ETSI TS 103 434 V1.1.1 (2017-09)

TECHNICAL SPECIFICATION

PowerLine Telecommunications (PLT);
Transcoding of HD and UHD video over powerline network

Reference
DTS/PLT-00048

Keywords
powerline, VDSL2

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Powerline Telecommunications (PLT).

The present document is for Gigabit Home Networking and includes Video Transcoding for UHD video for long range PLT networks and short range based PLT links.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document focuses on Gigabit Home Networking for Very High Speed Internet video distribution using video transcoding for the distribution of HD and UHD video streams over SISO and MIMO PLT networks [i.1].

The present document defines the transcoding of HD and UHD video for improvement of the house coverage of powerline networks for existing or forthcoming new video services as streaming and VOD MIMO-PLT and filling the gap between MIMO-PLT channels capacity and new services as UHD and HD video for forthcoming UHDTV, namely transcoding of H264/AVC into HEVC/H265.

The SISO/MIMO Powerline networks channels have time varying capacities depending on noises, overage, range as HD and UHD encoded in H264/AVC video streams have additional bit rate compared to stream [3], [4] encoded in HEVC/H265, the usage of transcoding for video streaming over Powerline using SISO & MIMO PLT modems is explored by testing.

The present document includes the technical specification for video transcoding and transportation standards impact on Powerline Networks coverage and produce technical guidance to the Powerline telecommunication vendors to cope with very high rate services over Powerline communication for the UHD and HD video transcoding coding.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] Recommendation ITU-T H.265 (12/2016): "High efficiency video coding".

[2] Recommendation ITU-T H.264 (04/2017): "Advanced video coding for generic audiovisual services".

[3] ETSI TS 101 154 (V2.2.1) (06-2015): "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream".

[4] ETSI TS 101 154 (V2.3.1) (02-2017): "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TR 101 562 (V1.1.1) (05-2011): "PowerLine Telecommunications (PLT); MIMO PLT Universal Coupler, Operating Instructions - Description".

[i.2] ETSI TR 103 234 (V1.1.1) (12-2014): "Power Line Telecommunications; Powerline recommendations for very high bitrate services".

[i.3] ETSI TR 103 343: "Power Line Telecommunications (PLT); Powerline HDMI® analysis for very short range link HD and UHD applications".

[i.4] DIRAC.

NOTE: Available at http://www.bbc.co.uk/opensource/projects/dirac/.

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AV	Audio Video
AVC	Advance Video Coding (H264)
BB	Broad Band
CE	Consumer Electronic
CEC	Consumer Electronic Command
DCT	Discrete Cosinus Transform
DSL	Digital Subscriber Line
Gbps	Giga bit per second
GOP	Group Of Picture
HD	High Definition
HDMI	High Definition Machine Interface
HEVC	High Efficiency Video Coding (H265)
HPNA	Home Phone line Networking Alliance
I-UWB	Impulsion based Ultra Wide Band
LDPC	Low Density Parity Check
LVDN	Low Voltage Distribution Network
MB-OFDM	Multi-Band - Orthogonal Frequency-Division Multiplexing
MIMO	Multiple Input Multiple Output
OFDM	Orthogonal Frequency Division Multiplexing (Multi-carrier transmission)
PE	Protective Earth
PHDMI	Powerline High Definition Machine Interface
PLC	PowerLine Communication
PLT	PowerLine Telecommunication
PSD	Power Spectral Density
PSNR	Peak Signal to Noise Ratio
Rx	Receiver port (Rx port)
SAD	Sum of Absolute Differences
SISO	Single Input Single Output
SSD	Sum of Square Differences
STB	Set-top-Box
STF	Specialist Task Force
TC	Technical Committee

TS	Technical Specifications
TV	Television
Tx	Transmitter port (Tx port)
UEP	Unequal Error Protection
UHD	Ultra High Definition
UHDTV	Ultra High Definition Television
UWB	Ultra Wide Band
UWB-I	Ultra Wide Band Impulse
VOD	Video On Demand
WLAN	Wireless Access Network

4 Video transcoding for Home PLT networks

4.1 Introduction

The present document includes recommendations given in Technical Reports resulting from STF investigations made during the over past 5 years (2012-2017) in ETSI TC PLT.

In the past, PLT systems used only one transmission path between two outlets. It is the differential mode channel between the phase (or live) and neutral contact of the mains. These systems are called SISO (Single Input Single Output) modems. In contrast, MIMO PLT [i.1] systems make use of the third wire, PE (Protective Earth), which provides several transmission combinations for feeding and receiving signals into and from the LVDN (Low Voltage Distribution Network).

This investigation on MIMO PLT channels and noises enlarge the throughputs of PLT networks allowing Gigabit networks using MIMO PLT modems and is a major accomplishment for PLT technology.

TC PLT investigated the benefits of emerging technologies: the new generation of MIMO (Multiple Input-Multiple Output) powerline telecommunication modems and new video codec HEVC/H265 [1].

The resulting of measurements exhibit the extension of a PLT network for video services when using HEVC as video codec compared to H264/AVC [2], therefore the present document recommend the integration of a video transcoder in a broadband gateway and the present document specify a real time video transcoding algorithm from H264 /AVC to H265/HEVC for bit-rate reduction.

This investigation on video transcoding combined with MIMO PLT networks allows UHD video streaming [3] on wireline and wireless networks.

For very high speed uncompressed video distribution on short range PLT links is also based on video transcoding using wavelets.

This investigation is focussing on uncompressed video links as HDMI® ports for short range high speed links exploring the gap between the PLT transmission and the video compression using JPEG2000 tandem schemes and joint source and channel coding innovative processing schemes.

In 2010, ETSI Specialist Task Force (STF) collected all kind of MIMO channel properties in several European countries. The measurement campaign and experimental results are documented in the technical report [i.1].

As in the STF 410 on PLT MIMO and following the objective of increasing the bit rate of PLT modems on Short Range PLT links for PHDMI the UWB (Ultra Wide Band) using MB-OFDM and I-UWB have been investigated.

The present document address home wireline networks such as PLT, Coax and HPNA and also hybrid networks with WLAN for lossless or visually lossless compression transmission.

4.2 Powerline Home Networking

Modern residential homes contain an increasing number of consumer electronic (CE) devices for communications and entertainment, which should be interconnected among themselves and to the outside service providers that deliver entertainment content, telecom services and Internet access.

Today, broadband residential services are delivered to homes by coaxial cable, twisted pair, or optical fibre. Regardless of the access transmission media, the signal is terminated in the modem (DSL, cable, or Optical Networking Unit), and a home owner or network installer can distribute the signal inside the home to connect various CE devices.

There are two kinds for home network technologies usually deployed in a house:

- Wired - communicates through data cables (most commonly Ethernet-based).
- Wireless - communicates through radio waves.

Wired Home Networks: A type local area networking technology which is based on a special type of cable which is used to transfer data from one place to another in the form of analogue and digital signals, these cables are called as coaxial cables.

In-home PLT is a technology which delivers telecom services to every corner of a household through already existing electrical wiring. In recent years, PLC has emerged as a potential candidate for domestic high bit rate services.

The current in-home PLC technology, based on Single-Input Single-Output (SISO) configuration, under achieves the capacity offered by the physical PLC channel. The in-home PLC channel offers multiple signal feed ports as, usually, it comprises of three wires: Phase, Neutral and Protective Earth.

4.3 Video transcoding for Home PLT networks

The transcoding is the process that converts from one compressed bitstream (called the source or incoming bitstream) to another compressed bitstream (called the target or transcoded bitstream).

The present document give specifications for two types of video transcoding for PLT networks [i.2] and [i.3]:

a) The transcoding of HD and UHD video streams from H264 /AVC to H265/HEVC for bit rate reduction as measured in the tests performed in STF 468 and avoiding the cascading operations.

b) The transcoding of the uncompressed HD and UHD video decoded in H264 or H265 into visually lossless JPEG2000 and DIRAC codec [i.4] for short range PLT links as Powerline HDMI® using UWB transmission.

The basic requirements in transcoding are:

- the information in the source bitstream should be exploited as much as possible;
- the quality of the transcoded video should be as high as possible, or as close as possible as if the original video was encoded in the target format; and
- the transcoder complexity (delay, processing power and memory requirements) should be kept at minimum, targeting real-time implementation.

5 MIMO-PLT

In powerline communications, the use of MIMO-PLT offer to Home Networking, several improvements over legacy SISO powerline transceivers:

a) Increasing the coverage in a home or building.

b) The ability of MIMO signals to cross over to other phases in the electrical wiring increases coverage and performance for many areas of the building.

c) Improving the throughput as MIMO is based on a highly optimized signal processing spatially multiplexed signals over each port.

MIMO-PLT specifications are based on characteristics of multiple-input multiple-output (MIMO) PLT networking transceivers capable of operating over premises powerline wiring.

MIMO-PLT transceivers are able to transmit and/or receive over three powerline conductors (e.g. Phase, neutral, and ground) using more than one Tx and/or Rx port, thus providing a significant increase of data rate, noise immunity improvements, and enhancing the connectivity of the home network in increased coverage.

Subsequent channel capacity calculations have suggested that the in-home PLC channel capacity can be increased through MIMO technique based on experimental networks the other on real networks.

6 Specifications of video Transcoding for PLT

6.1 Introduction

The contemporary inhome single phase electrical power delivery network consists of three wires. Therefore, multiple signal feeding ports are available in most inhome PLC channels.

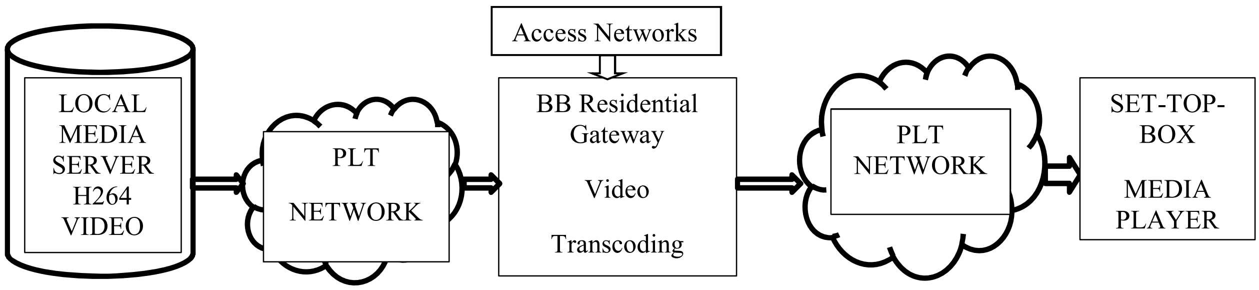

Figure 1: Broadband Residential Gateway with Video Transcoding

6.2 Use cases for transcoding

Many equipment and infrastructure are in the past years adapted to support the encoding of video streams in Recommendation ITU-T H.264 [2], while compliant actual equipment in Recommendation ITU-T H.265 [1] format are on market.

Transcoding is one of the most promising technologies, which provides video adaptation in terms of bit-rate reduction, resolution reduction and format conversion to meet various requirements.

The wide use of the AVC standard today and the expected adoption of HEVC raises a new demand for AVC to HEVC transcoding.

In practical, a video transcoder should make tradeoff between complexity and coding performance while making full use of the input bit-stream [3], [4] to generate a new one at a reduced bitrate.

According to Recommendation ITU-T H.265 [1] standard, the current HEVC model still belongs to block-based hybrid video coding framework, except that the block size is extended to up to 64x64 compared with that of AVC (16x16). Basically, AVC and HEVC share a similar prediction, transform, quantization, and entropy coding architecture.

However, since rate-distortion cost of multiple modes still needs to be evaluated, a mass of sum of absolute difference/sum of square difference (SAD/SSD) computation as well as fractional pixel interpolation has to be involved in the motion re-estimation or motion refinement process.

6.3 Transcoding for local network

This clause provides technical specifications of PLT transceivers for HD & UHD video transcoding on multiple-input and multiple-output (MIMO) Gigabit home networking.

In order to extend the coverage of PLT networks at home, the video transcoder, shall include the following clauses.

A method for transcoding a stream of video data in H.264 format into a stream of video data in H.265 format method being implemented by a transcoding including the following steps:

1) Merging of an adjacent macroblocks from data stream received from a H.264 encoder according to a metric of similarity of DCT (DCT: discrete cosine transform) coefficients after applying an inverse quantization operation.

2) Estimation of motion vectors in H.265 format on the basis of motion vectors in H.264 by performing, a refinement by weighted averaging of motion vectors from H.264 encoder merged blocs.

3) Transcoding method based on the macroblocks fusion correspond to predicted data in intra mode, the transcoding combines the resulting macro block of a prediction direction which is the prediction direction nearest according to the H.264 format to a linear combination of the prediction directions associated with macroblocks merged.

4) Transcoding method based on determination whether adjacent macroblocks may be merged, the transcoding device obtains a sum of absolute differences between information of DCT coefficients, after inverse quantization, adjacent macro-blocks, and compares the sum of absolute differences of information with a first predefined threshold.

7 Powerline HDMI® short range link

7.1 Foreword

This clause include technical specifications for transmitting video over the powerline medium HD and UHD contents that typically are exchanged through the HDMI® cable between transmitter video sources like Blu-ray™ players or set-top boxes and receiver video sinks like video displays.

NOTE: Blu-ray™ is the trade name of a product supplied by Sony. This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of the product named. Equivalent products may be used if they can be shown to lead to the same results.

7.2 Use cases of Powerline HDMI® short range link

Uncompressed HD video transmission avoids compression at the transmitter and decompression at the receiver, therefore providing:

- lower latency which permits timing sensitive applications like multimedia applications and gaming;
- higher interoperability between devices, because, unlike compressed video transmission, the receiver device just displays the video content and does not need to be able to decoded the video codec; and
- no degradation in picture quality due to compression losses in the transmission.

To address these needs several powerline solutions have been created and are developed:

- Point to point uncompressed video transmission.
- Point to multi point uncompressed video transmission.

This clause addresses the transmission of uncompressed HD & UHD video from HDMI® socket over the powerline medium for short range links that typically are exchanged through the HDMI® cable between transmitter video sources like Blu-ray players or set-top boxes and receiver video sinks like video displays.

The present document provides guidance for Short Range Powerline modems for Very High Bit Rate links short range such as Powerline HDMI® links.

7.3 HDMI® over Powerline

Actual of the Powerline standard will reach data rates of approximately 1 Gbps for SISO PLT modem and 2 Gbps, using MIMO technology with 2x2 spatial streams and higher order carrier modulation constellations, but will also be incapable of supporting the newer video formats.

Current powerline technologies operating in 1 MHz to 100 MHz band are unable of accommodating such high throughput and many investigations on UWB over powerline exhibit an enhancement of bit rate using wider frequency band with a specific PSD.

This PLC throughput is not sufficient for UHD uncompressed video from a HDMI® port, for this reason this recommendation for Powerline HDMI® jointly use a visually lossless video compression based on wavelet.

This PHDMI modem specifically designed for video transmission organizes the source devices (transmitters) and the sink devices (receivers) into a short range powerline video network (figure 2), that allows for example:

- Point to point uncompressed video transmission.
- Point to multi point uncompressed video transmission.

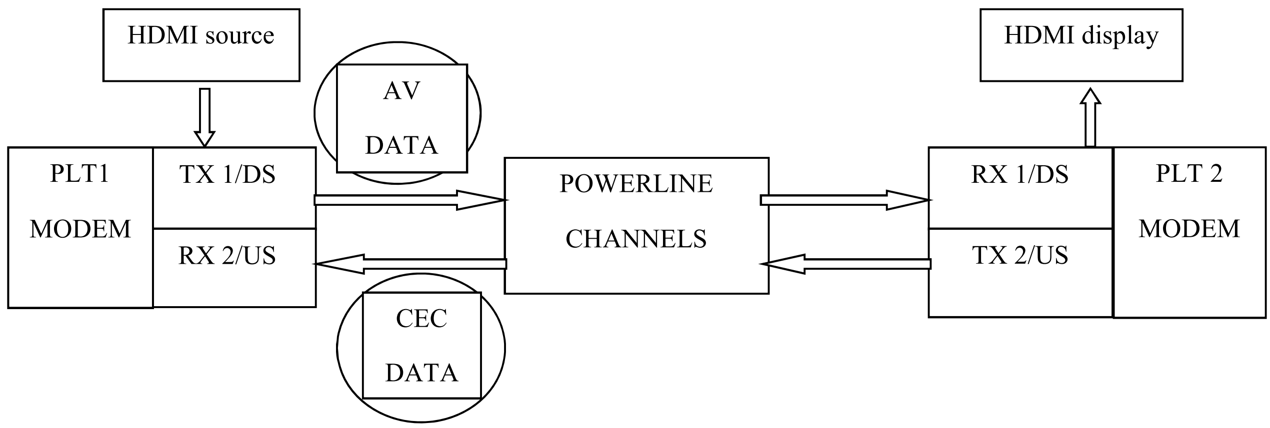

Figure 2: PHDMI architecture based on 2 PLT modems and HDMI® data (AV & CEC)

In this case the short range Power Line Communications (PLC) is used for information exchange over the lines power common feeding of devices such as HD/UHD TV, STB, Blu-Ray player, etc.

7.4 Specifications of Powerline HDMI®

The present document provides guidance for Short Range Powerline modems for Very High Bit Rate links short range such as Powerline HDMI® links.

In the context of video data transmission over powerline channel this contribution address, for a given uncompressed image, determines an estimation of the instantaneous capacity PLT channel and proceed to wavelet based uncompressed image decomposition for compression based on PLT channel estimation and the required bit-rate for a transmission with a certain redundancy to correcting errors due to noises.

The Powerline HDMI® for a point to point transmission of video data over PLT channels, according to figure 3, shall include the following joint processing of video matching with PLT channel capacity:

1) Splitting video into GOP sequences of uncompressed images by using a difference of histograms of each image.
2) Image quality by computation of PSNR: Peak to Signal to Noise ratio at the emitter side.

3) A wavelet based resolution pyramidal decomposition is applied to each image of this sequence for video compression before transmitting data spreading allowing redundancy rate (lower resolution is more protected than higher resolution) is depending on resolution of the wavelet pyramid and transmission is performed using pulse like modulation.

4) An optical flow (motion of each pixel) map computation is performed on successive images of a GOP and this map is also transmitted to the reception modem connected to a display for the reconstruction of the image from interpolation.

5) The video compression rate applied to the wavelets coefficients is depending on powerline channel capacity dynamic estimation for tracking time varying channels. This compression rate take in account the redundancy of video data based on spatial resolution obtain by wavelet pyramidal decomposition.

At the receptor side, the image is reconstructed or restored depending on the PSNR of image at the emission.

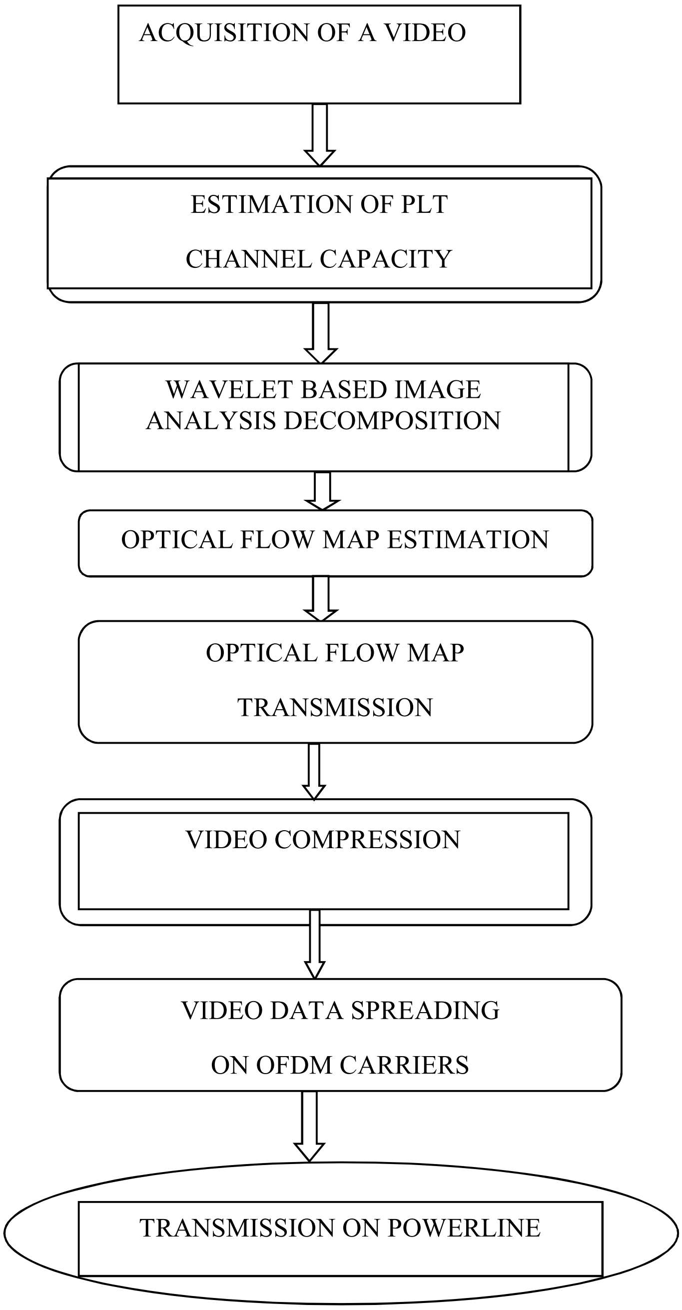

Figure 3: PHDMI general scheme for video compression based on Powerline Channel capacity estimation

In this clause 7.4, the capacities of the reference channels are estimated, while considering all constraints derived in the first clause 7.3. The constraints are imposed by a limited frequency band, a limited transmit signal power density and the noise scenario of the powerline channel. In a first step a noise scenario, taken from a typical channel measurement is considered.

A transmission method is described for transmitting video data over a powerline communications transmission channel, an emitter obtaining video data in the form of a succession of uncompressed images, the emitter performing:

A wavelet-decomposition of each uncompressed image is performed, the wavelet-decomposition enabling obtaining data with different resolutions; performing a compression of each wavelet-decomposed image; transmitting in (UWB-I: for pulse form) with spreading, of each compressed image to a receptor.

An UEP (Unequal Protection) of data redundancy , the rate of which, for each data item in compressed image, is defined according to the resolution of video data item, the redundancy of the data with the lowest resolution being greater than the one of the data of any other resolution.

Splitting the succession of uncompressed images into uncompressed image sequences is performed, by detecting changes in scenes on the basis of differences in luminance histograms between two consecutive images.

For determining speed maps representing the motion of the pixels of an uncompressed image to a following uncompressed image in the same sequence of uncompressed images an algorithm as SAD is applied; and transmitting the obtained speed maps to the receptor to enable receptor to apply an image enhancement operation by inter-image interpolation for at least one sequence of reconstructed images, on the basis of motion vectors maps.

Estimation of the capacity of the powerline communications transmission channel is also performed and compression of each wavelet-decomposed image, according to the estimated capacity of the powerline communications transmission channel.

The computation of the speed maps is based on sum of absolute differences algorithm (SAD) in each sub-band of each resolution level, and determines a motion vector map, for each resolution level, from the results of applying the sum of absolute differences algorithm to each sub-band of resolution level.

The reconstruction of uncompressed images from data received from the communication device via the powerline communications transmission channel is performed ; obtaining a division of the reconstructed images into sequences; applying the image-enhancement operation by inter-image interpolation for at least one sequence of reconstructed images, on the basis of speed maps.

The transmission method, in which the wavelet-decomposition is a second-generation wavelet decomposition and, in the image-enhancement operation for sequence of reconstructed images, the receptor applies a second-order temporal filtering to the two-dimensional components of the wavelets.

The transmission method is based on computation of the speed maps, the emitter performs: determining motion vectors for a first resolution level; and estimate search zones for applying a block matching algorithm in a second resolution level of a higher order than first resolution level, by applying a margin around the motion vectors determined for first resolution level.

The capacity of the powerline communications transmission channel is estimated and implementing the compression of each wavelet-decomposed image, according to the determined capacity of the powerline communications transmission channel.

The emitter estimate the speed maps based on a sum of absolute differences algorithm to each sub-band of each resolution level, and for determining a speed map, for each resolution level, from the results of applying the sum of absolute differences algorithm to each sub-band of resolution level.

The transmission of video data over time varying channel shall include a communication device obtaining the video data in the form of a succession of uncompressed images and a device communication of determining the capacity of the transmission channel, and the communication device shall perform the following clauses (figure 3):

1) At the emitter level, each uncompressed image is decomposed to obtain data of different resolutions; images (UHD (2160p), HD (1080p), HD (720p)).

2) Depending on the capacity of the transmission channel including powerline; the compression of each image is performed by wavelet decomposition.

3) The transmission by UWB (I-UWB pulse coding , or MB-OFDM) of each compressed to a receptor, in order to protect video data from noises, a redundancy is introduce to the data rate for each data of the compressed picture image is defined depending on the resolution of the video data.

4) A (UEP: Unequal Error Protection) Coding is performed by the emitter exploiting the redundancy of data at lower resolution being higher than that of any other data resolution.

5) A GOP is obtained as the succession of image uncompressed images by detecting scene changes on the basis of the luminance histogram differences between consecutive image sequences.

6) Determining maps representative of the displacement speed of the pixels of an uncompressed to a compressed non following in a sequence of images uncompressed image.

7) Transmission of the maps the obtained speed receptor to enable the receptor to apply an image by inter-frame interpolation process improvement for at least one sequence of images reconstructed on the basis of the velocity maps.

8) Determining the capacity of the transmission channel including a power line channel, the implementation of compression of each wavelet decomposed image according to the determined capacity of the transmission channel by modem as powerline.

9) A transmitter use the redundancy rate of compressed image data of each level is greater than the rate of redundancy data, the compressed to such higher resolution.

10) The transmission method based on a emitter performing the following processing:

    Splitting the video into GOP of the succession of uncompressed images by detecting scene changes on the basis of the luminance histogram differences between consecutive image sequences.

11) A transmission method is based on a emitter performing the following processing:

    - Determination of speed maps representative of the displacement speed of the pixels of an uncompressed to a compressed non following in a video sequence of uncompressed images:

        a) Transmission of optical flow (vectors) map receptor; and the receptor performs the following processing:

            - Reconstruction of uncompressed data received from the emitter via the transmission powerline-channel.

            - Obtaining a division into sequences of reconstructed images.

            - Application of the image enhancement operation by inter-frame interpolation for at least one of reconstructed images.

The transmission method is based on wavelet decomposition of an image of a video sequence, and in that, in the image enhancement of the images reconstructed for operation sequence, the receptor uses a temporal sequence of the two components of two-dimensional wavelet filter.

Determining motion vectors for a first level (lower resolution) of resolution; search areas for applying a matching algorithm (SAD) to macro-blocks in a higher resolution, applying a margin around the motion vectors determined for the first resolution level.

The transmission emitter perform the wavelet decomposition such as JPEG2000 encoding string and the compression communication transceiver. Transmission method based on the UWB modulation includes also a LDPC encoder exploiting the data redundancy.

A system for transmitting video data over a transmission channel power line, the system comprising at least an emitter video data in the form of a succession of uncompressed images and estimation of the capacity of channel power line:

a) Decomposition by each wavelet of uncompressed image for obtaining data of different resolutions.

b) Compression of each image wavelet decomposed, depending on the determined capacity of the transmission channel by powerline Transmission by pulse spreading, each compressed in order to introduce redundancy to the data rate for each data of the compressed picture image is defined according to the resolution of the video data the data redundancy of lower resolution is higher than that of any other resolution data.

c) Video splitting into GOP means of the succession of images uncompressed sequences by detecting scene changes on the basis of the luminance histogram differences between consecutive images.

d) Determination of maps of the displacement speed of the pixels of an uncompressed to a compressed non next in a sequence of images uncompressed image.

e) Transmission of maps the obtained speed at receptor to apply a sequence of an image by inter-frame interpolation process improvement for at least image reconstructed.

f) Determination of the capacity of the transmission channel and power line, the implementation of compression of each wavelet decomposed image according to the determined capacity of the powerline transmission channel.

History

Document history		
V1.1.1	September 2017	Publication