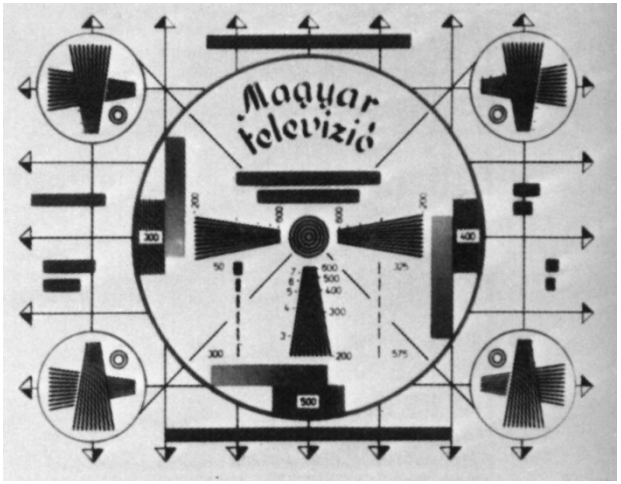
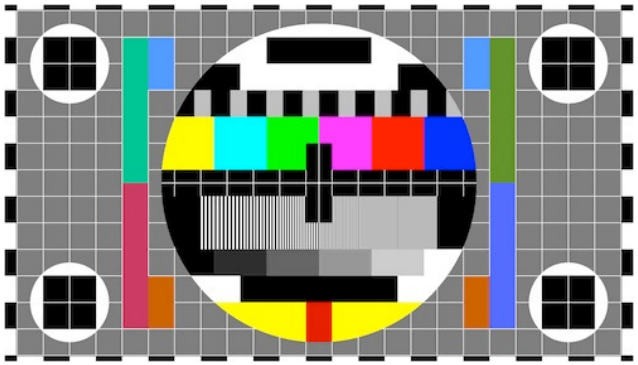


Infocommunication
Video broadcasting

Tamás Csapó

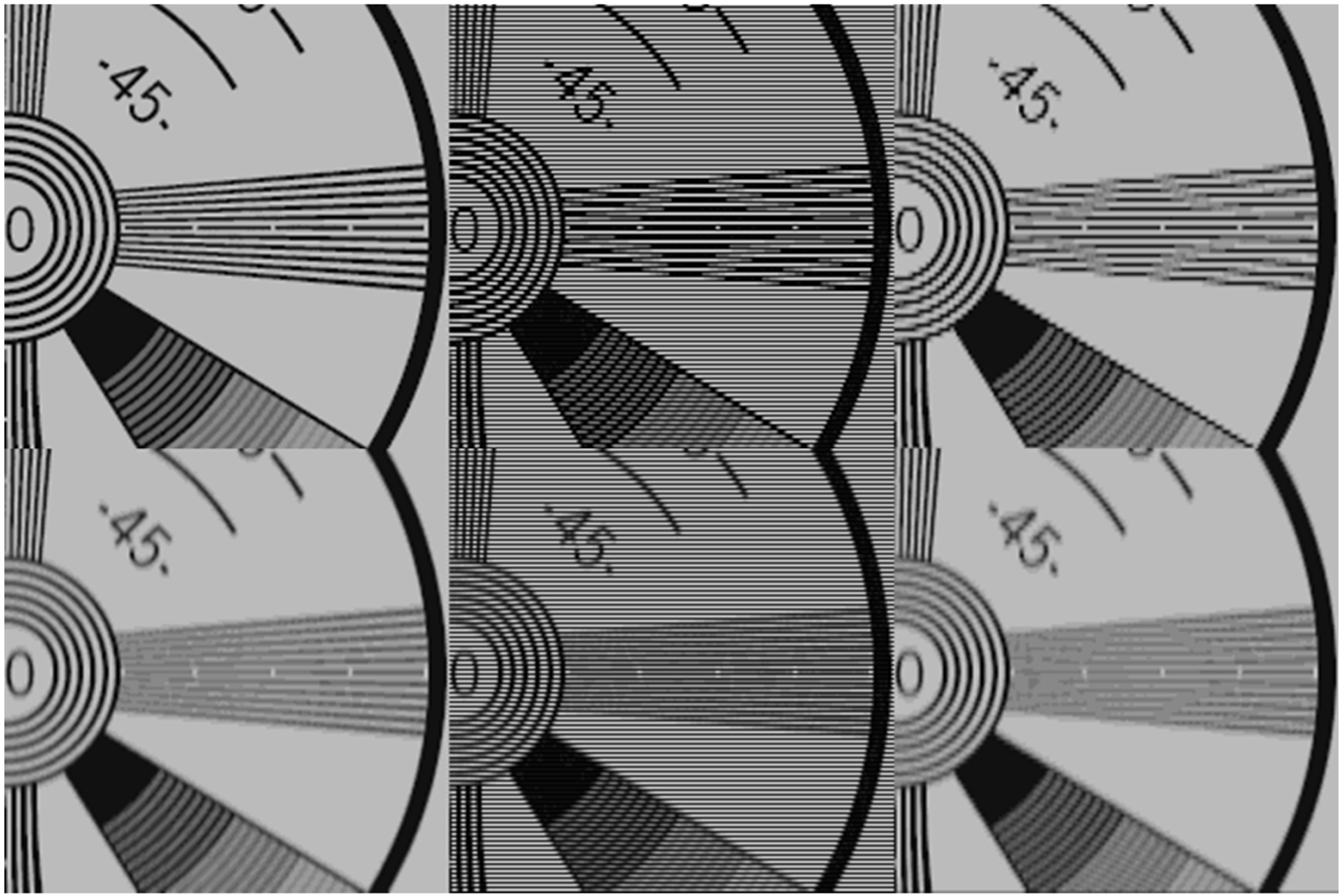
<csapot@tmit.bme.hu>

2018 Spring



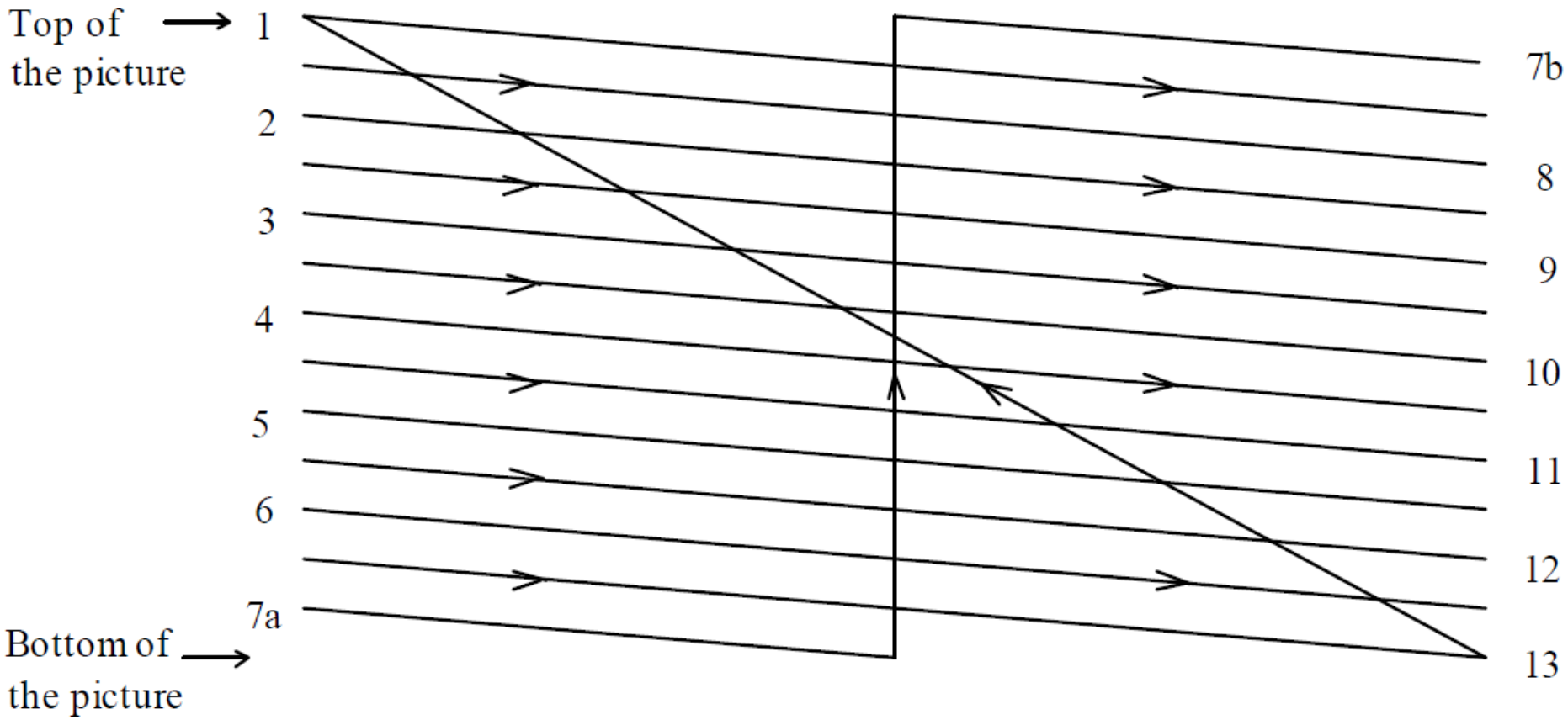
Digital Video Broadcasting

Flickering



Source: https://en.wikipedia.org/wiki/Interlaced_video

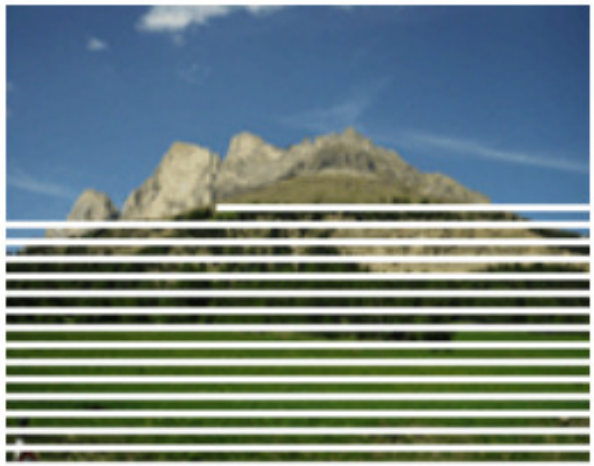
Line interlacing



Source: PP

Example for interlacing

Upper field (top) - all odd lines (1,3,5,7, etc.) are drawn first.



Lower field (bottom) - now all even lines (2,4,6,8, etc.) are drawn.

As looking at the TV one recognizes a picture like the one above.

Source: http://www.paradiso-design.net/videostandards_en.html

Number of lines on TV

3 x 3 x 3 x 3 x 5	= 405	(United Kingdom)
3 x 5 x 5 x 7	= 525	USA, Japan, …
5 x 5 x 5 x 5	= 625	EU, Australia, Africa, Asia, …
3 x 3 x 7 x 13	= 819	(France)

Source: http://alpha.tmit.bme.hu/vitma301/gyak09_foliak.pdf

Color difference signals

$$Y = 0.3 \cdot R + 0.59 \cdot G + 0.11 \cdot B$$

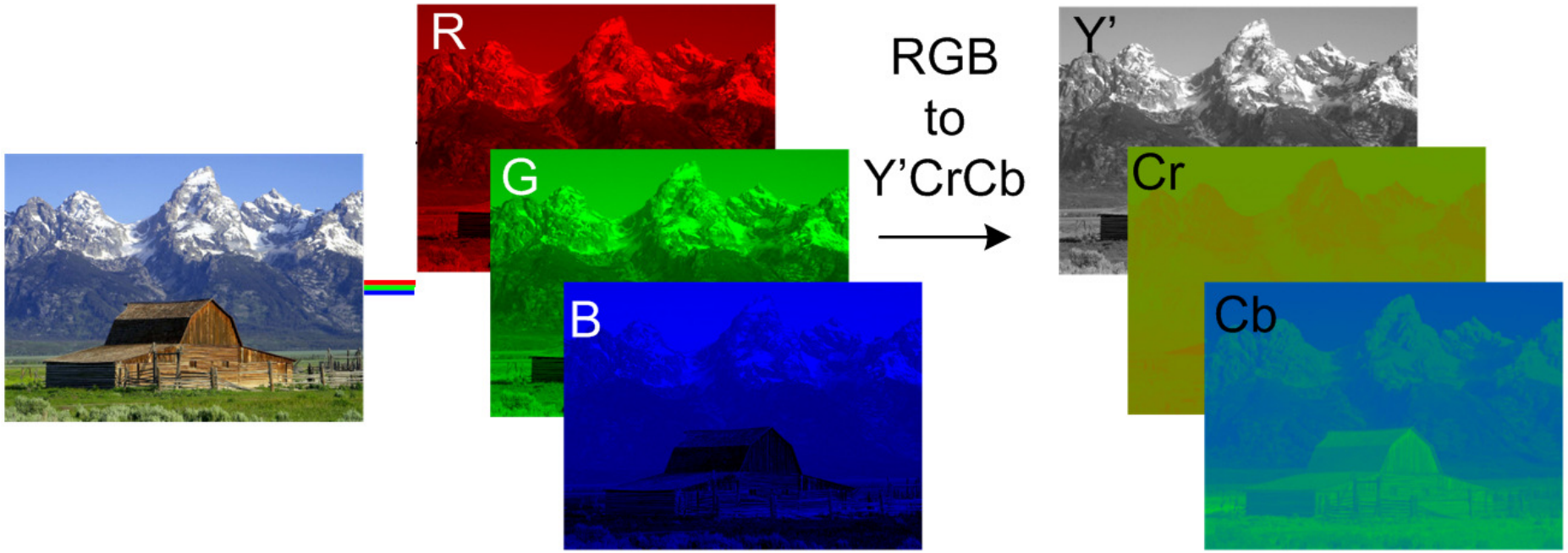
$$-(R-Y) = \frac{0.59}{0.3} \cdot (G-Y) + \frac{0.11}{0.3} \cdot (B-Y)$$

$$-(G-Y) = \frac{0.3}{0.59} \cdot (R-Y) + \frac{0.11}{0.59} \cdot (B-Y)$$

$$-(B-Y) = \frac{0.3}{0.11} \cdot (R-Y) + \frac{0.59}{0.11} \cdot (G-Y)$$

Source: http://alpha.tmit.bme.hu/vitma301/gyak09_foliak.pdf

C_R and C_B



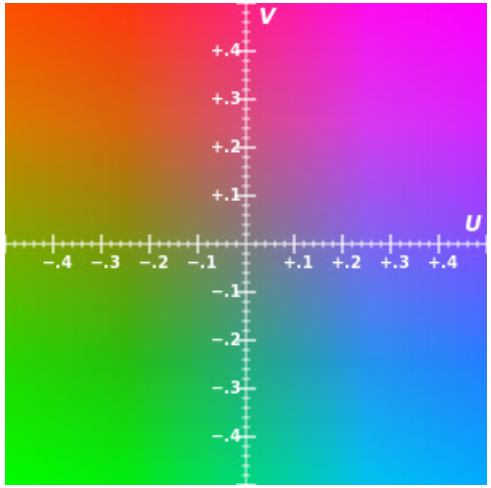
Source: https://en.wikipedia.org/wiki/YCbCr

PAL, NTSC, SECAM color difference signals

- PAL:
  - Y + ***QAM***{u,±v}

$$u = \frac{(B - Y)}{2.03}$$

$$v = \frac{(R - Y)}{1.14}$$

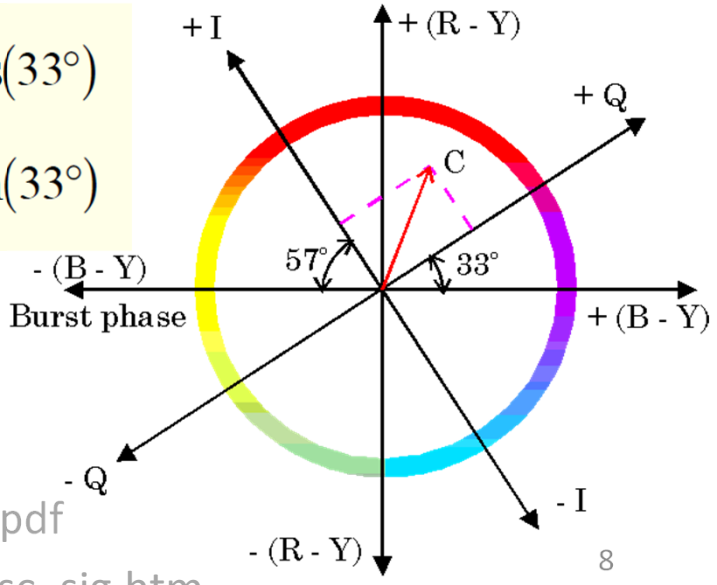


- NTSC:
  - Y + ***QAM***{I,Q}

$$I = -u \cdot \sin(33°) + v \cdot \cos(33°)$$

$$Q = +u \cdot \cos(33°) + v \cdot \sin(33°)$$

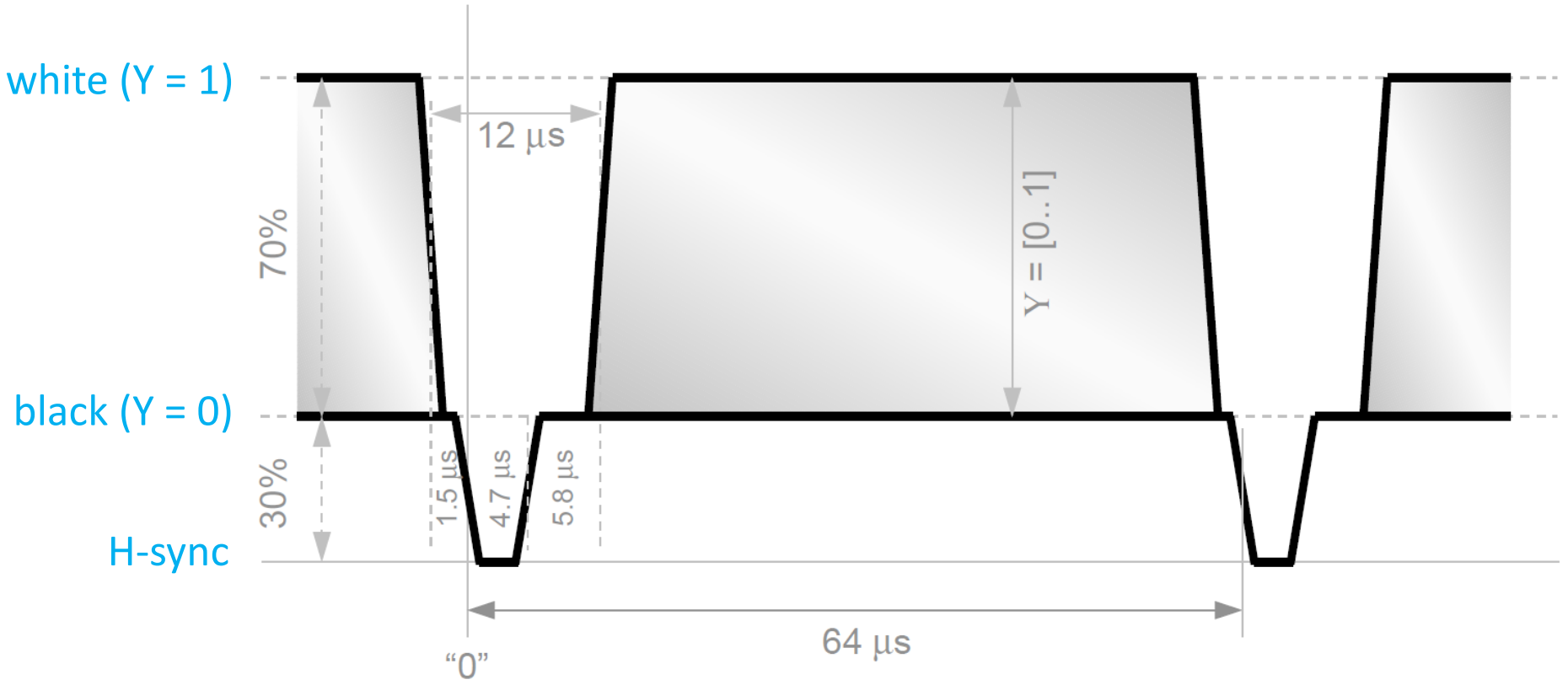
- SECAM:
  - Y + ***FM1***{u} \ ***FM2***{v}



Source: http://alpha.tmit.bme.hu/vitma301/gyak09_foliak.pdf

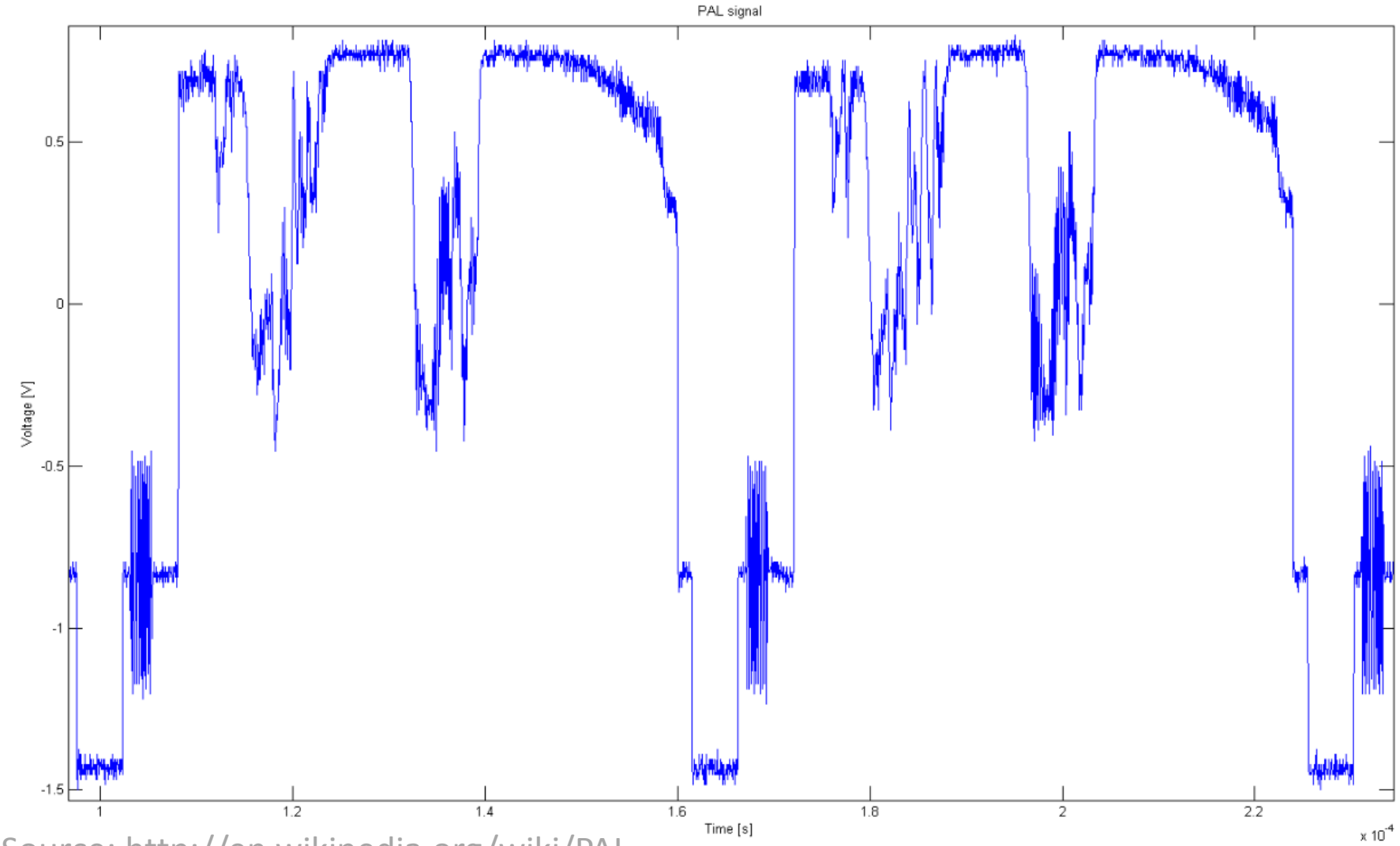
Source: http://cnyack.homestead.com/files/modulation/ntsc_sig.htm

Baseband time function of the analog TV



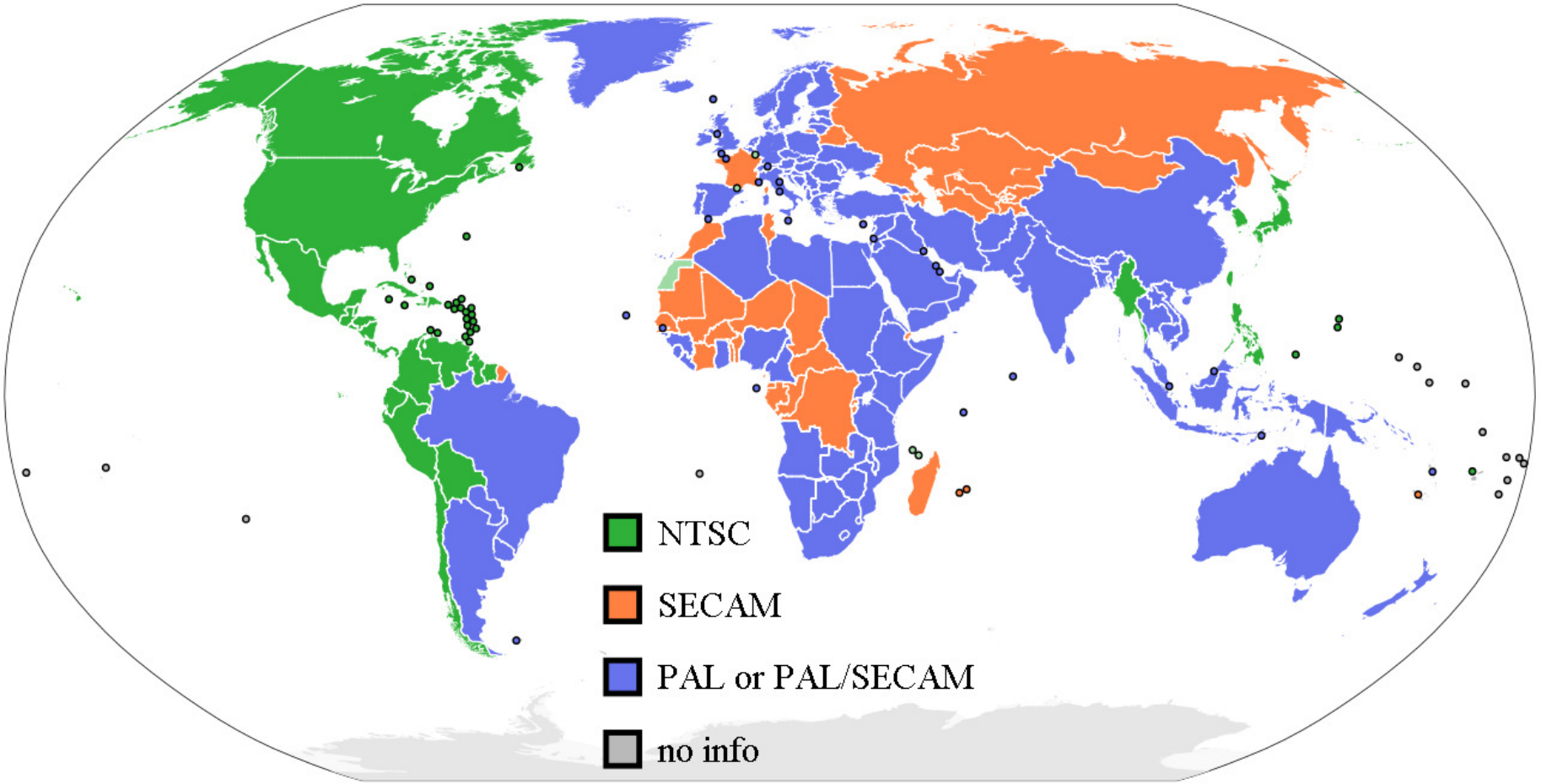
Source: http://alpha.tmit.bme.hu/vitma301/gyak08.pdf

Oscillogram of composite PAL signal—two lines



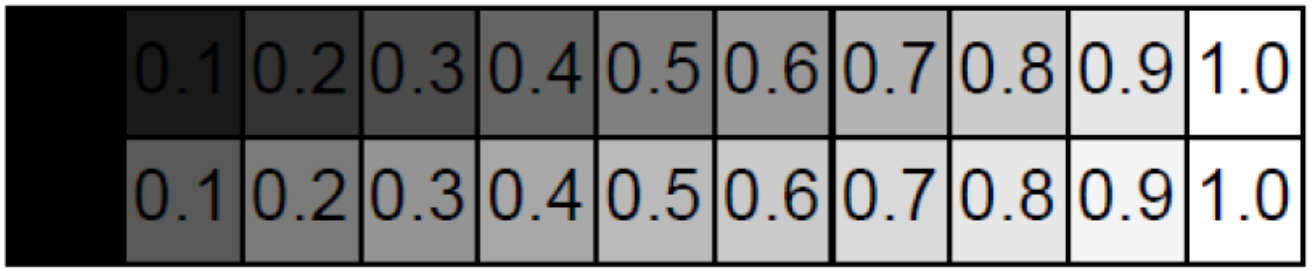
Source: http://en.wikipedia.org/wiki/PAL

Analog TV systems by nation

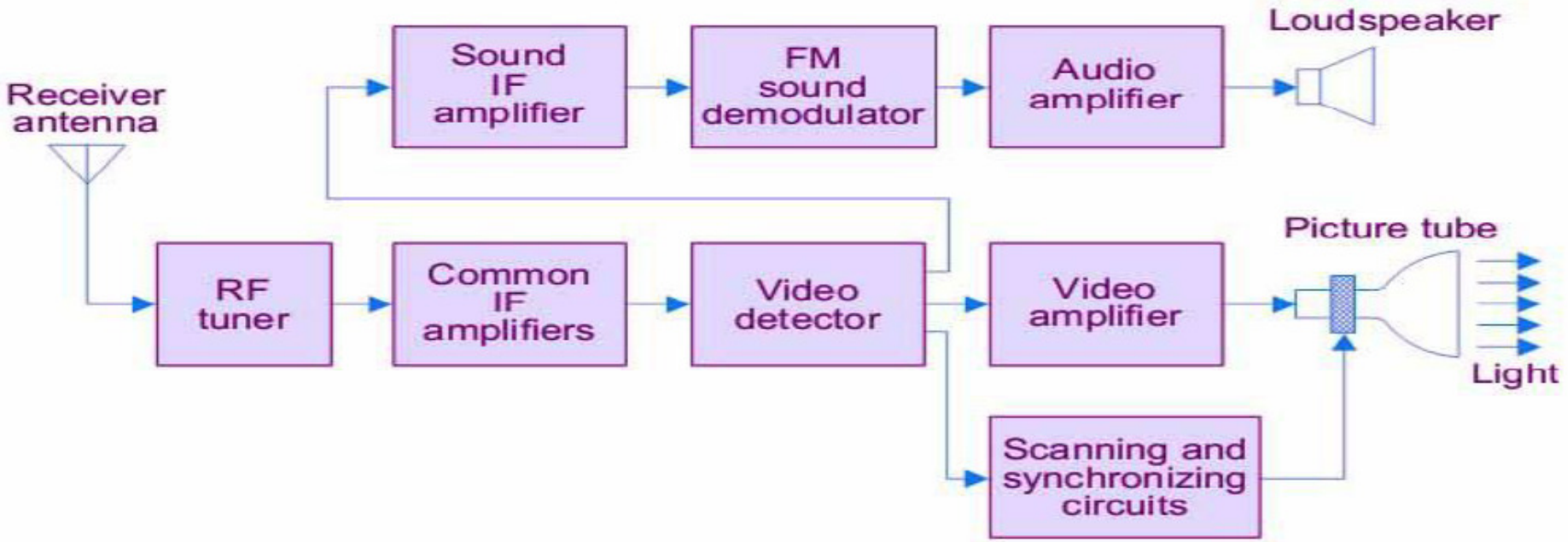


Source: http://en.wikipedia.org/wiki/PAL

Gamma correction



Source: http://alpha.tmit.bme.hu/vitma301/gyak08.pdf



Source: https://users.encs.concordia.ca/~msoleyma/ELEC691X/Lecture%20Notes/Lecture%201.pdf

DIGITAL TV

- Video Compression as Fast As Possible
- Video
- https://www.youtube.com/watch?v=qbGQBT2Vwvc

DVB-C (Cable / Community)

- cable provider
  - change some analog channels to digital
  - use same 8 MHz raster
- 8 MHz, QAM-64 (6 bit/symbol)
- elementary function: 15% raised cosine
- 6 MBaud signal, 38 Mbps multiplex channel
  - HD: ~6-8 Mbps required
  - SD: ~2 Mbps required
  - several HD and SD channels on the 8 MHz raster

DVB-S (Satellite)

- worse SNR than DVB-C
- QPSK modulation
- same 38 Mbps multiplex channel as in DVB-C
  - requires 37 MHz
  - (no problem, in GHz region)
- for sparsely populated areas

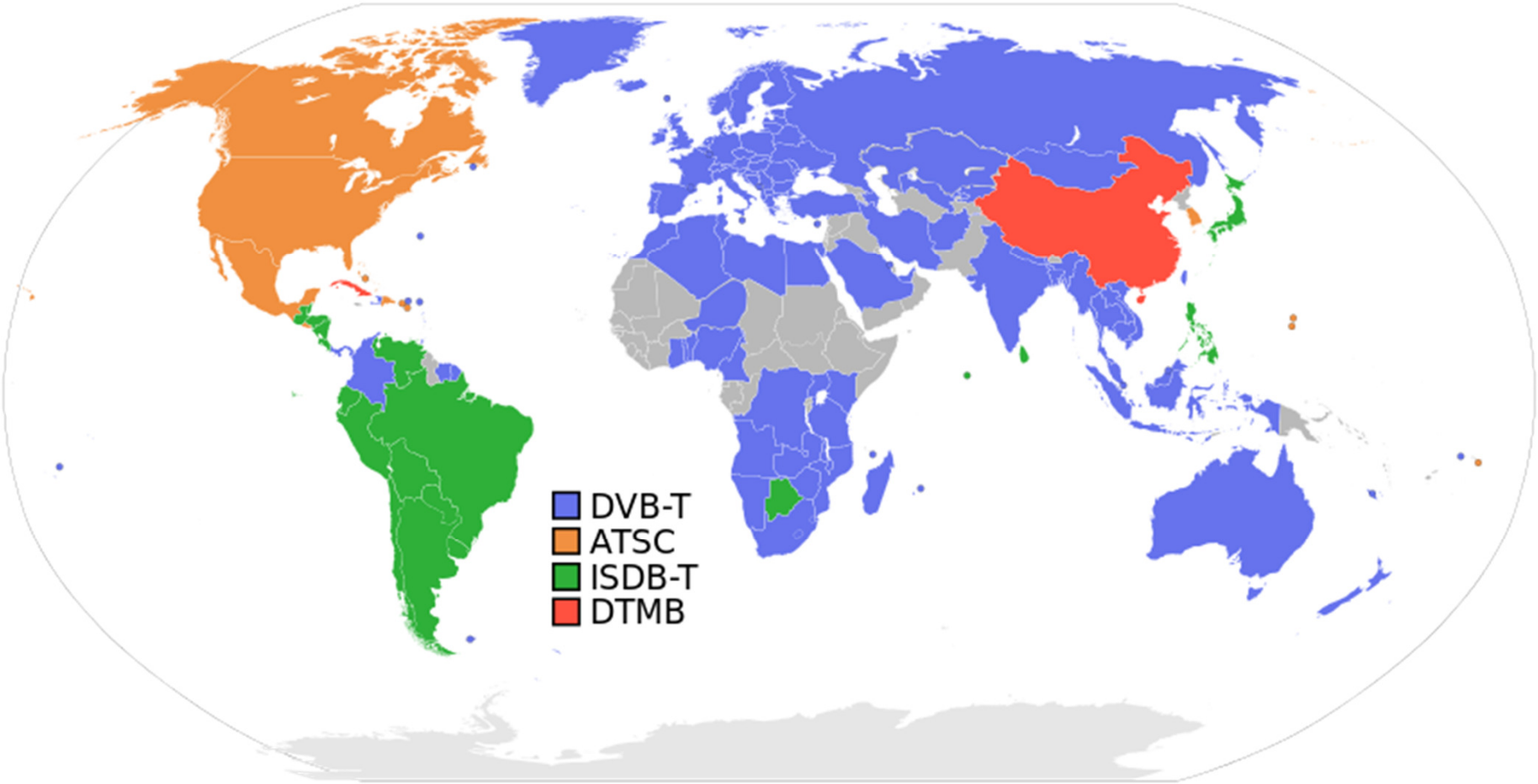
DVB-H (Handheld)

- Mobile TV
- access to service while in moving vehicle
- display size: larger postal stamp
- tuner consumes much power
- not widespread (lack of business model)

DVB-T (Terrestrial)

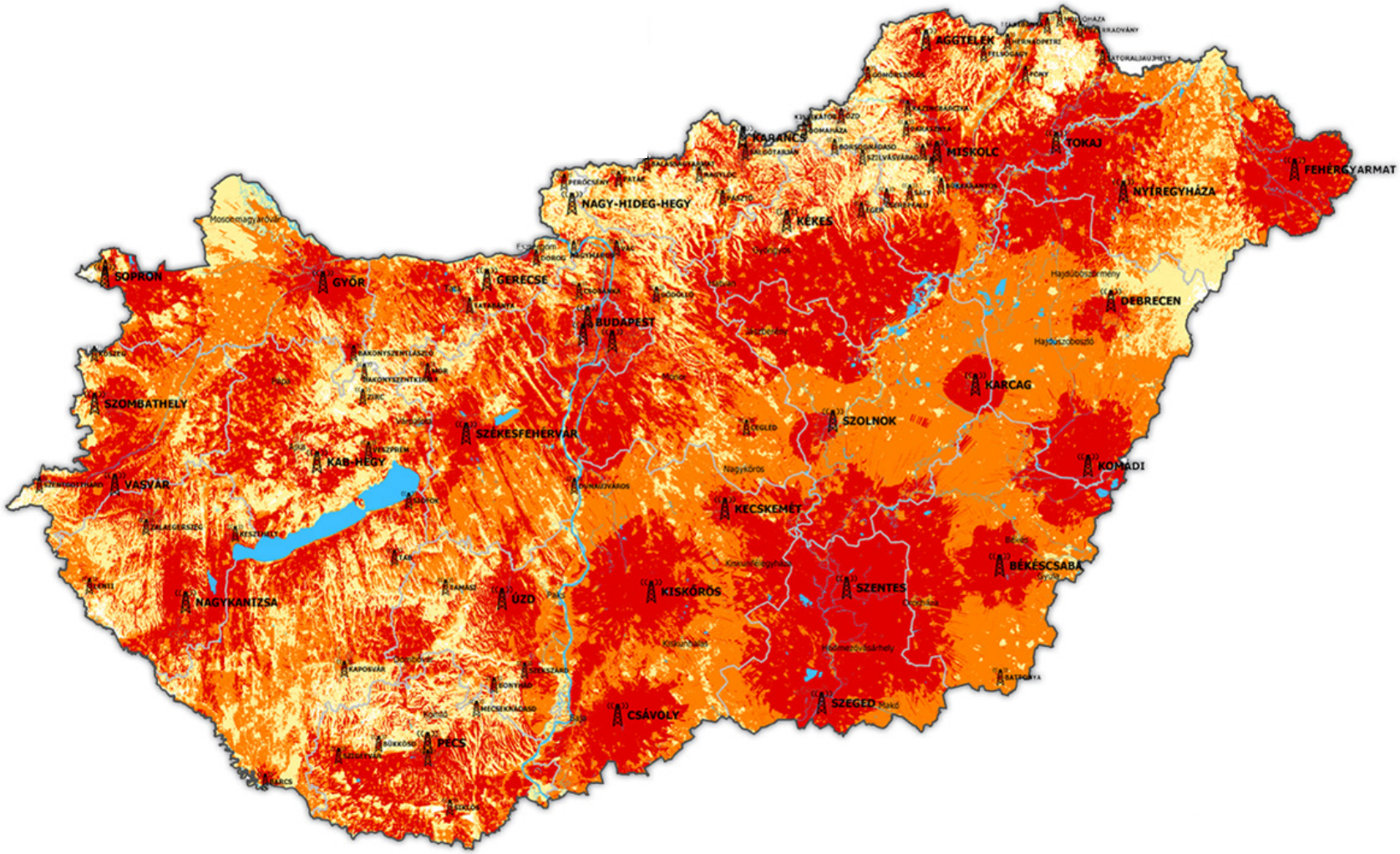
- problems:
  - multipath propagation, dispersion
  - ISI (vs. analog: ghost image)
- Forward error correction
- Cyclic error correction
  - Reed-Solomon code, RS(204, 188)
- OFDM with ~6000 subcarriers
  - QAM-16
- different from country to country
  - Hungary: MPEG-4, H.264 source coding

Digital TV systems by nation



Source: http://en.wikipedia.org/wiki/Digital_terrestrial_television

DVB-T coverage in Hungary



Source: http://mindigtv.hu/lefedettseg

MTVA Radio and Television History Museum

(Budapest VIII., Pollack Mihály square 8-10)

Information: http://www.mtva.hu/en/radio-es-televiziotoerteneti-kiallitohely (in Hungarian)