Draka

4K BROADCAST SIGNALS AND INFRASTRUCTURE

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Today's broadcasters´ infrastructure is designed for 720p, 1080i or even 1080p video content. The important question for broadcasters looking at the infrastructure is what will be the future content and will it affect my infrastructure. For example, the typical infrastructure of an outside broadcast truck is the coaxial cable 0.6/2.8AF. For a stadium it is the coaxial cable 1.4/6.6AF or 1.6/7.3AF.

Cable type	Maximum cable length measures with HD 1080i
0.6/2.8 AF	90 m
0.8/3.7 AF	120 m
1.0/4.8 AF	140 m
1.4/6.6 AF	200 m
1.6/7.3 AF	240 m

Video content 1.5G

The HD-SDI signal is defined by SMPTE 292M. Like the SDI signal, this content is an uncompressed component signal, serial transmitted via one coaxial cable.

The resolution of 1080i is 1080 lines x 1920 pixel.
The i stands for interlaced.

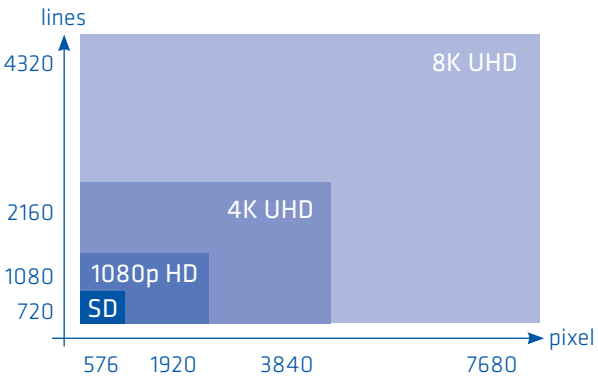
The resolution of 720p is of course 720 lines x 1280 pixel, p stands for progressive scan. The bit rate is 1.485Gbit/s. Based on the SMPTE 292M specification the maximum transmission distance of 0.6/2.8AF is 70m plus headroom.

Practical tests showed 90m. The coaxial cable 0.6/2.8AF is the typical infrastructure of an outside truck.

Video content 3G

The HD-SDI signal is defined by SMPTE 424M. The resolution is 1080 lines x1920 pixel, the scan is progressive; the bit rate is 3Gbit/s. Identical to SMPTE 292M, the maximum transmission length is specified at maximum 20dB attenuation at half clock frequency. Based on these key points, the maximum transmission distance of a 0.6/2.8AF network is 47m plus headroom, practical test 80m

Looking at the next generation of possible video contents we would like to look at 4K. The main question of the broadcasters in that 4K context: is my existing infrastructure still future-proof?



Resolution 4K

3840 x 2160 progressive scan, the bit rate is 12Gb/s.
The high bandwidth of 12 Gb/s (4 times 3G /1080p) reduces the transmission length dramatically.

Three different 4K solutions for broadcast production are in discussion:

1. Single link (1x12Gb/s, ½ clock frequency = 6GHz)
2. Dual link (2x6Gb/s, ½ clock frequency = 3GHz)
3. Quad link (4x3Gb/s, ½ clock frequency = 1.5GHz)

The dual link and quad link solutions will solve the issue with the high bandwidth for new installation. To know the 4K situation of an existing broadcast infrastructure, we have to look at the single solution.

The latest SMPTE calculation is based on a maximum allowed attenuation of 40dB/100m at ½ clock frequency.

Maximum Transmission length 4K calculated@ 40 dB max.

Cable type	OD [mm]	Usage	Attenuation [dB] at 6 GHz	max. length [m] 4K Single link	Attenuation [dB] at 3 GHz	max. length [m] 4K Dual link	Attenuation [dB] at 1.5 GHz	max. length [m] 4K Quad link
0.6/2.8 AF	4.5	Racks, VAN	97.4	41	59.3	67	40.4	99
0.8/3.7 AF	5.9	Racks, VAN	71.5	56	46.5	86	31.3	127
0.8L/3.7 Dz	5.9	Patch	77.9	51	51.9	77	33.9	117
1.0/4.8 AF	7.0	Standard	56.	71	37.3	107	24.9	160
1.4/6.6 AF	9.2	Stadium	45	86	30.2	132	19.6	204
1.6/7.3 AF	10.3	Stadium	41.7	95	26.4	151	16.9	236

The increase of the maximum allowed attenuation from 20 dB (known from SMPTE 292M and SMPTE 424M) to 40dB at 4K enables a maximum transmission length of 0.6/2.8AF up to 41m. For the technical realization it is essential to check the equipment e.g. equalizers if they are suitable for 4K to achieve the maximum values.

AVB, IPTV

To realize future broadcast infrastructure, several solutions are under discussion and development. AVB (Audio Video Bridging) and SMPTE 2022 are two of them, pushed by different suppliers.

But the discussions are going on: Maybe 4K is not enough, maybe 8K is the right one? And please don't forget 3D, and if we are talking about a user friendly 3D the best solution would be without 3D glasses....

Which broadcast infrastructure, i.e. which cable construction, can handle this explosion of data rate?

We can expect copper cables are limited in transmission distance due to the huge bandwidth, while optical cables have almost no limitations.

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