

Ultra HD

WBU-ISOG Forum

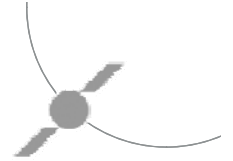
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Geneva

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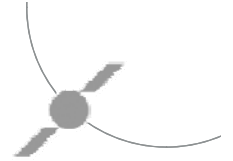
Key messages ...



- **The future of HD is emerging: Ultra HD (UHD)**
 - **Ultra HD standards and specifications not yet fully finalized but: 4k format with HEVC, a new compression standard, could be the next choice**
 - **Ultra HD should provide an unprecedented vivid experience to viewers, and might also boost 3D, with Full HD per eye**
- **Ultra HD is a disruptive technology for TV:**
 - **If current Cinema production in 4k is paving the way for Movie TV channels in UHD...**
 - **...its broad adoption will represent significant investments for TV broadcasters**
- **First end-user equipment will appear in 2013/2014 but it will take time to become mass market**
- **The satellite is ready for 4k Ultra HD**
- **Progressive adoption of Ultra HD will bring back the satellite broadcasting in the frontline, way beyond DSL technologies**
 - **Ultra HD will increase the digital divide by marginalizing DSL technologies for TV distribution**
 - **Satellite will be the only distribution channel to provide UHD in every house**
- **Eutelsat wants to play a key role and be proactive**



Agenda



- **Digital Cinema and TV formats**
- **Interest of 4k**
- **Ecosystem for 4k TV**
- **Capacity needed for 4k TV via satellite**
- **Conclusions**

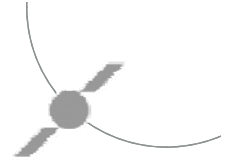


How to define Digital Cinema and TV formats ?



- **Main elements used to define a format in Digital Cinema and TV :**
 - number of pixels per line
 - number of lines
 - aspect ratio (**pixels per line / number of lines**)
 - interlaced or progressive (i or p)
 - frame rate (**frames per second: fps**)

2 formats are commonly used in digital cinemas



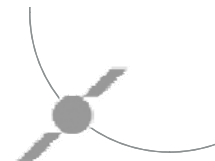
Digital Cinema formats (from Digital Cinema Initiatives (*) – DCI) : 2k and 4k

Digital cinema formats :	2k (DCI)	4k (DCI)
Pixels/line x number of lines (aspect ratio)	Most common: 2048 x 1080 p (1.89) (2.2 Mpixels/frame)	Most common: 4096 x 2160 p (1.89) (8.8 Mpixels/frame)
Frame rate	24 fps Or, high frame rates: 48 fps (**) 60 fps (**)	24 fps Or, high frame rates: 48 fps (**) 60 fps (**)

(*) Digital Cinema Initiatives = Joint project founded in 2002 by American Majors

(**) Note: High Frame Rates (HFR) are recommended by some famous Directors like James Cameron, but the majority of films are still in 24 fps

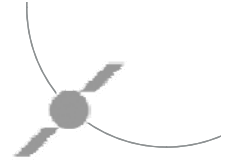
The 2 existing formats (Quad being experimental) will be complemented by 2 new UHD TV formats



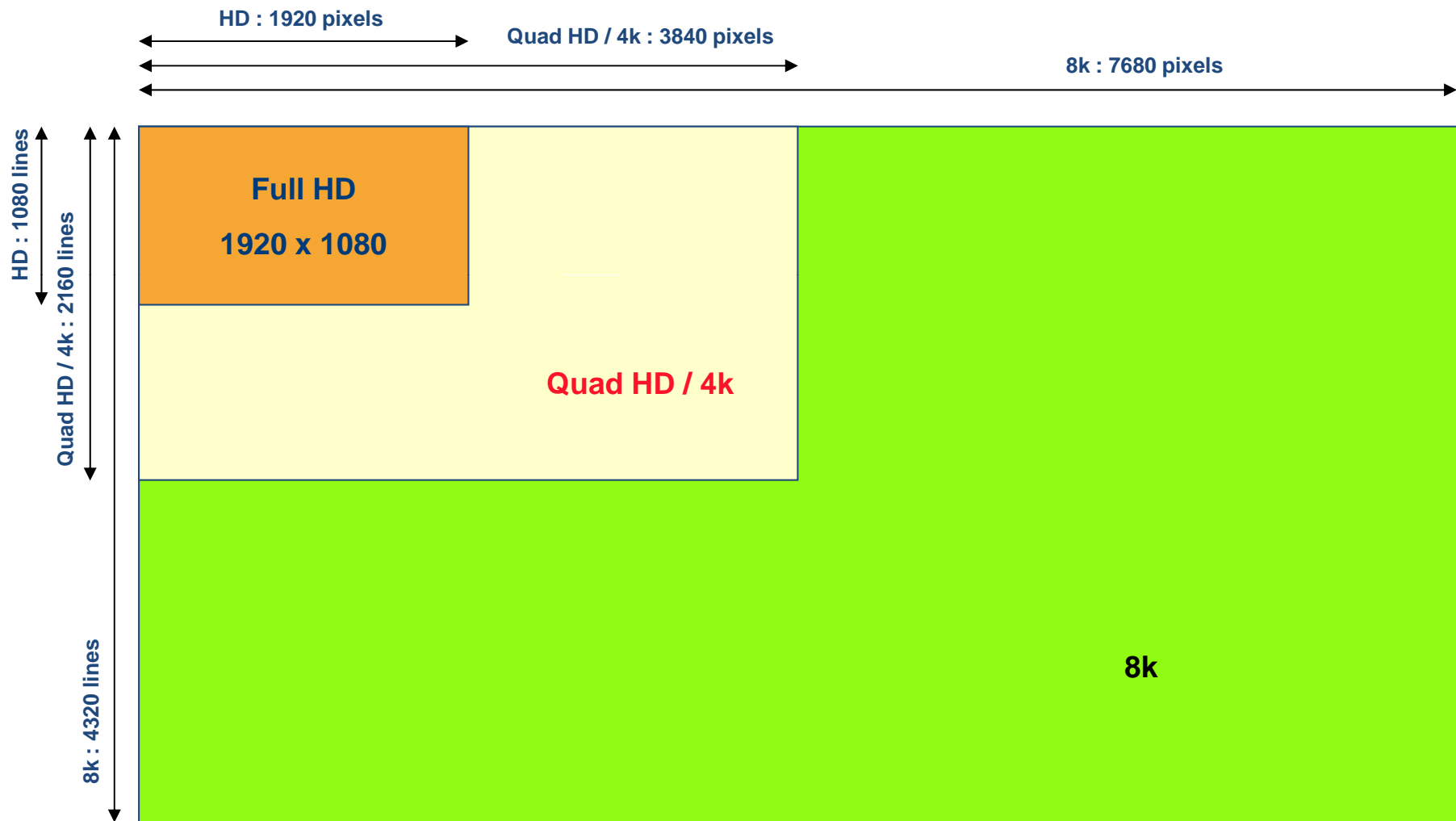
Digital TV formats from HD to 8k

Digital TV formats :	High Definition (HDTV)	Quad HD	Ultra HDTV 4k (UHDTV1)	Ultra HDTV 8k (UHDTV2)
Pixels x number of lines Aspect ratio : 16/9	1280 x 720 p (0.922 Mpixels/frame) 1440 x 1080 i (1.6 Mpixels/frame) 1920 x 1080 i or p (2.1 Mpixels/frame)	4 x HDTV 3840 x 2160 p (8.3 Mpixels/frame)	3840 x 2160 p (8.3 Mpixels/frame)	7680 x 4320 p (33.2 Mpixels/frame)
Frame rate	25 fps (50 fps soon ?) Or: 30 fps (USA, Japan, ...) – 60 fps soon ? + 24 fps (Blu-ray)	25, 50 fps, ... Or: 30, 60 fps, ... + 24 fps	25, 50, ... fps 30, 60, 120 fps + 24 fps (100 fps: not yet)	25, 50, ... fps 30, 60, 120 fps + 24 fps (100 fps: not yet)
Comments	Most of the HDTV channels are in « i » (interlaced mode) Next step ?: 1920 x 1080p 50 fps ?	Experimental, not standardized ITU-R BT.709 Currently used for demonstration	Recommendation ITU-R BT2020 Constant & Non constant luminance 10 & 12 bits	Recommendation ITU-R BT.2020 (+ Super Hi-Vision works from NHK) Constant & Non constant luminance 10 & 12 bits

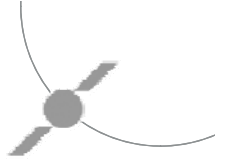
4k and 8k will multiply by 4 and 16 the number of pixels vs HD



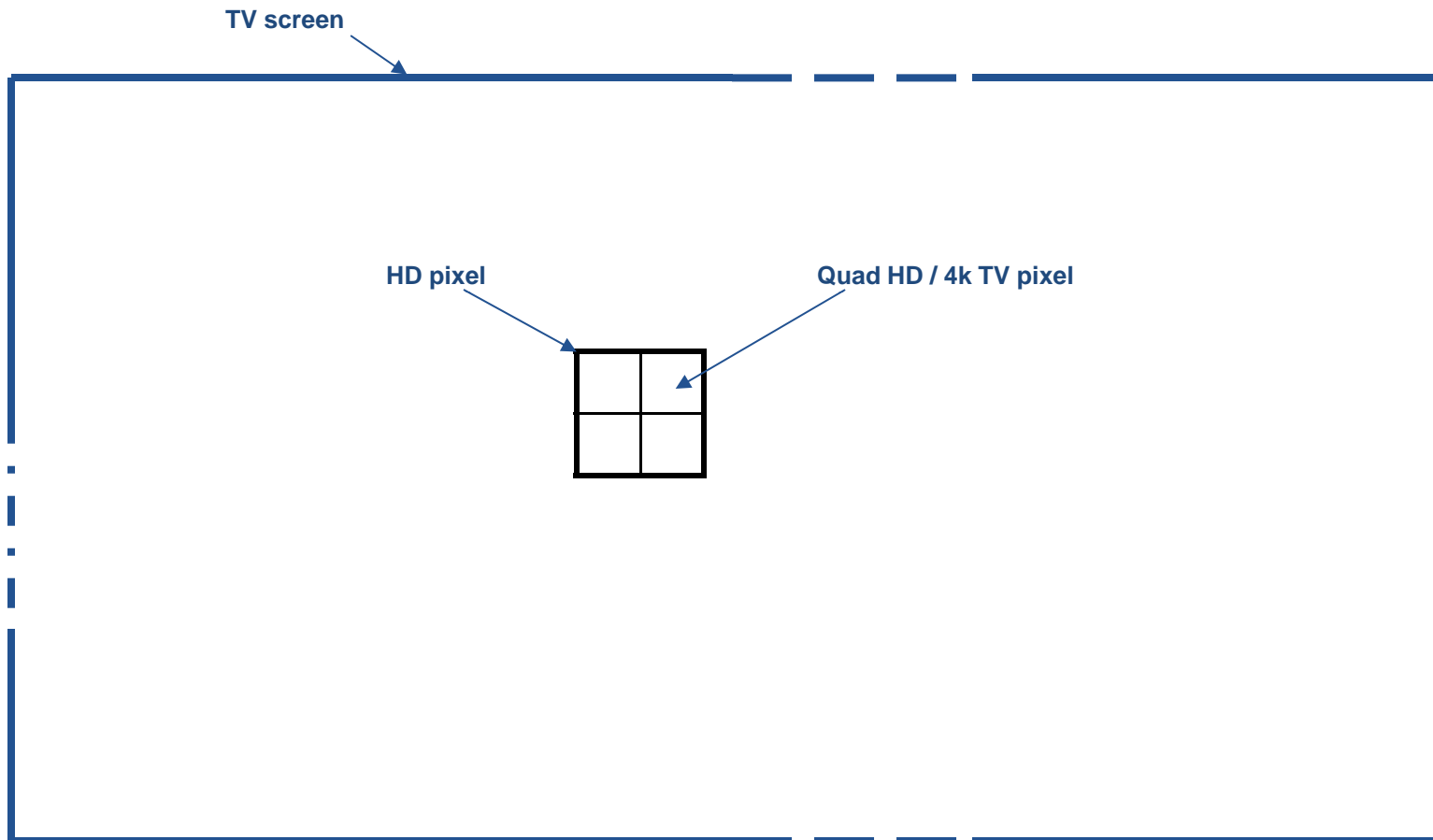
Ultra High Definition TV : resolutions



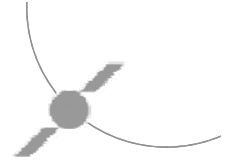
Quad HD / 4k TV sets vs HD TV sets



A Quad HD TV screen has 4 times more pixels than an HD screen (8.3 M vs 2.1 M)



4k at the cross-road of TV and Digital cinema



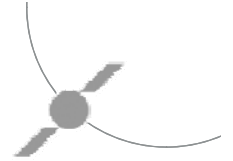
In Digital Cinema 4k is more and more used:

- 4k cameras already available (RED, Sony, Canon, ...)
- Production in 4k is under way (Around 20 movies shot with Red cameras per year)
- Post-production in 4k is possible
- For movie theatres, 4k projectors already available, but first theatres where equipped with 2k (only) projectors. However, retro-compatibility is possible
- Digital archiving of 35 mm films:
 - 2k (2048 x 1080) is below the resolution of 35 mm celluloid films
 - 4k is above : the digitalization of celluloid archives should be in 4k

4k can be at the cross-roads of TV and cinema:

- As next TV standard
- 4k production and archiving :
 - Leads to big stock for TV broadcasting, VoD, ...
 - Can facilitate the creation of cinema TV channels in 4k
- ... however, producing TV shows and live programs in 4k will involve significant cost increase as the entire production chain (from cameras, post production, TV stage) will have to be renewed

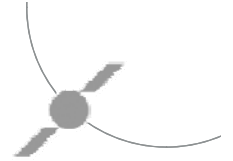
Efficient ultra HD TV will rely on several specifications and standards, not yet fully finalized



Ecosystem for 4k TV (1)

- **Recommendations and specifications for UHDTV:**
 - **ITU: ITU-R BT.2020**
 - **SMPTE: encapsulation and signaling of the video bit stream ST2036-3 (10 Gbit/s) not sufficient**
 - **DVB: commercial requirements in progress – Technical work in 2013, but key question: DVB-S2 enhancement (6 – 12 months), or revolutionary change to DVB-S3 (2 to 3 years) ?**
- **Encoding / compression:**
 - **High bit rate would be required with MPEG-4 (however Industry gives quite good figures)**
 - **New standard needed: HEVC (High efficiency Video Coding), 50% better than MPEG-4 (H264/AVC)**
 - **July 2012: Draft International Standard**
 - **January 2013: Final Draft International Standard**
- **Audio: 5.1, 10.2, 22.2, ...**
- **Connectivity:**
 - **HDMI connectors:**
 - **HDMI 1.4b can be used for 4k up to 30 fps**
 - **Above 30 fps: HDMI 2.0 (up to 60 fps)**

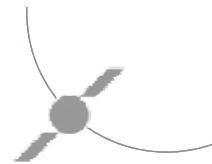
First end-user equipment will appear in 2013/2014 but it will take time to become mass market



Ecosystem for 4k TV (3)

- **Pay-TV Set Top Boxes (STB):**
 - Now, the most advanced STB (generally proprietary STB from pay-TV operators) are: DVB-S2 (and S), HD (and SD), MPEG-4 (and 2)
 - Next generation for 4k: DVB-S2 (or « S3 »), HEVC (& MPEG-4, MPEG-2), UHD 4k (& HD, SD)
 - Availability of HEVC / 4k chipsets (decoders): Autumn 2013 for 25/30 fps, Autumn 2014 for 50/60 fps
 - → 4k Set Top Boxes: 2014 for 25/30 fps, 2015 for 50/60 fps
- **TV sets:**
 - The first 4k TV sets are proposed in B to B, as Quad HD - Most likely in 2013 for the early adopters consumers
 - Will mainly concern big screens (50" and more) to see the difference (4k vs HD)
 - Problem of connectivity, if 50 fps is used ...
- **Connectivity:**
 - **HDMI connectors:**
 - HDMI 1.4b can be used for 4k up to 30 fps
 - Above 30 fps: HDMI 2.0 (up to 60 fps)
- **Blu-ray consortium: players and disks**
 - Blu-ray players with upscalers now and in 2013
 - Blu-ray disks (50 GB) OK for 4k with HEVC ?

Summary of the 4k TV Ecosystem: at home



DTH satellite



Ready

2013 ?

First 4k Blu-ray players and disks: 2013 ?

4k TV set:
- Quad HD: end 2012 / beg. 2013?
- UHDTV1: 2013 ?



2014 ?

4k Satellite Set Top Box
With HEVC: 2014 ?



HDMI connectors:

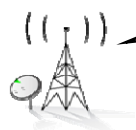
- for 4k 25/30 fps : 1.4b OK
- for 4k 50/60 fps : wait for 2.0

2014 ?



4k via fiber:
same time as via satellite

DTT retransmitter

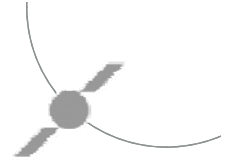


4k via DTT: not before 2015 with DVB-T2 & HEVC, and not everywhere



4k via ADSL ? : not before HEVC, and not everywhere

Encoding and transport of 4k TV via satellite



Summary of the possibilities offered by the satellite:

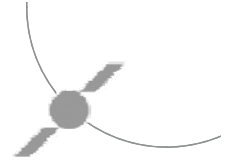
Assumptions made:

- HEVC improvement: could be up to 50% with respect to (wrt) MPEG-4 (current equipment)
- Compression gives higher efficiency with progressive scanning, than with interlaced
- « DVB-S3 » could achieve 20% improvement w.r.t. DVB-S2 (TBC)

Type of content	Bit rate in DTH with MPEG-4 encoding (Mbit/s)	Number of MPEG-4 channels per 36 MHz transponder (DVB-S2)	Bit rate in DTH with HEVC encoding (Mbit/s) <i>(Figures to be confirmed)</i>	Number of HEVC channels per 36 MHz transponder (DVB-S2)	Possible number of HEVC channels per 36 MHz transponder with « DVB-S3 »
HDTV 1080i 25	7 to 8 Mbit/s	7 to 8	Around 4 Mbit/s	Up to 15 ?	Up to 18 ?
HDTV 1080p 50 (soon ?)	Around 9 ?	Up to 6 ?	Around 7 ?	Up to 9 ?	Up to 10 ?
4k at 25 fps (p)	< 10 (*)	Up to 6	6 to 9	7 to 8	Up to 9 ?
4k at 50 fps (p)	< 20 (17) (*)	Up to 3	12 to 13	4 to 5	Up to 6 ?

(*) Best figures given by manufacturers based on the last version of their MPEG-4 encoder

Conclusions (1)



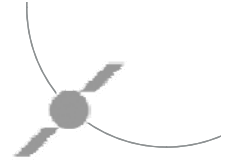
● Which standard for Ultra HD in TV ?

- Most likely: 4k with 50 fps (25 fps on a big screen would lead to discomfort)
- Will 1080p 50 fps be “The Standard” before 4k ?
 - Most likely not : it will be economically better to produce new STB with 4k, as well as 1080p 50, instead of 1080p 50 only
 - But HD channels could be upgraded soon from 1080i 25 to 1080p 50

● Advantages of 4k for TV:

- Already used in the cinema domain (however with 24 fps):
 - Stock for TV
 - Will pave the way for 4k cinema TV channels
- 4k TV sets should be available quite soon (2013)
 - Manufacturers will see a new opportunity for the renewal of TV sets
 - Good argument to sell big screens (50” +) with high margin

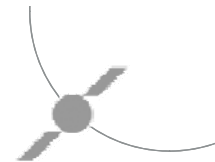
Conclusions (2) : Possible scenario N°1



Possible scenario with DVB-S2 Evolution

	S1 2013	S2 2013	S1 2014	S2 2014	S1 2015	S2 2015
HEVC encoding specifications	Final draft released	Chipset 4kTV up to 30fps		Chipset 4kTV up to 60 fps		
DVB modulation specifications		DVB-S2 Evolution released ?				
			STB 4kTV DVB-S2E 25 / 30 fps		STB 4kTV DVB-S2E 50 / 60 fps	
				First 4kTV channels at 25 / 30 fps ?		First 4kTV channels at 50 / 60 fps ?

Conclusions (3) : Possible scenario N°2



Possible scenario with DVB-S3 “Revolution”

	S1 2013	S2 2013	S1 2014	S2 2014	S1 2015	S2 2015
HEVC encoding specifications	Final draft released	Chipset 4kTV up to 30fps		Chipset 4kTV up to 60 fps		
DVB modulation specifications				DVB-S3 Revolution Released ?		
					STB 4kTV DVB-S3 50 / 60 fps	
						First 4kTV channels at 50 / 60 fps ?

Thank you for your attention ...