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China Automotive Fragrance and Air Purification Systems Research Report, 2023

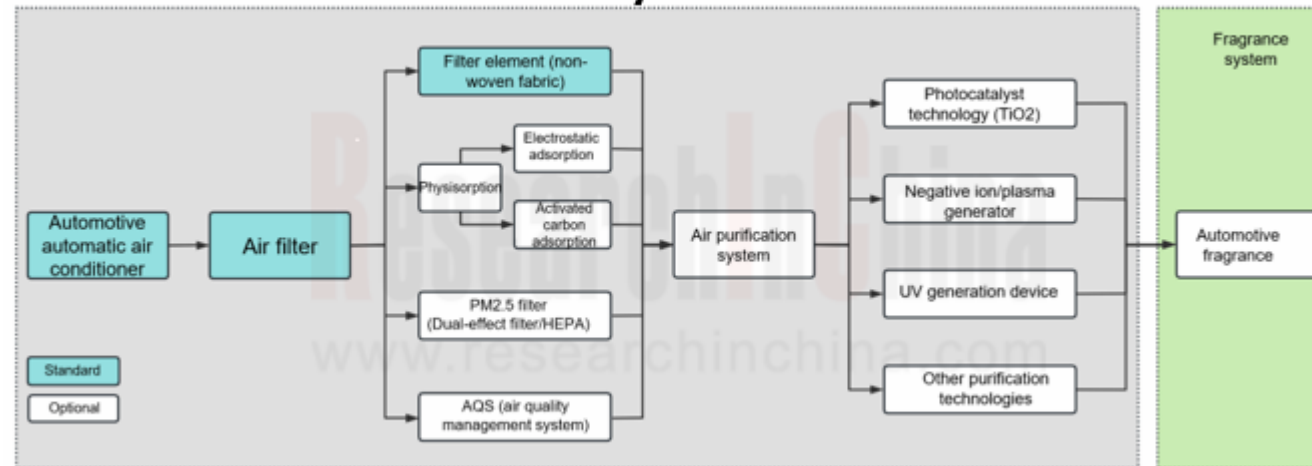
May 2023

Automotive fragrance and air purification systems: together to create a comfortable and healthy cockpit

Technology trend: intelligence of fragrance system and integration of air purification system

In the passenger car market, the fragrance and air purification systems boom: the fragrance system has developed from the initial "perfume bottle + negative ion generator" to independent intelligent fragrance system; in some models, the air purification system is integrated with the air filter to constitute a complete automotive air management system, and also packs comprehensive air management technologies such as advanced filter elements (dual-effect element, HEPA element, etc.), air quality system (AQS), and air purification system (e.g., negative ion generator and UV generation device).

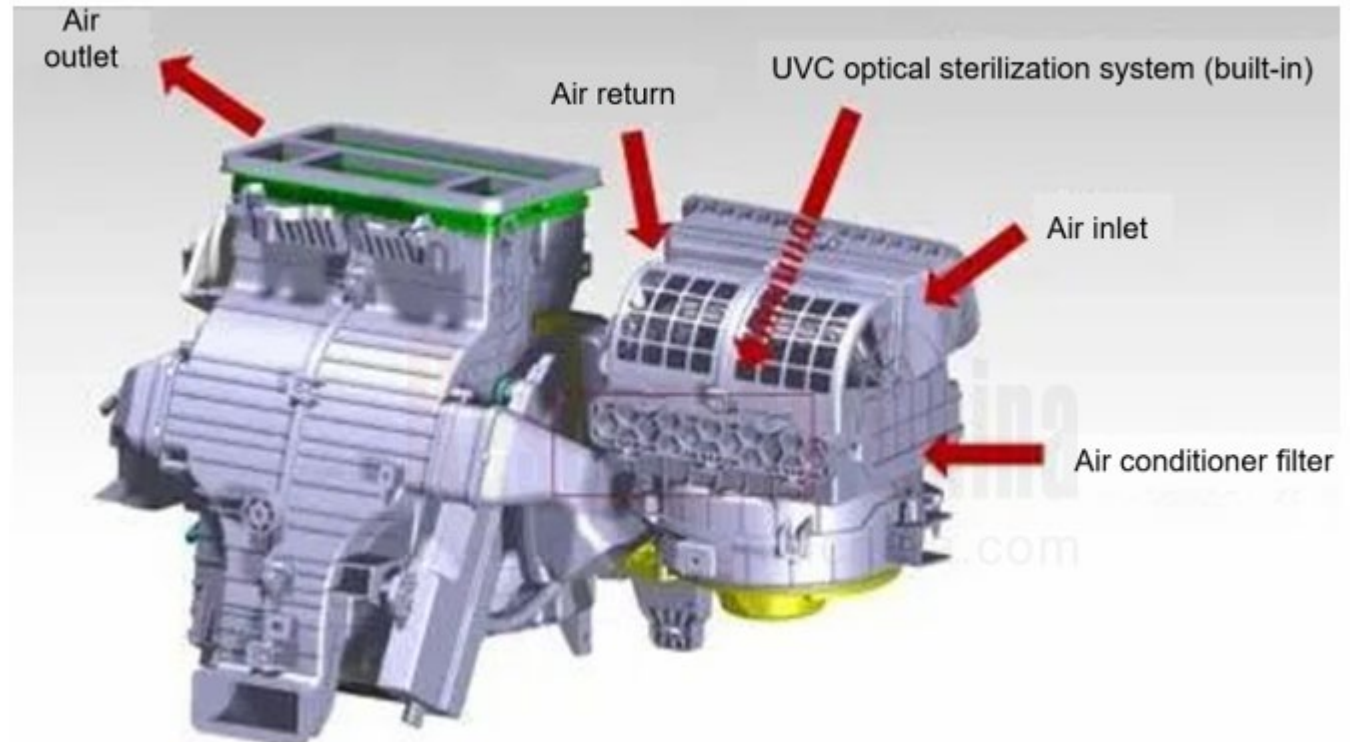
Composition of Air Filter, Air Purification System and Fragrance System



Source: ResearchInChina

At present, the fragrance system heads in the direction of intelligence, for example, carrying the NFC chip for rapid recognition (NIO ES6, ZEEKR 001, etc.), delivering fragrance according to driving scenarios (IM L7), and using magnetic suction technology and rotating fragrance frame (XPeng G9, etc.); the air purification system tends to integrate a variety of filtration and sterilization technologies, including photocatalyst (Oshan A800, etc.), UV sterilization (SAIC Roewe RX5 PLUS, etc.) and negative ion generator (e.g., Geely Boyue). The air purification technology of the current mainstream car models is negative ion/plasma generator, with sterilization rate higher than 80%. In the future, the more advanced technologies will be UV sterilization system and photocatalyst technology, with sterilization rate higher than 99%.

UVC Sterilization System Built in Air Conditioners of SAIC Roewe Ei5 and Roewe RX5 PLUS



Source: SAIC

TOP20 Passenger Car Models by Fragrance System Installations in China, 2022

The TOP20 passenger car models by installations of fragrance and air purification systems in China in 2022 are as follows:

TOP20 Passenger Car Models by Fragrance System Installations in China, 2022

Ranking in 2022	Model	Brand	Installations (10,000 units)	Installation Rate	Ranking in 2021	Ranking Change
1	BMW X3	BMW	10.85	94.41%	1	Same
2	Mercedes-Benz E-Class	Mercedes-Benz	10.62	73.10%	2	Same
3	ZEEKR 001	ZEEKR	7.14	100.00%	14	↑
4	AITO M5	AITO	5.26	100.00%	-	-
5	BMW 5 series	BMW	5.08	29.60%	4	↓
6	NIO ES6	NIO	4.23	100.00%	5	↓
7	Li L9	Li Auto	4.02	100.00%	-	-
8	Geely PREFACE	Geely	3.82	35.33%	6	↓
9	AION Y	GAC Aion	2.88	30.43%	10	↑
10	Buick GL8	Buick	2.60	21.99%	3	↓
11	NIO ET7	NIO	2.29	100.00%	-	-
12	XPeng P5	XPeng	2.02	53.64%	15	↑
13	AITO M7	AITO	1.78	100.00%	-	-
14	NIO EC6	NIO	1.72	100.00%	8	↓
15	Han	BYD	1.67	7.59%	-	-
16	Tank 500	Tank	1.46	80.87%	-	-
17	NIO ES7	NIO	1.38	100.00%	-	-
18	Range Rover Evoque	Land Rover	1.32	94.87%	9	↓
19	AION V	GAC Aion	1.29	48.39%	11	↓
20	NIO ET5	NIO	1.04	100.00%	-	-

Source: ResearchInChina

Rapid growth: in 2023, the automotive fragrance installation will exceed 1 million units, and the air purification system installation will surpass 6 million units.

From 2020 to 2023, the installations of automotive air purification and fragrance systems will sustain steady growth. It is predicted that in 2023 the installations of automotive air purification systems will exceed 6 million units, and that of fragrance systems will reach 1.03 million units.

Overall the air purification system is mainly a standard component of passenger cars. The installation of standard fragrance systems began to surge in 2022, and is expected to reach 582,700 units in 2023, exceeding the optional for the first time.

Air Purification System Installations, 2020-2023



Source: ResearchInChina

List of Air Purification System Suppliers (in No Particular Order)

Air purification and fragrance systems are generally integrated into the functional module of air conditioning systems, and the main suppliers are as follows:

List of Air Purification System Suppliers (in No Particular Order)

Type	Supplier	Air Purification System	Fragrance System
Air Purification System	Valeo	Air filter (including filter element products), PM2.5 sensor, ion generator, OXY'Zen comprehensive air quality management system, advanced cockpit air filtration system	Additional features of the air purification system
	Denso	Air filter (including filter element products), PM2.5 sensor, air purifier, plasma generator	Additional features of the air purification system
	MAHLE	Air filter (including filter element products)	Modular fragrance system
	Hanon	Ion generator, air quality system (AQS), CO2 sensor, UV LED photocatalyst system	Additional modules of air quality system (AQS)
	Sailing Technology	PM2.5 sensor, negative ion generator, AQS air quality management system	Pre-installed fragrance system
	CUBIC	Negative ion generator	Fragrance generator
Fragrance Control System	Desay SV	-	Provide intelligent fragrance control systems
	PATEO		
	Sunlord Electronics		

Source: ResearchInChina

Denso introduced AiO BOX

In 2022, Denso introduced AiO BOX, an air quality solution that fully integrates all air purification system components and uses the unique airflow cleaning technology. With a plasma generator and double electrodes, it can release positive and negative ions simultaneously at the front and rear air outlets. The high integration of PM2.5 sensor and HVAC enables fanless air filtration.

The simple version of AiO BOX equipped with plasma generator, PM2.5 sensor and CN95 filter was mass-produced in late 2022. Denso plans volume production of the complete version of AiO BOX equipped with evaporator cleaning system and intelligent fragrance unit in 2024.

Denso AiO BOX Air Quality Solution



Source: Denso

Sailing Technology provides complete air system solutions for OEMs

Sailing Automotive Electronics (Taizhou) Co., Ltd. provides complete air system solutions for OEMs. During 2022-2027, the company plans to produce a total of about 34.11 million designated products, including more than 12.77 million PM2.5 filters, more than 7.4 million negative ion generators, more than 12.78 million fragrance systems and more than 1.16 million AQS systems. By the end of 2022, some of the designated products have started to be delivered to automakers. For example, Sailing Technology has already provided fragrance systems for **Li L9 and XPeng G9**.

Sailing Technology provides Toyota with a customized negative ion fragrance system, with the concentration adjusted via WeChat applet and the center console screen. This system is applicable to models like Sienna, Venza, Highlander and Frontlander, with the fragrance bottle placed in the glove box.

Toyota Sienna's Negative Ion Fragrance System Provided by Sailing Technology



Source: Sailing Technology

OEMs: upgrade air purification system functions, and emerging OEMs prefer intelligent fragrance systems.

Since 2020, mainstream models have offered upgrading air purification system functions. Some automakers (e.g. Geely and WM Motor) have passed the CN95 certification for their air filters. International OEMs are cooperating with air purification system integrators like Valeo and MAHLE to add an air quality manager (AQS) and negative ion/plasma technology to their original air purification systems, aiming to further improve the pollutant filtration efficiency of their existing air purification systems.

Chinese emerging OEMs (NIO, Li Auto, XPeng Motor, AITO, etc.) boast a higher installation rate of fragrance systems, and prefer intelligent fragrance systems. Their fragrance suppliers are international groups (Givaudan, Symrise, IFF, Firmenich, etc.). Most conventional international OEMs (Mercedes-Benz, BMW, etc.) adopt non-intelligent fragrance system designs.

At present, some Chinese OEMs have the ability to independently develop intelligent fragrance technologies, especially human feature recognition and monitoring, and fragrance system intelligent control (automatic opening / intelligent fragrance delivery / automatic fragrance switching / voice control).

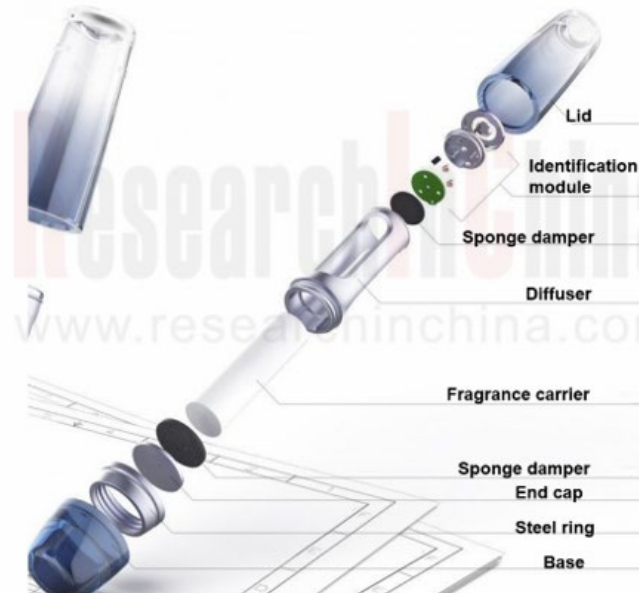
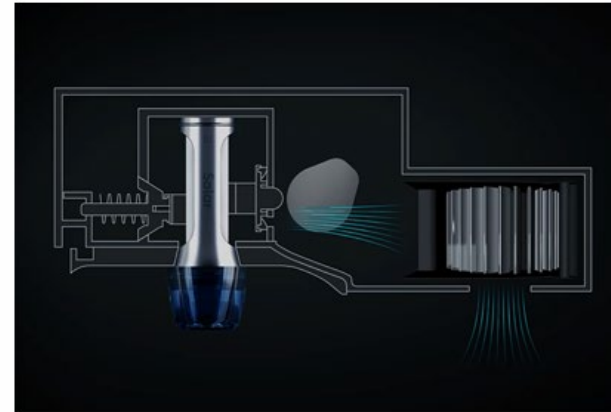
Self-developed Fragrance Technology of Some OEMs

OEM	Fragrance Technology Release Date	Fragrance Technology Features
Changan Auto	Mar. 2023	Voice control over automotive fragrance
	Nov. 2022	Automatic fragrance switching + automatic driver recognition
FAW	Oct. 2022	Cyclically automatic fragrance switching in specific scenarios
	Jul. 2022	Fragrance system integrated into the ambient light
	Jun. 2022	Human feature recognition + automatic fragrance opening
SAIC	Jun. 2022	Automatic intelligent fragrance delivery according to the operating mode of the air conditioner

Source: ResearchInChina

Release Principle and Composition of NIO Fragrance System

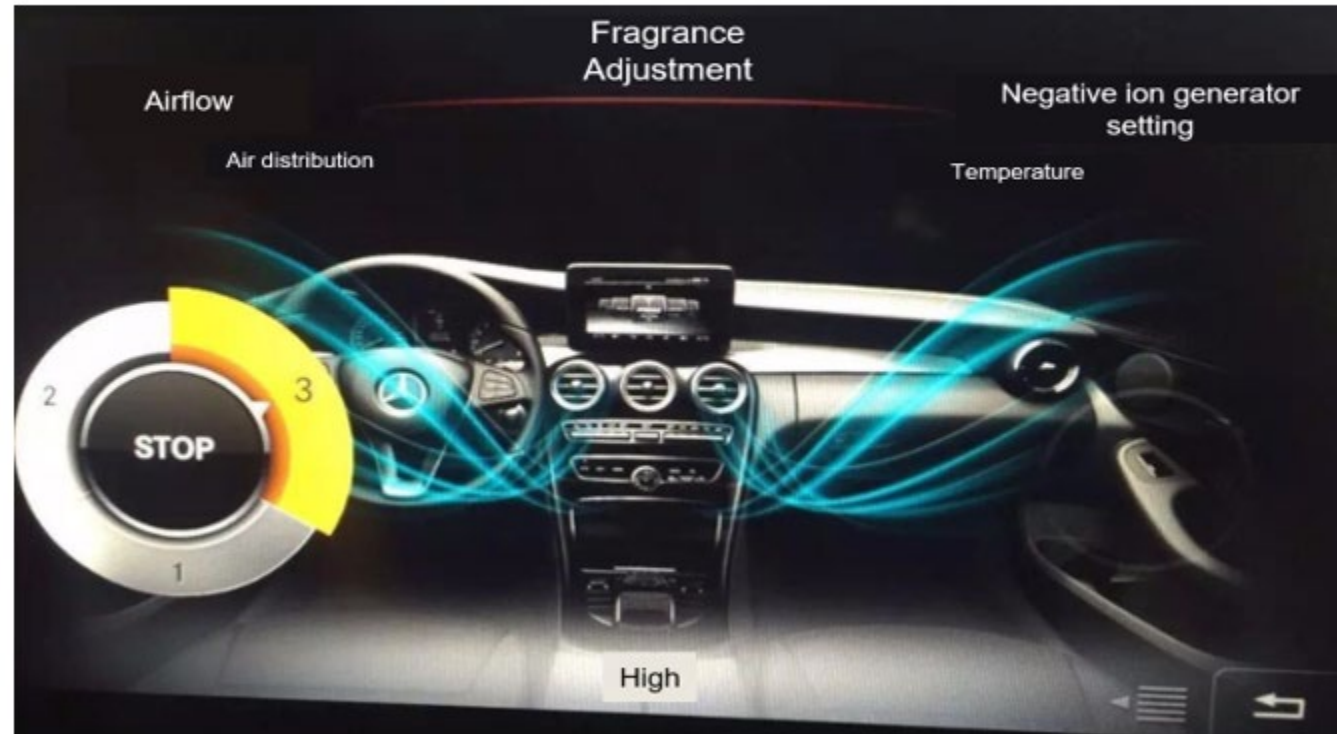
All of NIO's models carry an intelligent fragrance system, which is connected to the IVI system and can be turned on independently. Its fragrance bottle is equipped with magnetic suction technology and NFC chip for fast recognition. The system is designed by Shanghai ARTOP Industrial Design Co., Ltd.



Source: NIO

Mercedes-Benz was the first OEM to introduce fragrance systems, which is installed in C-Class (AMG Models), GLS, CLS, S-Class, GLE, E-Class, G-Class and other models. Provided by the international fragrance group Symrise, the fragrance for S-Class is integrated with the Mercedes-Benz Air Balance system that offers the negative ion air purification function.

Mercedes-Benz's fragrance bottle is located in the glove box and supports 3 levels of concentration



Source: Mercedes-Benz

Based on the original air conditioner filter, Geely's intelligent air purification system (IAPS) adopts the architecture of "AQS + PM2.5 four-layer air purification device + negative ion generator", which can efficiently filter conventional dusts, harmful gases, PM2.5 particles, $>0.74\mu\text{m}$ droplets, and $>0.3\mu\text{m}$ particles.

Geely's AQS (Air Quality Sensor)



Source: Geely

Table of Content (1)

1 Overview of Fragrance and Air Purification Systems

- 1.1 Overview of Fragrance System
 - 1.1.1 Development History of Fragrance System
 - 1.1.2 Principle of Fragrance System
 - 1.1.3 Structure of Fragrance System
 - 1.1.4 Fragrance Control System: Control Principle of Encryption Chip
 - 1.1.5 Fragrance System Technology: NFC Chip Recognition (1)
 - 1.1.5 Fragrance System Technology: Magnetic Suction/Scenario Linkage Mode (2)
 - 1.1.6 Fragrance Materials and Suppliers
- 1.2 Air Purification Technology
 - 1.2.1 Development History of Air Purification System
 - 1.2.2 Principle of Air Purification System: Sources of Pollution and Conventional Purification Process
 - 1.2.3 Structure of Air Purification System: High-efficiency Air Purification Process
 - 1.2.3 Structure of Air Purification System: Purification Characteristics
 - 1.2.4 Major Air Purification Technologies: Negative Ion/Plasma System
 - 1.2.4 Major Air Purification Technologies: Ultraviolet Light
 - 1.2.4 Major Air Purification Technologies: Photocatalyst
 - 1.2.5 Air Filter Technologies: AQS Monitoring / Physisorption
 - 1.2.5 Air Filter Technologies: Filter Element/HEPA Filter Mesh
 - 1.2.6 Other Air Purification Component: Ultrasonic Atomizer

2 Fragrance and Air Purification Systems Market

- 2.1 Industry Regulations and Certification
 - 2.1.1 Industry Regulation: "Guideline for Air Quality Assessment of Passenger Car
 - 2.1.2 CN95 Filter Certification, 2020-2022
 - 2.1.3 Automotive CN95 Certification, 2020-2022
- 2.2 Market Data
 - 2.2.1 Installations of Fragrance and Air Purification Systems, 2020-2023

- 2.2.2 Price Range of Models Installed with Fragrance and Air Purification Systems, 2021-2022
- 2.2.3 Power Type of Models Installed with Fragrance and Air Purification Systems, 2020-2022
- 2.2.4 TOP20 Passenger Car Models with Air Purification System in China, 2022
- 2.2.5 TOP20 Passenger Car Models with Fragrance System in China, 2022
- 2.2.6 Mercedes-Benz's Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.6 BMW's Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.6 Audi's Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.6 Chery's Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.6 BYD's Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.6 Geely's Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.6 GAC Aion's Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.6 Toyota's Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.6 Volkswagen's Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.6 Emerging Automakers' Installation Rate of Fragrance and Air Purification Systems, 2020-2022
- 2.2.7 Industry Chain of Fragrance and Air Purification Systems

3 Fragrance and Air Purification Systems Manufacturers

- 3.1 Valeo
 - 3.1.1 Profile
 - 3.1.2 Development History of Air Purification Products
 - 3.1.3 Integrated Air Management System
 - 3.1.4 Cockpit Filter: Triple Layer Filtering
 - 3.1.5 Filter Element: Combined Filter

Table of Content (2)

- 3.1.6 Valeo Oxy'ZEN
- 3.2 Denso
 - 3.2.1 Profile
 - 3.2.2 Air Purification System Components
 - 3.2.3 Air Quality Solutions
- 3.3 MAHLE
 - 3.3.1 Profile
 - 3.3.2 Air Management Product: Filter + Fragrance System
- 3.4 Hanon
 - 3.4.1 Profile
 - 3.4.2 Intelligent Air Quality Solution
- 3.5 Freudenberg
 - 3.5.1 Profile
 - 3.5.2 MicronAir Blue Filter
- 3.6 Sailing Technology
 - 3.6.1 Profile
 - 3.6.2 Toyota Fragrance System
- 3.7 CUBIC
 - 3.7.1 Profile
 - 3.7.2 Negative Ion Generator + Fragrance Generator
 - 3.7.3 R&D
- 3.8 Goldensea Hi-Tech
 - 3.8.1 Profile
 - 3.8.2 Products
- 3.9 Dongjian Technology

- Fragrance Control System Manufacturers

- 3.10 Desay SV

- 3.10.1 Profile
- 3.10.2 Fragrance Control System
- 3.10.3 Fragrance Control System for Pets
- 3.11 PATEO CONNECT+
 - 3.11.1 Profile
 - 3.11.2 Scenario-based Fragrance Control System
- 3.12 Sunlord Electronics: Fragrance Control System
- 3.13 ST
 - 3.13.1 Profile
 - 3.13.2 ST25TV NFC Chip
 - 3.13.3 Applications of NFC Chip

4 Fragrance and Air Purification System Cases of OEMs

- Self-developed Fragrance System Technologies of OEMs
- Comparison of Parameters of Fragrance Systems between Models of OEMs
- Comparison of Parameters of Air Purification Systems between Models of OEMs
- 4.1 Tesla's Air Purification System
- 4.2 Li Auto's Fragrance and Air Purification Systems
- 4.3 NIO's Fragrance and Air Purification Systems
 - 4.3.1 Intelligent Fragrance System
 - 4.3.2 Air Purification System
- 4.4 XPeng's Fragrance and Air Purification Systems
- 4.5 BYD's Fragrance and Air Purification Systems
 - 4.5.1 DiLink System
 - 4.5.2 Fragrance System
- 4.6 AITO's Fragrance and Air Purification Systems
 - 4.7.1 SAIC IM's Fragrance System
 - 4.7.2 SAIC IM's Air Purification System
- 4.8 Mercedes-Benz's Air Balance System

Table of Content (3)

- 4.9 BMW's Fragrance and Air Purification Systems
 - 4.9.1 Negative Ion Fragrance System for BMW Models
 - 4.9.2 Air Purification System
- 4.10 SAIC Audi's Fragrance and Air Purification Systems
- 4.11.1 Geely's Fragrance System
- 4.11.2 Geely's Intelligent Air Purification System (IAPS)
- 4.12 Volvo CLEANZONE
- 4.13 Chery's Air Filtration System
- 4.14 Toyota's Nanoe Air Purification System
- 4.15 Changan Forest Air Purification System
- 4.16 Renault's Fragrance and Air Purification Systems
- 4.17 SAIC Roewe's UV Sterilization System
- 4.18 HiPhi's Fragrance and Air Purification Systems
- 4.19 GAC Aion's Intelligent Health Cockpit
- 4.20 Weltmeister EX6 Plus 6: CleanPro Healthy Cabin



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