



Hikvision Quality White Paper

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HIKVISION[®]

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Letter from President of Hikvision International Product and Solution Center

Over past years, Hikvision has experienced record growth and won the trust of customers globally, becoming the world's leading provider of innovative security products and solutions. In this development, quality management has been a pillar for the success of the company. To create values for customers with high quality products and solutions is the common faith that all dedicated people of Hikvision have shared and the principle we have conducted in the day-to-day operations.

At Hikvision, we make it clear that the quality is considered first when conducting businesses, as delivering quality and reliable products and solutions is the basic requirement for the trust of customers. Meanwhile, we emphasize technological innovations in improving the quality and take them to provide leading products and solutions for the market. And we judge our quality management based on customer satisfaction, for our goal is to meet customers' requirements and solve their problems.

In the quality management, we are believing and following the philosophy of "Do It Right the First Time". Our quality management process is so designed that it conforms with high and strict standards at the very start in all aspects of product life cycle, covering material quality classification management, exploration and innovation for design quality, intelligent enhancement for manufacturing quality, and quality services for all sectors.

These quality management systems and procedures support us in achieving customer satisfaction and continuous improvement throughout our businesses. We maintain our absolute commitment to providing high quality products and solutions and delivering greater values to our customers.

Frank Zhang,
President of Hikvision International Product and Solution Center



About this document

About this document

This document aims to provide an overview of Hikvision's research and practices in quality management, providing users with an open and transparent perspective to understand Hikvision's quality management capabilities.

Hikvision will update this document in real time; the latest version will be made available on our official website.

(<https://www.hikvision.com/cn>).

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Revision History

First released in April 2020.

About Hikvision

Hikvision is the world's leading provider of innovative security products and solutions.

Hikvision now has more than 40,000 employees, over 19,000 of which are R&D engineers. The company annually invests over 8% of its annual sales revenue to research and development for continued product innovation. Hikvision has established a complete, multi-level R&D system that includes every operation from research to design, development, testing, technical support, and service. Centered at its Hangzhou headquarters, the R&D teams operate globally, including R&D centers in Montreal, Canada and London, the UK, as well as five cities in China.

Hikvision advances the core technologies of audio and video encoding, video image processing, and related data storage, as well as forward-looking technologies such as cloud computing, big data, and deep learning. Over the past several years, Hikvision deepened its knowledge and experience in meeting customer needs in various vertical markets, including public security, transportation, education, healthcare, financial institutions, and energy, as well as intelligent buildings. Accordingly, the company provides professional and customized solutions to meet diverse market requirements. In addition to the video surveillance industry, Hikvision extended its business to smart home tech, industrial automation, and automotive electronics industries — all based on video intelligence technology — to explore channels for sustaining long-term development.

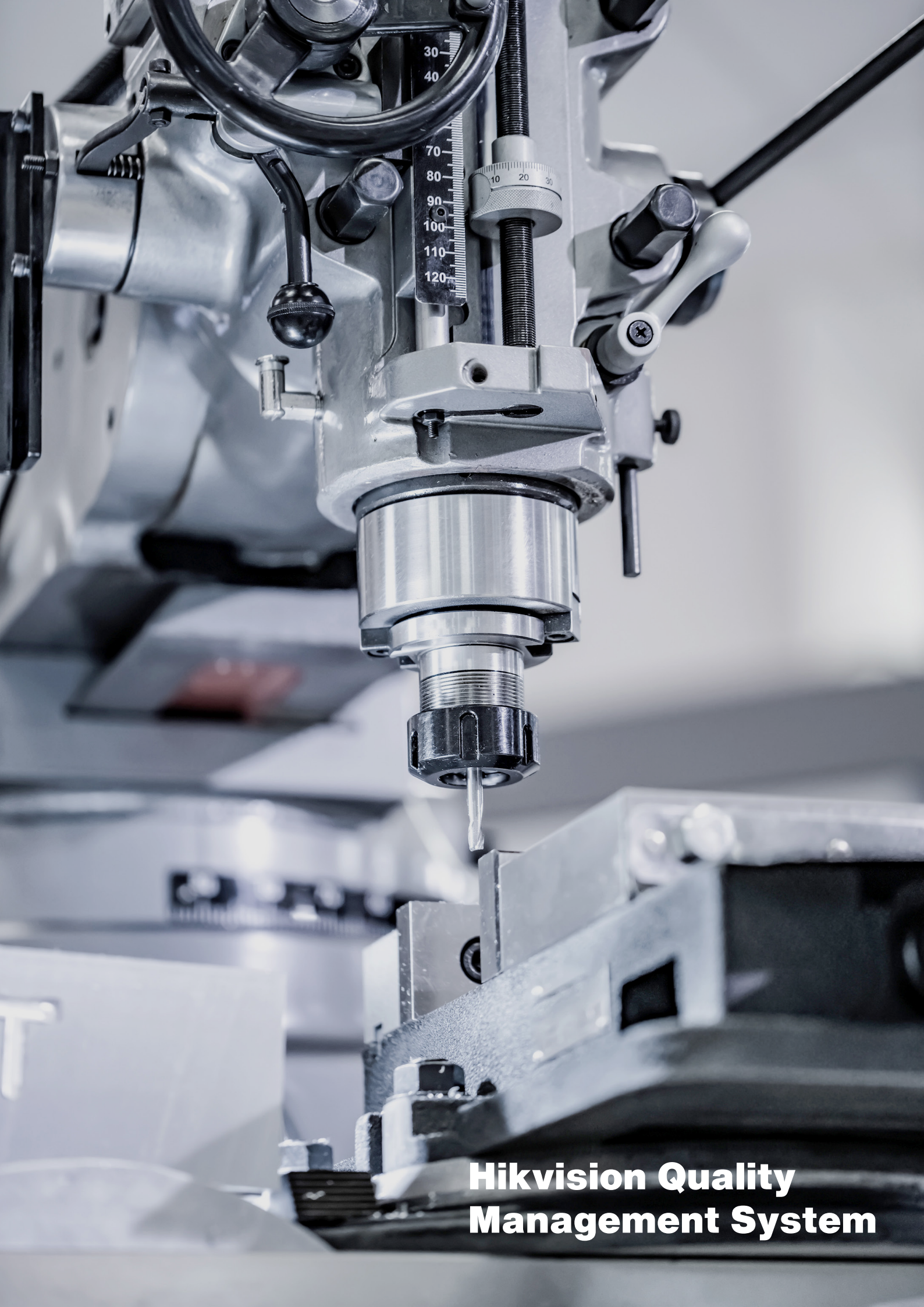
Hikvision has established one of the most extensive marketing networks in the industry, comprising 59 overseas regional subsidiaries, to ensure quick responses to the needs of customers, users and partners. Hikvision products serve a diverse set of vertical markets covering more than 150 countries.

Hikvision went public in May, 2010, and is listed on SMEs Board at Shenzhen Stock Exchange.

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**Hikvision Quality
Management System**

1. Hikvision Quality Management System

1.1 Management System

Management System Certification

Hangzhou Hikvision Digital Technology Co., Ltd. (short-named as Hikvision) has established a comprehensive quality management system in accordance with the requirements of international standards since the company's establishment. In 2005, this quality management system is successfully certified in compliance with the ISO 9001 Quality Management System for the first time, and the system has been maintained to date.

To realize the company's quality philosophy - "Achieving Customer Success, Doing It Right the First Time (DRIFT)" - Hikvision is constantly improving its management system to more effectively meet customer requirements:

Improving the management system to promote high product quality

- The R&D process has passed CMMI (Capability Maturity Model Integration) Maturity Level 5 (the highest level) certification;
- A management system for hazardous substance processes covering all business processes has been established, so as to ensure that products comply with RoHS environmental protection requirements;
- A measurement management system has been established based on process data detection and management, to ensure the accuracy and effectiveness of the data;
- A supply chain security management system has been established to ensure timely and safe delivery of products;
- The IATF 16949 Automotive Quality Management System (QMS) has been introduced to carry out quality control activities with high and exacting standards and requirements;
- Other certifications include: information technology service management system, five-star after-sales service certification, five-star (the highest level) green supply chain evaluation for security camera and disk storage, and Zhejiang manufacturing certification.

Focusing on quality and comprehensive balance to efficiently improve business operations

We have established a comprehensive management system involving many areas including environment, health, safety, social responsibility, and information security:

- An ISO14001 Environmental Management System and Energy Management System to save energy, reduce emissions and improve employees' working environment;
- An ISO45001 Occupational Health and Safety Management System and Corporate Social Responsibility System, focusing on health and safety from the perspective of employees;
- An information security management system to strengthen information security management, prevent disclosure of business information, and ensure the continuous operation of the company.

Hikvision has made unremitting efforts to optimize quality management in many aspects covering material, R&D, supply chain, and service. We have aligned ourselves with world-class companies, drawing on successful practical experience to create a unique "customer satisfaction-oriented" management system for Hikvision. With this comprehensive quality management system, we will continue to strive to provide better products and services for customers worldwide.

Market Access Product Certification

Thanks to the trade globalization, increasing numbers of countries and regions have established market access and industry certification systems to better protect the environment, and the health and safety of product users.

Since the global regulatory environment and technical standards are complex and continuously changing, the requirements imposed by industrial regulations are becoming increasingly stringent. In response to global market demands, Hikvision's professional product certification team cooperates closely with world-renowned third-party certification agencies to formulate product certification strategies meeting market requirements, thus maintaining timely and efficient one-stop delivery of product certification.

Hikvision is also committed to establishing an efficient product certification and compliance system. By training key employees and ensuring that they are well-informed, we have improved overall certification and compliance awareness, while further improving certification and compliance related items in aspects like system processes and control activities.

CCC Certification

In December 2001, China's General Administration of Quality Supervision, Inspection and Quarantine issued the "Management Regulations for Compulsory Product Certification", replacing the existing import product safety and quality licensing system, and electrical product safety certification systems with a compulsory product certification system. China Compulsory Certification (short-named as CCC or 3C) is a statutory compulsory product certification system which protects consumers' personal safety and strengthens supervision of product quality. It governs and controls many areas including electromagnetic compatibility, safety, and radio frequency.

In the early stages, the scope of CCC's compulsory control for Hikvision products is identified, and product performance and specifications are designed in line with CCC certification requirements. Products are strictly inspected during the test phase to ensure full compliance with relevant requirements.

CE Certification

CE certification is a compulsory certification for electronic and electrical products available in the EU market. These products must meet CE certification requirements regardless of whether they come

from the European Union (EU) or other regions.

CE certification has different requirements for products with different features. That is, products with different features must follow different coordination directives, including: CE-EMC directive, CE-LVD directive, CE-RED directive, and CE-RoHS directive.

Hikvision has cooperated with well-known third-party CE certification agencies worldwide to select applicable CE certification directives based on products' features. If one product involves multiple categories, Hikvision will strictly comply with the requirements imposed by directives from all these categories.

CB Certification

The CB System is an international system operated by the IEC System for Conformity Testing and Certification of Electrotechnical Equipment and Components (IECEE). It serves as a mutual recognition scheme for product certification popular in countries worldwide and aims at promoting trade globalization and reducing the trade barriers resulting from differences in certification rules between countries.

The CB System is adopted to test the safety performance of electrical products and components in accordance with the International Electrotechnical Commission (IEC) standards; results are included in CB test reports. Products meeting the requirements can be granted with CB certificates, indicating broad worldwide recognition of their safety.

Hikvision attaches great importance to product safety. In addition to meeting sales regions' market access safety certification requirements, we perform relevant CB certification upon products in order to enhance the market competitiveness of their safety performance.

Explosion-proof Certificate

Combustible substances (including flammable gas/dust) can easily cause explosions when mixed with air and ignited. Electrical equipment for areas subject to explosion risk must incorporate specific explosion-proof design (including structural and electrical designs) to avoid ignition of nearby flammable substances during operation.

The explosion-proof certificates are issued for equipment/components used in areas with explosion hazards in China, indicating an assessment of their conformity, and imposing specific explosion-proofing requirements upon these products to ensure the safety of users and reduce the risk of explosion. Despite not a compulsory requirement for market access, its value is highly recognized in electrical product selection for the coal mining and natural gas sectors.

Hikvision has developed a specialized portfolio of explosion-proof products, including explosion-proof IPCs, dome cameras and hand-held terminals, to expand these products' application scenarios, and provide more safe and reliable products for sectors involved in areas with explosion hazards.

E-mark Certification

E-mark certification is a certification system for vehicles and major components, which is derived from regulations issued by the United Nations Economic Commission for Europe (UNECE). It focuses on the electromagnetic compatibility and flame retardancy of vehicles' electronic and electrical components.

Up to date, 56 countries in Europe are qualified to issue E-mark certificates. E-mark product testing is performed by laboratories accredited by certification agencies of the Ministries of Transportation of UNECE member countries, with certificates issued after test report and ISO system approval. Certain agencies may require on-site factory audits of manufacturers.

When a requirement for E-mark certification of Hikvision products, including automotive cameras and DVRs, is identified based on target markets, this guides product design and testing. Once a product is completed, model testing is conducted by world-renowned third-party certification agencies, and E-mark certificates are obtained from the Ministries of Transportation of UNECE member countries.

1.2 Quality Management Organization

Hikvision's quality management is conducted by consistently revolving around the principles of "Leading Technology, Quality First, Customer Satisfaction, Continuous Innovation". To fully ensure products comply with customers' requirements throughout their entire life cycle, we must first establish an organization capable of realizing its conceptions, and assign clear duties and responsibilities.

Quality Management Committee

The Quality Management Committee is Hikvision's top quality management body. Composed entirely of senior managers in business area, it meets regularly to review and discuss quality levels, the current situation and key issues facing Hikvision products, and to clarify the strategic quality orientation, medium-term and long-term objectives.

Hierarchical Quality Management Architecture

Hikvision carries out total quality management (TQM), and implements quality management concepts through a hierarchical quality management architecture.

As the permanent organization of the Quality Management Committee, the R&D and Quality Management Department plans, organizes, supervises and promotes the quality management of products and services via the whole process from customer requirements to customer satisfaction. The R&D Quality Management, Manufacturing Quality Management, and Service Quality Management organize and promote quality management in their respective fields to ensure the implementation and realization of quality management strategies for product development, manufacturing, and service processes.

1.3 Quality Policy and Values

Hikvision's quality policy is "Leading Technology, Quality First, Customer Satisfaction, Continuous Innovation".

Leading Technology

Hikvision emphasizes technological innovation to take the lead in market trends and seize market opportunities leveraging advanced technologies.

Quality First

We always consider quality first when conducting business, ensuring product and service in compliance with customer requirements during operational management.

Customer Satisfaction

We judge our quality management based on customer satisfaction, continually listening to them and solving their problems.

Continuous Innovation

We are striving unremittingly to further improve our capabilities in management and technical innovation, enhance our capacity to meet customer requirements, and to achieve sustainability and excellence in our operations.

At the same time, the concept of "Achieving Customer Success, Doing It Right the First Time (DRIFT)" remains an integral part of our core values, forming a guiding principle for and basis of employees' conduct.

- **Achieving Customer Success**
In our customer-centric business, we create value for customers, understanding and fulfilling their current and future requirements, and solving their problems.
- **Doing It Right the First Time (DRIFT)**
We are striving unremittingly to improve employees' quality awareness, standardize quality activities, improve our quality capabilities, and to inculcate the DRIFT principle, in order to deliver customer success with the maximum efficiency and strongest competitiveness.

We are supporting quality promotion, education and training, and improvement and incentive activities, to firmly inculcate our employees with the "Achieving Customer Success, Doing It Right the First Time (DRIFT)" principle.



**Product Life Cycle
Quality Implementation**

2. Product Life Cycle Quality Implementation

2.1 Material Quality Classification Management

Hikvision has established a comprehensive management system for material quality. With a team of experts drawn from fields including material technology, quality management, failure analysis, and experimentation and testing, and by leveraging powerful business data systems (SAP, PLM, SRM, and MES, etc.), we have streamlined the quality data flow over the material and product life cycle to effectively manage processes from material selection and certification through to supplier selection and certification, supplier quality management, and incoming quality control, ensuring that our materials meet market and customer requirements.

2.1.1 New Material Selection and Certification

Hikvision's Device Application Department acts as a resource platform and business management department for material sourcing and technology management. We are striving to become an industry leader in device application, with a professional team engaged in areas including electronic and electromechanical components, PCB processing and materials, wiring harness design, structural materials and CAE, packaging design, material compliance and data control.

When new material requirements arise from customers or product designs, the cross-domain team of device application experts introduces and assesses materials and manufacturers, conducting comprehensive evaluation from perspectives including technology, quality, business operations, and audit of quality control systems. Materials and manufacturers are formally introduced only after assessment and approval are passed. Throughout the material and manufacturer introduction process, experts from the Quality Department have a right of veto, guaranteeing that the materials and manufacturers introduced continue to provide premium products and services.

Material Laboratory

Hikvision has established an industry-leading material laboratory providing strong technical support for the selection and certification of new materials. The material laboratory includes elemental analysis (ROHS2.0), performance, failure analysis, precision measurement, environmental, and device labs. Hikvision is continuously investing in equipment for these laboratories, and focuses on improving the competency of testers to guarantee the selection process for new materials.



2.1.2 Supplier Quality Management

Supplier quality management concerns two main areas: management of suppliers' quality operational capability and management of material production process. We have created various checklists for quality operational capability assessment based on material characteristics, and have performed grade-based management of suppliers' production process quality.

Management of Suppliers' Quality Operational Capability

Hikvision evaluates suppliers based on their past performance, grades them based on multiple aspects and implements strict quality management strategies. Grade-A (excellent) suppliers act as strategic partners in our business; Grade-B (good) suppliers are the major raw material suppliers for our business operations. Grade-A and Grade-B suppliers account for over 60% of total suppliers. Grade-C and Grade-D suppliers are weak in certain respects. We implement targeted counseling to improve their capacity, encouraging them to improve rapidly and rectify their weakness. If they continue to fail to meet our expectations, they will be eliminated.

Management of Material Production Process

Management on the material production process covers two stages: material design and development, and mass production.

- Development stage: Hikvision becomes involved in suppliers' production control for material quality management well in advance, during the early product design stage. Taking into account suppliers' actual quality capabilities, we monitor their quality control methods and actual production data during prototyping and trial production in order to identify and rectify weakness and risks in a timely fashion.
- Mass production stage: At the beginning of each year, Hikvision sets clear objectives for improvements in material quality for all suppliers. Taking into account different suppliers' quality risk levels, we monitor and analyze suppliers' material quality data and production process yields to identify any severe threats to quality, and institute specific improvements to materials.

Based on the above, the supplier quality management team conducts quarterly centralized training to provide our main suppliers with guidance on quality requirements, share improvements addressing severe issues, and introduce quality management tools, in order to enable our suppliers to continue raising their levels of quality management.

2.1.3 Quality Control of Incoming Materials

Hikvision conducts strict inspection and on-line monitoring of the quality of each batch of incoming materials from suppliers to ensure that these materials meet expectations from the source.

Specifications for inspection of different types of incoming materials are prepared in accordance with their characteristics, and items are automatically selected for inspection by the system. Routine

material inspection is conducted by Incoming Quality Control (IQC), and items relevant to reliability and compliance are sent to the testing center for further verification. Batches of materials passing inspection can be used as normal materials.

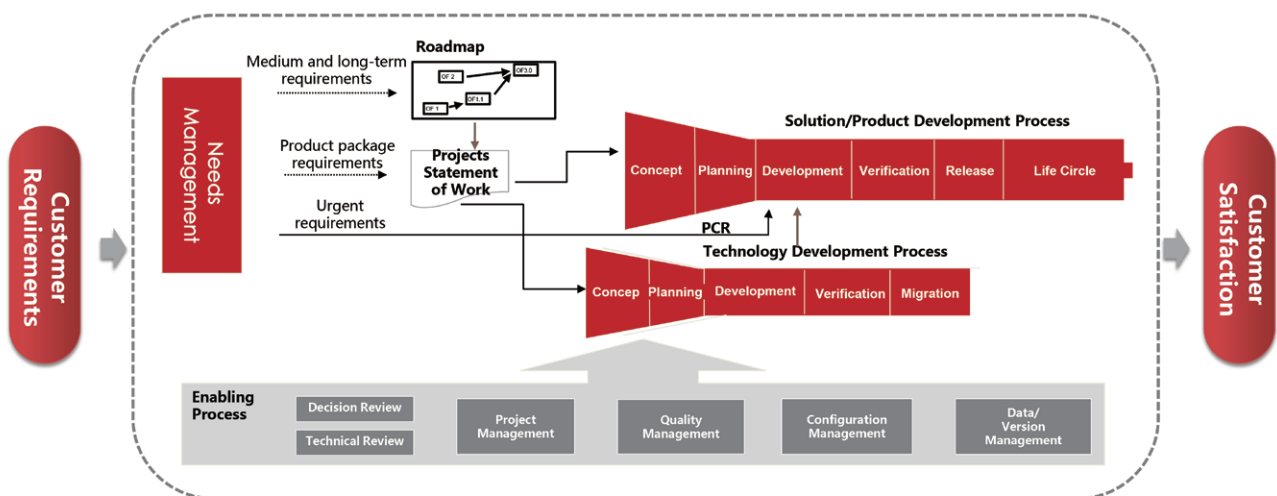
The system triggers notifications when non-conforming materials are found during inspection, or batches of non-conforming materials are found on the production line. After implementing temporary measures, we trace quality issues back to suppliers, continuously monitoring the proportion of non-conforming materials in subsequent batches until it is confirmed that suppliers' improvements meet expected results.

2.2 Exploration and Innovation for Design Quality

2.2.1 Integrated R&D Management System (iRDMS)

By consolidating industry best practices including IPD, CMMI and Agile, and integrated with our business, Hikvision has developed a leading integrated R&D Management System (iRDMS), which we are continually striving to improve. This provides process standards and implementation guidelines for product and solution development, ensuring efficiency in research and development, and enabling us to provide premium products and solutions rapidly for our customers.

The iRDMS system covers business processes including requirements management, product planning, product/solution development, and technological development. It also standardizes basic support activities including project, quality, and configuration management. Based on our comprehensive understanding and systematic management of market and customer requirements, it ensures successful development of in-demand products. Through parallel development, technological development and management, this speeds up our responses to the market, shortening the product development cycle; this continuously improves our system engineering capabilities, fosters quality and cost advantages in designs, raises product stability, manufacturability and serviceability, and contributes to continual improvements in customer satisfaction.



Product Development Process

The product development process is the core of the iRDMS system, which specifies six stages of product development: conception, planning, development, verification, release, and product life cycle, as well as the activities involved, thus forming end-to-end flow. The cross-functional product development teams consist of members from areas including manufacturing, service, and procurement in addition to R&D. They get involved in product development from the early stages, engaging in risk management and various areas of activity ahead of time, improving the implementation and collaboration during each stage. They assess product risks at each stage from technical and market perspectives based on technological and decision review points, and formulate strategies and plans to ensure product delivery and quality.

Project Management

Development and implementation of each product is organized as a project. R&D projects are standardized and managed according to categories and levels. First, market needs and feasibility are clarified before a project is established. Based on the management teams' decisions, a statement of work (SOW) for the product development project is issued, defining its objective and scope. During project planning a project team is established, the project process is defined, and a project schedule formulated. After clarification, a consensus is reached in order to ensure that objectives are jointly achieved. The project manager carries out many supervision activities during project execution and throughout the entire life cycle of the project, including project progress reporting, risk management, change management, and milestone review. After a project's conclusion, project members are organized to summarize the experience and lessons that can be drawn from it, accumulating and passing on the knowledge.

Quality Management

Product quality undergoes rigorous technical review and testing. Technical reviews cover requirements, design, and code reviews, and a team of technical experts is organized, tasked with detecting defects in advance of development in order to minimize rework costs. Unit, integration, hardware, and system testing are performed; hardware and system testing are performed by an independent test team to guarantee their objectivity and expertise. The testing involves advanced testing methods and tools in order to improve its efficiency and quality. All defects are recorded and managed on the platform, guaranteeing their tracking and resolution.

Process Quality Assurance (PQA) includes quality activities as below: formulation of quality objectives and plans; supervision of the R&D process; identification of R&D process problems, and any risks threatening the achievement of quality objectives; organization and formulation of resolution and response measures; tracking and closure of these measures; tracing of quality issues and test defects, and organization of root cause analysis and specific improvements necessary to avoid the occurrence of similar problems.

Configuration Management

Configuration management is an important activity aiming to guarantee product integrity and

consistency and traceability. The system clearly defines the configuration items for delivery and management throughout the product development process, formulates software version and branch management strategies, and standardizes the change management process. It establishes and maintains the integrity and consistency of deliverables through configuration identification, version control, baseline and change control, status tracking, configuration auditing, and management of third-party software and open source components. We use SVN and PLM tools for version control of output, realizing product traceability.

Information Platform and Tool Support

We have invested a large amount of resources in our information management platform, effectively integrating R&D processes with the proprietary R&D management system, such as product management, project management, quality management and other business processes. So far, the R&D management system supports the activities of tens of thousands of R&D personnel, and has become an effective tool for process management.

In addition to the information platform, we have introduced numerous proven tools, for example, the Jenkins continuous integration platform, which incorporates a variety of automated testing tools for continuous code building, inspection and verification, permitting early defect detection and greatly reducing the cost of correcting software defects.

2.2.2 Hardware Test Guarantees

The Hikvision Test Center, established in 2010, is under the organizational jurisdiction of the Product R&D Center. As a part of the product R&D and management system, it provides varied hardware testing services for products in the R&D and design stages, ensuring that products are launched only after full quality verification.

Currently covering an area of over 6,000 m², the test center is industry-leading for hardware and software configuration and in terms of management expertise. The hardware test team has grown and expanded with Hikvision's continuous development to reach about one hundred in workforce, including test and project engineers and management personnel.

Hikvision Test Center has received China National Accreditation Service for Conformity Assessment (CNAS) accreditation in 2015, and is also a laboratory accredited by International Laboratory Accreditation Cooperation (ILAC). Moreover, it closely cooperates with the best-known third-party test agencies worldwide, for irregular technical exchanges from time to time.

As the categories of Hikvision products increase in number and find favor with customers in different regions around the world, Hikvision Test Center will customize design and hardware test solutions in line with product characteristics, target market access requirements, differences in customers' application scenarios, and end users' actual requirements, to develop corresponding enterprise hardware test standards for a variety of products. These enterprise standards are often superior to market access requirements and industry standards, providing further guarantees of product design quality.

Environmental Reliability Testing

As their regions of use broaden, products may encounter harsher climate conditions during transportation, storage and use. Hikvision Test Center is equipped with an environmental test chamber used to simulate the harsh climates of various regions worldwide, and verify products' resistance to these environments.

The internal cavity of the walk-in environmental test chamber has a capacity of over 100 m³. Typical items for environment reliability testing include start-up and operation at low temperature, operation at high temperature, cycling environment between high and low temperatures, steady damp heat, and alternating damp heat environment. The test standards include IEC 60068-2-2, IEC 60068-2-1, IEC 60068-2-14, IEC 60068-2-78, and IEC 60068-2-30, etc.

Special Environmental Reliability Testing

In addition to a changing climate, harsh special environments can greatly challenge product reliability, for example, low pressure at high altitudes, seawater corrosion in coastal areas, and strong sunlight in desert areas. Hikvision Test Center's facilities include test equipment to simulate the harsh special environments that products may face, further verifying their resistance to these harsh environments.

- Low-pressure testing: The low-pressure test chamber can simultaneously simulate both low-pressure and high-low temperature environments, at specific test pressure values dependent on products' target environments.
- Solar radiation testing: The solar radiation test chamber simulates continuous high-intensity sunlight exposure, revealing whether products will malfunction, fade or deform, and whether parts will fall off in this environment.
- Salt spray testing: The salt spray test chamber permits assessment of products' anti-corrosion ability by spraying them with salt spray solutions with certain concentrations.
- Deicing test: Under severe cold conditions, moisture in the air may condense to form ice crystals on products' surfaces, deteriorating their performance. Ice-proof products may deice themselves by heating up or using other methods. The ice water spray test chamber is used to verify products' deicing capabilities at low temperatures.
- Impact protection testing: Products are verified for their impact protection performance, ensuring that they can work normally after physical shock. The test standards adopted frequently include IEC 62262.
- Water-proof and dust-proof testing: products with water-proof and dust-proof requirements can be verified in accordance with the IEC 60529 standard.



Solar Radiation Test Chamber

Mechanical Reliability Testing

Mechanical reliability testing simulates the mechanical interference products may undergo by using test equipment such as vibration and mechanical shock benches and drop tables, to evaluate products' mechanical reliability.

Typical mechanical reliability test items include random vibration with casing, shock with casing, drops with casing, random vibration uncased, sinusoidal vibration uncased, shock uncased, and drops uncased. The test standards tested include IEC 60068-2-64, IEC 60068-2-6, IEC 60068-2-27, and IEC 60068-2-31.

Electromagnetic Compatibility Testing

Electronic and electrical products generate electromagnetic interference during use. To prevent interference between different products, Hikvision strictly controls products' electromagnetic compatibility (EMC). The EMC test falls into two categories: electromagnetic interference testing and electromagnetic susceptibility testing. Typical test items include electrostatic disturbance immunity, electrical fast transient disturbance immunity, surge disturbance immunity, radiated disturbance and conducted disturbance. The test standards include EN 55032, EN 50130-4, FCC part15b, EN 61000-3-3, and ISO 7637-2.

Hikvision Test Center possesses several electromagnetic compatibility anechoic chambers for testing radiated disturbance and radiation disturbance immunity. It also has several shielded rooms and other world-leading EMC test devices, including arbitrary electric pulse generators, electrostatic generators and surge generators, broadband antennas, and signal data analyzers.



EMC Testing Anechoic Chamber

Safety Test

Hikvision strictly tests product safety performance to ensure personal safety of users. In addition to products' normal use and possible failures, we also consider foreseeable misuse by users. Typical standards for worldwide safety testing include IEC 60950-1, EN 60065-1, IEC 62368-1, and UL 62368-1, etc. These tests usually cover hazards in four areas: electrical, mechanical, thermal, and fire hazards.

- Electrical hazard related test items include: input current, insulation resistance, electrical strength, and current leakage, checking the products for electric arc, current leakage and other defects during normal use and in harsh abnormal environments, which will cause electrical hazards to the human body.
- Mechanical hazard related test items include: steady force tests, stability tests, and constant force tests, to ensure that products will not fall during use causing injury.

- Thermal hazard related temperature rise test: the natural convection chamber is used to simulate the upper limit of the ambient temperature during product usage. The thermocouple is used to monitor the temperatures of various parts of products during usage and identify overheating. In comparison with mainstream global safety standards, Hikvision has also developed more stringent standards for temperature rise testing for monitoring the heat of core components (chips, etc.) and preventing overheating-related reductions in product performance and service life.
- Fire hazard-related tests: A fire resistance tester is used to evaluate the fire resistance of non-metallic materials.



Natural Convection Chamber

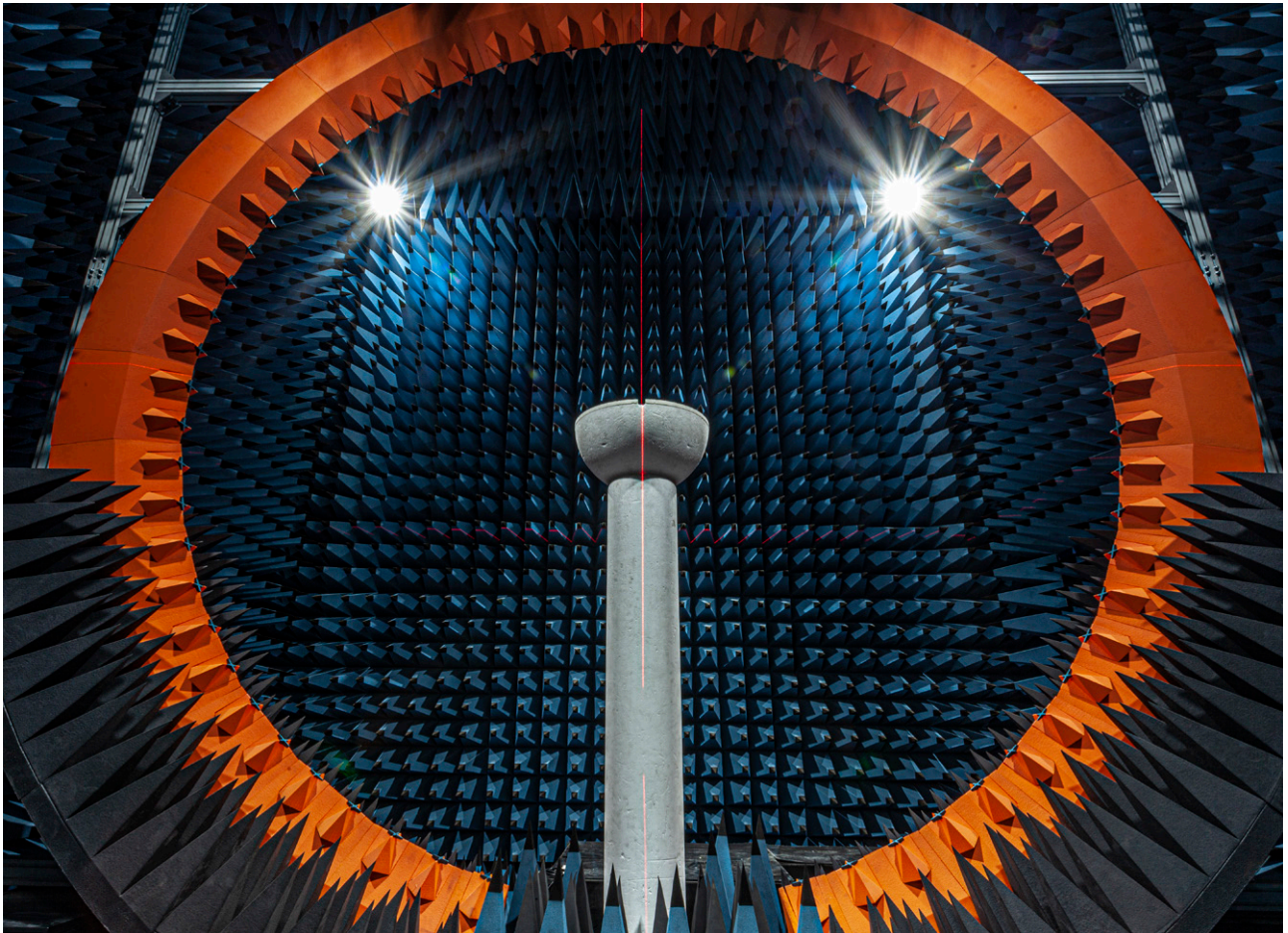
Radio Frequency Tests

As wireless communication technologies rapidly develop, increasing numbers of products incorporate wireless communication capabilities, including Wi-Fi, Bluetooth, 2G/3G/4G, GPS, and Radio Frequency Identification (RFID).

Hikvision Test Center is equipped with test devices such as an OTA darkroom, vector signal analyzers, vector network analyzers and spectrum analyzers to test wireless communication products for radio frequency (RF) consistency and compliance with RF certification requirements. The strict

control of RF performance leads to products that deliver better wireless communication experiences.

The OTA darkroom possesses 64 high-precision probes with test frequencies up to 6 GHz, leading China in terms of its test capability and scale.



OTA Darkroom

2.2.3 System Test Guarantees

The hardware tests carried out by Hikvision Test Center ensure that all product hardware specifications are fully tested and verified before launch, and that products suit customers' varied application scenarios. Product software is fully tested and evaluated by Hikvision Testing Department for aspects of quality including functionality, reliability, security, and ease of use.

Hikvision Testing Department was set up soon after the company was established, and has now grown into a professional team proficient in testing quality features including functionality, performance, stress, and safety, with a 12,000 m² testing laboratory. It provides comprehensive software quality assurance testing for all Hikvision products, in a comprehensive and detailed manner, through our self-developed test management platform, our automated test platform, other testing tools and devices, and a stability test laboratory, and adopts quality assurance systems and models such as CMMI and IPD to help to keep products in line with user needs over their entire life cycle.

2.2.3.1 Full Coverage, Automated Functionality Tests

As Hikvision's intelligent and non-video product business expands, the markets' performance and stability demands for products have increased.

Manual testing can no longer meet the specialized requirements related to full-coverage testing and highly exacting testing. To this end, Hikvision Testing Department has independently developed a large number of specialized test tools and devices, actively promoting the application of automated testing to ensure full-coverage testing of functional requirements.

Card Swipe Test Tools and Devices

Card swipe test tools and devices repeatedly simulate personnel presenting cards (or QR codes) for authentication, for testing of access control and personnel passage control devices. Configurable swipe parameters include number of swipes, distance, dwell time, interval between swipes, and number of repetitions. This fulfills large-scale testing requirements, and fully simulates varied conditions encountered by products in application.

Personnel Access Test Tools and Devices

Personnel access test tools and devices test personnel access system stability, simulating various situations including normal passage, interrupted passage, reverse intrusion, memory mode, tracking detection, overrun detection, and anti-crush functionality.



Personnel Access Test Tools and Devices

Panel Pressing Test Tools and Devices

Buttons, touch screens, and fingerprint products' functions and stability are tested in a 7×24h mode. Panel pressing test tools and devices include truss-mounted robots that can move freely in multiple directions. Their rubber, metal, and fingerprint test heads simulate single- or multi-point pressing operations.

Automated Test Applications

Automated testing has been explored since 2010, and now covers protocols, interfaces, and user interfaces (UI), for areas including smoke obscuration, functionality, stability, and performance. Great progress has been made in the development and accumulation of test platforms, frameworks, technology libraries, and solutions capable of handling varied needs, which continue to be repeatedly updated, thus forming a comprehensive automation ecosystem.

Automated testing is widely carried out for platform software, software and hardware compatibility and integrated diagnosis, providing effective assistance to developers in identifying problems in advance, increasing R&D efficiency, and guaranteeing software product quality.

By the end of 2019, the number of platform software component test cases has reached 20,000, with an overall automation rate exceeding 60%, and a cloud platform automation rate exceeding 70%:

- For software and hardware compatibility testing, we use an automated compatibility test platform which supports compatibility testing for all types and models of encoding, decoding, and access control devices.
- In terms of integrated diagnosis/testing, we have developed an integrated component/software framework, the component and architecture integration and error diagnosis system, which allow detection and identification of integration phase-related problems. To date, it has been applied in the development testing of over 400 components.

2.2.3.2 Comprehensive and Diversified Stability Tests

Products in long service are affected by their external environments, along with internal parameter settings. Our systems maintain normal operation, providing users with continuous, reliable services; that is, this means product stability. Given customers' special requirements for security products, Hikvision's testing team is committed to improving stability testing, and to providing higher-quality, more stable products.

Hikvision's Testing Department possesses a comprehensive, multipurpose, system-level stability laboratory. By the end of 2019, it has an area of nearly 12,000 m², and nearly 10,000 test devices which cover all the categories of Hikvision products undergoing research or on sale. In addition to stability testing, it includes facilities for performing stress, performance, and scenario testing, offering a variety of specialized laboratories for areas including educational environments, judicial environments, and imaging testing. The stability test laboratory is still being enlarged, and is expected to expand by

3,000 m2 in 2020, continuously supporting and improving Hikvision's stability testing capabilities.

Stability tests focus on two main perspectives: design of product functions and user application scenarios, strategically covering product design problems and critical functionality. Targeted and continuous verification is performed by simulating common user scenarios to ensure that Hikvision devices can continuously operate for at least 7×24 hours without malfunction.

Back-end Stability Tests: check that devices under test do not malfunction under abnormal or high-pressure conditions, such as: hot and cold restarts, or running with maxed-out CPUs;

Dome Stability Tests: check the mechanical durability of devices under test, including accuracy of positioning after long and repeated rotation;

Camera Stability Tests: concern the stability of test equipment video streaming and include: previewing streaming for long periods and dynamically monitoring scenes.



Testing in Stability Laboratory

2.2.3.3 User Scenario Suitability Tests

Before their launches, Hikvision software and hardware products are tested for targeted scenarios dependent on their characteristics and actual usage scenarios. For hardware products, we verify quality features in customers' actual physical environments. Software products' functionality, performance and stability are verified in specially established virtual system-level environments.

Hardware Product Tests

To date, Hikvision's hardware product scenario tests mainly cover outdoor and Beta testing. Taking Hikvision wireless bridge products as an example, hardware product scenario testing includes:

- Outdoor tests: Hikvision wireless bridges suit applications such as point-to-multipoint (PTM), wireless relay and long-distance transmission. Testing under various weather conditions is performed to verify the compliance with high signal penetration, long-distance, and point-to-multipoint performance requirements.
- Beta tests: After functionality and system tests, Beta tests for the wireless bridge products in real user scenarios verify their video transmission stability in various climates.



*Long-distance/PTM
Scenario Tests*



*Outdoor High-penetration
Scenario Test*



Beta Test at Snowy Junction

Software Product Tests

Hikvision has set up scenario testing laboratories at company headquarters, and R&D centers worldwide, to conduct verification of software and system products' operational quality in the virtual software environments of their customers' areas. Below, the AI Cloud system is taken as an example to illustrate scenario testing of an integrated system.

We verify overall system integration around business and data flows under user scenarios, ensuring that the integrated AI Cloud system's functions and features meet the demands of user application scenarios, given the system's cloud computing and material-information fusion data architecture, based on intelligent applications, resource management and scheduling, data resource, and operation and maintenance (O&M) service platforms, its computing storage and data resource pools, and algorithm library.

System Integration Verification: Key service scenarios and typical data processes for the AI Cloud system integration are classified, and simulated data for user scenarios including cascade and cluster scenarios is constructed in the headquarters G5 laboratory, permitting verification of system integration points and multi-product interaction.

Big Data Performance Verification: Taking on-site project data and business conditions into account, storage dataset (1-20 billion records) and real-time datasets (5-200 million records) in certain scale are simulated, constructing a G5 laboratory level big data environment, and service scenario automation scripts designed, permitting verification of big data single-solution from perspectives of performance support, resource consumption, business responsiveness, and stress testing.



Verification Environment in G5 AI Cloud Lab Data Center

2.3 Intelligent Enhancement for Manufacturing Quality

Hikvision has set up supply chain manufacturing bases and regional logistics centers inside and outside China.

Manufacturing bases in China include sites in: Binjiang Base, Hangzhou; Tonglu Base, Hangzhou; and Chongqing, with a combined area of around 1 million m², and the annual production exceeding 100 million units in 2019.

Our manufacturing base in India covers an area of 20,000 m², with an annual production capacity of 7.2 million units. A manufacturing base under construction in Brazil is planned with an annual production capacity of 3 million units.



Hikvision Tonglu Manufacturing Base

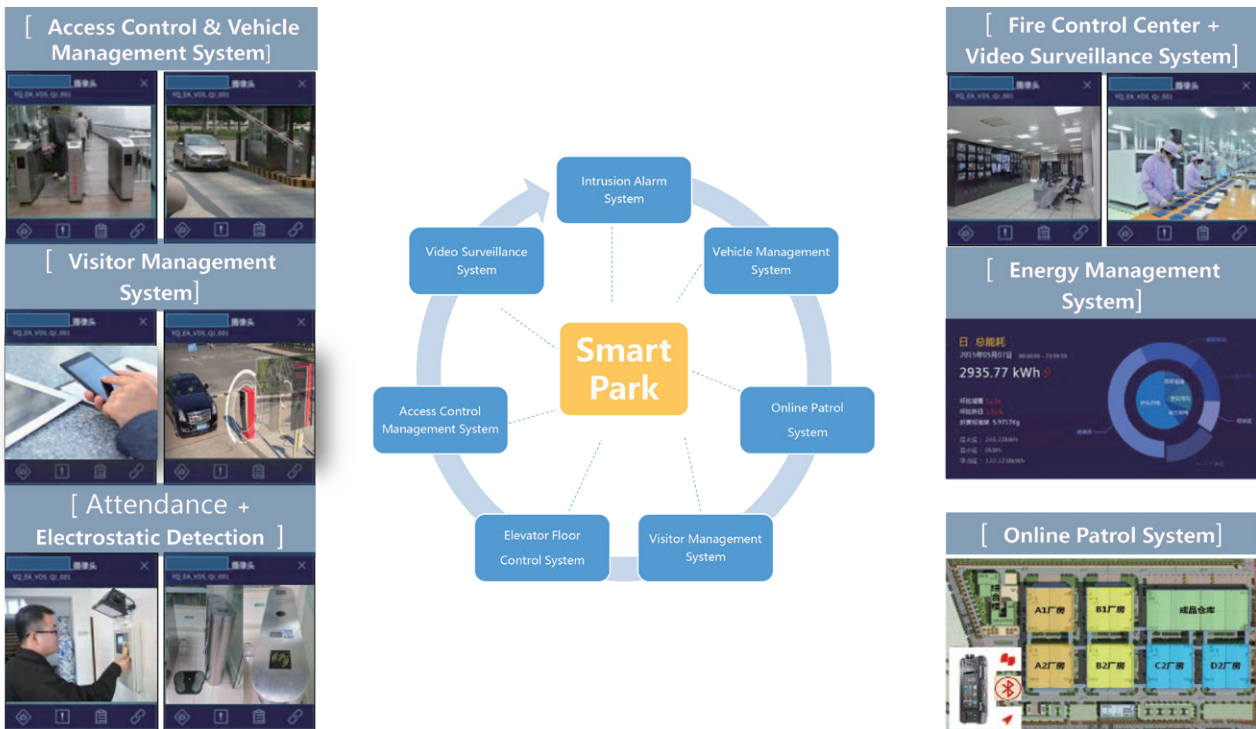
Hikvision's four overseas regional logistics centers are located in the Netherlands, the United States, Panama and Dubai, covering Europe, North America, Latin America and the Middle East, and ensuring timely global logistics/distribution.

These regional manufacturing bases and logistics centers guarantee fast, high-quality and cost-effective global supply. To guarantee standardized management of the entire process from procurement to delivery, Hikvision has established the Supply Chain Management Center promoting an all-region quality management system.

"Intelligent Manufacturing" is driving our continuous and rapid development, which will sustain continuous enhancement of our supply chain's competitive advantage, and ensure that our manufacturing bases can efficiently and flexibly meet global customers' requirements in quality consistency and product delivery timeliness.

2.3.1 Smart Industrial Parks

Hikvision has applied a proprietary product and system integration platform to manage our supply chain's manufacturing bases, thus optimizing park management efficiency, greatly reducing supply chain management and maintenance costs, and increasing the orderliness of our manufacturing bases.



2.3.2 Intelligent Manufacturing

Modern intelligent techniques have revolutionized conventional labor-intensive factory processes, including: high-speed dual-track SMT production lines; automated component manufacturing; automated adhesive dispensing; automated assembly, inspection and packaging of complete machines; automated sorting and handling; and intelligent warehouse logistics. Intelligent devices operate efficiently and reliably, basically eliminating boring manual operations conventionally required, and greatly improving product quality and capacity.

Automated SMT Production Line

The motherboard PCBA factory specializes in surface mounting, welding and testing of PCBA components. Up to now, it has possessed 115 high-speed dual-track SMT lines, 27 wave soldering lines, with daily production capacity of over 300 million components, and up to 900,000 PCBA units.

The factory has brought in a globally-sourced range of advanced equipment, including advanced automatic printers, automatic SMT machines, reflow solder machines, automatic optical detectors, automatic labeling machines, solder paste detectors, anti-mismatch systems, equipment data and operation monitoring systems, automated testers, and automated board splitters, as well as world-

leading PCBA production technologies, to guarantee product quality and efficiency.



Automated SMT Production Line

Automated Assembly Line

Only manual loading is required as the first step. Automated assembly devices then complete a series of actions including fully automated assembly, structural locking, barcode label printing, automatic labeling, automatic airtightness testing, and data classification and uploading. One-click production switching is possible for various types of products, enhancing product diversification.

Data classification and uploading ensures that data can be traced back to relevant materials and processes, fully realizing intelligent manufacturing.



Automated Assembly Line for Network Cameras

Automated Aging Test Lines

After assembly, products undergo mobile power aging in aging stores with automated power supply systems, under the control of a visual code scanning system. After passing a set aging time, they are automatically and sequentially moved out to the test station. Operators need only perform simple plug-in operations for running test software to perform automated product testing.

Product aging and testing data are automatically uploaded to the management system, fulfilling intelligent management of product automated aging and testing processes.



Automated Aging Test Line for PTZ Cameras

Automated Packaging

After assembly and testing, products are transferred to the automated packaging line. Operators need only put packing boxes on a conveyor belt; the products are packaged in sequence as they pass along it.



Automated Packaging Line

Automated Handlers and Palletizers

Unmanned handlers and palletizers automatically palletize cartons in the factory and interwork with automated guided vehicles (AGVs), by automatically transporting products with roller, photoelectric induction, six-axis robot palletizing, vacuum adsorption, and other technologies.

These devices significantly reduce labor intensity, essentially improving palletization efficiency and reducing logistics costs.



AGV Interworking with End-of-line Roller for Picking Materials



AGV Interworking with Case Seal Roller for Releasing Materials



Hikvision Visual Scanning



Robotic Palletizing

Intelligent Warehouse Logistics System

AGV trolleys, 3D warehouses, and sorting lines are main components of Hikvision's intelligent warehouse logistics system.

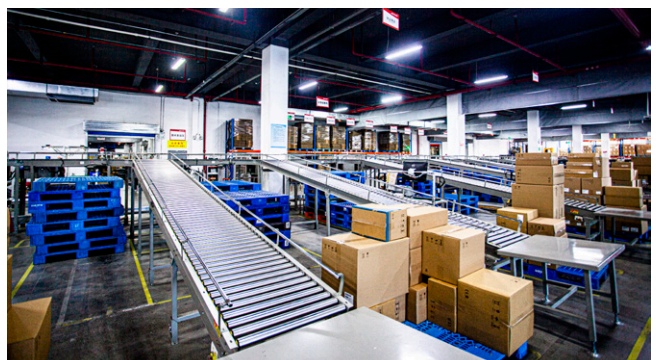
In each production plant, operators need only submit task requirements. The system automatically plans routes, and dispatches AGV trolleys as required to deliver materials to production lines and automatically deliver completed products to the designated warehouses. After arriving at the 3D warehouse, products are transferred to the conveyor lines by automatic pallet forks, and quickly and accurately delivered to their designated storage locations via tracked shuttle cars and palletizers.

At shipment time, the products reach the designated warehouse platforms through cooperation of tracked shuttle cars and palletizers, and are transported by AGV trolleys to picking station for pickup. They then arrive at the sorting line via outbound lines and screw conveyors, where they are sorted by HD industrial cameras before finally reaching their designated sorting ports.

The manufacturing base in Tonglu, Hangzhou currently boasts more than 800 AGV trolleys and 11-floor 3D warehouse. The 3D warehouse can deliver up to 1100 packages/hour; the sorting line can sort 2,800 cartons/hour, and the industrial cameras can identify products with an accuracy rate of up to 96%. Raw materials are distributed easily and automatically, while finished products are automatically and intelligently warehoused, stored, and delivered.



AGV Trolley for Transporting Goods



Automated Sorting Lines

2.3.3 Software Platform Support

Orderly production management guarantees the manufacture of high-quality finished products. Hikvision's technical support software platform for production management promotes sustainable and reliable supply chain management.

MES Application

The Manufacturing Execution System (MES) performs resource planning and provides interoperability of information covering the manufacturing process from raw materials to finished products, and consolidates full-range data integration of manufacturing, planning, production scheduling, inventory management, quality traceability, devices and tools, etc., to provide technical support for full product traceability. The uses of the Andon system, BOM code scanning and verification, and first article inspection (FAI) allow easier management of the manufacturing process in practice.

- Andon system: Abnormal quality on the production line is automatically reported to the responsible person in time for rapid response.
- BOM code scanning and verification: This is used to confirm that online materials are consistent with system BOM data, providing a foolproof guarantee that materials on production lines are 100% correct.
- First article inspection (FAI): During manufacturing of the first article, self-inspection and special inspections are performed, as per inspection requirements of each manufacturing process; their results are related to the manufacturing release decision, helping to avoid batch anomalies.

Push Notification System for Production Line Abnormalities

The push notification system for quality abnormalities independently developed by our supply chain gathers problems and experiences, shares internal data, and instantly pushes abnormal cases, transmitting new or updated quality requirements in real time and helping improve front-line employees' quality awareness.

MOA Inspection System

Process inspectors operate Hikvision's proprietary MOA inspection system, inspecting manufacturing processes one by one according to established requirements, verifying their compliance, and checking policy-associated MES system manufacturing modules. Inspection background data can be queried, counted and analyzed in real time.

Real-Time Aging Status Monitoring System

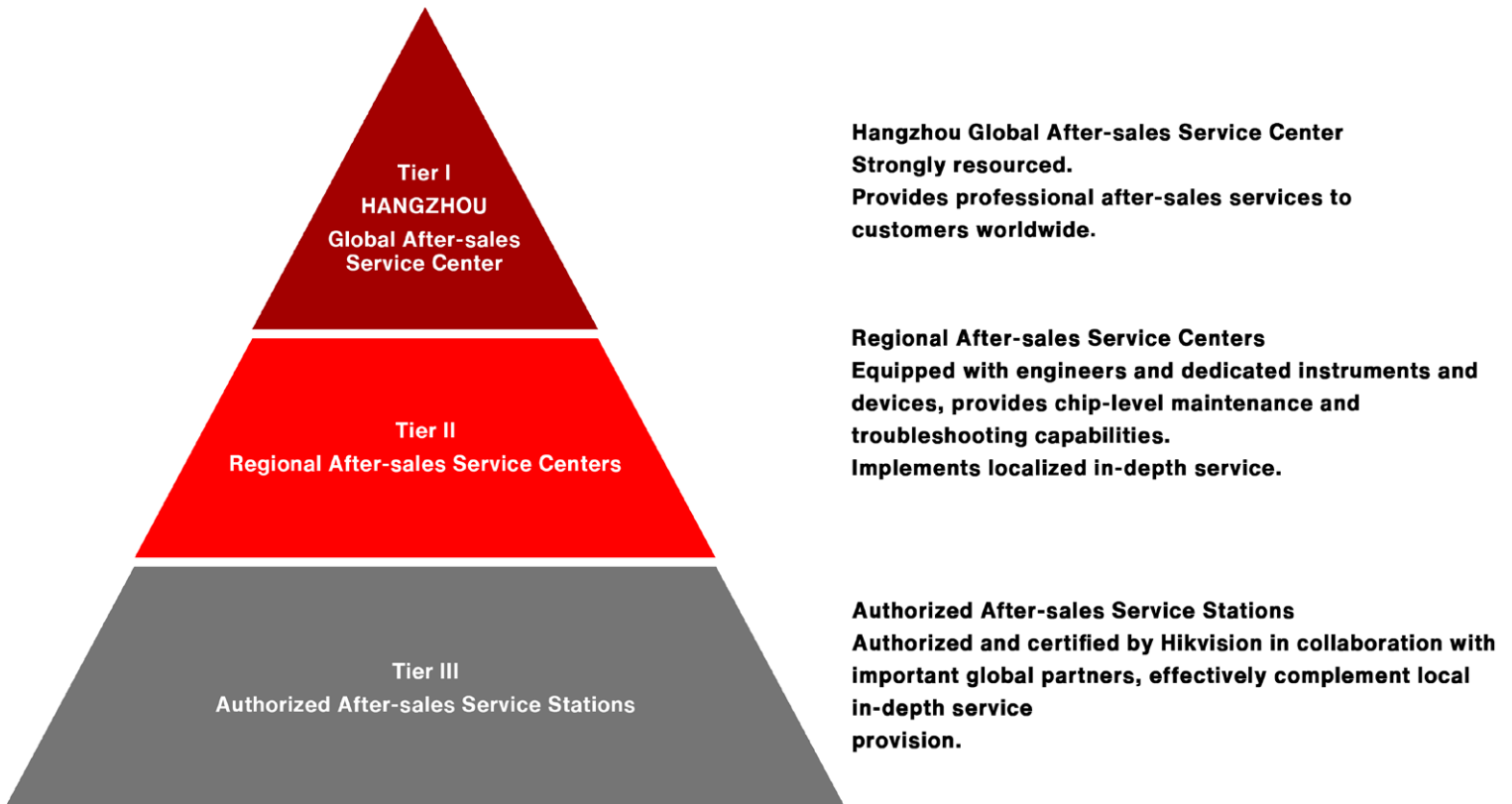
The proprietary real-time aging status monitoring system, integrated with configuration upgrading, aging, and manufacturing process testing, displays the real-time progress of each process, and is associated with error-report data from each process, helping quickly locate defective machines in the manufacturing process and the troubleshooting status, to ensure fast and high-quality production line output.

2.4 Quality of Service for All Sectors

Global After-sales Service Guarantees

Hikvision has set up a three-tier after-sales service system networks worldwide, to better meet customer service needs and strives to provide excellent service to customers. By the end of 2019, to provide strong guarantees for growing customer service needs and practically relieve customers' service concerns, after-sales service networks has been set up as follows:

- One global after-sales service center: Being strongly resourced, this provides professional after-sales service to customers worldwide.
- 74 regional after-sales maintenance centers: Being key to Hikvision's local service delivery, these serve our major markets.
- 115 authorized customer service stations: Authorized and certified by Hikvision in collaboration with important global partners, these extend and effectively complement local in-depth services.



Global Technical Support Service

In addition to our global after-sales service system, a technical support service team for client product troubleshooting and service response provides rapid problem resolution, efficient and considerate service

to ensure timely troubleshooting of faulty products.

Hikvision's technical support service team includes an HQ-based expert technical support team and local technical support team in each business center. It provides remote technical guidance through call centers and emails, offering essential on-site services based on project circumstances, and greatly contributing to customer service satisfaction.

The call center-based support hotline provides "5×8" hour real-time online service and receives e-mail queries. With a one working day response guarantee, it provides customers with technical consultation and general troubleshooting support.

Branch technical support teams can report complex problems to HQ-based technical expert teams through the customer problem management system; these teams cooperate to provide customers with corresponding solutions based on their actual issues and needs. For "escalated" complex problems, the technical support teams coordinate to establish special response teams aiming for issue solving rate of over 85% within 3 days and that of over 95% within 5 days.



**Hikvision Quality:
Real-life Experience**

3. Hikvision Quality: Real-life Experience

"The CCTV has made our job easier and is one of the best systems we have worked with. We easily monitor all entrances. A control room was set up for our use with access to all cameras. This is a first-class set up!"

Managing Director of Blueline Security Management Ltd., Cowes Yacht Haven, UK

"Having used their products many times before on other high-profile projects, we had no doubt that the choice of Hikvision surveillance products would provide the customer with an efficient and reliable intelligent surveillance solution... Hikvision's product quality is backed by an equally good experience with their after-sales service."

General Manager of CST Securite. Senegal's New International Airport, Senegal

"Since installation, the Food Plus system has been able to reduce and control shoplifting, is easy to use, and provides a good alert system. Additionally, Hikvision was found to be the most cost effective solution available with the best on-going support after completing the installation!"

**The systems administrator for Chandarana Supermarkets, Ltd.,
Nairobi Supermarket Chain 'Food Plus', Kenya**

"We have been very pleased with the progress that we have made with Hikvision and Maxtag over the last 18 months...With the need to protect privacy becoming more critical, we expect centralised management to become increasingly important!"

Head of Digital & IT Operations, The Fuller's Estate, UK

"Prior to the Orange Group project, we had previously used Hikvision successfully for many other clients, and we were confident that the solution we proposed combined a competitive cost with superb quality and performance, which was a crucial factor in securing this multi-site contract!"

Director at Servitel, Telecommunications Company Orange, Africa

"The system's end-to-end unified hardware and software delivers advanced situational awareness of the factory's personnel, vehicle production line, paint shop, data centre, offices and finished vehicle storage."

Director of Autojaya. SGW Plant, Indonesia

"We are amazed by the Hikvision technologies which we recently have implemented at our training ground and stadium. The PanoVu camera is opening an entirely new world for us in the world of Performance Analysis. Being able to capture the full pitch at high resolution is simplifying our analysis process so much. Being able to provide real-time feedback to coaches and players empowers us even more!"

Ajax's Performance Technologists, Football Club Ajax, Netherlands

"We have been so impressed with the Hikvision surveillance technology and the support we have received that we are continuing to roll out this Hikvision-based security blueprint to many other power

substation sites across South Africa."

Principal Director of CPI, Electricity Supply, South Africa

"The quality of Hikvision products demonstrates the quality of Hikvision staff. I expect your products will continue improving and your business continue growing."

Chongqing China Railway Tunnel Group Co., Ltd.

During the Beijing Olympics, it was Hikvision that took on image and data networking for the Security Command Center, consolidating image monitoring systems at 31 Olympic venues, including the National Stadium and National Indoor Stadium, to provide a powerful "all-round, all-weather, whole-process, 3D" image monitoring system for the Olympic Security Command System, which greatly contributed to the success of the 29th Olympic Games and 13th Paralympic Games.

The Organizing Committee of the Games of the XXIX Olympiad, Beijing 2008

During the Nanjing Asian Youth Games' opening and closing ceremonies, and while undertaking security work for those games, your platform ran stably and reliably, providing robust services and support to the Security Command Center, and permitting timely and accurate dispatch and image monitoring, a contribution that was highly acclaimed by leaders at all levels.

Nanjing 2014 Youth Olympic Games

Hikvision's ultrahigh-capacity storage technology guaranteed effective storage of HD video for the BRICS Summit for about five months. Hikvision's integrated security command platform at the main venue allowed the command centers to handle emergencies, and carry out command and dispatch, and ensured all-round security and stability in core areas. The success of Hikvision's deep learning products and technologies at BRICS 2017, China, provided an important example of the application of artificial intelligence in large-scale international conference security services!

BRICS 2017 China, Xiamen International Conference Center

Hikvision participated in the construction, designing, installation, commissioning and operation of the CCTV video surveillance system for Canton Tower Model Station's "Smart Metro", providing high-quality products and solutions that were unanimously praised by both participants and media at the China Summit of Metro Operator, 2019. I hope Hikvision goes from strength to strength!

Guangzhou Metro Group Co., Ltd., 2019

The world-famous "2nd China International Import Expo" held in Shanghai was a great success. Your company arranged the security work for this event in its entirety, providing high-quality, efficient technical support, emergency disposal, and maintenance. We greatly appreciate your important contribution to our event's security!

Urban Rail and Public Transport Corps of Shanghai Municipal Public Security Bureau, regarding 2nd China International Import Expo, 2019

Hikvision has a deep understanding of residential community services, and provides targeted solutions that transform leading technologies into community-based applications which help customers achieve their goals. With Hikvision's intelligent products, residential communities can only get better and better!

Executive Director of Country Garden Group Services

Hikvision Quality White Paper

2020.April

