VCX - FORUM

Overview

GREETINGS

Dear Members and Visitors,

My personal goal over the past two decades has always been to improve the quality of cameras by providing test equipment and procedures to determine the quality and performance of cameras. I am very happy that VCX has picked this up for camera modules in mobile phones and managed to get the smart phone industry together.

In the book and on the website you will find detailed information on how this got together and how procedures work to ensure objectivity and provide a real help to customers on which phone includes an excellent camera.

Best regards,

Dietmar Wüller, VCX-Forum CEO

Welcome to VCX. As an association with trust and vision, it is important to us that you always find your way from the beginning. We have therefore put together this guide as our service manual.

On the following pages, you will learn about the VCX standard and our service. If you have any questions that remain unanswered, I am happy to answer you by e-mail 24/7.

Best regards,

Benjamin Pak, Coordinator

V   C   X

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*I*ntroduction -

The association of Vision and Trust

Due to the fast-evolving technologies and the ever-increasing importance of imaging in social media, the camera is one of the most important components of today's smartphones. Nowadays, smartphones are taking over a big share of the compact camera market. A simple reason for this might be revealed by the famous quote of Chase Jarvis:

"The best camera is the one that's with you".

Smartphones have essentially replaced low-to-mid end compact cameras, thanks to better imaging apparatus, convenience, and connectivity.

With the vast choice of devices and great promises of manufacturers, there is a demand to characterize image quality and performance in very simple terms in order to provide information that helps users choose the best-suited device. With a plethora of choices, exaggerated marketing claims, competing technologies, and techno mumbo-jumbo have created a confusing situation for customer planning for device acquisition; A market devoid of a transparent, open, and objective scoring system has exacerbated the situation.

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The VCX (Valued Camera eXperience) forum was established to create and maintain an independent, objective and transparent standard for smartphone camera assessment.

The Association is a **non- profit organization** that aims to bring together the world's smartphone camera manufacturers, camera component producers, chipset/ISP vendors, image quality labs, researchers from academia and other stakeholders in the mobile industry. VCX-membership is open to any organization that wishes to further the goals of VCX.

The forum aims to imbibe the latest developments in the camera industry and keep the score generation process and algorithms to reflect image quality as perceived by the user.

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It is more than 15 years ago that Vodafone started to test the cameras that got bundled with their services based on so-called key performance indicators (KPIs). The test procedure has been developed together with Image Engineering who established the first independent test lab for cameras in 1997 and contributed to many of the existing ISO standards for camera performance tests. The name was Vodafone Camera eXperience which was used internally.

When in 2016 the test results that got published by another institution were questioned by many industry members for their objectivity Vodafone and Image Engineering decided to donate their developments to the community and in 2017 the *VCX-Forum e.V.*, a non-profit organization, was established.

The abbreviation VCX is still used but the name behind it changed to

"Valued Camera eXperience."

Today the organization is member-driven and Vodafone and Image Engineering are members among about two dozens other companies including almost all of the big mobile phone manufacturers, chipset vendors, module manufacturers, and labs. All members are united in their intention to create a quality and performance measure that allows to compare their smartphone cameras with the ones of others and provide guidance to the customers on which camera to choose. That way the image quality of smartphone cameras is comparable and will be improved in the future.

V   C   X

"VALUED CAMERA EXPERIENCE"

VCX scoring system was born out of the need to create an transparent and objective image quality assessment system from the perspective of the consumer.

The VCX score aims to enable the comparison of camera accuracy and performance. A high score indicates an excellent camera performance for consumers. That way the VCX score is not just a simple comparison system but will also serve as a standard to help guide the industry to develop better cameras.

The mission of the association is the creation and dissemination of a standard for objectively assessing the image quality of cameras in mobile devices such as smart phones, tablets, computers, notebooks, etc. The main objective is to provide independent and credible information to consumers and industry likewise.

The VCX-Forum seeks to be the most objective assessment and the ideal mediator between consumers and companies.

PURPOSE AND PRINCIPLES

VCX-Forum aim to bring together the world's smartphone camera manufacturers, camera component producers, chipset/ISP vendors, image quality labs, researchers from academia and other stakeholders from the mobile industry. VCX-membership is open to any organization that wishes to further the goals of VCX.

The Association is a not-for-profit organization; it does not primarily pursue its own economic ends.

The members shall not receive any profit shares, and in their capacity as members, will also not be granted any other benefits from the funds of the Association. No person may be benefited by distributions that are outside of the Association's purposes, or by way of disproportionately high remuneration.

Principles

The initiating companies have the intention and motivation to bring the VCX Score to a larger audience. The list below includes opening up aspects of VCX to key industry players. VCX is based on 5 tenets which guarantee results that can be mapped to real life experience:

Tenet 1. VCX measurements shall ensure the out-of-the-box experience

This tenet dictates that the device under test shall ideally be obtained from an unbiased/untainted source i.e., a random sample/s from a store that sells the device under test. This ensures that neither special samples from suppliers nor custom hardware/software are accepted. The results are obtained from a device/devices that are launched onto the market. The device is tested using the default camera application and setting (except for flash test cases).

Tenet 2. VCX shall remain 100% objective

The complete process on how the score is created from measurements is based on objective analysis of the device under test, followed by a fixed and unbiased processing of the numerical results. No human interaction or subjective scoring is involved when creating the VCX score.

Tenet 3. VCX shall remain open and transparent

The VCX score can be accessed by anyone and not restricted to device vendors or mobile operators. The VCX score is designed to reflect the user experience with a mobile phone camera to make it much easier for end-users to decide on a new device. The VCX score is published on the website www.vcx-forum.org. This white paper details the entire testing and measurement procedure, which is open to critique and scrutiny by the imaging community at large.

PURPOSE AND PRINCIPLES

High-level weighting criteria are published along with the details of high-level components of what makes the final VCX score (performance/response and image quality in various lighting conditions).

Tenet 4. VCX shall employ/use an independent imaging lab for testing

VCX as a quality improvement process has been adopted by various entities in the mobile imaging industry, but the final results are obtained from an independent trusted lab. Other independent imaging labs are welcome to join the VCX process, although the final results on the www.vcx-forum.org website, are restricted to be measured by trusted labs to ensure the highest quality results. Processes and procedures for inclusion of other entities to actively contribute to VCX are underway.

Tenet 5. VCX shall seek continuous improvement

VCX has been developed over several years with close cooperation between Vodafone and Image Engineering. Continuous input from Vodafone customers has been taken into account for improvement. Several vendors from the mobile device and chipset industry are now members and have already contributed positively to its improvement and this cycle of feedback from customers and vendors shall continue.

LOGO COLOURS
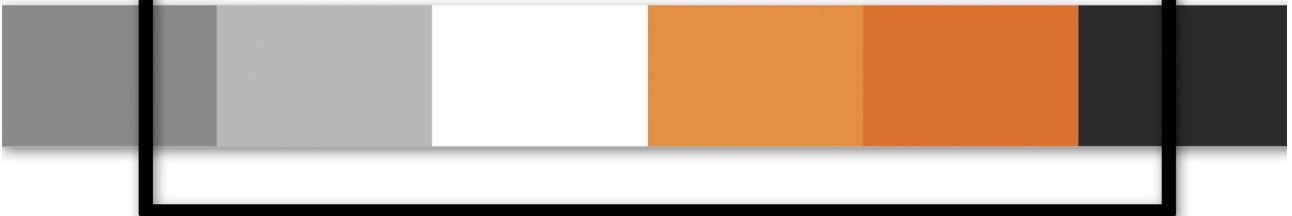
These are examples of how to label the Logo

The Logo is the abbreviation for Valued Camera eXperience, and consists of neutral colours.
The logo can be used on its own or in combination with the full name – Valued Camera eXperience.
Depending on the size of the Logo, the full name " Valued Camera eXperience" can either be placed
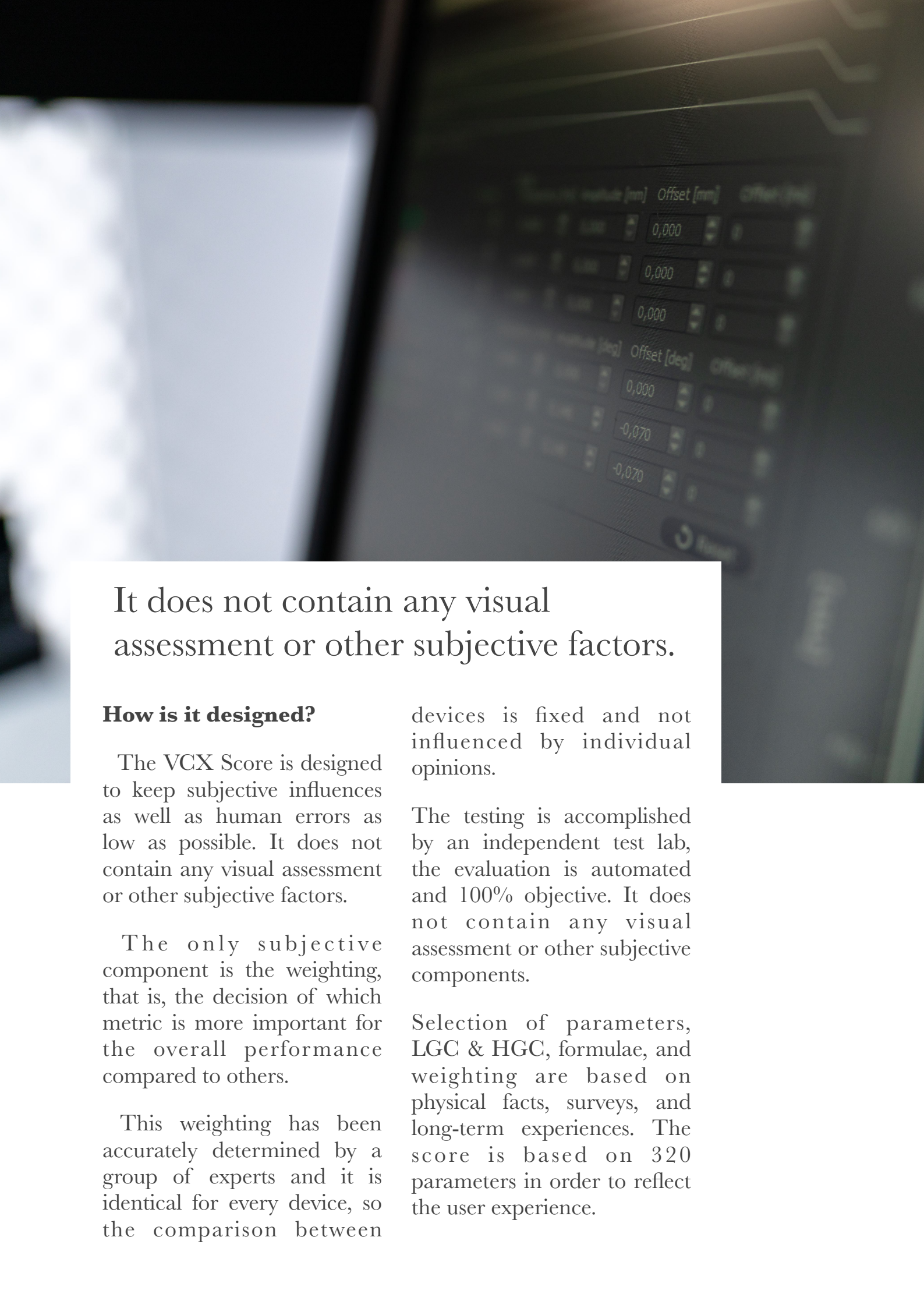in-between the brackets or directly underneath the brackets.

What is VCX score —

The VCX score is a numeric indicator of the camera value of mobile phones and products and is based on an objective assessment of equipment.

The range is designed in such a way that a value of 100 means that the device yields the best possible result in every metric that is achievable with today's camera technology. The score is the sum of the rear camera (80%) and front camera (20%).

It does not contain any visual assessment or other subjective factors.

How is it designed?

The VCX Score is designed to keep subjective influences as well as human errors as low as possible. It does not contain any visual assessment or other subjective factors.

The only subjective component is the weighting, that is, the decision of which metric is more important for the overall performance compared to others.

This weighting has been accurately determined by a group of experts and it is identical for every device, so the comparison between devices is fixed and not influenced by individual opinions.

The testing is accomplished by an independent test lab, the evaluation is automated and 100% objective. It does not contain any visual assessment or other subjective components.

Selection of parameters, LGC & HGC, formulae, and weighting are based on physical facts, surveys, and long-term experiences. The score is based on 320 parameters in order to reflect the user experience.

The entire analysis is only based on the captured images of test charts and scenes under defined lighting conditions and the analysis algorithms are applied to these images. For each of the metrics used, a single score is calculated via bespoke algorithms/formulae developed specifically for VCX Forum by VCX members, derived from use-case studies. Based on a fixed algorithm, the score is calculated using the numerical results. The total score is a weighted sum of the individual scores.

Why is it objective?

All devices are tested under the same conditions under multiple illumination levels and use cases. All images are analyzed without any human interaction. The same parameters, LGC & HGC, formulae, and weighting are applied to all devices in exactly the same way. The measured results are converted into the VCX score in exactly the same way. To prevent manufacturers from cheating, the detailed scoring process is limited to members who have to sign the association code with ethical standards.

To be improved

The weighting of the different aspects of the image quality is the result of a case study on how mobile phones are used as well as internal research. It correlates well with the outcome of other independent studies.

The transformation of metrics into scores is performed under the definition of a theoretical worst and theoretical best value. The scaling is performed in different ways between the extreme points, depending on the metric itself.

For some metrics, the correlation between "metric" and "influence in image quality" is linear, so the score is a linear function of the metric. This would be in the case of a simple "the higher the better" or "the lower the better" assumption. For others, this assumption is not true. Some metrics require a different approach to the one previously mentioned because it would not reflect the perceived quality. Sharpening is a good example of this behavior. No sharpening is not beneficial for the image quality, as an image would appear flat. At the same time, too much sharpening very quickly results in an artificial and unpleasant. So, there is a "sweet spot" below or above which leads to a reduction in the score.

We regularly check the latest development in the camera industry and update every year the test procedure, the score generation process as well as the weighting of the scoring system with the continuous evolution of technology. e.g. it does not reflect the improvements in camera performance or when new technologies need to be included in the procedure.

Mission

All of us have noticed the increase of image quality produced by cell phone cameras especially under low light conditions over the past years. This also means that test procedures need to evolve and keep track of technological development. To make sure that VCX produces meaningful results in the future the standard department meets at least three times a year and discusses and implements new test procedures. On a year basis, VCX tries to update the whole procedure and take it to the next generation.

With its effort, VCX offers an objective consumer-oriented test procedure for mobile phone cameras that are widely accepted and used in the industry and known for its high-quality results. The publications on the website do not only contain the benchmarking numbers but also many of the images that were captured to achieve the results. That way consumers and other visitors to the website can objectively compare the quality themselves.

A star based rating system in addition to the score. This will make it easier for everyone who is the market to buy a new device to understand the quality of the camera at a glance without getting into the details of the scoring system. For all who are interested in a bit of deep dive into the score, the details are always available. The star rating system will also make it easier for phone manufactures to communicate the quality of the cameras on smartphone in a simple and effective way. Let's get into what this all means right away

5 Stars: crème de la crème. The camera offers top quality results out of the box and makes use of the best of the current technology. Among the 5 star phones, there might be minor differences in the features but overall these phones are a cut above the rest.

4 Stars: These cameras are top crop with little compromise. Some of these might offer a special feature set like ultra-wide angles, super-zooms, etc., which make them special. The phones that have earned 4.5 stars are the best among this group.

3 Stars: These phones will satisfy most people who are looking for a camera that performs effortlessly out of the box. They offer satisfying performance across the range. The phones earning 3.5 stars are the better ones among this bunch.

2 Stars: Mid-tier performance that could keep quite a few of us happy for most situations. These might not be the best for low light, zoom or fast focus but for everyday purposes, these would be perfect. The phones earning 2.5 stars are the better performers in this group.

A single star: These phones provide acceptable performance out of the box for daily use. The phones with 1.5 stars perform better in this group.
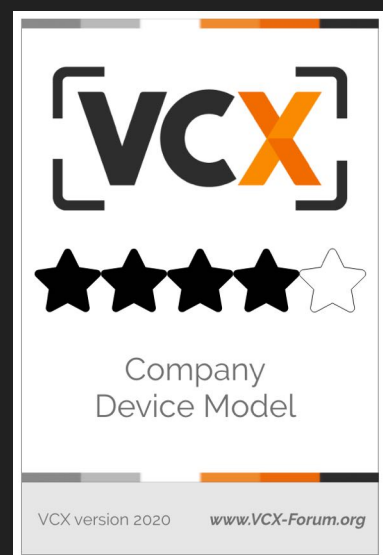
< VCX-Forum star-rating badge - Color >
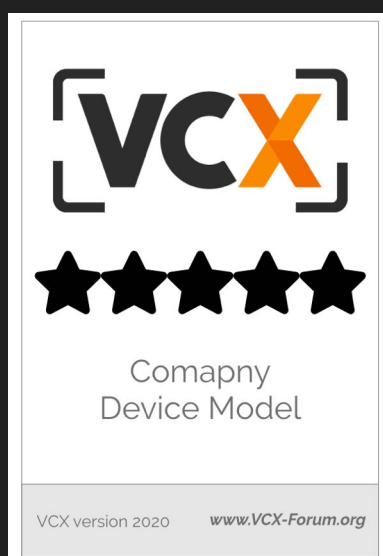
< VCX-Forum star-rating badge - Plain >

The overall process is as follows.

We gather information about market trends and new products. Due to a limited budget the board needs to select which devices to test.
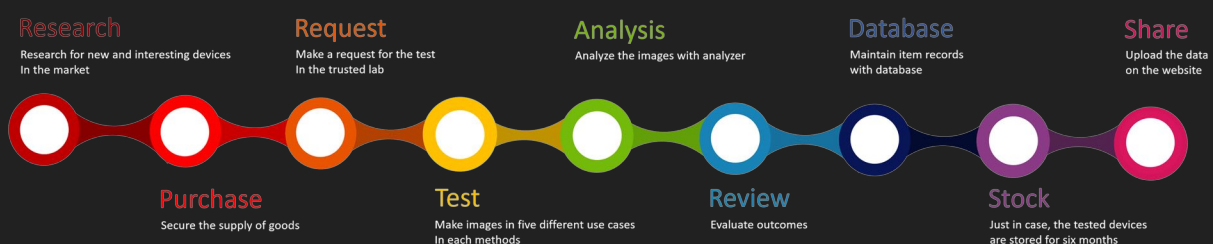
The product will be purchased directly from a shop in the same way as an ordinary user would. (Please note that this course may change for timing and marketing reasons later.)

VCX requests a test from one of the "Trusted Laboratories". This includes the three-element test mentioned above as well as shooting and analysing a certain number of images captured under five different lightning and capture conditions.

The analysis is computational and automated. The resulting measurement results are converted into actual scores after review.

Test data, device information, and extracted images are stored in the database. The used product is also kept for a certain period of time.

Finally, the score will be made available to members and the public via the Internet website.

Research
Research for new and interesting devices
In the market

Request
Make a request for the test
In the trusted lab

Analysis
Analyze the images with analyzer

Database
Maintain item records
with database

Share
Upload the data
on the website

Purchase
Secure the supply of goods

Test
Make images in five different use cases
In each methods

Review
Evaluate outcomes

Stock
Just in case, the tested devices
are stored for six months

Objective - VCX-Forum membership

invite participation from key industry players to contribute, foster, enhance and extend the VCX to suit the changing expectation of customers.

Key advantages
1. Access to the C1 level documents 1 such as scoring calculation config file, test procedure document for all regular and honorary members.
2. All members (except honorary members) are entitled to set up an affiliated lab by following the rules and regulations stipulated by the lab authority. The VCX-Forum e.V. will support all members (except honorary members) in implementing VCX tests and usage. (e.g. information about setting a lab up)
3. All members can use the VCX assets.
4. All members have the opportunity to cooperate with the same field experts in many different companies
5. All members can sponsor a VCX test.
6. Influence the management and direction of VCX (non-technical)
7. Voting rights (technical and non-technical)
8. Shape an upcoming industry standard

Notes
• Members are obliged to stick to this code, especially the code of ethics.
1. Yearly partnership fee (whose expenditure is planned to be transparent)
2. Typical expenditure to include customer surveys, organizing conferences, tool development, website/portal maintenance, marketing etc.)
3. Commitment to contribute to the advancement of VCX
4. Restricted control on VCX management and VCX-Core team
5. Membership is not permanent and not irrevocable
6. No veto rights
7. Lab certification, process, equipment, training are not part of the VCX partnership framework
8. 8. Roles and responsibilities need to be fleshed out of course. Aspects: Weighting, formulae, parameters, process, analysis, test procedure, tools, and standards.

The VCX Forum has been working with its members on the system and infrastructure.

Now, we will strive to improve our technology to develop and exchange accurate and objective quality and performance indicators that are our ultimate goal.

We will also serve as a compass for the mobile camera industry. This requires constant attention and encouragement from you. We appreciate your interest in VCX-Forum.

THANKS FOR READING

C o n t a c t

VCX-Forum e.V.

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Address	Im Gleisdreieck 5, 50169, Kerpen-Horrem, Germany
Phone	+49 2273 99991 90-1
Fax	+49 2273 99991 10
Email	info@vcx-forum.org
Website	**vcx-forum.org**