

IMS Profile for High Definition Video Conference (HDVC) Service

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1 Introduction

1.1 Overview

The IP Multimedia Subsystem (IMS) Profile for High Definition Video Conference (HDVC) service, documented in this Permanent Reference Document (PRD), defines a *minimum* mandatory set of features that a video communication client and the network are required to implement to guarantee an interoperable, high quality IMS-based video communication service over fixed and mobile access.

The HDVC service comprise point-to-point video calls and video conferences with one full duplex audio stream with tight synchronization to one main video stream and another video stream aimed for sharing of for example presentation slides.

This PRD defines the following two different types of HDVC UEs that can be used for the HDVC service:

- **PRD IR.94 compliant HDVC UE**: this type of UE fulfils both the HDVC specific requirements specified in section 2 of this PRD and simultaneously all requirements in the PRD **IR.94.**

- **Access Unaware HDVC UE**: this type of UE fulfils the HDVC specific requirements but has no interaction with the access in terms of QoS, bearer handling, and so on. The requirements on an Access Unaware HDVC client are specified in section 4 of this PRD.

The term "HDVC UE" is used throughout this document to reference both types of UEs defined above.

NOTE: An HDVC UE is either a PRD **IR.94** compliant HDVC UE or an Access Unaware HDVC UE. The functionality to change type dynamically is not considered in this document.

The purpose of the Access Unaware HDVC client specification is to allow for a wide range of video conferencing devices. This may be from dedicated high end dual HD-screen video conference devices connected over high speed fixed broadband IP access to downloaded HDVC apps on tablets or smartphones connected via Wi-Fi or cellular access without session based QoS control. It is understood that the HDVC service requires sufficiently good access characteristics to provide a useful service but the means to achieve that for an Access Unaware device are outside the scope of this specification.

The specification is compatible with PRD **IR.94** such that a UE compliant only with PRD **IR.94** , that is does not support the HDVC specific requirements in section 2, with support from the network, still may be used as a participant in a High Definition Video Conference.

1.2 Relationship to 3GPP Specifications

This profile is based on, amongst others, the open and published 3GPP specifications as listed in the section 1.5 or in the referenced GSMA PRDs. 3GPP Release 8 is taken as a

basis. It should be noted, however that not all the features mandatory in 3GPP Release 8 for video services are required for compliance with this profile.

Conversely, some features required for compliance with this profile are based on functionality defined in later releases. All such exceptions are explicitly mentioned in the following sections or in the referenced GSMA PRDs.

Unless otherwise stated, the latest version of the referenced specifications for the relevant 3GPP release applies.

Besides the 3GPP specifications, the profile is using ITU-T specified codecs.

1.3 Scope

The scope of this version of the profile is the User-Network Interface that is the interface between a UE using the HDVC service and the network.

The profile does not limit anyone, by any means, to deploy other standardized features or optional features, in addition to the defined profile.

1.4 Definition of Terms

Term	Description
3GPP	3rd Generation Partnership Project
AMR	Adaptive Multi-Rate
AMR-WB	Adaptive Multi-Rate Wideband
AAC-LD	MPEG-4 Low Delay Audio Coder (Advanced Audio Coding – Low Delay)
BFCP	Binary Floor Control Protocol
HDVC	High Definition Video Communication
IANA	Internet Assigned Numbers Authority
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
ISIM	IMS Subscriber Identity Module
PEN	Private Enterprise Number
PRD	Permanent Reference Document
QoS	Quality of Service
RFC	Request For Comment
RTCP	RTP Control Protocol
RTP	Real-Time Transport Protocol
SDP	Session Description Protocol
SIGCOMP	Signalling Compression
SIP	Session Initiation Protocol
UE	User Equipment
UICC	Universal Integrated Circuit Card
USIM	Universal Subscriber Identity Module

1.5 Document Cross-References

Ref	Document Number	Title
1	GSMA PRD IR.92	IMS Profile for Voice and SMS.
2	GSMA PRD **IR.94**	IMS Profile for Conversational Video Service
3	3GPP TS 23.203	Policy and charging control architecture
4	3GPP TS 24.147	Conferencing using the IP Multimedia (IM) Core Network (CN) subsystem; Stage 3
5	3GPP TS 24.229	IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3
6	3GPP TS 26.114	IP Multimedia Subsystem (IMS); Multimedia telephony; Media handling and interaction
7	ISO/IEC 14496-3:2009	Specification of AAC-LD Information technology - Coding of audio-visual objects. Part 3: Audio
8	ITU-T Rec. G.711	G.711 : Pulse code modulation (PCM) of voice frequencies
9	ITU-T Rec. G.719	G.719 : Low-complexity, full-band audio coding for high-quality, conversational applications
10	ITU-T Rec. G.722	7 kHz audio-coding within 64 kbit/s
11	ITU-T Rec. H.239	Role management and additional media channels for H.300-series terminals
12	ITU-T Rec. H.264	"Advanced video coding for generic audio-visual services" | ISO/IEC 14496-10:2005: "Information technology - Coding of audio-visual objects - Part 10: Advanced Video Coding".
13	IETF RFC 3016	RTP Payload Format for MPEG-4 Audio/Visual Streams
14	IETF RFC 3551	RTP Profile for Audio and Video Conferences with Minimal Control
15	IETF RFC 4122	A Universally Unique Identifier (UUID) URN Namespace
16	IETF RFC 4796	The Session Description Protocol (SDP) Content Attribute
17	IETF RFC 5404	RTP Payload Format for G.719
18	IETF RFC 6184	RTP Payload Format for H.264 Video
19	IETF RFC 6263	Application Mechanism for Keeping Alive the NAT Mappings Associated with RTP / RTP Control Protocol (RTCP) Flow
20	GSMA PRD RCC.07	RCS 5.1 Advanced Communications: Services and Clients specification
21	3GPP TS 24.167	3GPP IMS Management Object (MO); Stage 3

2 Specific features for the HDVC service.

2.1 Conference

In addition to the conference features listed in section 2.3.3 of PRD **IR.94** , an HDVC UE and the network must support “Conference creation with a conference factory URI” described in section 5.3.1.3.2 of 3GPP TS 24.147. For joining a conference for which the conference URI is known to the conference participant, the HDVC UE and the IMS core network must support the procedure as described in section 5.3.1.4.1 of 3GPP TS 24.147.

Support for floor control for conferencing is optional for the UE and for the network.

If floor control is supported by the UE then the UE shall use the Binary Floor Control Protocol (BFCP) as described in section 8.2.1 of 3GPP TS 24.147 and support one or both of the floor participant and the floor chair roles.

If floor control is supported by the network then the network shall use the Binary Floor Control Protocol (BFCP) as described in section 8.2.2 of 3GPP TS 24.147 and support at least the floor control server role.

2.2 Screen Sharing

Screen sharing shall be supported in HDVC UE and in the network by a dedicated video stream to the HDVC SIP session, typically using low frame rate and high resolution, similar to what is specified for ITU-T Recommendation H.239.

The screen sharing media is sent from one sender to all participants in a conference.

NOTE: Although the screen sharing is a one to many type of communication, the screen sharing video stream is a full duplex stream. Any participants can thus act as sender of the screen sharing media. The control of which participant that at a certain instant shall be the source for the screen sharing is provided by procedures in the network to elect the conference participant that is source for the screen sharing. Floor control using the Binary Floor Control Protocol (BFCP) can be used for this purpose but the network may also use implementation specific procedures to identify the sender.

The screen sharing media stream shall be identified in SDP with a video media line placed after the media line for the main video content. The media line shall use the attribute “a=content:slides”, as defined in IETF RFC 4796 and shall use the “3gpp_sync_info: No Sync” attribute as defined in section 6.2.6 of 3GPP TS 26.114 to indicate that the stream shall not be synchronized with the main voice and video streams. The codec used must be a valid video codec for a HDVC video stream as specified in section 4.6 of this PRD.

The use of a second video stream shall be supported in point to point video calls and in conferences.

3 PRD IR.94 based clients

3.1 PRD IR.94 Compliant HDVC UE

A PRD **IR.94** Compliant HDVC UE shall fulfil the HDVC service specific requirements specified in section 2 of this PRD and all requirements in the PRD **IR.94** A PRD **IR.94** Compliant HDVC UE need not fulfil the requirements specified in section 4 of this PRD.

The use of EPS bearers for screen sharing as described in section 2.2 is dependent on operator network policies.

3.2 Interworking HDVC service with a UE compliant only with PRD IR.94

An UE that fulfils the requirements in PRD **IR.94** but does not implement the HDVC service specific features specified in section 2 of this PRD may be used to access the HDVC service with the following restrictions:

- The UE is not required to distinguish the procedure to join a HDVC conference for which the conference URI is known to the conference participant described in section 2.1 from a basic point to point video call to another PRD **IR.94** compatible UE.

- The UE is only required to be able to support a single video media stream. In a multi-party video conference, it is up to the network implementation to support the UE in selecting what video media stream that should be sent downstream to the UE.

4 Access Unaware HDVC UE

4.1 General

An Access Unaware HDVC UE shall fulfill the HDVC service specific requirements specified in section 2 of this PRD and all requirements listed in the following subsections.

4.2 Support of generic IMS functions

4.2.1 General

The Access Unaware HDVC shall support all requirements in section 2.2 of PRD **IR.94** and section 2.2 of PRD IR.92 that are not explicitly replaced in the following subparagraphs.

4.2.2 SIP Registration Procedures

The Access Unaware HDVC UE and the network supporting the HDVC service must support the procedures in section 2.2.1 of PRD IR.92 and in section 2.2.1 of PRD **IR.94** with the following exceptions:

- The situations when the Access Unaware HDVC UE shall register with IMS are not mandated by this PRD.
- The Access Unaware HDVC UE must include an Instance ID in the "+sip.instance" header field parameter (Instance ID) of the Contact address as specified in section 2.2.1 of PRD IR.92 . If the Access Unaware HDVC UE has no IMEI URN (see 3GPP TS23.003 section 13.8) then the instance ID is generated as a string representation of a UUID as a URN as defined in IETF RFC 4122.

4.2.3 Authentication

If the Access Unaware HDVC UE has access to one or both of an ISIM or USIM on a Universal Integrated Circuit Card (UICC) in the device and is not configured to use another identity then the Access Unaware HDVC UE shall support the requirements and use the procedures defined in section 2.2.2 of PRD IR.92 with the exception that support and use of the procedures for authentication at the Ut reference point is only required if the Access Unaware HDVC UE supports the Ut reference point.

If the Access Unaware HDVC UE has no access to one or both of an ISIM or USIM on a UICC or is configured not to use the identity associated to one or both of an ISIM or USIM on a UICC then the Access Unaware HDVC UE shall follow the procedures in 3GPP TS 24.229 section 5.1.1 for IMS registration and authentication using SIP digest with or without TLS and using configured identity parameters as described in section 4.8.

4.2.4 P-CSCF Discovery

If the Access Unaware HDVC UE uses authentication credentials from an ISIM on a UICC as described in section 4.2.3 and that ISIM supports the P-CSCF list, then the Access Unaware HDVC UE shall use a P-CSCF from this list. Otherwise, if the Access Unaware HDVC UE has a preconfigured P-CSCF address list as described in section 4.8 then the Access Unaware HDVC UE shall use a P-CSCF from this list.

If no P-CSCF contact information is available either from the ISIM or the configuration, a client on a device using dynamic IP addressing may rely on the procedures defined in section 9.2 of 3GPP TS 24.229 to obtain the P-CSCF contact information from the DHCP query performed upon network attach.

4.2.5 Hosted NAT Traversal

The Access Unaware HDVC UE and the network shall support the procedures for traversal of a hosted NAT specified in 3GPP TS 24.229, Annex F. If the Access Unaware HDVC UE use IMS AKA then the procedures specified in 3GPP TS 24.229, Annex F.2 shall be supported, otherwise the procedures specified in 3GPP TS 24.229, Annex F.4 shall be supported.

The Access Unaware HDVC UE must send keepalives for each RTP media stream, as described in 3GPP TS 24.229, Annex F.5, if the normal RTP media stream packet sending frequency is too low to maintain the NAT bindings.The Access Unaware HDVC UE shall send RTP keep-alive as soon as an SDP offer or answer is received as described in 3GPP TS 24.229, Annex F.5.

NOTE: A UE that is receiving screen sharing will send keepalives in the send direction to keep keep NAT bindings open.

The bandwidth used for RTCP shall be sufficient to keep NAT bindings open for the RTCP flow, as described in IETF RFC 6263.

4.2.6 The use of Signalling Compression (SIGCOMP)

The Access Unaware HDVC UE must not use SIGCOMP when the initial IMS registration is performed.

4.3 Supplementary Services

4.3.1 General

The Access Unaware HDVC UE shall support all requirements in section 2.3 of PRD **IR.94** and section 2.3 of PRD IR.92 with the following exceptions:

- The Access Unaware HDVC UE is not required to support Call barring variants "Barring of Outgoing International Calls Except to home country" and "Barring of Incoming calls when roaming".

The Access Unaware HDVC UE shall support the extensions to the Conference specified in section 2.1 of this PRD.

4.3.2 Supplementary Service Configuration

For supplementary service configuration, the Access Unaware HDVC UE should and the network must support XCAP at the Ut reference point as specified in section 2.3.2 of PRD IR.92.

The Access Unaware HDVC UE may use for example web based management for supplementary service configuration as an alternative to the XCAP.

4.4 Call Setup Considerations

The Access Unaware HDVC UE shall support all requirements in section 2.4 of PRD IR.94 and section 2.3 4 of PRD IR.92 with the exceptions that the requirements on integration of resource management and SIP in section 2 of PRD IR.94 and in section 2.4.2 of PRD IR.92 do not apply.

If the Access Unaware HDVC UE receives an SDP offer for audio but it does not support any of the codecs offered, it shall respond with an error response 488 (Not Acceptable Here) that contains an 305 (Incompatible Media Format) warning code and SDP listing codecs it supports.

4.5 Voice media.

4.5.1 General voice media requirements.

The Access Unaware HDVC UE and the network shall support the DTMF event requirements in section 3.3 of GSMA PRD IR.92 and the voice media requirements in section 3.2 of GSMA PRD IR.92 with the exception that the Access Unaware UE may use alternative voice codecs as specified in the following sections.

NOTE: The need for the use of SRTP for access unaware HDVC UE in a similar way as described in section 2.13.1.3.1 of PRD RCC.07 is for further study.

4.5.2 Voice Codecs

An Access Unaware HDVC UE should support the Adaptive Multi-Rate (AMR) speech codec for narrow band voice, the AMR wideband (AMR-WB) codec for wideband voice, and may support the Enhanced Voice Services (EVS) codec for super-wideband, and fullband voice.

If AMR, AMR wideband or EVS is used, then the Access Unaware HDVC UE and the network shall support the requirements in sections 3.2.1 and 3.2.5 of PRD IR.92.

An Access Unaware HDVC UE that is not supporting the AMR speech codec shall support the G.711 speech codec (described in ITU-T G.711 recommendation).

An Access Unaware HDVC UE that is not supporting the AMR wideband codec shall support G.722 speech codec (described in ITU-T G.722 recommendation).

The entities in the IMS core network that terminate the user plane may support the EVS codec, and shall support the AMR speech codec, the AMR-WB speech codec, the ITU-T G.711, and the ITU-T G.722 speech codecs. The network must support transcoding between ITU-T G.711 and AMR codecs and also between ITU-T G.722 and AMR-WB codecs.

If super-wideband voice is supported, wideband and narrowband must also be supported. If fullband voice is supported, super-wideband, wideband and narrowband must also be supported. If super-wideband or fullband voice is supported then the following rules apply:

- A UE shall support the EVS codec and should support the ITU-T G.719 codec (described in ITU-T G.719 recommendation) or the AAC-LD codec (described in recommendation ISO/IEC 14496-3:2009).

- The entities in the IMS core network that terminate the user plane shall support the EVS codec. The ITU-T G.719 or the AAC-LD codec, and the transcoding between EVS and these codecs may be supported if needed for super-wideband or fullband voice interoperability with UEs not supporting EVS (non HDVC UEs or HDVC UEs before EVS is introduced).

4.5.3 G.711 Payload Format Considerations

When G.711 is supported, the G.711 payload format of IETF RFC 3551 must be supported. An offer with stereo must also include an offer with mono. The frame length shall be 20 ms, and shall support encapsulating up to four(4) non-redundant audio frames into the RTP packets. Codec agnostic parts of section 12.7.2 of 3GPP TS 26.114 and the parts relevant to G.711 apply.

4.5.4 G.722 Payload Format Considerations

When G.722 is supported, the G.722 payload format of IETF RFC 3551 must be supported. An offer with stereo must also include an offer with mono. The frame length shall be 20 ms, and shall support encapsulating up to four (4) non-redundant audio frames into the RTP packets. Codec agnostic parts of section 12.7.2 of 3GPP TS 26.114 and the parts relevant to G.722 apply.

NOTE: Although the sampling frequency for G.722 is 16 kHz, it should be set to 8000 Hz in the SDP since it was (erroneously) defined this way in the original version of the RTP A/V profile.

4.5.5 G.719 Payload Format Considerations

When G.719 is supported, the G.719 payload format of IETF RFC 5404 must be supported. An offer with stereo must also include an offer with mono. The frame length shall be 20 ms,

but shall support encapsulating up to four (4) non-redundant audio frames into the RTP packets. Codec agnostic parts of section 12.7.2 of 3GPP TS 26.114 apply.

4.5.6 AAC-LD Payload Format Considerations

When AAC-LD is supported, the MP4A-LATM payload format of IETF RFC 3016 must be supported, specifying object type 23. An offer with stereo must also include an offer with mono. Codec agnostic parts of section 12.7.2 of 3GPP TS 26.114 apply.

4.6 Video Media

An Access Unaware HDVC UE and the network shall fulfil all video media requirements in section 3.3 of PRD **IR.94** .

The Access Unaware HDVC UE and the network shall support the use of an additional video stream for screen sharing in a Conference session as specified in section 2.2 of this PRD.

Support for H.264 Main and High Profiles are optional for the Access Unaware HDVC UE and the network. When Main or High profile is supported, SD video content shall comply with clauses 5.5 and 5.6, and HD content with clauses 5.5 and 5.7 of ETSI TS 101 154. Each sequence parameter set of H.264 shall contain the vui_parameters syntax structure including the num_reorder frames syntax element set equal to zero (0) as per TS 26.114 section 5.2.2.

When end-points support same profile, but the offered levels are not identical the one offering (or wanting to offer) the higher level must be able to adapt to the lower level, as specified in IETF RFC 6184.

Asymmetry in receive and transmit capability must be supported by all end-points, for example receive 1080p, but transmit 720p. Asymmetry is specified for the H.264 codec using the “max-recv-level” and “level-asymmetry-allowed” attributes specified in RFC 6184, and for the H.265 codec using the “max-recv-level-id” attribute as specified in 3GPP release 12 TS 26.114 section 6.2.3.

Support for H.265 (HEVC) Main Profile, Main Tier, Level 3.1 as specified in 3GPP release 12 TS 26.114 section 5.2.2 is recommended in the UE and the entities in the IMS core network that terminate the user plane.

The bandwidth SDP parameter is mandatory on media level and optional on session level.

4.7 End System Identification

Endpoints that need specific handling or interpretation of the SDP or media based on what remote endpoint it connects to (for example a system from the same vendor) may need to uniquely identify each other. Such identification is optional, but if present it shall be done through using an IANA Private Enterprise Number (PEN) as (the first part of) the first product token in the User-Agent SIP header, for example 193/1.0. A vendor can optionally use a single PEN for multiple products by separating the PEN and the textual product-ID with a single hyphen (“-“), for example 193-VisualProduct/1.0. It is the responsibility of the holder of the PEN to ensure that the combination of PEN and product-ID is sufficiently unique.

4.8 Configuration

4.8.1 Configuration Parameters

An Access Unaware HDVC UE needs at least the following parameters configured to be able to provide the HDVC service:

- One or more P-CSCF identifiers e.g. IPv4 or IPv6 address and port, Fully Qualified Domain Name.
- Credentials for authentication

The above parameters are configured as specified in sections 4.2.4 and 4.2.3 respectively.

If an Access Unaware HDVC UE provides no further IMS based functionality beyond that which is detailed in this specification then the following parameters must be able to be provisioned (using the mechanisms described in section 4.8.2):

- The IMS parameters described in 3GPP TS 24.167 taking into account the clarifications described in section A.1.6.2 of PRD RCC.07 for a configured SIP URI and Tel URI. The P-CSCF address list may be configured as described in 3GPP TS 24.167 and used as described in section 4.2.4;
- The IMS Mode Authentication Type;
- If the IMS Mode Authentication Type is set to "SIP Digest" (as described in section 4.2.3) then also the following parameters as described in section A.1.6.3 of PRD RCC.07:
    - Realm;
    - Realm User Name; and
    - Realm User Password.

- If Digest is used for authentication at the Ut refererence point then also the following parameters as described in section A.1.2.1 of PRD RCC.07:
    - XCAP Root URI;
    - XCAP Authentication Username;
    - XCAP Authentication Secret; and
    - XCAP Authentication Type.

- The wifiSignalling element as defined in section A.2.10 of PRD RCC.07; and
- If the Access Unaware HDVC UE uses a UUID value as Instance ID as described in section 4.2.2, the uuid_Value as described in section A.1.13 of PRD RCC.07.

In situations where the configuration is not provisioned by the network, it is up to the Access Unaware HDVC UE implementation to define which parameters are configurable and what values are used for those parameters that are not configurable.

4.8.2 Configuration Methods

Editor's Note: The mechanism to configure parameters on the device is for further study and may be dependent on the nature of the device. The following options are considered: OMA DM, HTTP as defined in PRD RCC.07, Broadband Forum TR-069, factory or manual configuration.

Annex A HDVC UE classes

A.1 General

The IMS profile for HDVC service in the main body of this PRD defines the minimum mandatory requirements that must be implemented by all HDVC devices as a least common denominator. An HDVC device may also implement additional codecs to provide better user experience with higher bandwidth use.

A.2 HDVC UE classes definition

In order to allow HDVC devices to find the most appropriate codec in the SDP negotiation, a set of HDVC UE classes are defined to mandate the support of alternative codecs or codec profiles.

HDVC UE Class	Mandatory support
1	Video media requirements in the main body of this PRD
2	Video media requirements of HDVC UE class 1 with the addition to support H.264 Constrained High Profile codec is mandatory. Within the class there are two defined subclasses: • Class 2a supporting at least H.264 Constrained High Profile level 3.1 • Class 2b supporting at least H.264 Constrained High Profile level 4.1 The answer to an offer of H.264 Constrained High Profile with a certain level may indicate that the offer is accepted but at a lower level.

A device supporting an HDVC UE class higher than one (1) must form the SDP offers such that the list of payload formats in the video media offer also includes a media format compatible with class one (1) with lower priority.

NOTE: A media format has a lower priority if it is listed further right in the payload format list in the m-line.

Annex B Document Management

B.1 Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
0.1	31/08/2012	First draft presented for information at RILTE #26	RILTE	Lennart Norell/ Ericsson
0.2	19/09/2012	Draft PRD submitted to RILTE #27	RILTE#27, IREG#64	Lennart Norell/ Ericsson
1.0	22/02/2013	DAG & PSMC approval.	PSMC #1092	Lennart Norell/ Ericsson
2.0	18/04/2013	CRs 1002-1008	PSMC#112	Lennart Norell/ Ericsson
2.1	06/05/2013	Minor CR´s T9 and T10	IREG	Lennart Norell/ Ericsson
3.0	21/10/2013	CR 1009-1010	RILTE	Lennart Norell/ Ericsson
4.0	27/05/2014	CR 1011	RILTE	Lennart Norell/ Ericsson
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