Non-Referenced Video Quality Testing and Monitoring

with HDMI video capture

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App Experience

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Why Ensuring Video Quality is Important?

Examples of Video Quality degradation:

Block Loss

Blocks from the streaming video are lost due to the transmission in the delivery and access network

Blockiness

Video Processing handle the amount of information at the chosen bit rate, and the result is the image is composed of blocks.

Blur

A high amount of movement or action in the content of streaming video can result in a blurry picture due to image processing or connection speed

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Video Quality Testing Methods

IP Level Analysis

- Video Quality is measured at the **IP Layer** using **PCAP Analysis**
- The number of KPIs that can be measured depends on streaming protocol and if encryption is present or not
- The method is applicable for measuring the **availability** and **basic performance** of the video service

Application Level Analysis

- Video Quality is measured by **automating** the **Smartphone Application**, e.g. YouTube
- This methods allows measuring KPIs such as **app start duration**, **video availability, video start duration**
- The method is applicable for measuring **video** and **app availability**, **user experience** and **video performance**

Frame Level Analysis

- Video Quality is measured **directly on a captured video stream** independent of application and streaming protocols
- **Frame by frame analysis** results in an **extensive set of KPIs** related to picture quality can be provided
- The method is applicable for measuring the **video quality as „seen"** on the screen

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HDMI-based Video Quality Testing

- HDMI-based testing is one of the most flexible methods for Video Quality Testing and Monitoring

- The video stream is captured directly on the HDMI interface **from any HDMI output**, e.g. Set-Top Box, Apple TV

- Programable Infrared Transceiver can substitute any other original IR remote controller

- **Video source** can be live or on-demand TV, OTT, etc.

STB

SITE MPU

IR Transceiver

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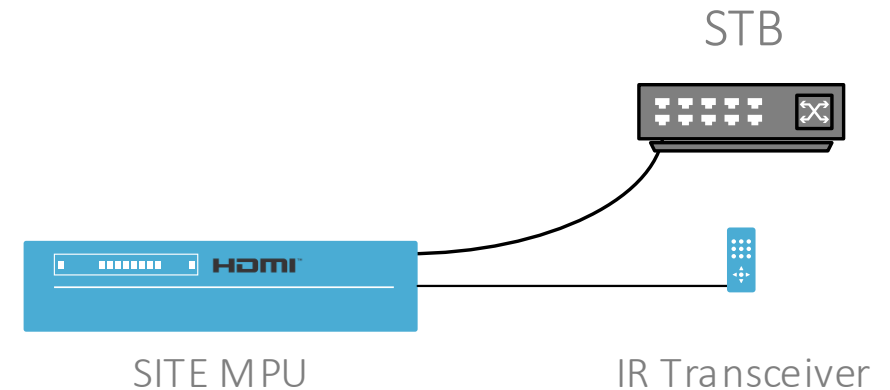
Generating the KPIs

- Video is captured on the HDMI interface - 4k video (3840x2160) @30fps or HD Video (1920x1080) @60fps

- The KPIs are calculated for each frame and averaged for the duration of the test

- Raw KPIs per frame can be stored as a result file

- The captured video stream can be stored for empirical analysis

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Use Case#1: Testing and Monitoring on STB for TV Channels

IR Control

HDMI Input   HDMI Output

MPU

Set Top Box
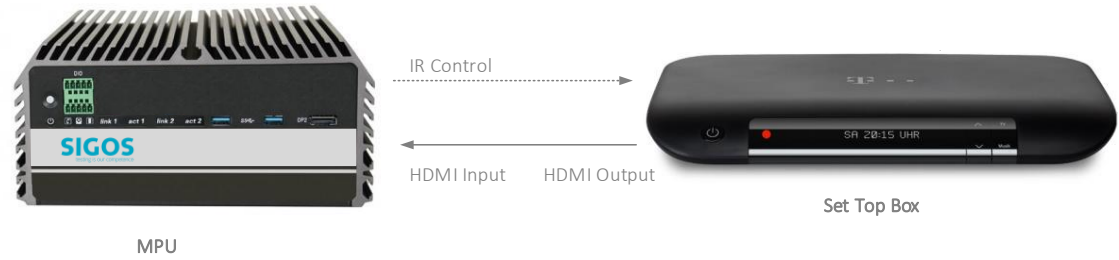
Step 1:
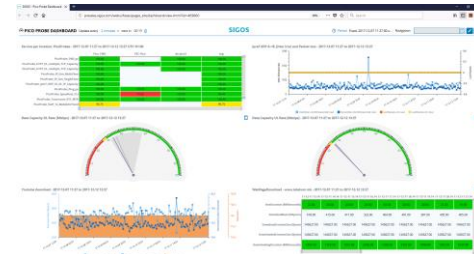Browsing through
the TV Programs

Step 2:
Switch to channel 1
and check video
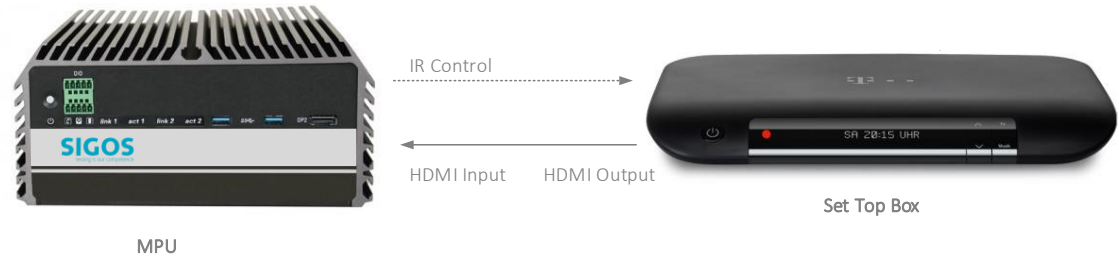quality

Step 3:
Switch to channel 2
and check video
quality

Step 4:
Switch to channel 3
and check video
quality, etc..

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Use Case#2: Testing and Monitoring Content on STB for VoD

IR Control

HDMI Input · HDMI Output

MPU · Set Top Box

Step 1:
Browsing through the menu TV Apps

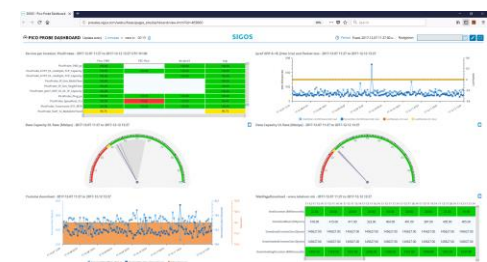**Step 2:**
Browsing through the menu activating Netflix

Step 3:
Selecting a movie to play

Step 4:
Play selected movie for X seconds

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Advanced Video Quality KPIs

Capturing/Processing

Blockiness (ⓟ)
Blur (ⓒⓟ)
Contrast (ⓟⓓ)
Exposure (ⓒ)
Flickering (ⓟ)
Interlacing (ⓒ)
Noise (ⓒ)
Spatial Activity (ⓒ)
Temporal Activity (ⓒ)
Audio MOS (ⓒ ⓟ ⓣⓓ)

Transmission

Commercial Black (ⓣⓓ)
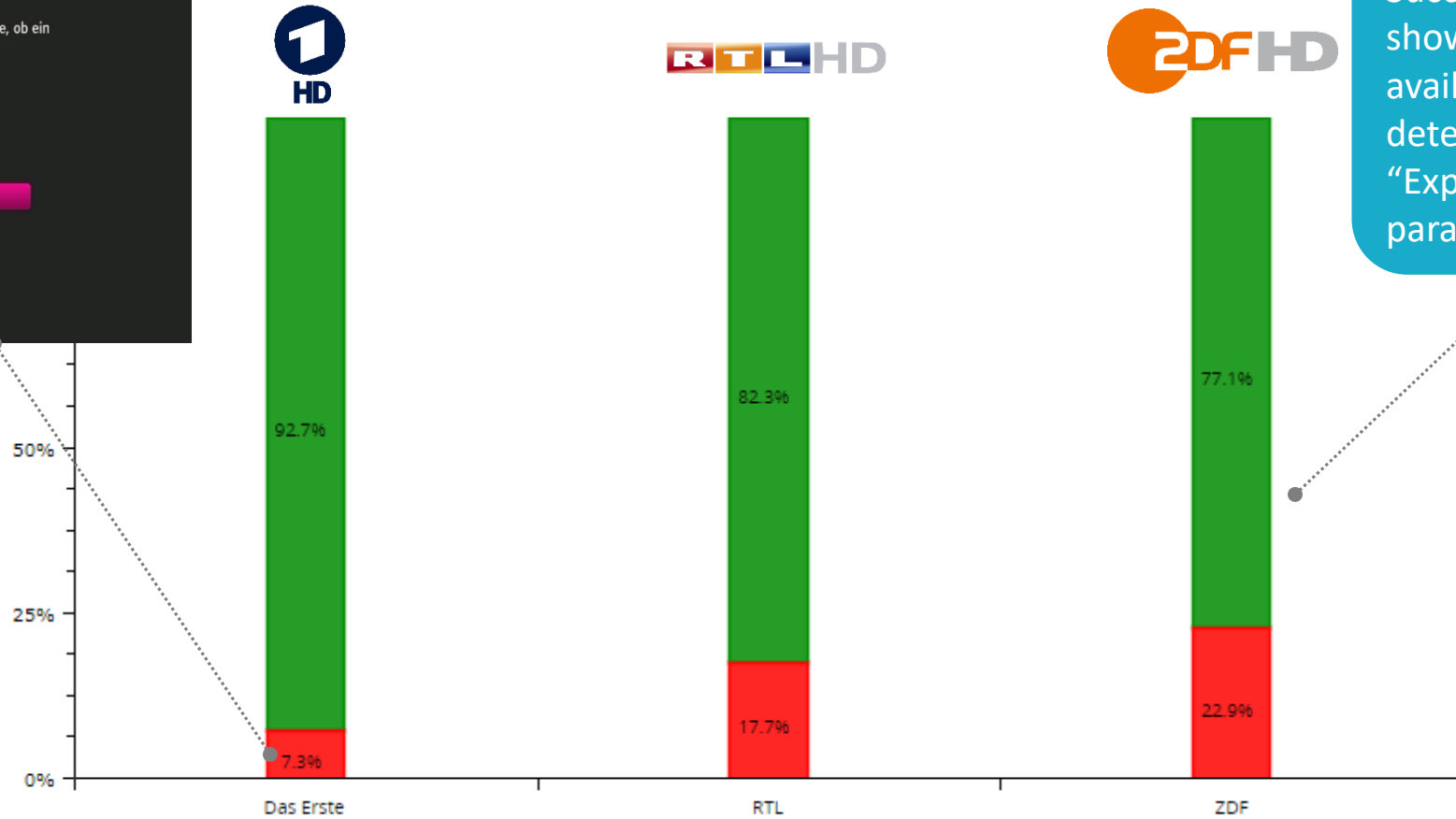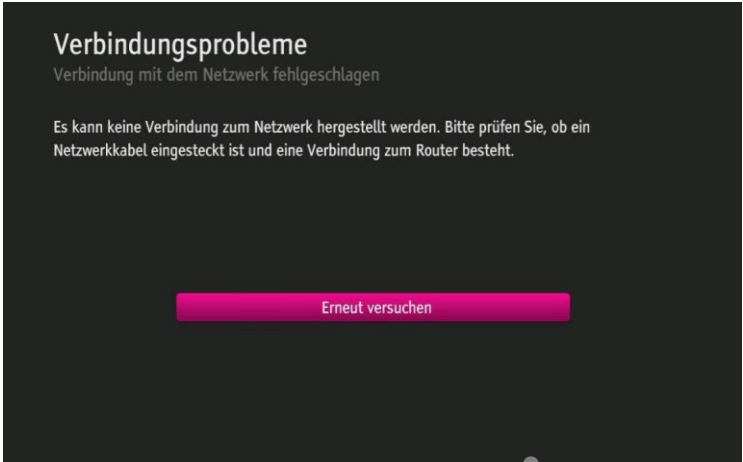Block Loss (ⓣ)
Freezing (ⓣ)
Slicing (ⓣⓓ)

Display

Commercial Black (ⓣⓓ)
Letterboxing (ⓓ)
Pillarboxing (ⓓ)
Slicing (ⓣⓓ)

Menu

Step Verification Success
Channel Success rate
Time to browse
Time between steps

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Channel Availability

Success Rate Chart that shows if the channel was available. Success rate is determined by the "Expected Channel" parameter.

Verbindungsprobleme
Verbindung mit dem Netzwerk fehlgeschlagen

Es kann keine Verbindung zum Netzwerk hergestellt werden. Bitte prüfen Sie, ob ein Netzwerkkabel eingesteckt ist und eine Verbindung zum Router besteht.

Erneut versuchen

92.7%

82.3%

77.1%

50%

25%

0%

7.3%

17.7%

22.9%

Das Erste

RTL

ZDF

Success (avg by ExpectedChannelName)   Failure (avg by ExpectedChannelName)

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Performance per Channel

	DasErste	RTL	ZDF
VideoHeight	720.0	720.0	720.0
VideoWidth	1280.0	1280.0	1280.0
FramesPerSecond	50.0	50.0	50.0
Blockiness_mean	0.88	0.96	0.87
BlockLoss_mean	1.45	1.53	0.81
Blur_mean	4.8	3.81	4.68
CommercialBlack_mean	0.0	0.02	0.0
Contrast_mean	43.12	47.49	46.91
ExposureTimeDistortion…	117.67	114.98	122.34
Flickering_mean	-0.78	-0.82	-0.78
Freezing_mean	0.09	0.0	0.08
Letterboxing_mean	0.0	0.02	0.01
Noise_mean	0.73	0.42	0.64
Pillarboxing_mean	0.0	0.02	0.0
SpatialActivity_mean	54.75	55.2	62.98
TemporalActivity_mean	5.88	5.24	5.69

The Video Quality Testing Solution allows users to create performance charts per channel

Alarming can be easily setup based on "value without distortion", which is available for each KPI

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Video Quality Dashboard
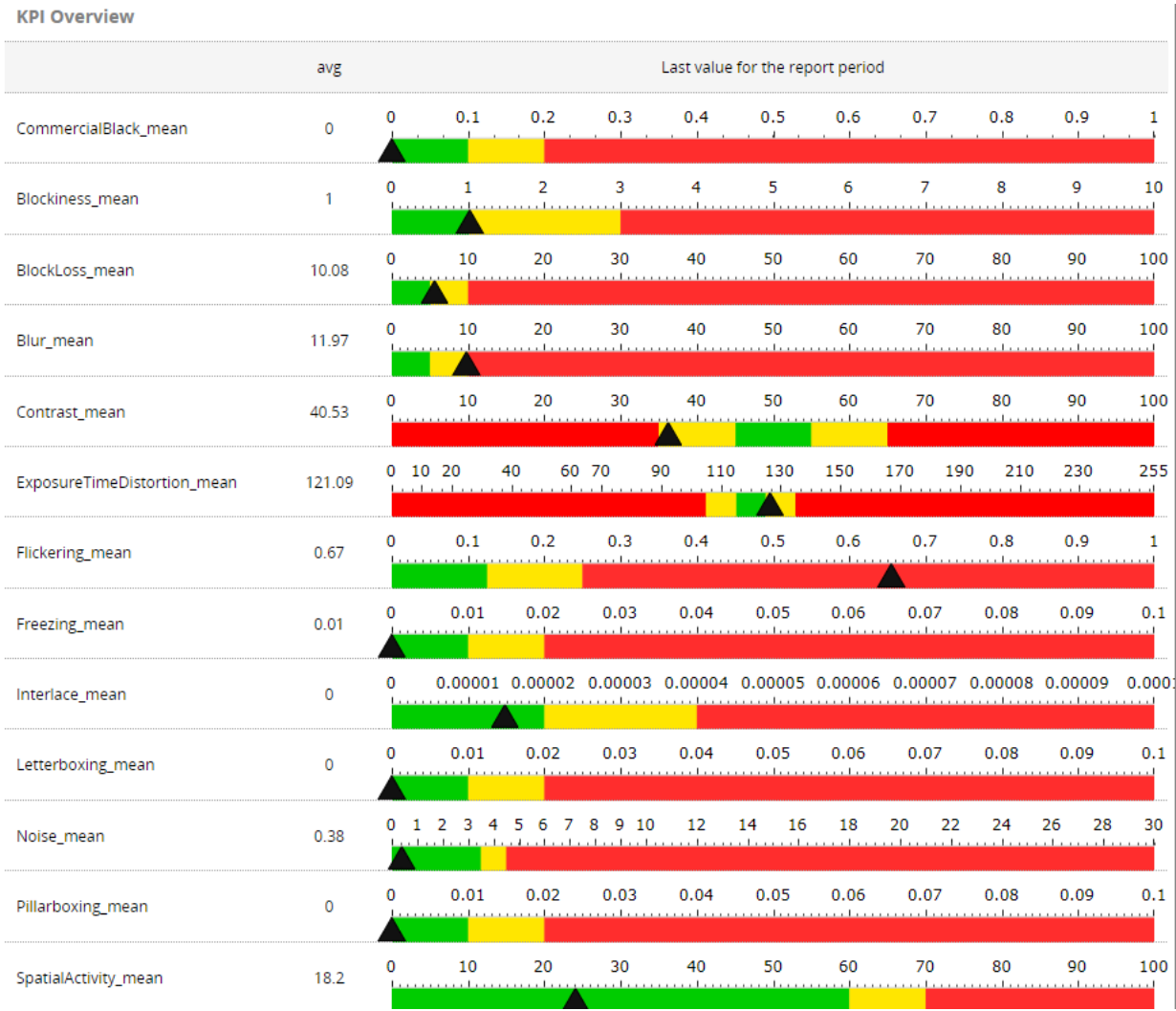
The KPIs and the recommended values can easily be presented to show at a glance the quality of the tested video stream

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Summary and Conclusions

- Video Quality Testing can be done using several methods

- HDMI-based testing offers a flexible solution, independent of underlying protocols and codecs

- HDMI-based testing can be used with any type of video content

- The method can be extended to any source, e.g. Smartphone video

- The method can be combined with IP level KPIs to provide a holistic view on the video service

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Thank you

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