

Video aspect ratios

4:3 = 1.33:1

16:9 = 1.78:1

2.35:1 Super 35 (Film format)

1.85:1 (Film format)

2.21:1 (Film format)

16:9 aspect ratio is a “average” widescreen format between 2.35:1 and 1.33:1(4:3).

Standard video aspect ratio 4:3

720 pixels



Resolution in standard video is 720x576. This Format is designed to carry video with 4:3 aspect ratio.

So why is not $720/576 = 4:3$?
The reason is that there is no direct relation between resolution and aspect ratio in standard definition video resolution.

576 pixels

16:9 aspect ratio - anamorphic widescreen



16:9 aspect ratio transmitted in a traditionally 4:3 system is called anamorphic widescreen format.

The picture is compressed horizontally to make it fit into the 4:3 frame and broadcasted as a normal TV channel.

Film cameras can make this by using an anamorphic lense which compresses the video 25% horizontally.

Video cameras usually do this by digital processing.

A 16:9 monitor will stretch the video horizontally by 25%.



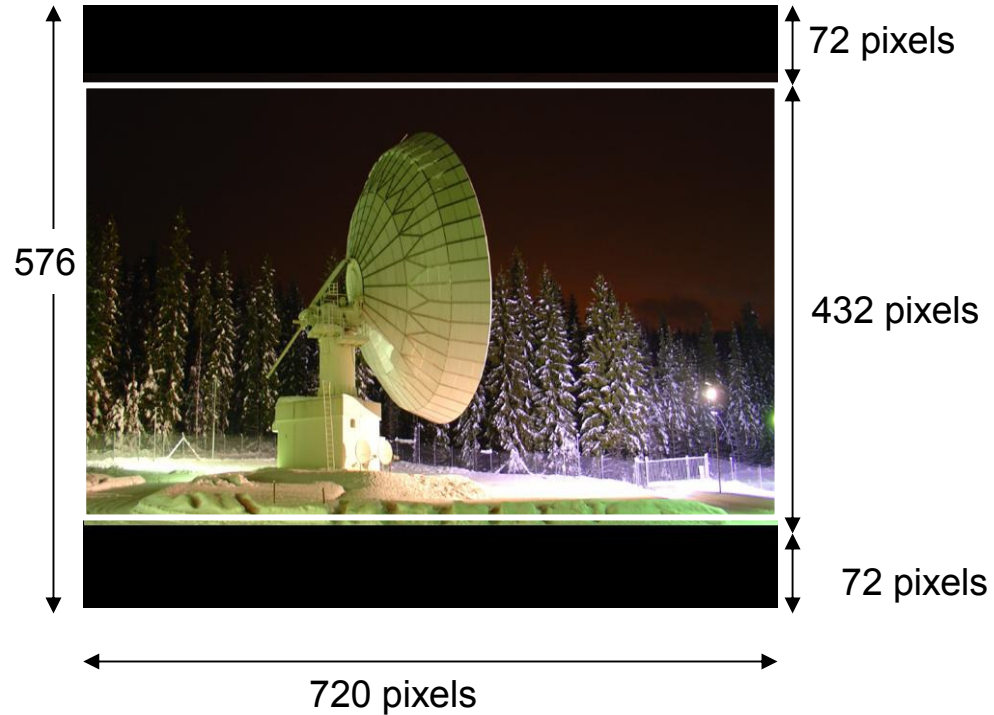
As a result of this the widescreen transmissions has 25% less horizontal resolution compared to true 4:3 transmission is viewed on a 4:3 monitor (compared on two monitors with the same vertical screen size).

Ideally the horizontal resolution for standard definition widescreen should have been 960x576 pixels to have the same pixel density as 4:3 720x576 displayed on a 4:3 TV with the same screen hight as a the 16:9 SDTV.

The resolution in 16:9 720X576 compares to 540x576 in 4:3 (same screen height)

16:9 anamorphic converted to a 4:3 letterbox

16:9 letterbox in 4:3 frame

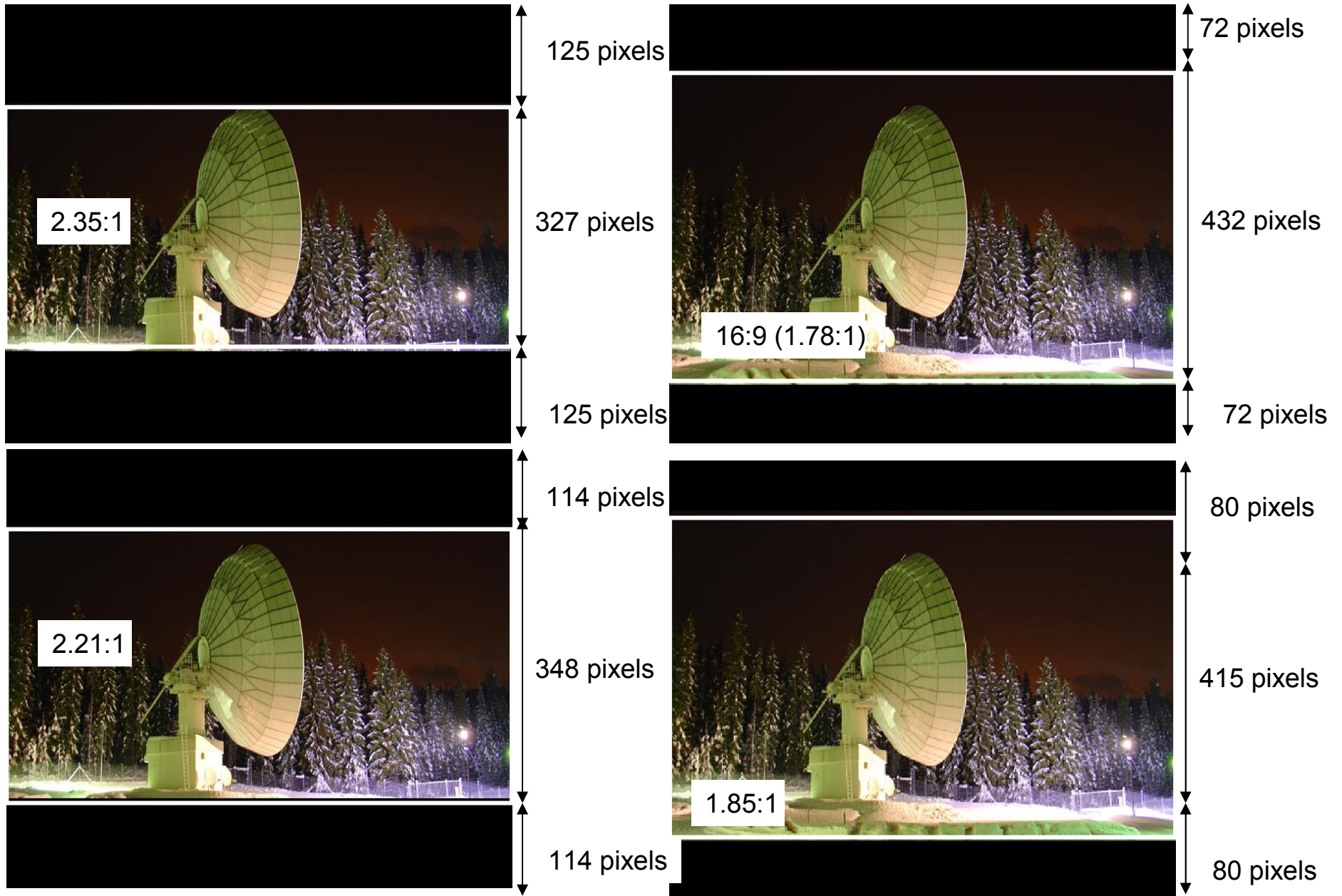


16:9 anamorphic in 4:3 frame

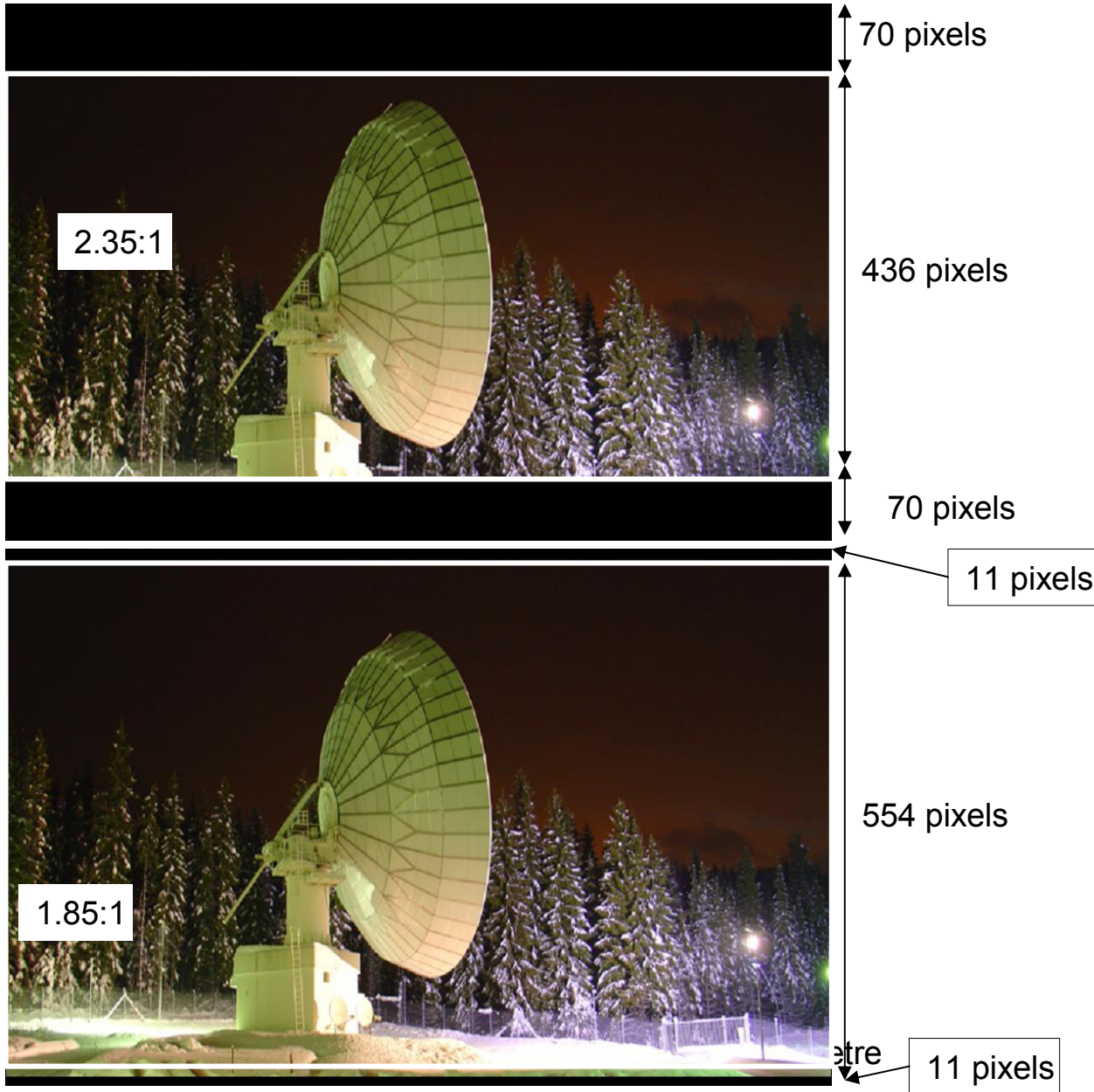


In a 16:9 letterbox the anamorphic widescreen is compressed 25% vertically to obtain the correct aspect ratio of 16:9.

Original film formats letterboxed to fit in 4:3 frame



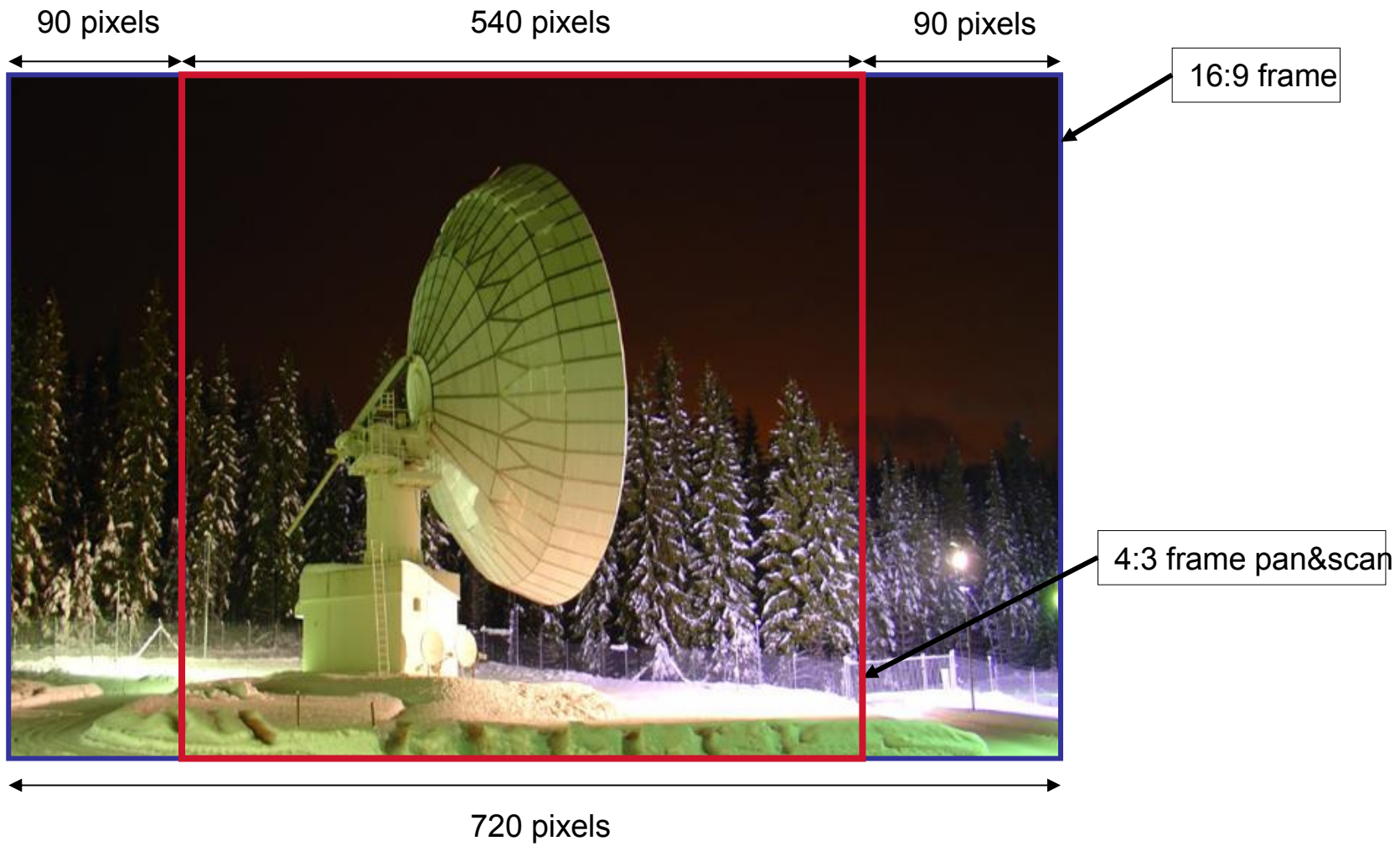
Original film formats letterboxed to fit in 16:9 frame



Original film formats letterboxed to fit in 16:9 frame



16:9 format pan&scan to fit in 4:3 frame (clipping the sides of the picture)



16:9 format pan&scan to fit in 4:3 frame (clipping parts of the picture)

If production is carried out in 720x576 16:9 and this is converted to 4:3 pan&scan “center cut” the effective resolution of the 4:3 transmission will be only 540x576.

Most 16:9 TV's will use an auto function which stretches&zoom the video and the result is that mpeg compression artifacts becomes more visible compared to a 4:3 production where the effective resolution is 720x576.

Many sportsevents is now produced in 720x576 16:9 and any pan&scan 4:3 version will have 25% loss of horisontal resolution.

Worst case happens when a 16:9 TV receives a 4:3 pan&scan transmission with 25% reduced horisontal resolution which is stretched 25% horisontal in the 16:9 TV. This results in wery poor picture quality on 4:3 and 16:9 TV..

In HDTV resolutions the relation 1920/1080 or 1280/720 both results in 1.78:1 (or 16:9). The resolution matches the aspect ratio 16:9.

Original film aspect ratios shown in 16:9 frame (clipping parts of the picture)

Conversion to 16:9 by cutting parts of the 2.35:1 picture. Parts of the video is lost.



16:9 frame

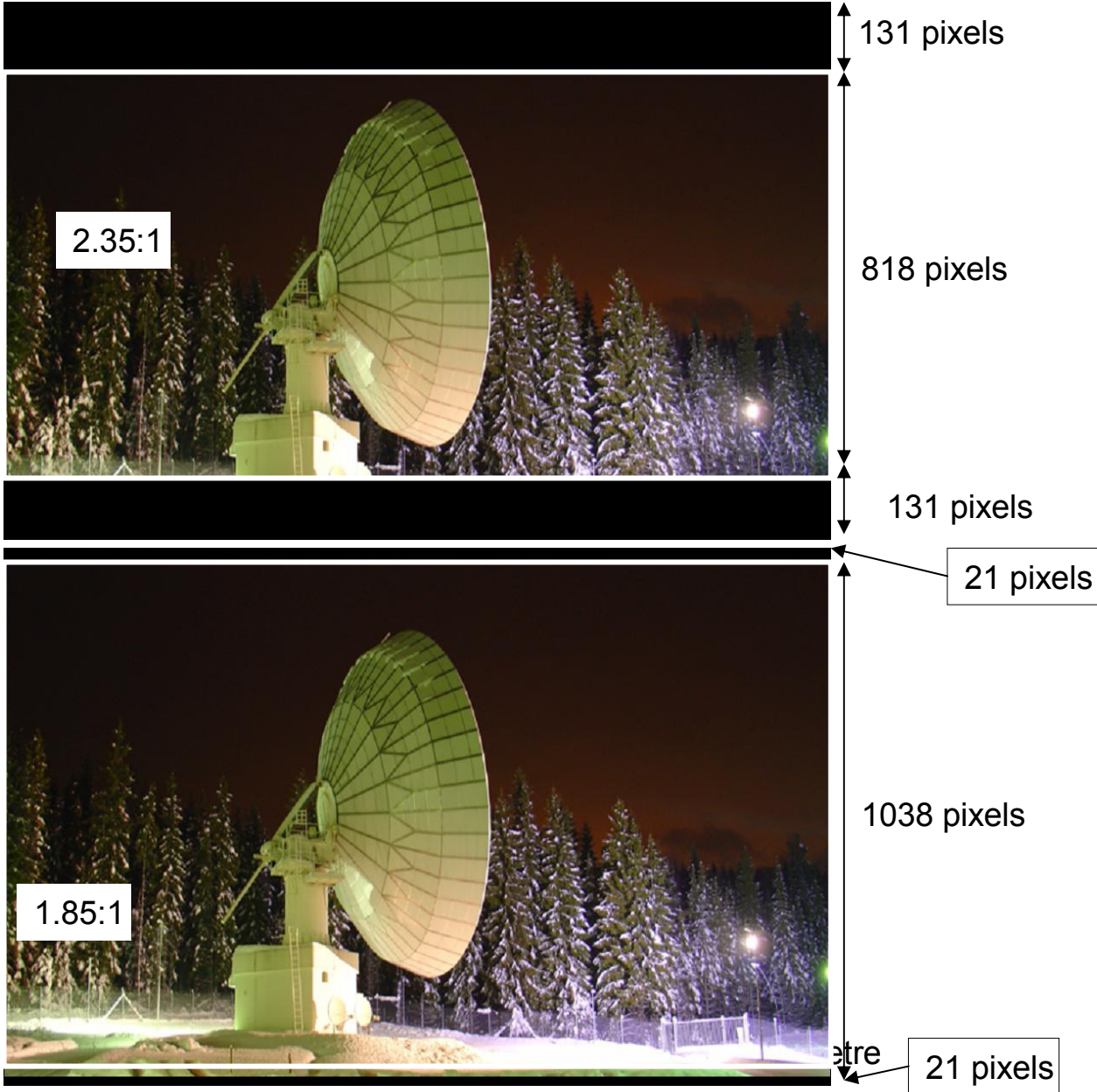
4:3 frame pan&scan

! Such conversion is not always allowed from the films creators

Original film aspect ratios shown in 1920x1080 resolution



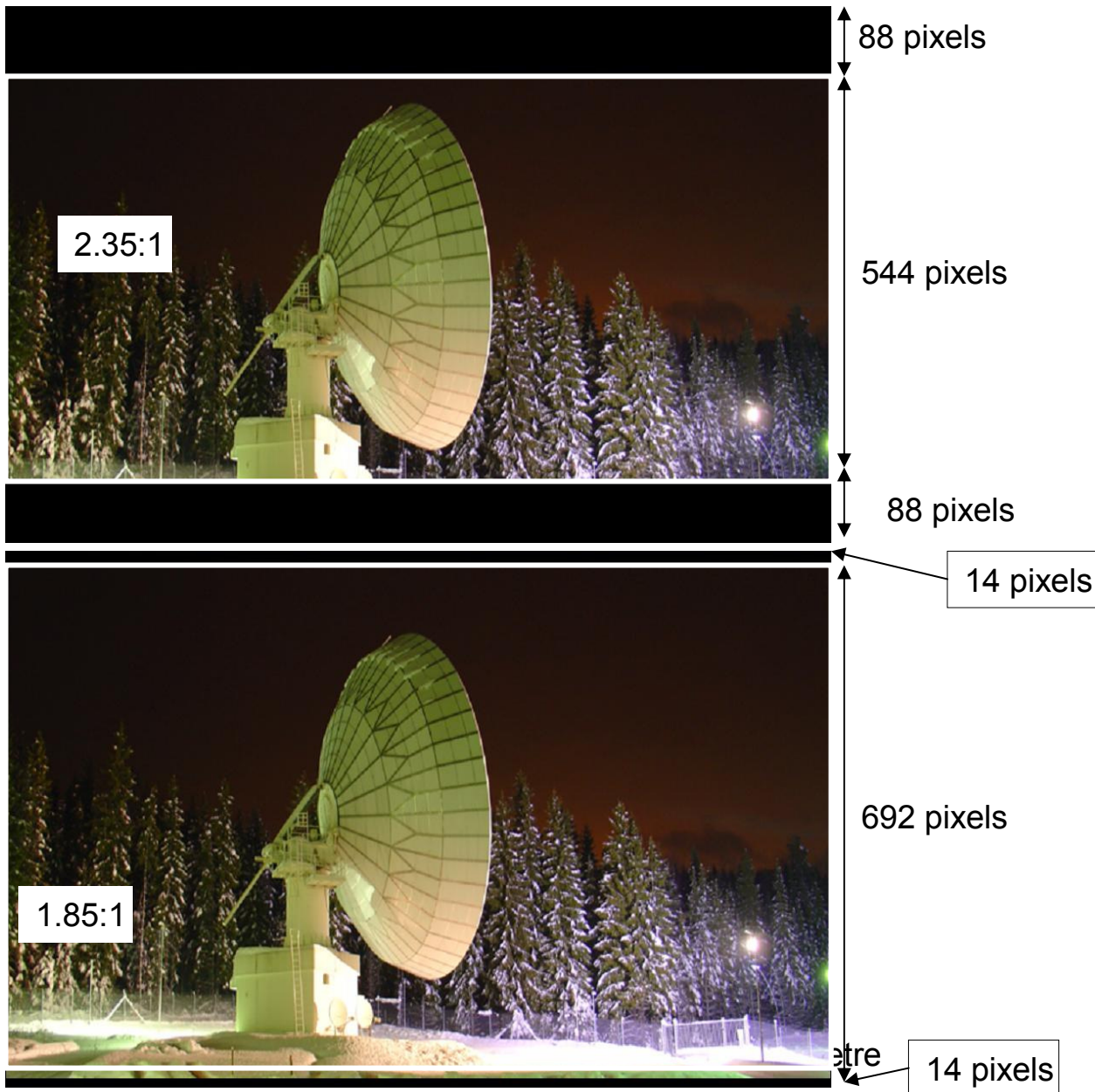
Original film aspect ratios shown in 1920x1080 resolution



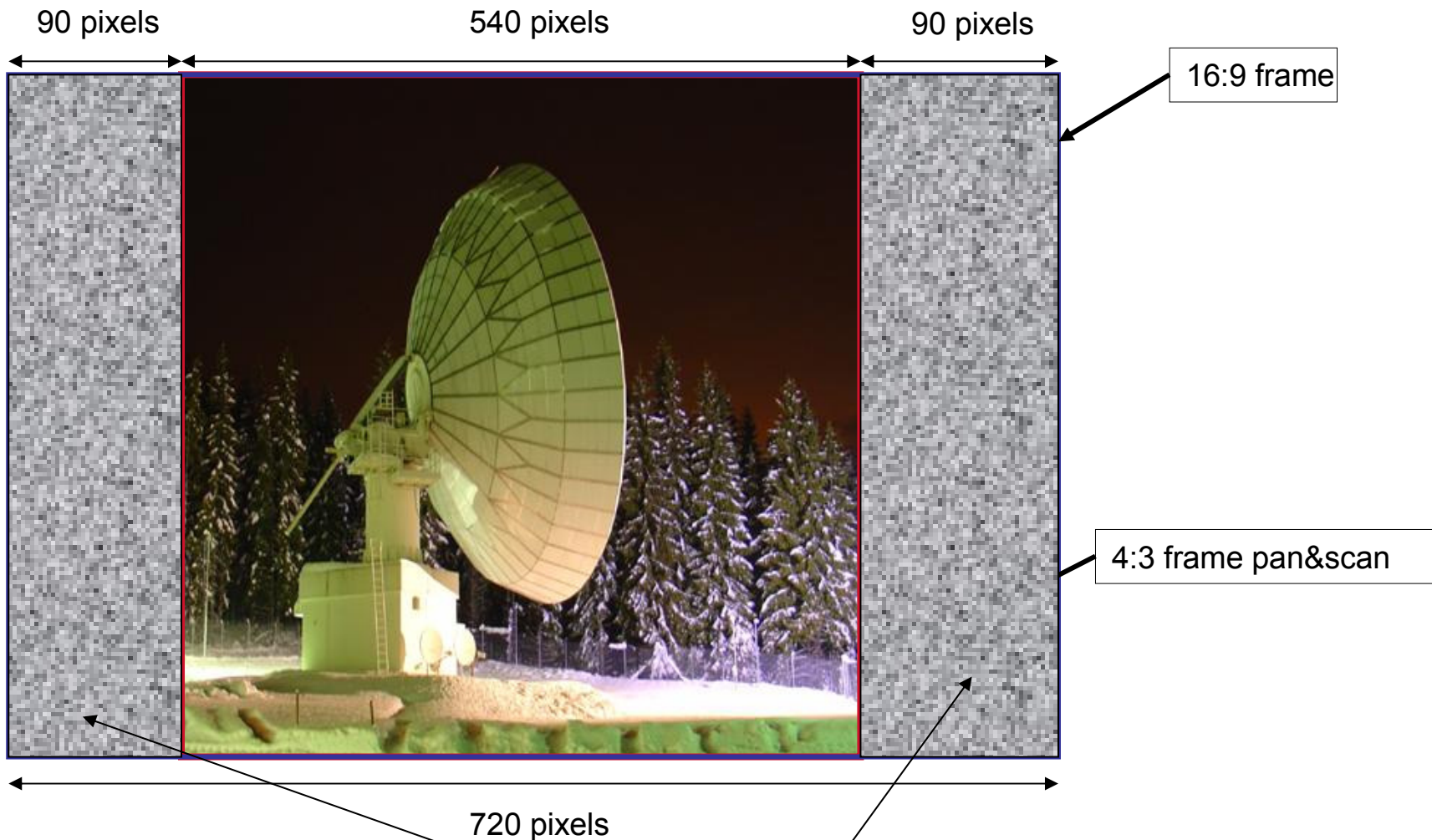
Original film aspect ratios shown in 1280x720 resolution



Original film aspect ratios shown in 1280x720 resolution

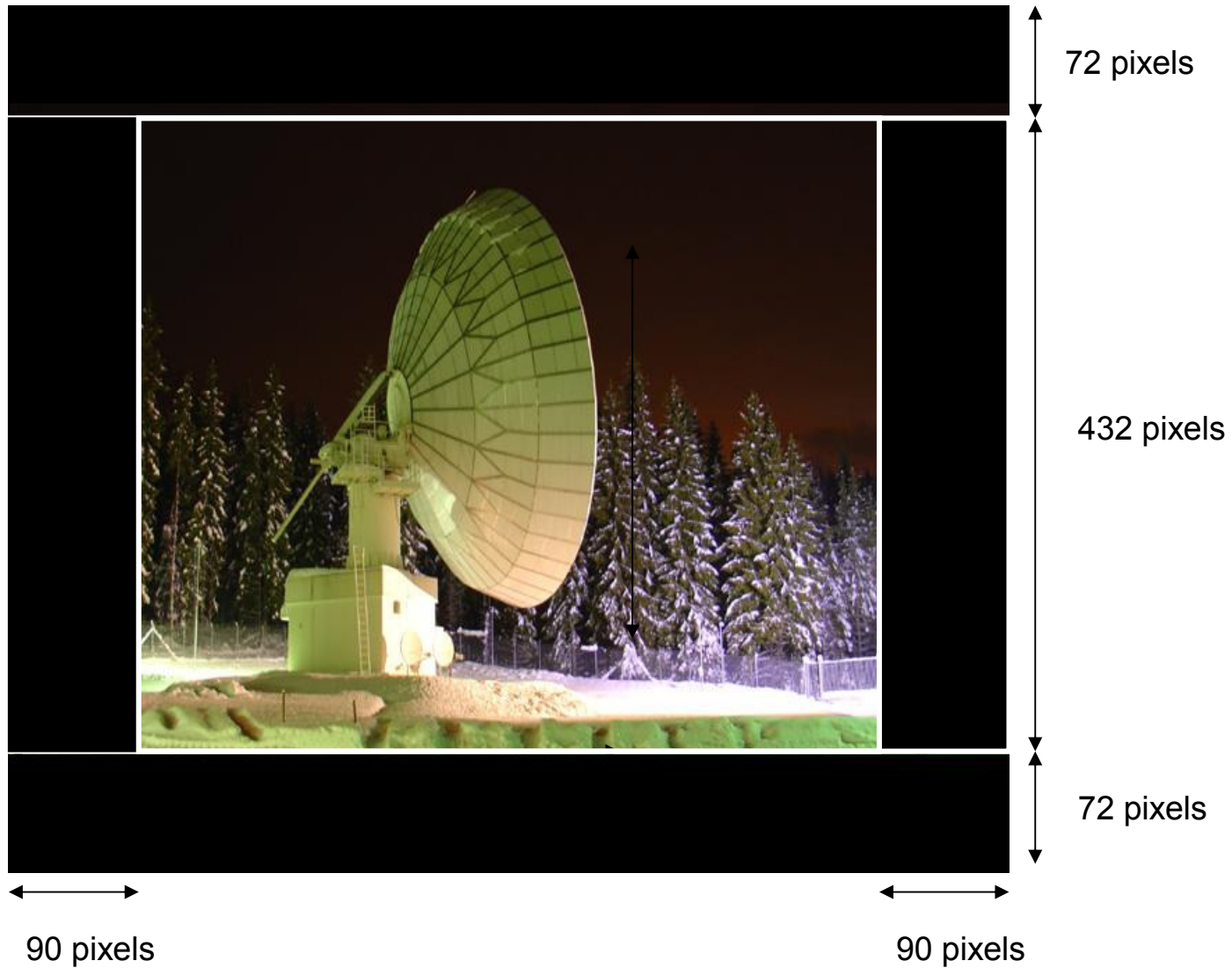


4:3 transmission/frame converted to 16:9 frame (adding vertical bars)



Static black bars should be avoided in order to reduce burn in on TV

4:3 frame converted to 16:9 by broadcaster, broadcasted as 16:9 and converted to 4:3 letterbox in the settopbox



23.02.2007

720 pixels Jens T. Sætre

Analog Widescreen signalling

- WSS is format for signalling 16:9 widescreen in analog PAL transmissions
- Some DVD recorders might think WSS is copyprotection and will not record if WSS is used.
- WSS specification EN 300 294 is available for free from www.etsi.org

Uses first half of videoline 23 (encoded pulses)
It can sometimes be seen on a TV set which does not handle line 23 correctly(video does not start until second half of line 23)



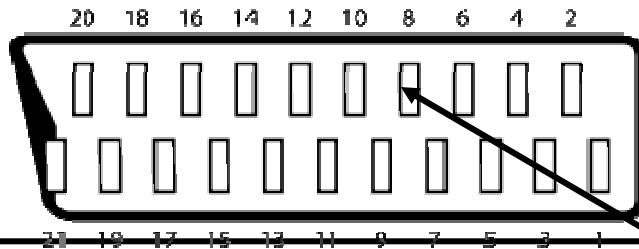
Table 2: Aspect ratio label, letterbox and position code

$b_0b_1b_2$	b_3	Aspect ratio label	Full format or Letterbox	Position	No. of active lines (see note 1)
0 0 0	1	4:3	full format	not applicable	576
1 0 0	0	14:9	letterbox	centre	504
0 1 0	0	14:9	letterbox	top	504
1 1 0	1	16:9	letterbox	centre	430
0 0 1	0	16:9	letterbox	top	430
1 0 1	1	> 16:9	letterbox	centre	not defined
0 1 1	1	14:9	full format (see note 2)	centre	576
1 1 1	0	16:9	full format (anamorphic)	not applicable	576

NOTE 1: The number of active lines is only an indication for the exact aspect ratio $a = 1,33$, $a = 1,57$ and $a = 1,78$.

NOTE 2: The actual transmitted aspect ratio is 4:3, but a 14:9 centre window should contain all the relevant picture content to encourage a wide screen display on a 16:9 television set.

Widescreen signalling from digital receivers



<http://en.wikipedia.org/wiki/SCART>

Pin 8, the *function switching* pin, carries a low frequency (less than 50 Hz) signal from the source that indicates the type of video present.

0 V-2 V means no signal, or internal bypass (often used when a settopbox receives 4:3 to make the TV's own auto format working)

4.5 V-7 V (nominal 6 V) means a widescreen (16:9) signal

9.5 V-12 V (nominal 12 V) means a normal (4:3) signal (is not used on digital settopbox)

Signal on pin 8 can sometimes turn off old TV's.

- Video format is always signalled on HDMI.

Some possibilities:

- 720x576i25 ,25 frames / 50 fields pr. second.
- 720x576p50 ,50 frames/ 50 frames pr. second
- 1280x720p50 ,50 frames/ 50 frames pr. second
- 1920x1080i25 ,25 frames/ 50 fields pr. second

- Aspect ratio is always signalled on HDMI.

Some possibilities (probably a few more)

- 4:3
- 16:9

HDMI specification is available for free at <http://www.hdmi.org/>

Aspect ratio and format in HDMI is defined by

http://www.ce.org/PDF/PREVIEW_pages_from_CEA-861-D_FINAL.pdf

(not available for free, \$193.00)