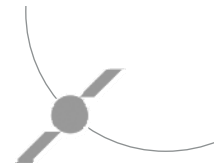


# Ultra HD distribution

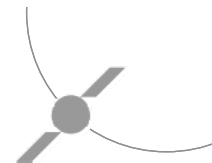
WBU-ISOG Forum  
Rio, November 2013



# Agenda

- Ultra HDTV key assumptions
- Why UHDTV1 / 4k TV first ?
- Formats, standards and specifications
- New investments needed for UHDTV1 channels
- Calendars
- Capacity for UHDTV1 via satellite
- Strategy for UHDTV1 implementation
- Eutelsat Ultra HD demonstration channels
- Ultra HD demonstration channel for Samsung

## Ultra HDTV, key assumptions ...



- **Why Ultra HDTV ?:**
  - TV manufacturers produce TV sets that are increasing in size and are lighter
  - HD is reaching its limits on large screens (55" or more)
  - ➔ need for a definition beyond HD : Ultra HDTV
- **Two formats specified by the ITU (\*) for Ultra HDTV (ITU-R BT.UHDTV) :**
  - UHDTV1 ("4k TV") : 3840 x 2160 pixels
  - UHDTV2 ("8kTV" / Super Hi-Vision by NHK): 7680 x 4320 pixels
- **UHDTV1 or UHDTV2 (Super Hi-Vision) ?:**
  - UHDTV1 ("4kTV") = tomorrow's standard (2014/2015)
  - UHDTV2 = the day after tomorrow's standard (as from 2017/2018)
- **The following needs to be considered:**
  - Ultra HDTV = disruptive technology (new cameras, production equipment, studios, ...)
  - A new encoding standard : HEVC will support deployment
  - First adopters (pay-TV platforms operators, thematic channels, ...) need support
  - ➔ **Satellite operators will play a key role for Ultra HDTV implementation**

(\*) ITU = International Telecommunication Union

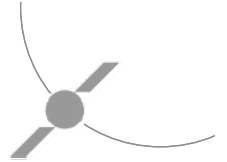


## Why Ultra HDTV1 (4k TV) in a first step ?



- **Cinema industry is a key supplier of TV programmes**
- **Digital production in cinema:**
  - **Started with 2k**
  - **But increasing productions in 4k for big screens and blockbusters**
- **Ultra HDTV will evolve like cinema :**
  - **HD can be compared to 2k**
  - **UHDTV1 (“4k TV”) can be compared to 4k cinema**

## 2 formats are commonly used in digital cinema



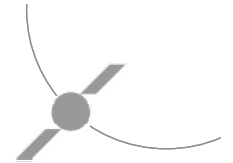
Digital Cinema formats (from Digital Cinema Initiatives (\*) – DCI) : 2k and 4k

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

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

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

# Existing TV formats and new UHD TV formats



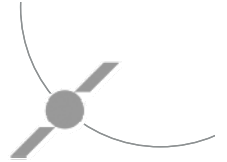
## Digital TV formats from HD to 8k TV / Super Hi-Vision

Digital TV formats :	High Definition (HDTV)	Quad HD	Ultra HDTV 4k (UHDTV1)	Ultra HDTV 8k (UHDTV2)
<b>Pixels x number of lines</b> <b>Aspect ratio : 16/9</b>	<b>1280 x 720 p</b> (0.922 Mpixels/frame) <b>1440 x 1080 i</b> (1.6 Mpixels/f) <b>1920 x 1080 i or p</b> (2.1 Mpixels/f)	<b>4 x HDTV</b> <b>3840 x 2160 p</b> (8.3 Mpixels/f)	<b>3840 x 2160 p</b> (8.3 Mpixels/f) (progressive)	<b>7680 x 4320 p</b> (33.2 Mpixels/f) (progressive)
<b>Frame rate</b>  <b>Bit depth</b> <b>Viewing distance</b>	<b>25 fps (50 fps soon ?)</b> <b>Or: 30 fps (USA, Japan, ...)</b> – 60 fps <b>+ 24 fps (Blu-ray)</b> <b>8 or 10 bits</b> <b>3 x H (30°) (*)</b>	<b>25, 50 fps, ...</b> <b>Or:</b> <b>30, 60 fps, ...</b> <b>+ 24 fps</b> <b>8 or 10 bits</b> <b>1.5 x H (60°)</b>	<b>25, 50, ... fps</b> <b>30, 60, 120 fps</b> <b>+ 24 fps</b>  <b>10 or 12 bits</b> <b>1.5 x H (60°)</b>	<b>25, 50, ... fps</b> <b>30, 60, 120 fps</b> <b>+ 24 fps</b> (100 fps “not yet” adopted) <b>10 or 12 bits</b> <b>0.75 x H (100°)</b>
<b>Comments</b>	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 at 50/60 fps	Recommendation ITU-R BT.2020	Recommendation ITU-R BT.2020 (+ Super Hi-Vision works from NHK)

(\*) H = Height of the screen

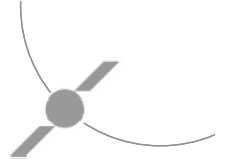
**Key point:** UHDTV is mainly for big screens → high frame rates recommended : 50, 60 fps as a minimum !

# Specifications and standards of importance



- **Recommendations and specifications for UHD TV:**
  - **ITU-R BT2020 issued**
  - **After DVB-S2 : Will DVB-S2x replace DVB-S2 for UHD TV ?**
- **Encoding / compression:**
  - **MPEG-4 : good efficiency with progressive mode, but industry is now focused on a new standard: HEVC (High Efficiency Video Coding)**
  - **HEVC up to 50% better than MPEG-4 (H264/AVC)**
    - January 2013: Final Draft Issued (ITU-T H.265)**
  - **HEVC can be applied to all formats : HD, Ultra HD**
  - **High frame rates recommended in UHD TV (50, 60 fps) → HEVC more than welcome**
- **Connectivity:**
  - **HDMI connectors:**
    - **Current limitation : 4k TV with HDMI 1.4b are limited to 30 fps**
    - **For 50/60 fps need to wait for HDMI 2.0 : end 2013**

# Investments needed for UHD TV1 channels creation



- **Production side:**
  - **Outdoor production:**
    - New cameras
    - New OB trucks / vans
    - (+ staff training)
  - **Studio production:**
    - New cameras
    - New studios, desks, ...
  - **Contribution :**
    - Satellite News Gathering vehicles (SNG) : new encoders
    - Fixed contribution (fiber, sat., ...) : new encoders / decoders
- **Post-production:**
  - **New computers**
  - **New acquisition cards, software**
  - **Storage (SSDs, hard drives, ...)**
- **Content management:**
  - **New play-out equipment**
  - **New content management equipment**
- **Encoding & Distribution:**
  - **New encoders**
  - **New servers with encoded content (MPEG-4, HEVC)**
  - **New network management systems**

Big investments needed → the first UHD TV channels should be with recorded contents (play-out : cinema, documentaries, ...) + event channels





## Calendar for UHD TV1 encoding



- **With MPEG-4:**
  - **Quad HD now if encoding at 50 / 60 fps:**
    - 4 x Full HD channels (1920 x 1080p 50 or 60 fps) via HDMI 1.4
    - Encoders from several manufacturers available
  - **With UHD TV1 ?:**
    - Not really in the roadmap of manufacturers
- **With HEVC:**
  - **Soft encoding: 2013 (for 30 fps) - 2014 (for 50 / 60 fps)**
  - **Hardware encoders: end 2014 / 2015 (according to industry)**
- **Modulation:**
  - **With satellite: no problem with DVB-S2**
  - **Cable: with DVB-C2**
  - **Terrestrial: with DVB-T2**

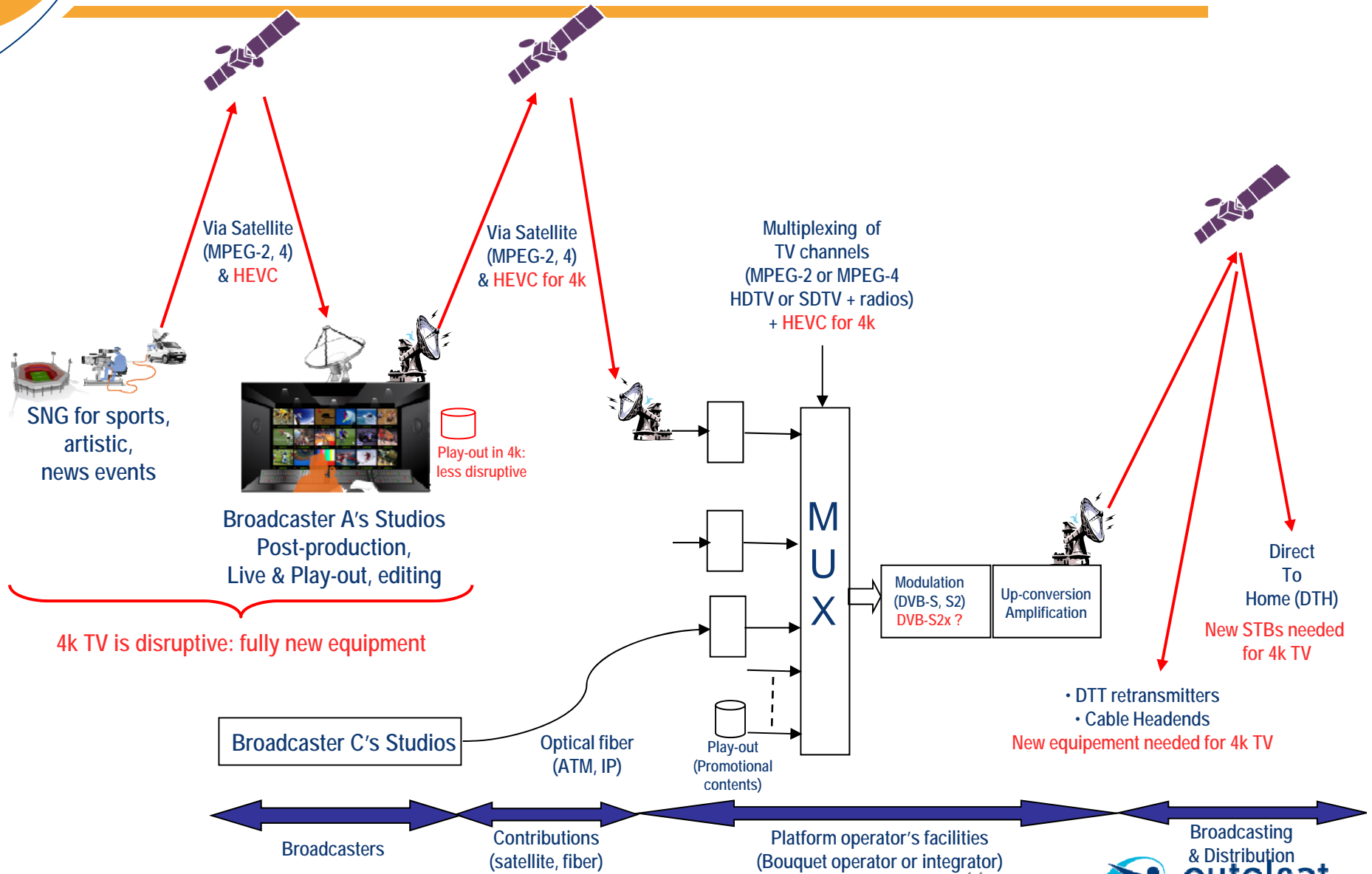
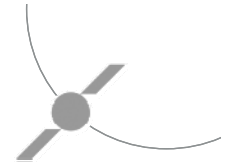


# Calendar for UHD TV1 end-user equipment (4k TV)

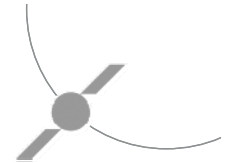


- **Chipsets and Set Top Boxes (STB):**
  - **Availability of HEVC / 4k chipsets (for decoders):**
    - Autumn 2013 for 25/30 fps
    - End 2013 / Beginning of 2014 for 50/60 fps
  - **Set Top Boxes:**
    - Beginning of 2014 for 30 fps
    - End 2014 for 50/60 fps
- **TV sets:**
  - **Current 4k TV sets for consumers are proposed with HDMI 1.4 (limited to 30 fps)**
  - **New models with HDMI 2.0 shown at IFA (Sept. 2013) : end 2013 in the shops**
- **Blu-ray consortium: players and disks**
  - **Some Blu-ray players have a 4k upscaler**
  - **But, how to record a 4k movie (the current 50 GB are not enough) ?:**
    - Additional layers on the disk (more than 2) ?
    - Adoption of HEVC encoding ?
    - 100 GB Blu-ray disks

# Summary of the UHD TV1 eco-system with satellite



# Calendar for UHDTV1 (4k TV) global distribution + home



DTH satellite



Ready

4k camcorders ?  
-Quad HD: semi-pro  
-- UHDTV1: 2014 ?



4k Blu-ray player  
and disks: 2014 ?



4k TV set:  
UHDTV1: 2013 (30 fps) / end 2013 (50/60fps)



2015

4k Satellite Set Top Box  
With HEVC: end 2014 (50/60 fps)



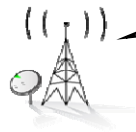
HDMI connectors:  
- for 4k 25/30 fps : 1.4b OK  
- for 4k 50/60 fps : 2.0 (end 2013)

2015



4k via fiber:  
same time as via satellite, but not everywhere

DTT retransmitter



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

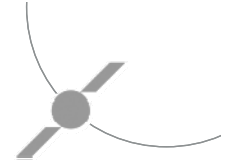
2015



4k via ADSL : with HEVC,  
but not everywhere

New boxes for 4k TV

# Capacity for UHD TV1 via satellite



## Summary of possibilities offered by satellites:

Assumptions made:

- HEVC improvement: from 30 to 50% with respect to MPEG-4 (current equipment)
- Compression gives higher efficiency with progressive scanning, than with interlaced

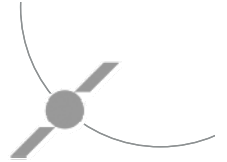
Type of content	Bit rate in DTH with MPEG-4 encoding	Number of MPEG-4 channels per 36 MHz transponder (DVB-S2)	Bit rate in DTH with HEVC encoding <i>(Based on current assessment from Industry)</i>	Number of HEVC channels per 36 MHz transponder (DVB-S2)
HDTV 1080i 25	7 to 8 Mbit/s	Up to 8	Around 4 Mbit/s	Up to 15
HDTV 1080p 50 (soon ?)	Around 10 Mbit/s	Up to 6	Around 5 Mbit/s	Up to 12
4k at 25 fps (p)	15 to 20 Mbit/s	Up to 4	7 to 10 Mbit/s	Up to 8
4k at 50 fps (p)	26 to 40 Mbit/s	Up to 2	13 to 20 Mbit/s	Up to 4

Ratio in 1 transponder: 8 HD channels (25i) with MPEG-4 now → 4 UHD TV1 channels (50p) with HEVC

Note 1: The bit rate figures are based on best inputs from industry (may change later on)

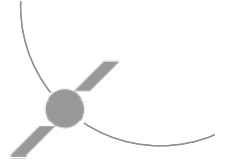
Note 2: DVB-S2x can lead to more channels per satellite transponder (up to 20% wrt DVB-S2)

# Strategy for UHD TV1 implementation



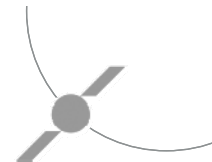
- **Key actors:**
  - Bouquet / pay-TV operators
- **Which type of channel(s) ?**
  - UHD TV1, most likely at 50/60 fps
  - The first ones: most likely channels with play-out (recorded encoded content)
    - Cinema (4k production at 24 and 48 fps)
    - Documentaries
    - Lifestyle
  - Also possible: event channels (with soft or hard HEVC encoders)
    - Sports
    - Operas, ballets
- **Key points for UHD TV1 implementation for bouquet operators :**
  - Installed base of STBs:
    - n x millions units
    - Two types (with satellite): DVB-S MPEG-2 SD & DVB-S2 HD MPEG-4
  - New STBs needed (HEVC + UHD TV1 / 4k TV)
  - Simulcast transmissions ? : SD + HD + 4k TV
  - Wait for DVB-S2x or do it with DVB-S2 ?
  - Strategy ? :
    - Convert all SD channels to HD ?
    - Replace all old STBs by a single new model decoding MPEG-2 / MPEG-4 / HEVC ?
    - ...

## Eutelsat demonstration channels (1)

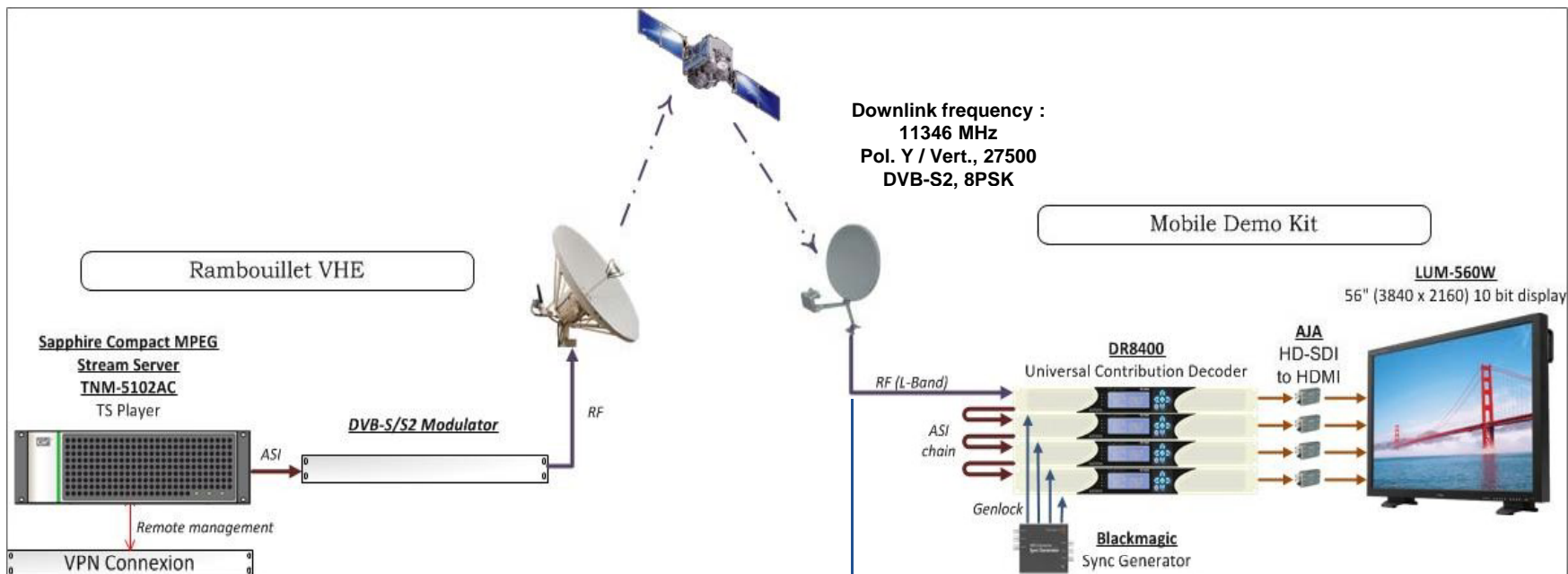


- **1<sup>st</sup> channel launched on 8 January 2013:** Quad HD MPEG-4
- **Transmitted via Eutelsat 10A (10° East)**
- **Technical solution set up with ATEME**
  - 4 Full HD streams (1920 x 1080p 50 fps) + 1 Audio (stereo now)
  - Play-out from a Sapphire server
  - MPEG-4 encoding : 4 video streams of 10.28 Mbit/s (50 fps)
- **Modulation: DVB-S2 8PSK**
- **For reception:**
  - 4 IRDs, with external synchronization
  - 4 x HD-SDI outputs (12 Gbit/s) with HD-SDI to HDMI converters
  - Viewing on a Quad HD monitor (e.g. Mitsubishi, Astro, TV Logic, ...)
- **2<sup>nd</sup> channel launched for IBC 2013:** HEVC at 30 fps
- **Both channels are multiplexed on the same transponder**

# Eutelsat demonstration channels (2): Quad HD + HEVC



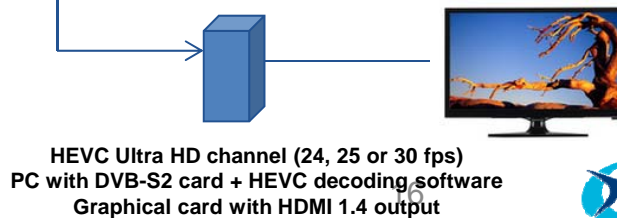
Eutelsat 10A (10° East)  
Transponder C07



Uplink from Eutelsat's teleport in Rambouillet  
2 Ultra HD channels multiplexed:

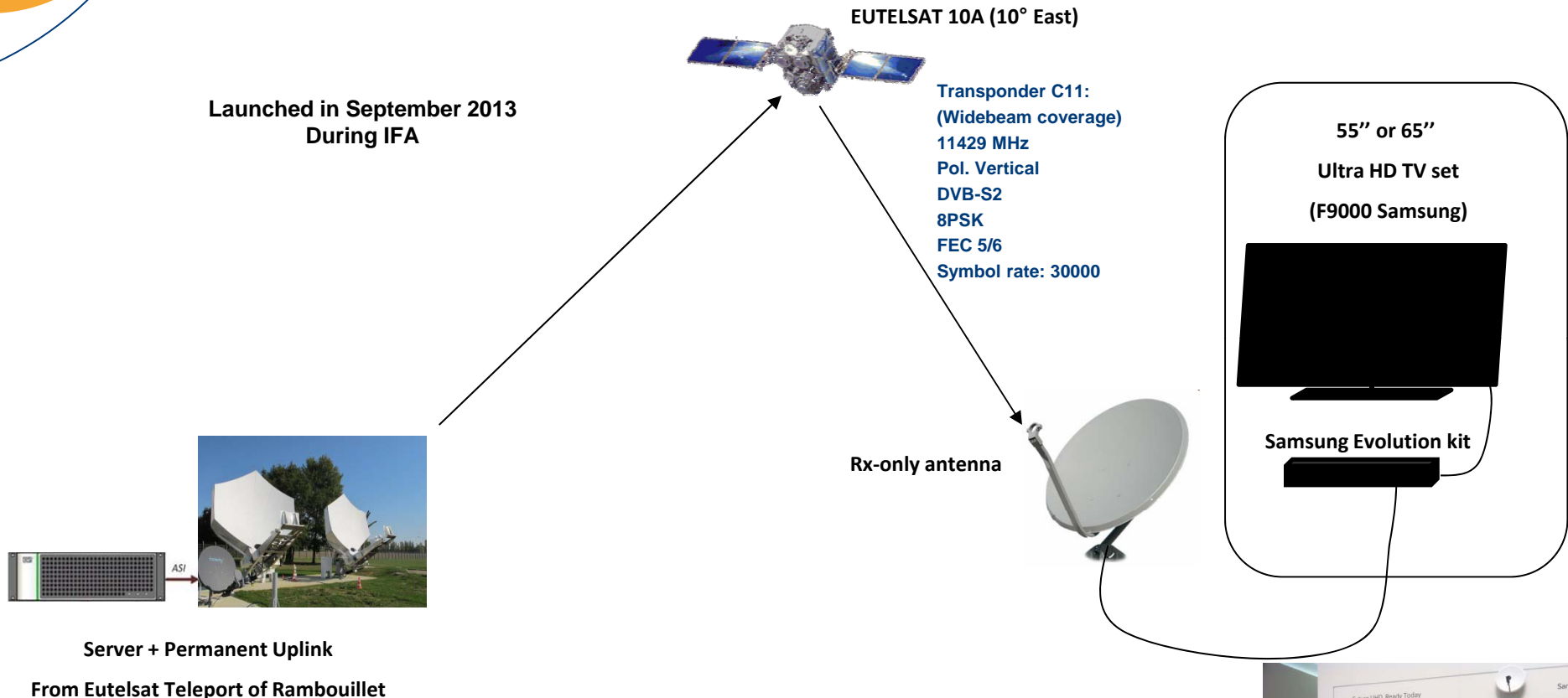
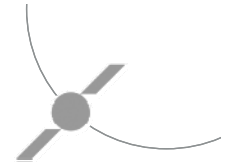
- Quad HD MPEG-4 at 50 frames/s
- HEVC at 30 frames/s

Receive site inside the Widebeam coverage of Eutelsat 10A  
(Europe, North Africa, Persian Gulf , ...)

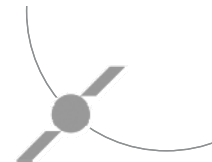




# SAMSUNG Ultra HD Channel via Eutelsat 10A



# Widebeam downlink coverage (10° East)



Downlink coverage for both Ultra HD channels :

