation of DTTB services;
- c)* that planning procedures are being developed to facilitate the introduction of these new systems in the existing radio frequency environment;
- d)* that these planning procedures are based on the use of propagation prediction methods and empirically derived protection ratios;
- e)* the characteristics of television receiving installations, receivers and antennas are the important elements in frequency planning;
- f)* that administrations and/or broadcasters need to verify and validate the results from the process of planning of digital terrestrial television, sound and multimedia broadcasting networks,

decides that the following Questions should be studied

- 1 What are the frequency planning parameters for such services, including but not limited to:
 - minimum field strengths;
 - implications of modulation and emission methods;
 - receiving and transmitting antenna characteristics;
 - implications of using diversity transmission and reception methods;
 - location correction values;
 - time variability values;
 - single frequency networks;
 - speed ranges;
 - environmental noise and its impact on digital terrestrial TV reception;
 - effect of wet foliage on digital terrestrial TV reception;
 - effect of wind turbine farms and airplane flutter on digital terrestrial TV reception;
 - building penetration loss;
 - indoor location variations?

- 2 What is the likely impact on matters related to the planning of broadcasting networks for terrestrial television broadcasting in the migration from existing¹ digital television modulation parameters to new and more spectrally efficient² modulation parameters?
- 3 What protection ratios are required when two or more digital transmitters of the same system, digital television and multimedia transmitters of different systems, or analogue and digital television transmitters are operating:
 - in the same channel;
 - in adjacent channels;
 - with overlapping channels;
 - in other potential interference relationships (e.g. image channel)?
- 4 What receiver and antenna system characteristics should be used for frequency planning with respect to more efficient use of the frequency spectrum (e.g. selectivity, noise figure, etc.)?
- 5 What are the protection ratios needed to protect television broadcasting services from other services sharing the bands or operating in adjacent bands?
- 6 What techniques can be used to mitigate interference?
- 7 What are acceptable durations of outages due to local short-term interference to DTTB services?
- 8 What are the technical bases required for planning which lead to efficient utilization of the VHF and UHF bands for terrestrial television services?
- 9 What are the characteristic multipath conditions that need to be taken into account in the planning of such services?
- 10 What time availability percentages can be practically achieved in DTTB service implementation and what margins in planning parameters are required to achieve these time availability percentages?
- 11 What planning criteria can be optimized to facilitate the implementation of terrestrial digital broadcasting, taking into account existing services?
- 12 What are the characteristics of the mobile multipath channel that need to be taken into account in the use of mobile reception, at different speeds?
- 13 What are the characteristics of the multipath channel that need to be taken into account in the use of hand-held reception, at different speeds?
- 14 What radio-frequency verification methods are appropriate for the verification and validation of the digital television and sound broadcasting planning processes?

further decides

- 1 that the results of the above studies should be included in (a) Report(s) and/or Recommendation(s);
- 2 that the above studies should be completed by 2023.

Category: S3

¹ For example DVB-T (ITU-R DTTB System B).

² For example DVB-T2.

Annex 9

QUESTION ITU-R 133-2/6

Enhancements of digital terrestrial television broadcasting

(2010-2013-2019)

The ITU Radiocommunication Assembly,

considering

- a) that terrestrial television broadcasting undergoes the transition from analogue to digital emission;
- b) that digital emission can provide opportunities for enhancements of broadcasting, including:
 - HDTV, UHD TV;
 - 3DTV, and Advanced Immersive Audio-Visual Systems;
 - broadcasting for portable, mobile and fixed reception;
 - high bit-rate data broadcasting;
 - medium and low bit-rate data broadcasting for tele information applications;
 - multimedia broadcasting;
 - interactive broadcasting;
- c) that there is considerable interest in maximizing the efficiency of the digital terrestrial television broadcasting;
- d) that there is considerable progress in development of compression techniques for digital television;
- e) that future integrated/hybrid systems may allow complementary terrestrial broadcasting with other methods of broadcast content delivery,

decides that the following Questions should be studied

- 1 What are the anticipated future developments in terrestrial television broadcasting technology including modulation and emission methods and channel coding and error correction methods?
- 2 What are the future requirements for digital terrestrial television broadcasting technologies?
- 3 What efficiencies will be achieved by the enhancements of broadcasting?
- 4 What are the technologies or applications that could be provided by digital terrestrial broadcasting systems and what sets of system parameters could be used for different applications?
- 5 What technical criteria can be optimized to facilitate the implementation of enhanced terrestrial digital broadcasting, taking into account existing services?
- 6 What are the appropriate strategies to introduce and implement digital terrestrial broadcast services, taking account of existing terrestrial broadcast services?

7 What are the technical and operational factors affecting the choice of scenarios for introducing enhanced digital television broadcasting?

8 What strategies should be employed by administrations, particularly those sharing common borders, for migration from an established digital terrestrial television broadcasting service to a more advanced digital terrestrial television broadcasting service?

9 What possibilities may the broadcast content delivery in future integrated/hybrid systems offer, in addition to terrestrial broadcasting?¹

further decides

1 that the results of the above studies should be included in (a) Report(s) and/or Recommendation(s);

2 the above studies should be completed by 2023.

Category: S3

¹ This Question should be brought to the attention of ITU-R Study Group 5 and ITU-T Study Group 9.

Annex 10

Suppression of ITU-R Questions

Question ITU-R	Title
9/6	Universal transmitters and retransmitters for both analogue and digital terrestrial TV broadcasting
11/6	Polarization of emissions in the terrestrial broadcasting service
52-1/6	Coverage in LF, MF and HF broadcasting
62/6	Subjective assessment of small, medium and large impairments in sound quality
127/6	Mitigation techniques required for the use of digital modulation in the "26 MHz" broadcasting band for local coverage
134/6	Recording of digital sound programme signals for international exchange
141/6	Internet delivery of sound and television broadcast originated soundtracks
