Latency Test Report

Test Report No.: A100128

Applicant	:	**Avonic B.V.**
Addres	:	**Exportweg 11a 2645 ED Delfgauw The Netherlands**
Equipment	:	**PTZ IP Camera**
Trade (model) Name	:	**AV-CM70-IP, AV-CM70-NDI**
Test types	:	**Internal SDI Latency test, Internal HDMI Latency test,**
		Internal IP Latency test
Test status	:	**Completed**

1. This test report shall not be reproduced in full or partial, without the written approval of Latency Lab
2. The results in this report apply only to the sample tested.
3. The test results are in compliance with the described test procedure
4. No claims can be made based on these test results

Test Results

Model	Date	Firmware	Output	Settings	IC1-latency
Avonic CM70-IP-B	19/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	HDMI	1080p60	47.2 ms
Avonic CM70-IP-B	19/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	SDI	1080p60	48.2 ms
Avonic CM70-IP-B	21/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	RTSP H.264 BP	1080p60 8192Kbps iFrame interval 15	81.4 ms
Avonic CM70-IP-B	21/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	Onvif H.264 BP	1080p60 8192Kbps iFrame interval 15	98.6 ms
Avonic CM70-NDI-W	02/05/2023	MCU V3.2.8 Camera V1.1.1 AF V1.0.8 NDI V5.1.1	NDI H.265 MP	1080p60 15000Kbps iFrame interval 15	88.4 ms

The measurements shown in this test report were made in accordance with the procedures explained in the extended test report.

Date: _04-05-2023_______________

Representative test engineer: _Daniël de Bakker__________

Approved by: __Walter Harrewijn__________

1. Conclusion

The IC1 latency (Internal Camera Latency based on test procedure version 1) results are presented on the front page.

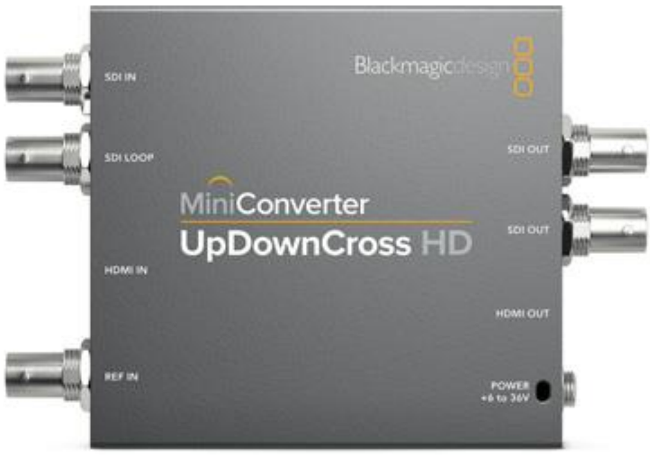
All tests have been executed with the cameras in both upright and upside down position. The difference in average IC1 latency is minimal, less than 10%. In most situations the latency even decreased when the camera was installed upside down. The installation position has a negligible effect on the latency and will not be noticed during use. In the test results the highest measured latency is presented, the actual latency can therefore be lower. Any claim that the latency of the tested camera increases when installed upside down are baseless.

2. Screens and components

2 x identical Samsung UE43TU7022. Both had their HDMI inputs set to ‘PC’ and ‘Game mode’ on

To measure the latency of the screens we use a specialized Raspberry PI based device that puts out a light flash through its HDMI port and has a light receiving photocell on the other end. It measures the time difference between the generation of the light flash and recording the light flash from the screen onto the photosensor.

The third device type that is needed, is a convertor from SDI to HDMI, as the screens above do not possess the ability to accept SDI signals. We use a Black Magic design UP/DownCross HD convertor to achieve this conversion.

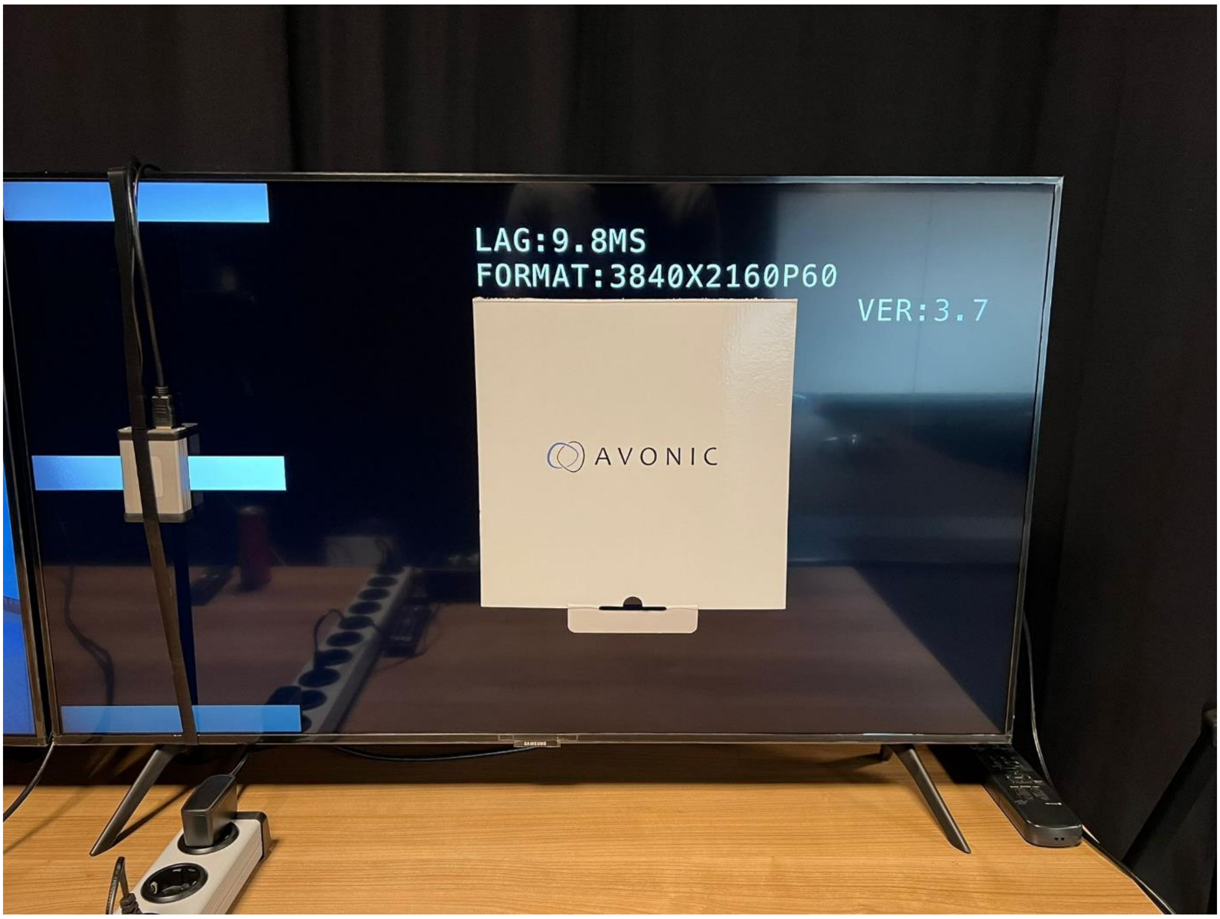


3. Measuring individual components for their latency

Screens

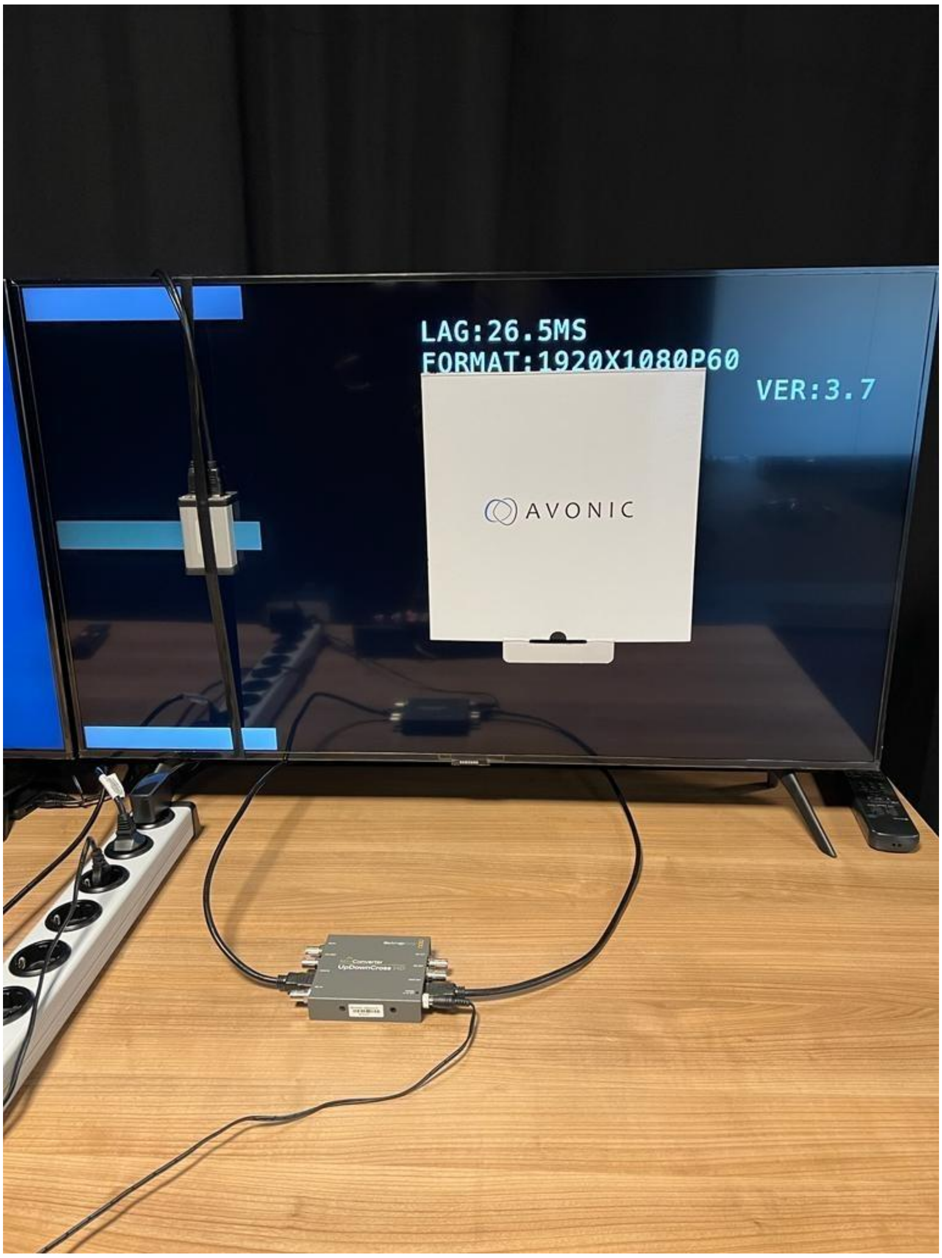
The photo below shows the average input latency of these tv screens to be an average of 9.8 milliseconds.

We measure the latency in the center of the screen, because the image is built from the top down. The center position is a representative average, the top is lower value (approximately 3 ms), the bottom higher at approximately 17ms.



HDMI/SDI converter

As the screen attached was already measured at 9.8ms we can deduct from the chain that the internal latency of the converter is 16.7 milli seconds on 1080p60, see photo below. Now that we have defined this latency, we can go ahead and start testing the cameras on both HDMI and SDI.



Laptop

Lenovo Legion 11th gen Intel Core i5-11400H @ 2.70Ghz 2.69 Ghz, 1920*1080 screen with a refresh rate of 165Hz. This computer makes use of an nVidia Geforce RTX3050 Ti Laptop GPU.

4. Explanation on how to measure internal camera latency.

In the case of measuring the internal latency of the camera, we use one Samsung monitor to display the output signal from the measurement device; this introduces a latency of 9.8ms as we established above. The next step is to point the camera on the center bar of that first screen. The signal will be transferred through the camera onto the second screen, which introduces another 9.8ms. The total amount of lag shown on screen minus the lag of the screens is the internal latency of the camera.

The camera is set up to manual exposure with a shutter time of 1/2000th of a second, sharpness off and minimal gain.

The latency measured is called the IC1 latency, this stand for "Internal Camera Latency based on test procedure version 1".

5. NDI Latency measurement

The NDI latency of the AV-CM70-NDI has been measured by the official NDI latency tester application. The program generates a colored screen and measures the differences between color changes by decoding the NDI stream from the camera. The measured results are exported into an Excel file. We have measured the camera over a period of 3.5 minutes and used the average of the readings generated by the NDI latency tester application.

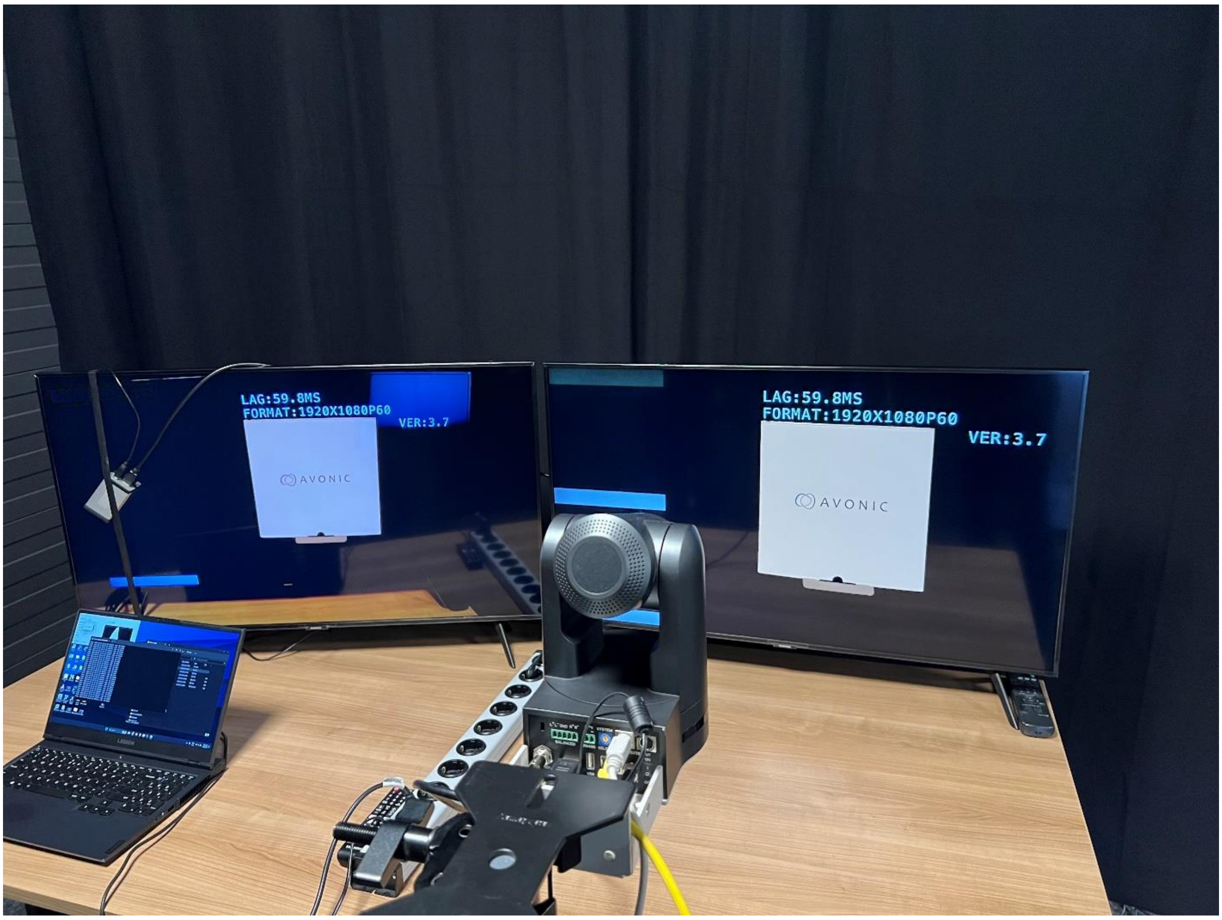
Camera Make and Model	Date	Firmware	Straight up (S) upside down (U)	Connection type	resolution and framerate	IC1 Latency	photo
Avonic CM70-IP-B	19/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	S	HDMI	1080p60	47.20 ms (470 measurements over 3 minutes)	1
Avonic CM70-IP-B	19/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	U	HDMI	1080p60	44.65 ms (468 measurements 3 minutes)	2

Avonic CM70-IP-B	19/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	S	SDI	1080p60	48,24 ms (468 measurements over 3 minutes)	3
Avonic CM70-IP-B	19/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	U	SDI	1080p60	47.95 ms (468 measurements over 3 minutes)	4
Avonic CM70-IP-B	21/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	S	internal development tool RTSP H.264 BP 8192Kbps 60FPS iFrame interval 15 frames	1080p60	81.36 ms* *end to end average latency over 3 minutes, is 91.16 ms including the screen. The latency of camera plus decoding computer is 91.16 ms minus 9.8 ms = 81.36 ms	5
Avonic CM70-IP-B	21/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	U	internal development tool RTSP H.264 BP 8192Kbps 60FPS iFrame interval 15 frames	1080p60	67.62 ms* *end to end average latency over 3 minutes, is 77.42 ms including the screen. The latency of camera plus decoding computer is 77.42 ms minus 9.8 ms = 67.62 ms	6
Avonic CM70-IP-B	21/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	S	Onvif H.264 BP 8192Kbps iFrame interval 15 frames	1080p60	98,57 ms* *end to end average latency over 3 minutes, is 108.37 ms including the screen. The latency of camera plus decoding computer is 108.37 ms minus 9.8 ms = 98.57 ms	7
Avonic CM70-IP-B	21/04/2023	MCU 3.2.7 Camera 2.7.2 AF 1.0.8	U	Onvif H.264 BP 8192Kbps iFrame interval 15 frames	1080p60	91,45 ms* *end to end average latency over 3 minutes, is 101.25 ms including the screen. The latency of camera plus decoding computer is 101.25 ms minus 9.8 ms = 91.45 ms	8

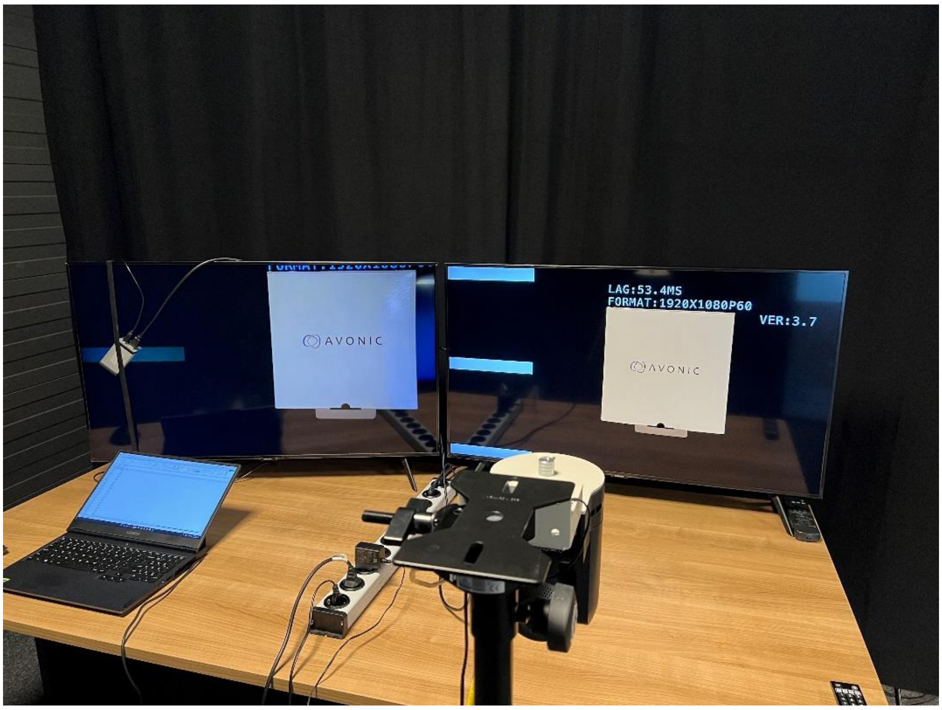
Avonic CM70-NDI-W	02/05/2023	MCU V3.2.8 Camera V1.1.1 AF V1.0.8 NDI V5.1.1	S	NDI Latency Tester H.265 MP 15000Kbps iFrame interval 15 frames	1080p60	88.35 ms* end to end latency, from generating color to detection of color change. Laptop used is the above mentioned Lenovo Legion	9
Avonic-NDI-W	02/05/2023	MCU V3.2.8 Camera V1.1.1 AF V1.0.8 NDI V5.1.1	U	NDI Latency Tester H.265 MP 15000Kbps iFrame interval 15 frames	1080p60	86.05 ms* end to end latency, from generating color to detection of color change. Laptop used is the above mentioned Lenovo Legion	10

6. Photo evidence

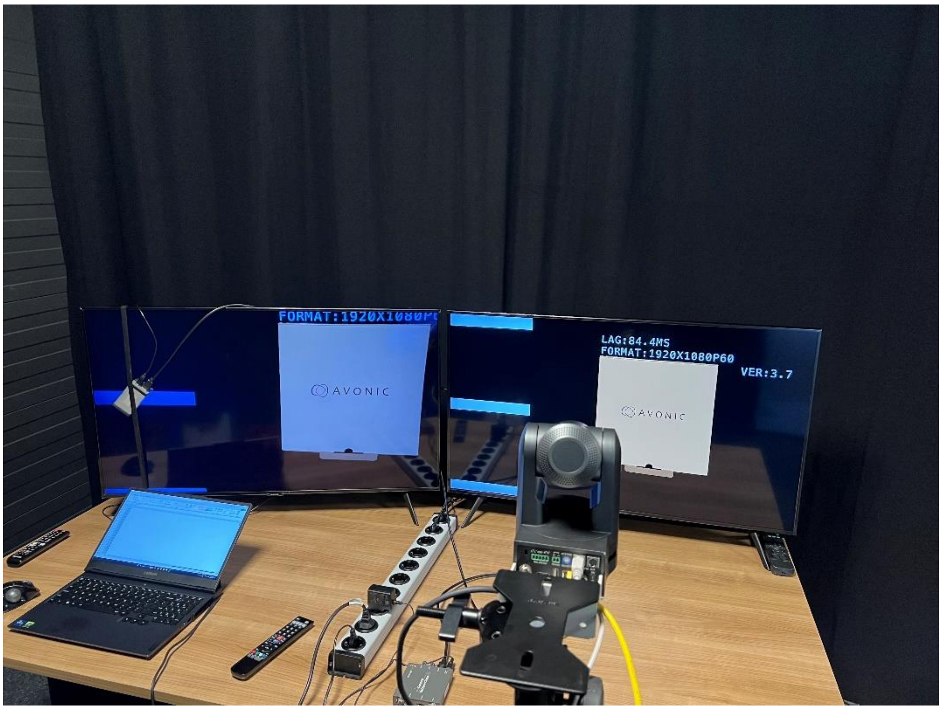
Test 1



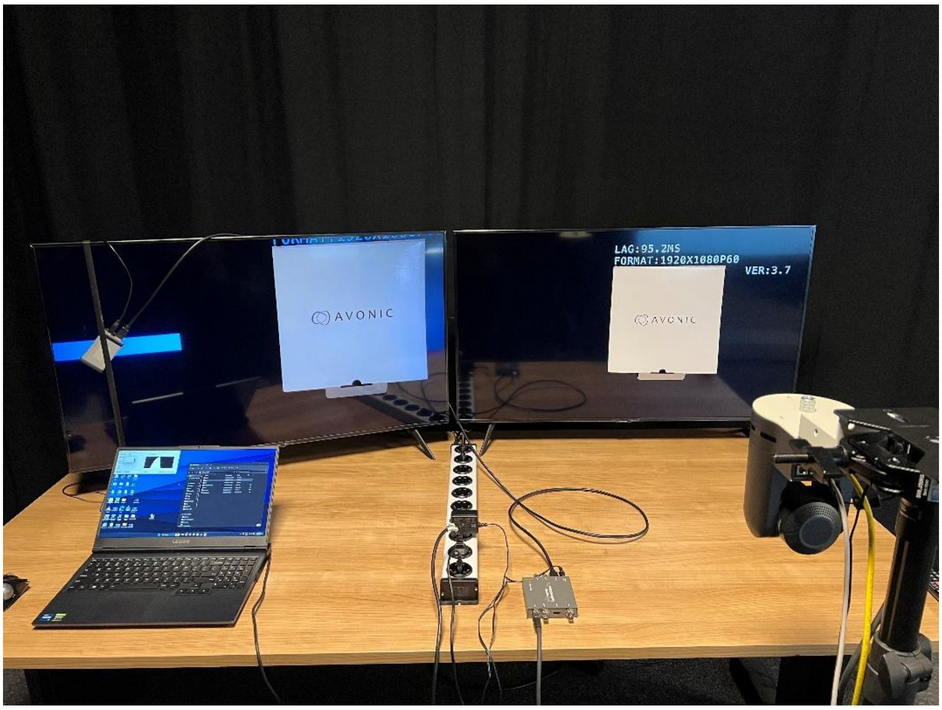
Test 2


LAG:53.4MS
FORMAT:1920X1080P60
VER:3.7
AVONIC
AVONIC

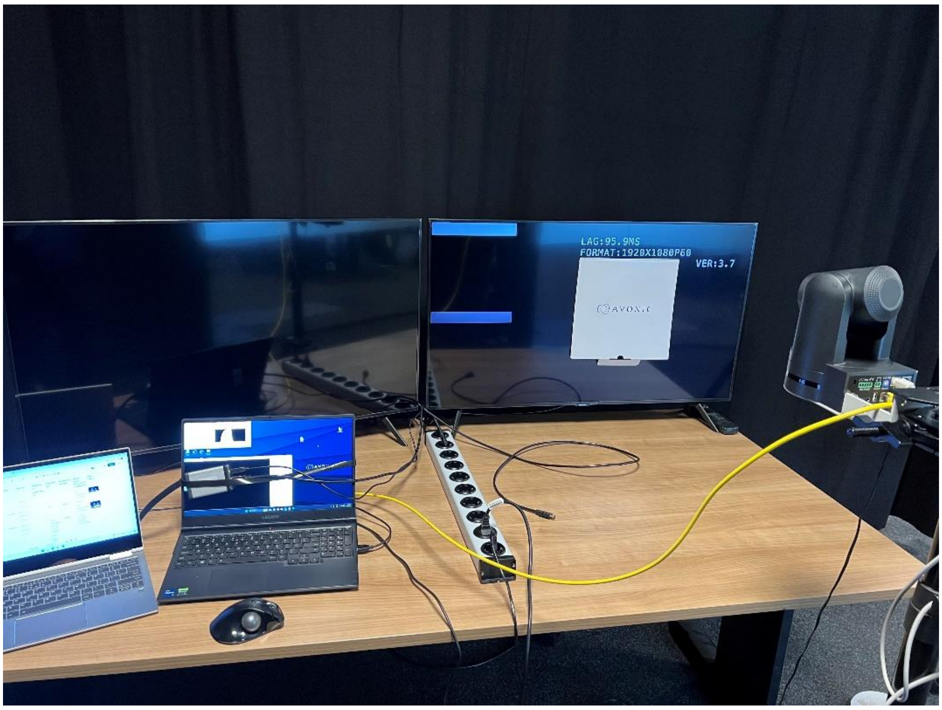
Test 3


LAG:84.4MS
FORMAT:1920X1080P60
VER:3.7
AVONIC
AVONIC

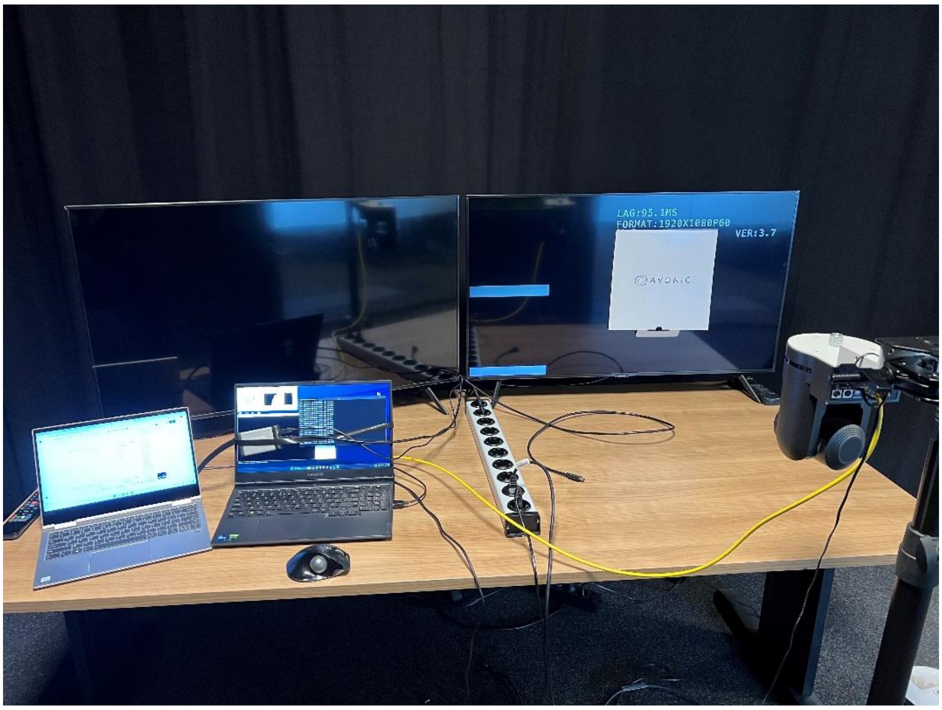
Test 4


AVONIC
LAG:95.2MS
FORMAT:1920X1080P60
VER:3.7
AVONIC

Test 5


LAG:95.9MS
FORMAT:1920X1080P60
VER:3.7

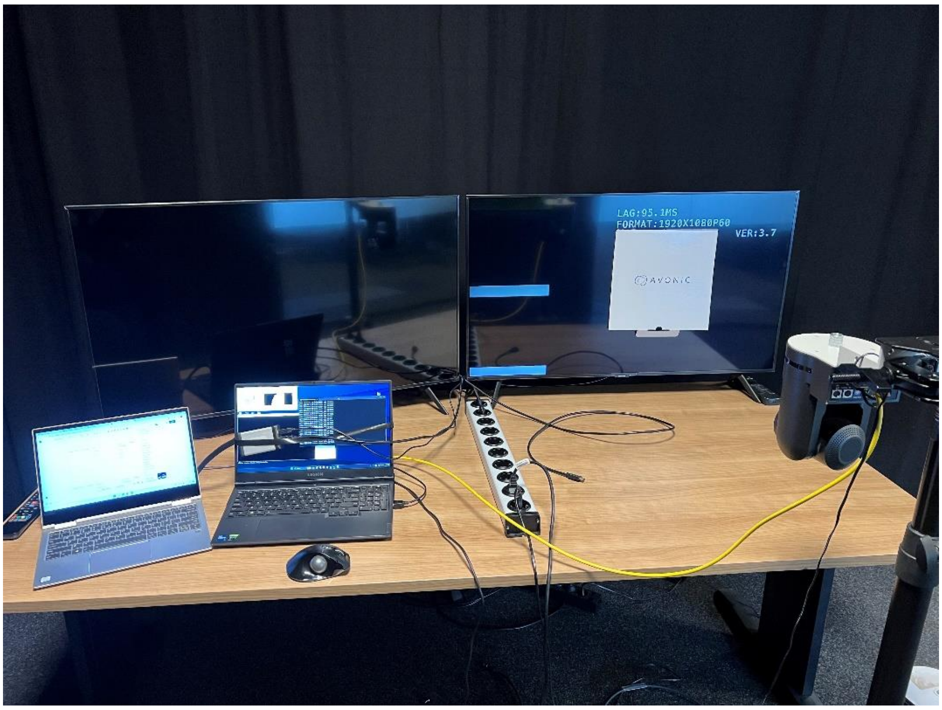
Test 6


LAG:95.1MS
FORMAT:1920X1080P60
VER:3.7
AVONIC

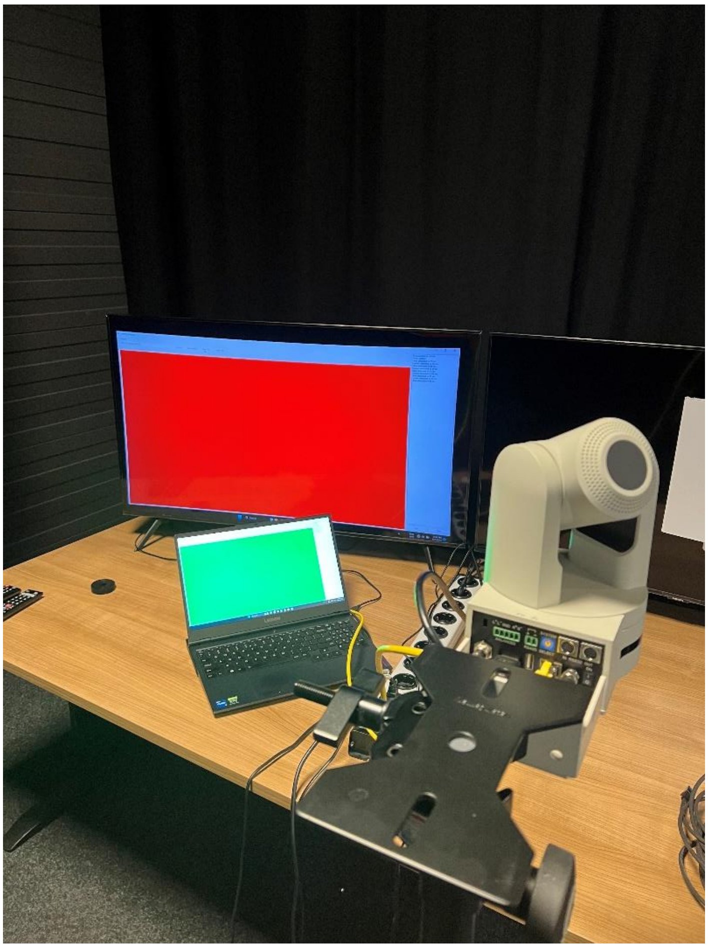
Test 7


LAG:95.1MS
FORMAT:1920X1080P60
VER:3.7
AVONIC

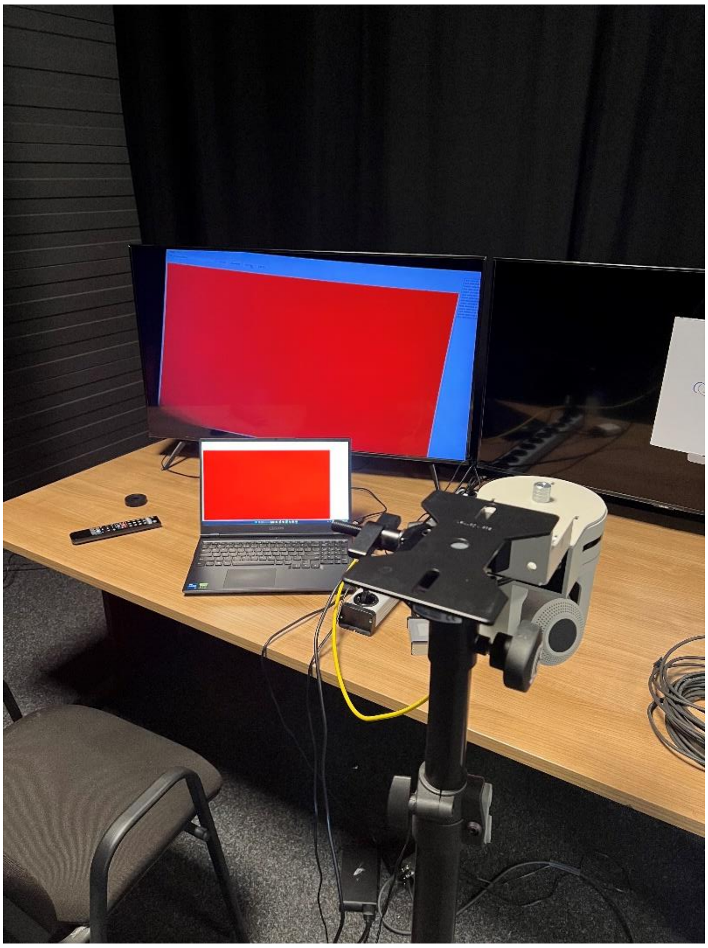
Test 8



Test 9



Test 10



7. Disclaimer

No claims can be made based on these test results. The results in this report apply only to the sample tested in the test setup of that particular test. No responsibility will be taken for a different outcome in a different setup with different devices.

Latency Lab is an internal department of Avonic.

When we say that cameras are not "frame perfect," we mean that the timing of each frame capture can vary slightly, and there can be slight differences between the duration of each frame. This can happen due to a variety of factors, including:

1. Sensor readout time: When a camera captures an image, the sensor needs to read out the information from each pixel. This process takes time, and the readout time can vary slightly from frame to frame.
2. Shutter speed: The duration of the exposure, or the time the camera's shutter is open, can also vary slightly from frame to frame.
3. Internal clock: The internal clock that controls the timing of the camera's operations can have slight variations in its frequency, which can result in slight variations in the timing of each frame.
4. Processor load: The camera's processor may have other tasks to perform, such as compressing the image data or running autofocus algorithms, which can affect the timing of each frame.
5. Environmental factors: Environmental factors, such as temperature or humidity, can also affect the timing of each frame.

Jitter in the internal clock can be a factor in causing variation in frame timing. If the clock frequency is not stable, it can result in slight variations in the timing of each frame. Additionally, if the clock is not synchronized with other devices that are being used in conjunction with the camera, this can also result in variations in frame timing.

It's worth noting that for most practical applications, the variations in frame timing are typically very small and are not noticeable to the human eye. However, in certain applications, such as high-speed video analysis or scientific experiments, even small variations in frame timing can be significant and can impact the accuracy of the data being collected.