

HDTV

25th Anniversary of the introduction of HDTV in Europe

HIGH DEFINITION TELEVISION COMES OF AGE THANKS TO ITU

High Definition Television (HDTV) is the most powerful and influential media in human experience. HDTV brings sharper pictures to television audiences, and provides a stunning viewing experience on today's large screen HDTV television sets. It will shape the way we experience and see the world.

HDTV is now replacing conventional television as all media channels make the transition to HDTV. Eventually all the world's television viewers, current 4.5 billion, will be watching HDTV, thanks to the work of the ITU.

The idea of HDTV came from Japan, and from the fundamental work of the research laboratories of Japan's national broadcaster, NHK.

2006 and 2007 marked the 25th anniversaries of the first demonstrations of HDTV, respectively in North America and in Europe.

Since 1972, the former CCIR Study Group 11 began to focus its activities on High-Definition Television recommending some of the characteristics of the first analogue systems, which, incidentally, produced base-band signals which could not fit in any of the broadcasting bands available at that time.

Only after the introduction of digital techniques and over twenty years of continuous studies, in 1998, it was possible to unanimously approve Recommendation ITU-R BT.709 in its current version. It represents what is recognized today as an outstanding achievement of the ITU: the specifications for a single worldwide standard for HDTV production and program exchange, based on an image sampling structure of 1920x1080 pixels in what has become known as the Common Image Format (CIF).

The approval of Recommendation ITU-R BT.709 triggered a high level of activity on the part of manufacturers and broadcasters to develop the tools and the know-how to implement extensive HDTV program production. Since then Recommendation ITU-R BT.709 has remained unchanged, thus allowing manufacturers to produce equipment at an ever-lower cost. Not surprisingly such equipment today costs even less than any other comparable equipment for television systems of inferior quality, thus demonstrating the benefits offered by international broadcasting standards, and the success of the ITU in its role as an international standard-setting body.

Dr Timofeev, Director of the ITU-R, states "The world owes the pioneers and all those who worked in the ITU on HDTV a great debt of gratitude. We can only hope to emulate their success in the coming age of Super High Definition Television, and for future technologies of the media".

Recommendation ITU-R BT.709
1982 – 2007



HDTV

25th Anniversary of the introduction of HDTV in Europe

THE ITU AND STANDARDIZATION OF HDTV CHRONOLOGICAL HISTORICAL BACKGROUND

- 1972** The initiative to develop a new high-definition television service is activated by a Japanese Proposal for a New CCIR Study Program on High Definition Television.
- 1974** Work on this subject begins in the CCIR by the adoption of Question 27/11, which subsequently leads to a number of Questions, Study Programs, Resolutions, and Decisions regarding HDTV, giving an international framework to the intensive studies carried out in Japan to develop early HDTV technology
- 1983** The study programs led to:
- Decision 58, to establish Interim Working Party (IWP) 11/6 to study HDTV;
 - Decision 60, to charge IWP 11/7 on digital television to investigate the application of digital technology within HDTV;
 - Decision 66, to charge IWP 11/4 on subjective assessments to investigate the means of assessment of HDTV system performance; and
 - Decision 59, to investigate jointly with Study Group 10 the means of video recording.

IWP 11/6 held meetings in Switzerland, the United Kingdom and Japan where High-Definition television systems are demonstrated. As a result of its activities, IWP 11/6 develops a “Proposal for a new Recommendation – Parameter values for signal generation in HDTV studios and for international exchange of HDTV programmes”, which was presented to the subsequent CCIR XVI Plenary Assembly in 1986, and amendments to Report 801: “The present state of high-definition television”.

The situation of high-definition television (HDTV) is reported by the Chairman of Study Group 11 to the CCIR XVI Plenary Assembly, indicating that all administrations generally agree on regarding the need for a single system of approximately twice the horizontal and vertical resolution of existing television systems and having a wide aspect ratio. Agreement also exists on the use of components, expressed in both analogue and digital form, the latter to be closely related to Recommendation 601 “Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios”. Discussions are still continuing about the precise parameter values, such as those concerning scanning, appropriate to achieve this aim.

HDTV

25th Anniversary of the introduction of HDTV in Europe

- 1986** 19 proposals for HDTV standardization are submitted to the XVIth Plenary Assembly. Report 801 is amended to include developments occurred after November 1985, which take into account that:
- progress resulted in the availability of HDTV production equipment from manufacturers in several countries;
 - there is a number of HDTV production facilities already use in various parts of the world, based on the parameter values given in Report ITU-R BT.801;
 - there is a need for HDTV studio standard to accommodate future broadcasting systems compatible with existing systems.

Since the views expressed diverge on a number of issues, many of which are of a fundamental nature, and in view of the apparent advantages that the adoption of a single set of parameters for HDTV would bring, the Plenary Assembly unanimously decided to postpone the taking of a decision on a standard at this time, but adopted a Resolution foreseeing an extraordinary meeting of Study Group 11 in 1988 to reach a conclusion on a draft recommendation on HDTV with a view to prepare appropriate contributions to the next CCIR Plenary Assembly in 1990. To accelerate the work of standardizing HDTV, the Plenary Assembly also enlarged the scope of the mandate of Interim Working Party 11/6.

- 1987** At the October Interim Meeting of Study Group 11, a number of European countries presented their first proposal for a Recommendation for HDTV, supporting a system with the following parameters:

Number of active lines:	1152
Field rate:	50.00 Hz
Scanning method:	Progressive
Aspect ratio:	Horizontal 19 to vertical 9
Samples per active line:	1920 for luminance, 960 for color difference

The confrontation between two systems becomes evident.

- 1988** At its May meeting, Interim Working Party 11/6 on HDTV studio standard, prepared a first draft Recommendation (future Recommendation 709) on basic parameters and colorimetry for HDTV. Study Group 11 at its Extraordinary Meeting (late May) adopted a set of 4 Draft Recommendations and 11 Reports on HDTV including the first draft version of future Recommendation 709 on HDTV for studio and program exchange, for submission to the next SG11 meeting (late May). By means of Decision 74, a so-called “Global approach” of Study Group 11 towards HDTV emphasizes the need for harmonization of standards and operating practices for HDTV equipment intended for consumer applications. At its Final Meeting, Study Group 11 (late May 1988) improved the results at the Extraordinary Meeting adding a new draft Recommendation BO/11 on HDTV telecine.

HDTV

25th Anniversary of the introduction of HDTV in Europe

1990 The XVIIth CCIR Plenary Assembly approved Recommendation 709, which leaves undefined a number of basic parameters (such as number of lines, field and picture rates, etc., due to disagreement between the 50 Hz and the 60 Hz Regions). However, a few important parameters are agreed upon, such as the picture aspect ratio (16:9) and a single worldwide agreement on both color rendition and on the equations for luminance, as well as on technical definition of a basic tri-stimulus color system for displays. Finally the digital HDTV bit rate values for the studio interface signal, important to determining both the interface for HDTV transmission and the use of digital recording, are agreed upon in principle. These agreements resulted in Recommendations 709 and 710, adopted by the CCIR XVIIth Plenary Assembly (1990). The main picture characteristics agreed on in Recommendation 709 are: 16:9 aspect ratio, 1920 samples per active line and an orthogonal sampling lattice.

Some important parameters relating to picture characteristics and picture scanning characteristics remained to be agreed upon. A number of concepts were proposed to possibly lay the basis for a worldwide standard. These include the Common Image Format (CIF), the Common Data Rate (CDR), the Common Image Part (CIP), and the Common Sampling Lattice (CSL) proposals.

The CIF approach suggests use of common values for parameters defining the active picture area in different HDTV system implementations implying a worldwide agreement on the following basic parameters:

- Aspect ratio of the image
- Aspect ratio of the picture element (pel)
- Number of active samples in the horizontal direction
- Number of active samples (lines) in the vertical direction
- Sample arrangement (orthogonal)
- Opto-electronic transfer characteristic at the camera
- Colorimetry, reference primaries, and reference white
- Electro-optic transfer characteristic at the display.

The blanking periods, total line period, and the total number of lines would be varied among members of the family to provide compatibility with existing picture rates.

1991 By mid 1991, publications reporting progress in the United States, the Nordic countries, the United Kingdom, in France, and in other parts of the world, show that bit-rate reduction schemes of the order of 60:1 could be successfully applied to HDTV source images. Developments in the MPEG confirm such possibility and eventually resulted in an early agreement of all the outstanding parameter values in Recommendation ITU-R BT.709.

HDTV

25th Anniversary of the introduction of HDTV in Europe

- 1992** The CCIR is superseded by the ITU-R and IWPs are replaced by TGs. Study Group 11 established Task Group 11/1 on HDTV television for studio and program exchange to continue the work of former IWP 11/6 as defined by Question 27/11 and 47/11 and in particular, to complete Recommendation 709. Task Group 11/2 is also set up to standardize digital studio interfaces including HDTV. Working Party 11A on conventional, enhanced and high-definition television is also working on non-urgent aspects of HDTV, sharing some tasks outlined in Question 27/11. At its meeting TG 11/1 sought agreement on Common Image Format and Common Data Rate to achieve a single standard, without success. It appeared evident that a solution could possibly be only in the digital domain.
- 1993** TG 11/1 proposed a new Question (213/11) on Target Digital standard for use in the development of future systems for studio and international program exchange. The Question is approved and resulted in Recommendation ITU-R BT.1200
- 1994** Task Group 11/1 finalized some parameters such as colorimetry and transfer characteristics. It also completed two draft new Recommendations on the use of bit-rate reduction in the HDTV studio and on a target standard for digital video systems setting. TG11/1 is disbanded and remaining activities are transferred to Working Party 11A.
- 1997** Working Party 11A (April 1997) made significant progress toward a common HDTV standard in Recommendation ITU-R BT.709, (in its new version ITU-R BT.709-3) applicable to both 50 Hz and 60 Hz field rates, interlaced or progressively scanned. Outstanding among others is agreement on a Common Image Format for future HDTV systems (CIF-HDTV). This 1080 x 1920 format is recommended as the preferred image system for new HDTV implementations included the High Definition Common Image Format, encouraged for use in new installations. The HD-CIF progress is supported by New Recommendation ITU-R BT.1360 on image capture format for HDTV for television and other video applications for future implementations.
- 1999** A draft revision to Recommendation ITU-R BT.709 is submitted by WP 11A to Study Group 11 for approval, with significant improvements. Study Group 11 (June 1999) adopted improvements to Recommendation BT.709-3, notably:
- In Part II of the Recommendation there is only one raster structure, and also one total number of lines, regardless of frame/field rate, thus helping equipment manufacturers to design switchable equipment.
 - Part II of the Recommendation now incorporates a number of new frame/field rates, thus helping in the international exchange of program material which originates on film and is edited electronically.
- 2000** The approval of this last version of Recommendation ITU-R BT.709 triggers a vast majority of manufacturers and broadcasters toward HDTV program production. Recommendation ITU-R BT.709 remains steady in this period thus allowing manufacturers to produce equipment at ever-lower cost. Study Group 6 implements a new structure by which responsibility of production matters is transferred to new Working Party 6P.