IPhones are fast, but others respond to the challenge with the camera quality

Two Finnish measurement and test automation companies, OptoFidelity and Sofica examined iPhones and other leading smartphones by measuring camera speed and quality, UI reaction and response as well as video playback performance. The tested smartphones were Apple iPhone 5s, 5c and 5, Samsung S4 -and Nokia Lumia 1020 (only camera and video playback measurements). Camera measurements were carried out by Sofica, and video playback performance and UI performance measurements were carried out by OptoFidelity.

In general, no matter which iPhone it is, it is fast, but other brands beat the Apples in camera quality. On the other hand UI and video playback performance of the iPhones smashed Samsung.
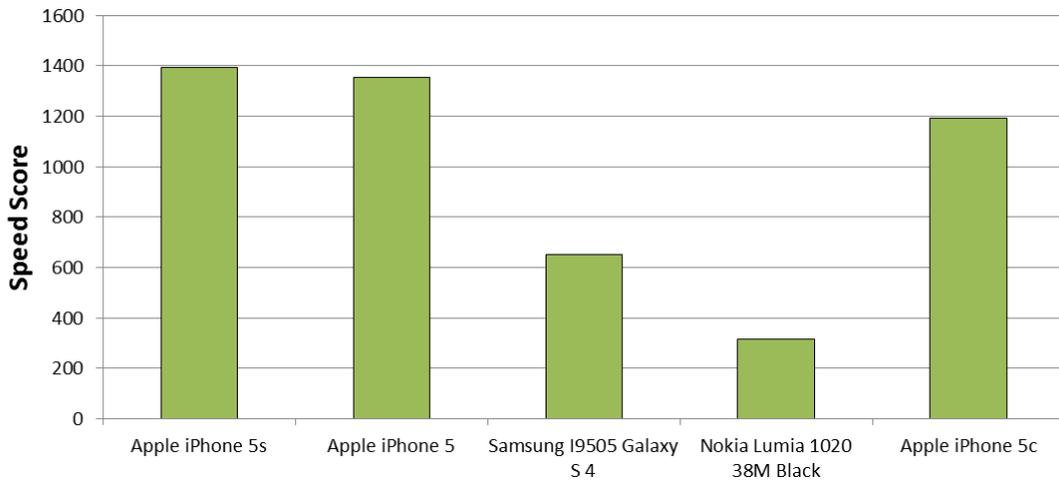
1. Camera speed and image quality measurement

Camera speed and image quality measurements were done in Sofica imaging laboratory by using ISO and CIE reference charts and high quality lights. The image quality measurements consisted of image resolution, image noise and color accuracy measurements.

Each measured device was rated with a Sofica Score, which is calculated by using a geometric mean of speed and quality scores. The scores are placed into a "Device Comparison Chart", an essential feature of Sofica Benchmark Report, which helps to compare the devices against others.

More information on Sofica SBR and camera measurements:
(http://www.sofica.fi/index.php?page=sbr).

1.2 Camera speed measurement results

In general, iPhone cameras are quick, especially consecutive capturing is outstanding. The fastest camera is in iPhone 5s, the second fastest in the older iPhone 5 and the third fastest in iPhone 5c. The European version of Samsung Galaxy S4 is surprisingly slow, especially image processing takes a long time. After all, the slowest camera is in Lumia 1020, in which a 41 megapixel sensor causes speed problems. Capturing one image takes over four seconds and five images in a row more than 20 seconds!

Image 1: Speed measurements: iPhones are faster than Galaxy S4 and Lumia

1.3 Camera quality measurement results

The quality differences of the phones are much smaller than speed differences. Onwards, the quality results were opposite to the speed measurements, since Lumia 1020 and Samsung S4 were better than iPhones. Both Lumia and Samsung scored nearly two times more quality points than the third one, the oldest version of iPhone 5. Surprisingly, 5s had the poorest quality.

An interesting observation during measurements is that Samsung S4 images are heavily post processed, since there is a lot of artificial sharpness and denoising. The shape of the MTF curves and exceptional good SNR values reveals these facts. The weakest point of iPhones seems to be the resolution (due to 8M sensor) and changes of color reproduction.

Lumia 1020 measurements were done using the latest Black software which boosted the image quality significantly. Even if the generic image quality of Lumia 1020 was exceptional good, the SNR and noise values were below average and the corner sharpness was poor.
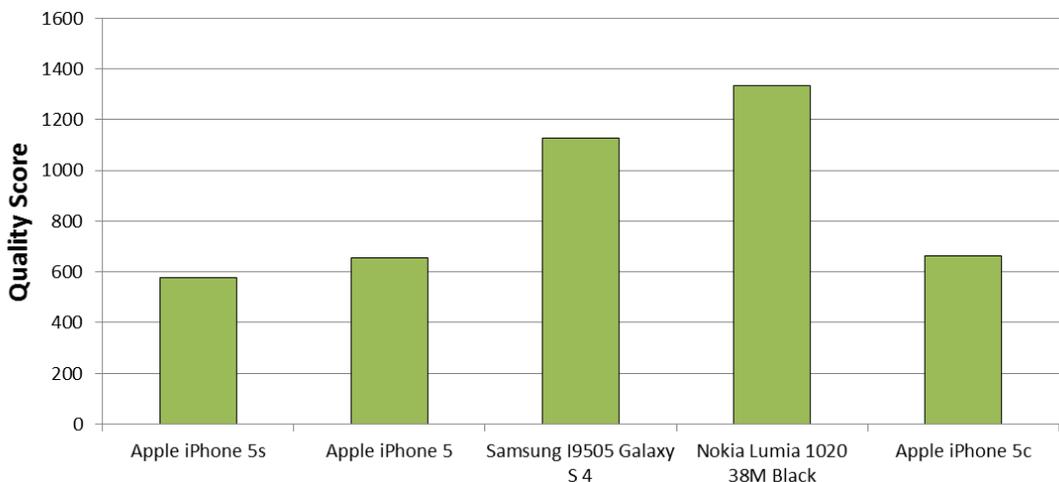
Image 2: Quality measurements: Nokia and Samsung beat IPhones in image quality

1.4 Device comparison chart

The summary of the speed and quality measurements is contradictory even though expected; devices with high quality scores were slow and vice versa. However, the deviation between speed results is significantly bigger than quality one.
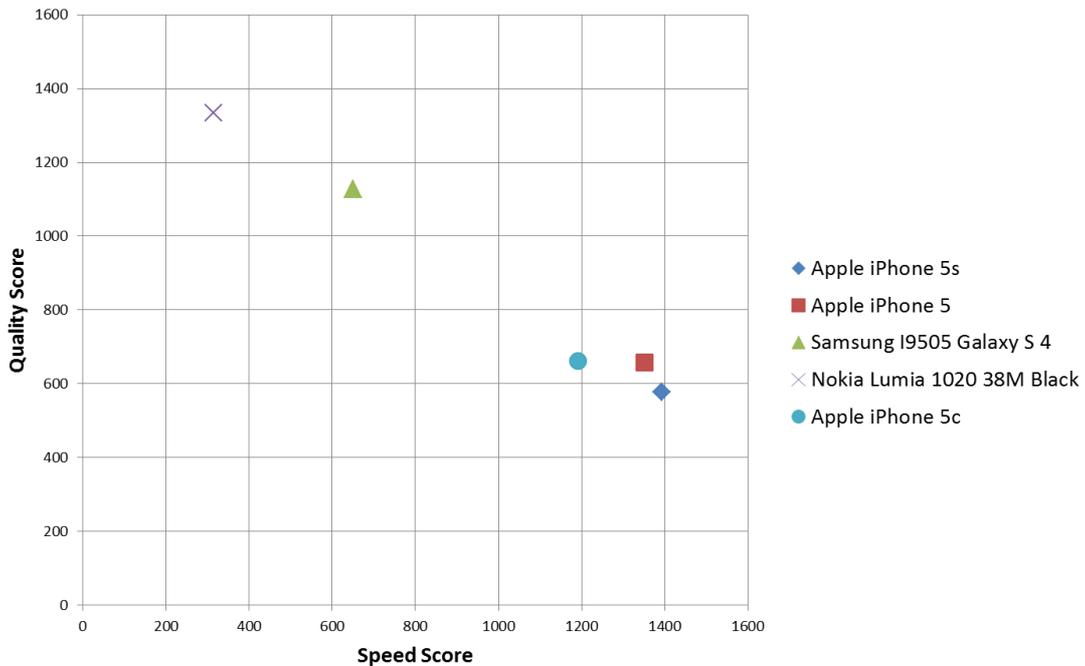

Image 3: Device comparison chart

According to the Sofica Score, which is geometric mean of the speed and quality scores, the best phone is iPhone 5 followed by iPhone 5c and 5s. Good quality scores of Samsung Galaxy S4 and Lumia 1020 cannot compensate poor speed results. Samsung Galaxy S4 has the fourth place and Lumia 1020 is the last one.
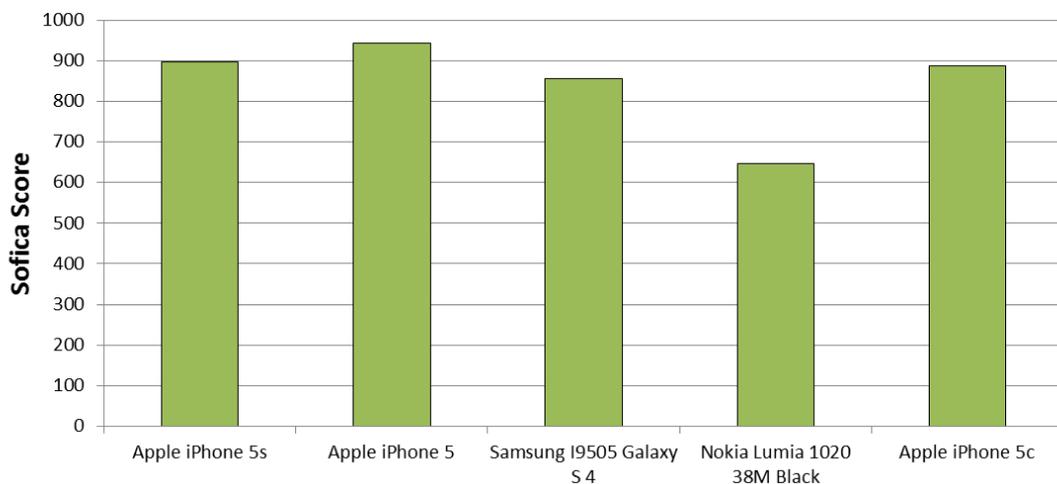

Image 4: Sofica Score

2. UI Latency and response measurements

The latency and response times of the devices were measured by OptoFidelity WatchDog. OptoFidelity WatchDog is a measurement instrument for analyzing user interface latency and response times during the whole R&D phase. In addition to measuring user interface response times, *OptoFidelity WatchDog* can also objectively quantify user reaction time to information on the user interface. In *this test case the* human interactions (taps) to open applications were measured. All measurements were triggered by tapping application icons and buttons, no hardware keys used. Only Device OS native applications were used.

Measurements were based on:

- Reaction time: Time starting from user tap release event to first visual UI change on device UI.
- Response time: Time starting from user tap release event to moment when UI interaction is completed, in this case application is opened and ready to use or user triggered functionality is completed.

The reaction and response times of the device were measured with following test cases:

- View finder launch time: Device camera view finder opening time. Measurement from tapping camera icon to the state when the View finder picture is visible.
- Photo capture time: Device photo capturing time. Measurement from tapping the photo capture button the state when Device is ready to take another picture.
- Calendar launch time: Calendar application launching time. Measurement from tapping the calendar icon to the state when application is ready to use.
- Calculator launch time: Calculator application launching time. From tapping the calculator icon to the state when application is ready to use.
- Photo Gallery open: Photo gallery opening time. Measurement from tapping the gallery icon to the state when application is ready to use.
- Music player launch time: Measurement from tapping music player icon to the state when application is ready to use.
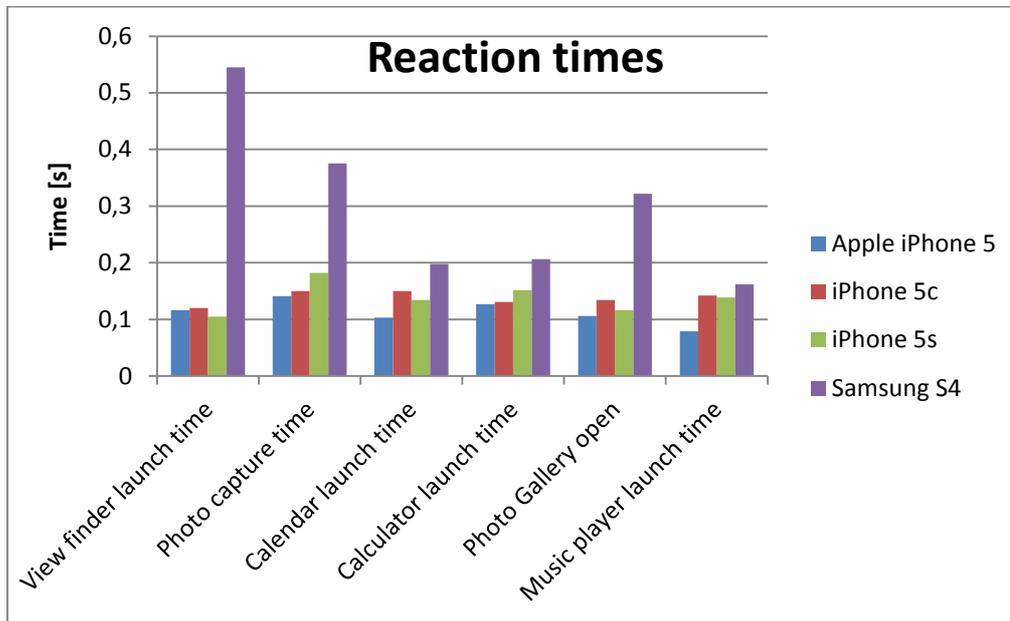
2.1 UI performance results

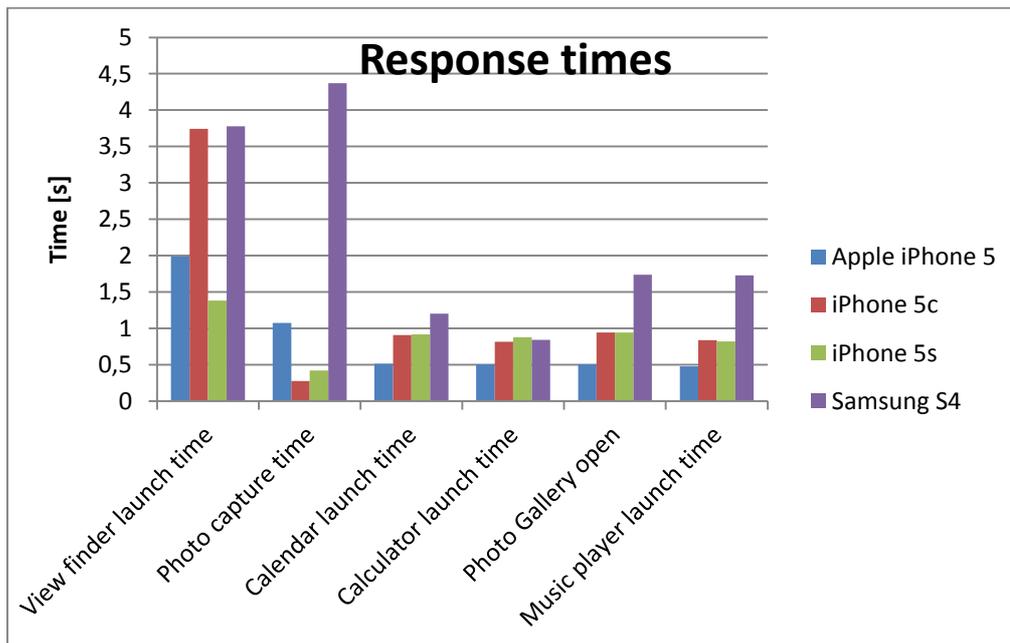**Image 5: UI Perfromance reaction times**

Image 6: UI Performance response times

All tested devices have a good overall UI performance. The old iPhone 5 version beats newer iPhone models both in reaction and response time almost in every test case. Still iPhones in general are the number one with applications reaction and response times. Samsung S4 is behind iPhones application performance but difference is not so significant that it would affect to the real user experience.

iPhone 5 and 5s have excellent camera application UI performance and the differences in reaction and response times are not significant. Only exception is the View finder launch time of iPhone 5c which is not in line with other measurements of the model.

S4 camera UI performance is much slower compared with iPhone 5, 5s devices. Difference is caused by slower camera auto focus. Especially the photo capturing time of Samsung S4 is significantly slow.

In general, the results of UI camera performance are very consistent with the results of Sofica camera measurements. WatchDog measurements were not carried out for Lumia 1020.

3. Video Playback Performance

Video Playback Performance was measured by using OptoFidelity *VideoMultimeter* measurement device. *OptoFidelity VideoMultimeter* is a professional measurement solution for measuring the true and objective video playback performance of mobile, tablet or any multimedia device.

In this test we measured the playback of a HD video (24 fps) from YouTube and the playback of a local H.264 video stored to the device with the following image qualities and speeds:

- Video resolution 720 p, speed 30 fps
- Video resolution 1080 p, speed 30 fps
- Video resolution 720 p, speed 60 fps
- Video resolution 1080 p, speed 60 fps

Test videos were generated with OptoFidelity Test Video Generator.

Three qualities were measured in the test. First of all we measured frame interval deviation, which shows to user as jerking. The target value for deviation is 0 msec. The other measured value was the average speed over the whole video clip that is AVG fps. The desired value varies depending on the reported speed of video (24, 30 and 60 fps). The third measured quality was the percentage of dropped frames over whole clip. If the dropped frame value is bigger, the user can see this as jerking of the video.

3.1 Video Playback Performance Results

The video playback performance of both iPhones is very good and the performance of 5c is as good as 5s. The playback is very smooth and both versions repeat local video quite perfectly and almost without any deviation. On playback of YouTube there is a little deviation in both models, but the amount of deviation is less than ±10 msec. Anyhow 5c could not repeat local 60fps HD video at all, but this is a more of a feature of the phone, not failure in the test.
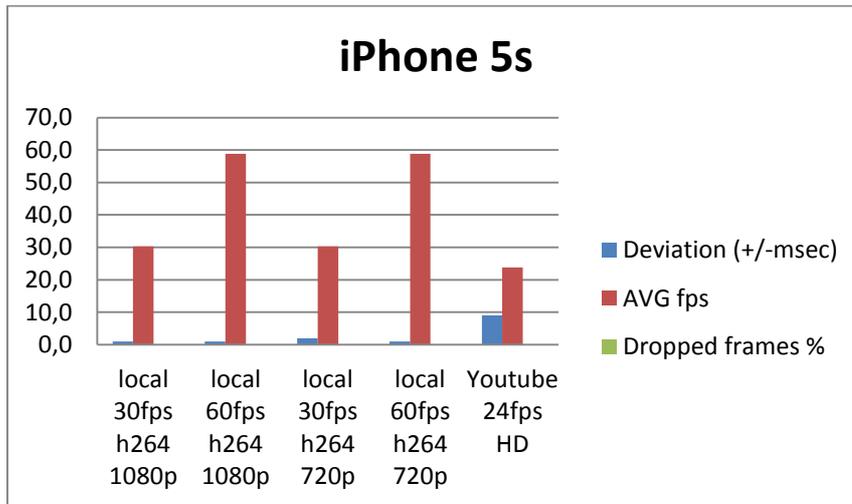
Image 7: iPhone 5s Video playback performance
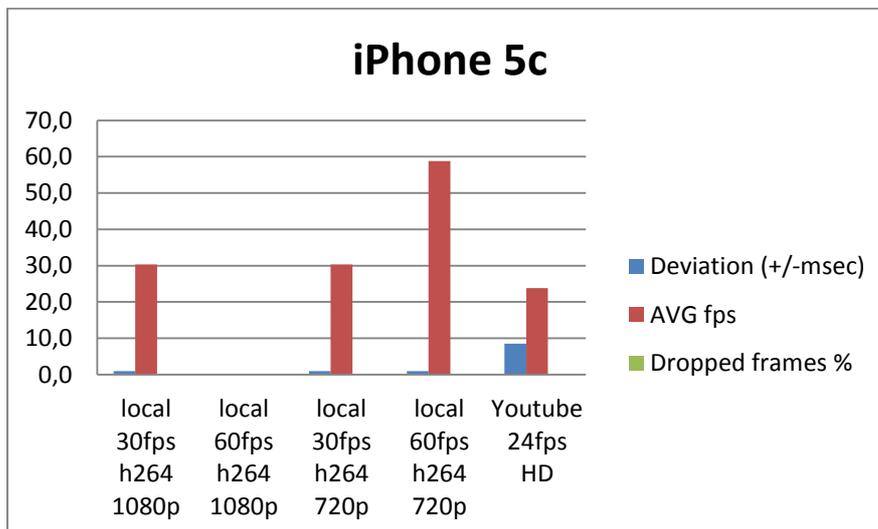
Image 8: iPhone 5c Video playback performance

The video playback performance of Samsung Galaxy S4 is mediocre. If compared to the price of the phone, performance is not acceptable. On YouTube playback there is a significant deviation (more than ±10 msec) and the amount of dropped frames is visible for a consumer. Either Samsung S4 could not repeat local 60fps HD video at all.

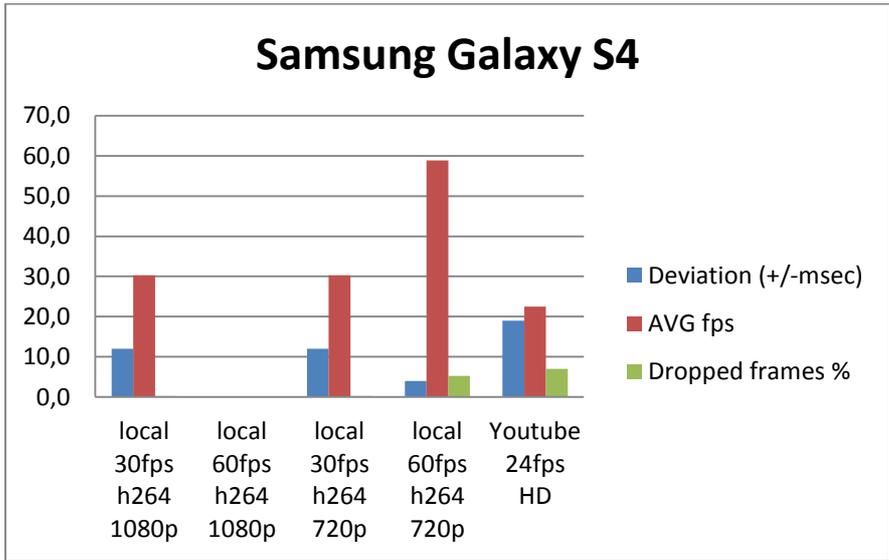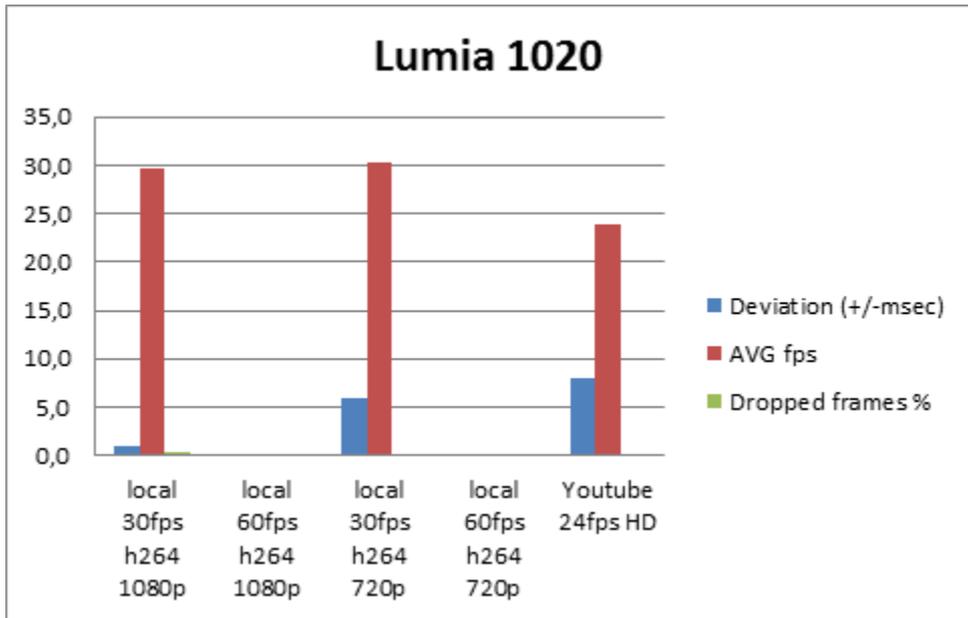**Image 9: Samsung S4 Video playback performance**

Image 10: Lumia 1020 Video playback performance

The overall video playback performance of Lumia 1020 was very good, but the failure to play 60fps videos at all is a big minus for phone in this category. When downloading 60 fps videos, the phone informs that there might be a problem with video playback. Then user has to make a choice to download videos as they are or to carry out a conversion.

No conversion was made for the report measurements, but the effect of converting was tested afterwards. After the conversion the video playback performance of Lumia improved and the phone played the videos. Due to conversion process, phone was dropping frames from 60fps video and eventually played converted video according to 30fps.

4. Overall Conclusion

Despite of some camera quality issues, iPhones are sleek and strong operators in the overall results. All the iPhone models have a finished touch and there are also surprisingly small differences between 5, 5s and 5c models.

Even though Samsung had good camera quality, there is more variety in the other results. Especially camera speed and the video playback quality of a HD video from YouTube weakened the overall performance of Samsung.

Lumia 1020 was the weakest phone in the test, but it has some very strong qualities as well. Exceptional good image quality and video playback performance are the strongest features of Lumia.

More information:

www.sofica.fi

www.optofidelity.com /sales"@"optofidelity.com