EBU **TECHNICAL**

# Trends & implementations of HDTV Broadcasting

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# Agenda

- Background to HDTV roll-out
- HDTV quality... How can we get there ?
- HDTV trends in europe
- conclusions

# Background to HDTV roll-out...

- **Strong penetration of HDTV ready flat panel displays (FPDs) in EU households**
  - **Lower prices every year**, more features, **larger**, thiner, design etc...
- **Inadequacy of Large FPDs in displaying SDTV**
  - Magnifying impairments.
- **Strong Increase in HDTV retail content**
  - (Gaming, blu-rays, etc)
- **Higher image quality expectations from the viewers**
  - (D-Cinema, Blu ray)
- **Non-EU HDTV channels available in EU through other delivery platforms**
  - Satellite , IPTV.
- **Maintain broadcast business model attractive with higher visual quality programs.**

# Enabling a **Real** HDTV service...

**delivery platform selection i.e. affordable capacity & large coverage?**

- Satellite : channel size depends on service provider.

  Modulations : DVB-S or DVB-S2 ?

- Terrestrial : GE06 – Geneva 2006 Frequency Plan

  provides guidance on frequency plan (8-7Mhz channels available , band III & IV/V)

  Which Reference planning configuration - RPC (fixed, mobile, portable ?)

| Reference planning configuration | RPC1 | RPC2 | | | | | RPC3 |
|---|---|---|---|---|---|---|---|
| Reception mode | Fixed | Portable outdoor | | Mobile | | Portable indoor | Portable indoor |
| Modulation | 64-QAM | 16-QAM | 64-QAM | QPSK | 16-QAM | 16-QAM | 16-QAM |
| Code rate | 3/4 | 2/3 | 2/3 | 2/3 | 1/2 | 2/3 | 2/3 |
| Location probability for planning | 95% | 95% | 95% | 99% | 99% | 70% | 95% |
| Max. net bit rate* (Mbit/s) | 27.14 | 16.09 | 24.13 | 8.04 | 12.06 | 16.09 | 16.09 |

* Source: EBU BPN005 - *Terrestrial Digital Television: Planning and Implementation Considerations*, Third issue, Summer 2001

  Modulations : DVB-T or DVB-T2 ?

- Cable: DVB-C
- IP based – ( DSL, FTTH etc...)

# Enabling a **Real** HDTV Service...

**Compression System selection ?**

- Production ( AVC-I or JPEG2000 or MPEG2-Long GOP or... A Headache !!!)
- Distribution (H.264/AVC or MPEG-2 or Upcoming H.264/SVC – scalable video coding)

**Image format selection ?**

- 1080**i**/25 (production & distribution)
- 720**p**/50 (production and distibution)
- 1080psf/25 (mainly drama production)
- 1080p/50 Next generation HDTV but...
  - good production master format (consistent down-conversion to 720p/50)
  - potential future distribution format .

**content?**

- xx% native HD content broadcast ?
- Generic or specialised ? Highly critical content (sport,high detail sequences) need higher bit-rates.

# Enabling a **Real** HDTV service... A few hints...

**DVB-T2 provide up to 45% gain over DVB-T using the same bandwidth.**

- But the overall bit rate depend on the select reception profile.

**Possible transmission characteristics of DVB-T and DVB-T2**

| | DVB-T | DVB-T2 |
|---|---|---|
| FEC | Convolutional Coding + Reed Solomon<br>1/2, 2/3, 3/4, 5/6, 7/8 | LDPC + BCH<br>1/2, 3/5, 2/3, 3/4, 4/5, 5/6 |
| Modes | QPSK, 16QAM, 64QAM | QPSK, 16QAM, 64QAM, 256QAM |
| Guard Interval | 1/4, 1/8, 1/16, 1/32 | 1/4, 19/256, 1/8, 19/128, 1/16, 1/32, 1/128 |
| FFT size | 2k, 8k | 1k, 2k, 4k, 8k, 16k, 32k |
| Scattered Pilots | 8% of total | 1%, 2%, 4%, 8% of total |
| Continual Pilots | 2.6% of total | 0.35% of total |

Source: DVB Project

| | Fixed reception | | Portable reception | |
|---|---|---|---|---|
| | UHF Bands IV/V | VHF Band III | UHF Bands IV/V | VHF Band III |
| DVB-T | 7-24 | 1-3 | 7-16 | 1-2 |
| DVB-T2 | $21^{9}$-40 | 4-5 | 14-24 | 2-3 |

# Enabling a **Real** HDTV service... A few hints...

**DVB-S2 provides up to 35% gain over DVB-S**

**H.264/AVC was proven to provide ~50% coding gain over MPEG-2 for delivery rates.**

**720p/50 provides 20% benefits in distribution than 1080i/25**

- EBU recommendation R124

**Minimum (video) bit rate to provide HD quality (**from EBU tests - BPN085-087**) :**

- 720p/50 – 10Mbps
- 1080i/25 – 12-14Mbps

**Using statistical multiplexing helps balance the rate on other channels**

**Clever combination → more HD services or higher quality at lower costs.**

# Enabling an HD service ...

## Set Top Boxes and TV-Tuners compatibility and availability ?

**Depends on digital switchover strategy....**

**Digital switchover and compression format**

| Country | Launch date | Compression format | Completion of ASO |
|---|---|---|---|
| United Kingdom | 1998 | MPEG-2 | 2012 |
| Sweden | 1999 | MPEG-2 / MPEG-4 AVC | Completed (2007) |
| Spain | 2000/2005 | MPEG-2 | 2010 |
| Finland | 2001 | MPEG-2 | Completed (2007) |
| Switzerland | 2001 | MPEG-2 | Completed (2008) |
| Germany | 2002 | MPEG-2 | Completed (2008) |
| Belgium (Flemish) | 2002 | MPEG-2 | Completed (2008) |
| The Netherlands | 2003 | MPEG-2 | Completed (2006) |
| Italy | 2004 | MPEG-2 | 2012 |
| France | 2005 | MPEG-2 / MPEG-4 AVC | 2011 |
| Czech Republic | 2005 | MPEG-2 | 2011 |
| Denmark | 2006 | MPEG-2 / MPEG-4 AVC | 2009 |
| Estonia | 2006 | MPEG-4 AVC | 2010 |
| Austria | 2006 | MPEG-2 | 2010 |
| Slovenia | 2006 | MPEG-4 AVC | 2011 |
| Norway | 2007 | MPEG-4 AVC | 2009 |
| Lithuania | 2008 | MPEG-4 AVC | 2012 |
| Hungary | 2008 | MPEG-4 AVC likely | 2011 |
| Portugal | 2009 | MPEG-4 AVC | 2012 |
| Ireland | 2009 | MPEG-4 AVC | 2012 |
| Russia | TBC | MPEG-4 AVC | 2015 |
| Slovakia | 2009 | MPEG-4 AVC | 2012 |
| Poland | 2009 | MPEG-4 AVC likely | 2014 |

Source: DigiTAG

# Trends in Europe – Terrestrial dependent countries...1/3

- Clear Roll-out Plan from Terrestrial dependent countries (>50% households dependent on DTT)
- Several HD services Launches and trials ongoing or planned

  Maintain relevance and competitiveness of terrestrial TV.
- Main configuration adopted except UK:

  DVB-T (64QAM-2/3-1/8) Bit Rate : 22.1Mbps (Fixed reception profile.)

  H.264/AVC

**Trials...**

- Finland (ongoing) – Helsinki area

  2 HD Muxes in VHF and 1 HD in UHF
- UK – End 2008 – DVB-T2 trials.

  Launch of 3-4 HDTV channels on 1 Mux – End 2009.

  DVB-T2, Stat. Mux, unknown image format.

  Estimated Rate : 34.5Mbps.

# Trends in Europe – Terrestrial dependent countries 2/3

- Ireland – trials made but unclear launch date.
- Estonia – trials ongoing.
- Slovenia – (RTVSLO, Kanal A, PopTV ) trial during olympics08 on UHF channel 26 – 1080i/25
- Poland – TVP during olympics 08.
- Portugal not trials but HD service launch planned.

**Launched...**

- Croatia – 1 HD Service since 2007.

  zagreb, Rijeka, osjiek, Split (30% population coverage)

- France – Since Oct. 2008, 5 HD services on 3 different multiplexes

  TF1, FR2, M6 HD → Mux 1 ; CANAL+ HD → Mux 2, Arte HD →Mux 3

  DVB-T, 1440x1080i/25

  Full transition to HD only services by 2012-2015

  Mandatory MPEG-4 tuners in all Receivers sold in France.

  - ➢ Law enforcement to regulate MPEG-2 to MPEG-4 migration in all DTT receivers.

# Trends in Europe – cable dependent countries...

**HDTV roll out over satellite or cable.**

- Few public broadcasters, (Dominated by pay-TV operators.)

  Switzerland (HD Suisse) 13Mbps, H.264/AVC, DVB-S, 720p/50

  UK (BBC HD) ~14Mbps, H.264/AVC,DVB-S,1080i/25

  Germany (Arte , ARD/ZDF) 720p/50

  - No plans on HD services over Terrestrial.

  Sweden (SVT HD) 720p/50

- Netherlands,belgium

**Use of terrestrial for mobile TV applications**

- Germany (DVB-T)
- Switzerland (DVB-H)

# Trends in Europe – Mixed market countries...

**Market evenly shared between IPTV, Sat., Cable and Terrestrial :**

- HD launches on terrretrial mainly by pay-DTT operators.

  Increase number of services offer for competitiveness.

- Norway

  Trial during olympics 08,

  Most DTT receivers already HD H.264/AVC capable.

  Launch HD service around 2010.

- Sweden

  TV4 - Trials in stockohlm (26% population coverage)

  DVB-T, H.264/AVC, 720p/50

# Conclusions ...

**HDTV roll-out is actively ongoing in Europe specially on Terrestrial**

- Compete with alternative, continuously growing platforms (satellite, IPTV, ...)

**All new HD services use H.264/AVC.**

- Migration path needed for Early Digital switchers from MPEG-2 to H.264/AVC.

**DVB-T is legacy as modulation standard in HD roll out except in UK**

- Move to new DVB-T2 attractive but too early/expensive for late Digital switchers

**Same assumption for DVB-S2 and DVB-S.**

**Further Readings ...**

- HD on DTT (Digitag) - http://www.digitag.org/HDTV_v01.pdf
- Accomodation of HDTV in the GE06 Plan – EBU tech 3334 – http:\\tech.ebu.ch
- Articles on DVB-S2 , T2 etc... On http:\\tech.ebu.ch

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# Thank you

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