



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.264

(05/2003)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS
Infrastructure of audiovisual services – Coding of moving
video

**Advanced video coding for generic audiovisual
services**

ITU-T Recommendation H.264

ITU-T H-SERIES RECOMMENDATIONS
AUDIOVISUAL AND MULTIMEDIA SYSTEMS

CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100–H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	
General	H.200–H.219
Transmission multiplexing and synchronization	H.220–H.229
Systems aspects	H.230–H.239
Communication procedures	H.240–H.259
Coding of moving video	H.260–H.279
Related systems aspects	H.280–H.299
Systems and terminal equipment for audiovisual services	H.300–H.349
Directory services architecture for audiovisual and multimedia services	H.350–H.359
Quality of service architecture for audiovisual and multimedia services	H.360–H.369
Supplementary services for multimedia	H.450–H.499
MOBILITY AND COLLABORATION PROCEDURES	
Overview of Mobility and Collaboration, definitions, protocols and procedures	H.500–H.509
Mobility for H-Series multimedia systems and services	H.510–H.519
Mobile multimedia collaboration applications and services	H.520–H.529
Security for mobile multimedia systems and services	H.530–H.539
Security for mobile multimedia collaboration applications and services	H.540–H.549
Mobility interworking procedures	H.550–H.559
Mobile multimedia collaboration inter-working procedures	H.560–H.569
BROADBAND AND TRIPLE-PLAY MULTIMEDIA SERVICES	
Broadband multimedia services over VDSL	H.610–H.619

For further details, please refer to the list of ITU-T Recommendations.

Advanced video coding for generic audiovisual services

Summary

As the costs for both processing power and memory have reduced, network support for coded video data has diversified, and advances in video coding technology have progressed, the need has arisen for an industry standard for compressed video representation with substantially increased coding efficiency and enhanced robustness to network environments.

This Recommendation represents an evolution of the existing video coding standards (H.261, H.262 and H.263) and it was developed in response to the growing need for higher compression of moving pictures for various applications such as videoconferencing, digital storage media, television broadcasting, Internet streaming and communication. It is also designed to enable the use of the coded video representation in a flexible manner for a wide variety of network environments. The use of this Recommendation allows motion video to be manipulated as a form of computer data and to be stored on various storage media, transmitted and received over existing and future networks and distributed on existing and future broadcasting channels

Source

ITU-T Recommendation H.264 was approved by ITU-T Study Group 16 (2001-2004) under the ITU-T Recommendation A.8 procedure on 30 May 2003.

This edition includes the modifications introduced by ITU-T Rec. H.264 (2003) Corrigendum 1 approved by ITU-T Study Group 16 (2001-2004) under the ITU-T Recommendation A.8 procedure on 7 May 2004.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU [had/had not] received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

© ITU 2004

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Foreword	xiii
0 Introduction	xiv
0.1 Prologue	xiv
0.2 Purpose	xiv
0.3 Applications	xiv
0.4 Profiles and levels	xiv
0.5 Overview of the design characteristics	xv
0.5.1 Predictive coding	xv
0.5.2 Coding of progressive and interlaced video	xv
0.5.3 Picture partitioning into macroblocks and smaller partitions	xv
0.5.4 Spatial redundancy reduction	xvi
0.6 How to read this specification	xvi
1 Scope	1
2 Normative references	1
3 Definitions	1
4 Abbreviations	8
5 Conventions	9
5.1 Arithmetic operators	9
5.2 Logical operators	9
5.3 Relational operators	10
5.4 Bit-wise operators	10
5.5 Assignment operators	10
5.6 Range notation	10
5.7 Mathematical functions	10
5.8 Variables, syntax elements, and tables	11
5.9 Text description of logical operations	12
5.10 Processes	13
6 Source, coded, decoded and output data formats, scanning processes, and neighbouring relationships	13
6.1 Bitstream formats	13
6.2 Source, decoded, and output picture formats	13
6.3 Spatial subdivision of pictures and slices	15
6.4 Inverse scanning processes and derivation processes for neighbours	16
6.4.1 Inverse macroblock scanning process	16
6.4.2 Inverse macroblock partition and sub-macroblock partition scanning process	17
6.4.2.1 Inverse macroblock partition scanning process	17
6.4.2.2 Inverse sub-macroblock partition scanning process	18
6.4.3 Inverse 4x4 luma block scanning process	18
6.4.4 Derivation process of the availability for macroblock addresses	18
6.4.5 Derivation process for neighbouring macroblock addresses and their availability	19
6.4.6 Derivation process for neighbouring macroblock addresses and their availability in MBAFF frames	19
6.4.7 Derivation processes for neighbouring macroblocks, blocks, and partitions	20
6.4.7.1 Derivation process for neighbouring macroblocks	21
6.4.7.2 Derivation process for neighbouring 8x8 luma block	21
6.4.7.3 Derivation process for neighbouring 4x4 luma blocks	22
6.4.7.4 Derivation process for neighbouring 4x4 chroma blocks	22
6.4.7.5 Derivation process for neighbouring partitions	22
6.4.8 Derivation process for neighbouring locations	24
6.4.8.1 Specification for neighbouring luma locations in fields and non-MBAFF frames	24
6.4.8.2 Specification for neighbouring luma locations in MBAFF frames	24
7 Syntax and semantics	27
7.1 Method of describing syntax in tabular form	27
7.2 Specification of syntax functions, categories, and descriptors	28
7.3 Syntax in tabular form	30
7.3.1 NAL unit syntax	30
7.3.2 Raw byte sequence payloads and RBSP trailing bits syntax	31
7.3.2.1 Sequence parameter set RBSP syntax	31
7.3.2.2 Picture parameter set RBSP syntax	32

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.