Kraftfahrt-
Bundesamt

Market Surveillance Report 2019

Finalised on 8 April

Contents

Abbreviations and Acronyms

ABE	Allgemeine Betriebserlaubnis (*National type approval*)
AFS	Adaptive front-lighting systems
C_F	Conformity factor
CVR	Central vehicle register
CO	Carbon monoxide
CO_2	Carbon dioxide
CoC	Certificate of conformity
CoP	Conformity of production
CoP-P	Conformity of production – product
CoP-Q	Conformity of production – quality
D_F	Deterioration factor
DPF	Diesel particulate filter
DRDE	Double real driving emissions test
EG-FGV	EG- Fahrzeuggenehmigungsverordnung (*Regulation on the EC approval of motor vehicles*)
EGR	Exhaust gas recirculation
eKFV	Elektrokleinstfahrzeuge-Verordnung (*Personal light electric vehicles-regulation*)
EU	European Union
EUDC	Extra urban driving cycle
DMÜF	Deutsches Marktüberwachungsforum (*German market surveillance forum*)
H_2O	Water
HO_2	Hydroperoxyl radical
ICSMS	Information and Communication System on Market Surveillance
ISC	In-service conformity
KBA	Federal Motor Transport Authority
K_i	Regeneration factor
km/h	Kilometres per hour
N_2	Dinitrogen
N_2O	Nitrous oxide
N_2O_3	Dinitrogen trioxide
N_2O_5	Dinitrogen pentoxide
NEDC	New European driving cycle
NH_3	Ammonia
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_3	Nitrate
NO_x	Nitrogen oxides
NSC	NO_x storage catalyst

OH	Hydroxyl radical
PEMS	Portable emissions measurement system
PM	Particulate mass
PN	Particle number
PPF	Petrol particulate filter
ProdSG	Product safety act
RAPEX	Rapid Exchange of Information System; the EU's rapid alert system for unsafe consumer products and consumer protection
RDE	Real driving emissions
SCR	Selective catalytic reduction
StVG	Straßenverkehrsgesetz (*Road traffic act*)
StVZO	Straßenverkehrs-Zulassungs-Ordnung (*Road traffic licensing regulation*)
THC	Total hydrocarbons
UDC	Urban driving cycle
UHCs	Unburned hydrocarbons
UWS	Urea water solution
WLTC	Worldwide harmonised light-duty vehicles test cycle
WLTP	Worldwide harmonised light-duty vehicles test procedure

A. Introduction

The German Federal Motor Transport Authority (Kraftfahrt-Bundesamt in German; the acronym KBA is used in the rest of this document) monitors the market to protect public interests such as health and safety. It takes both consumer and environmental aspects into account. It also endeavours to ensure fair competition by establishing a level playing field for all market actors and refraining from limiting the free movement of goods beyond what is allowed by European regulations.

In 2007, Directive 2007/46/EC of the European Parliament and Council introduced a comprehensive legal framework for approving motor vehicles and trailers, as well as systems, components and separate technical units intended for them.

In 2013 the EU Commission assessed this legal framework and concluded that it is in fact suitable for achieving the principal objectives of harmonisation, smooth operation of the internal market and fair competition, and should therefore continue to be applied. In connection with this assessment, a need to introduce market surveillance regulations was also identified. Consequently, an initial framework for monitoring the market for vehicles and associated equipment was created with Regulations (EU) 167/2013 and 168/2013 of the European Parliament and Council on type approval and market surveillance of agricultural and forestry vehicles and two- or three-wheel vehicles and quadricycles.

In September 2015, it emerged that illegal 'defeat' devices had been installed in vehicles of the Volkswagen Group equipped with 1.2-litre, 1.6-litre and 2.0-litre versions of engine model EA 189. In October, the KBA then ordered the removal of these devices within the scope of a recall of these vehicles, in order to restore compliance with Section 25, Paragraph 2 of the regulation on the EC approval of motor vehicles under Directive 2007/46/EC. These events, as well as weaknesses in implementing the EU type approval framework, highlighted the need to thoroughly rework the existing type approval and market surveillance rules for vehicles.

Regulation (EU) 2018/858 of the European Parliament and Council, which will apply from 1 September 2020, expands the existing framework for EU type approval, chiefly by introducing rules on market surveillance. For monitoring the motor vehicle market, it defines the obligations of the various market players in the supply chain, the duties of the responsible authorities in the member states and the steps which must be taken if any motor vehicle products should appear in the marketplace that pose serious safety or environmental risks, dilute the protection afforded to consumers or fail to comply with type approval requirements.

Regulation (EU) 2018/858 also defines more detailed rules for surveillance of the motor vehicle market than Regulation (EC) 765/2008, which sets out the requirements for accreditation and market surveillance in more general terms. It takes the special features of the type approval framework into account, as well as the need to supplement it with an effective market surveillance approach that also includes reliable follow-up tests of motor vehicle products covered by the regulation. To verify that the legal framework works as intended, the market surveillance authorities must establish the conformity of motor vehicle products, regardless of whether their type approvals were granted before or after this regulation entered into force. To ensure that these market surveillance obligations are reliably met throughout the EU, a required minimum number of yearly follow-up tests was mandated. An appropriate share of this minimum number of checks targets emissions. To make sure that vehicles fully comply with all applicable rules, within the scope of each individual inspection, it is essential to determine whether all emission-related type approval requirements applicable to the vehicle in question have actually been met.

To comply with these additional surveillance requirements, the KBA Market Surveillance department was established on 1 January 2017. It is responsible for enforcing the stipulations of various European and national guidelines, directives, regulations and laws on road vehicles.

The KBA monitors the markets for the following products:

- motor vehicles and their trailers as well as systems, components and separate technical units intended for them;
- agricultural and forestry vehicles; and
- two- or three-wheel vehicles and quadricycles.

The following report provides an overview of the basic organisation of market surveillance activities by the KBA (Part B), the market surveillance activities conducted in 2019 (Part C) and the market surveillance activities planned for 2020 (Part D). It concludes with a summary (Part E).

B. Organisation of Market Surveillance by the KBA

The market surveillance activities of the KBA are currently organised into five sections:

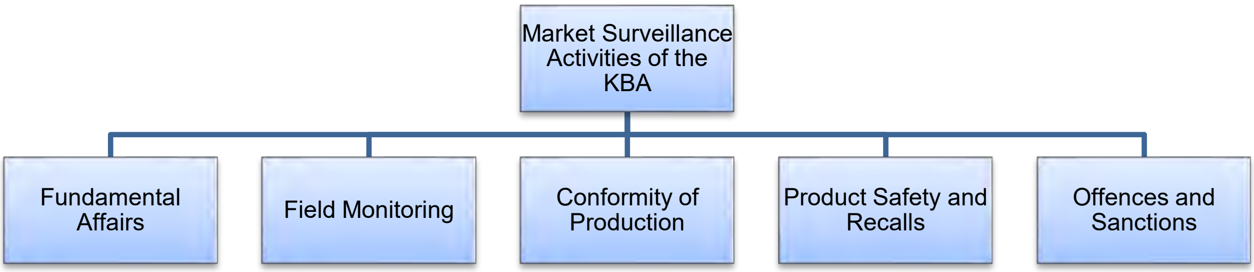


Figure 1: Sections of the KBA

The **Fundamental Affairs** section coordinates sharing of information with other national and European market surveillance authorities and is responsible for defining market surveillance concepts and strategies, communicating with residents and chairing the advisory board that was created at the KBA in 2018.

The **Field Monitoring** section carries out actual tests of vehicles to ensure that these meet the relevant requirements. They include exhaust emission tests, which are carried out using portable emission measurement systems (PEMSs) and on the KBA mission test center and in its own laboratory (currently under construction). Driving functions relevant to safety are also being tested to an increasing extent.

The **Conformity of Production** section checks type-approved products for conformity with the issued type approvals.

The **Product Safety and Recalls** section evaluates safety problems that fall under the Product Safety Act (ProdSG) and orders actions to remedy them when required, such as recalls and/or public warnings. Affected manufacturers must document recall campaigns and submit monitoring reports to the KBA. If required, the KBA also works with the approval bodies of the German federal states to prohibit the use of recalled vehicles, whose owners have failed to comply. The Rapid Exchange of Information System (RAPEX), the EU's rapid alert system for unsafe consumer products and consumer protection, is also used to share information with the European Commission and EU member states.

The **Offences and Sanctions** section sanctions manufacturers and dealers for the prohibited sale of vehicles or vehicle parts that lack required approvals. Tests are also performed of vehicle parts offered for sale, mainly on the Internet but also at dealerships and trade fairs. Operators of online sales platforms are requested to cease dealing in prohibited products. In addition, the KBA penalises failures to comply with obligations or injunctions under the ProdSG (e.g. violations in connection with recall campaigns) or type approval legislation. This section also processes requests from the customs authorities (decisions on whether or not vehicles and vehicle components may be imported).

I. Fundamental Affairs

The existing and new rules on surveillance of the market for vehicles and related products require regular harmonization with other national and European market surveillance and type approval authorities. The Fundamental Affairs section is charged with coordinating these activities and participating in committees. The KBA is currently involved in the following national and international bodies:

- Member of the German Market Surveillance Forum (DMÜF)
- Member of the working group 'Framework Regulation (EU) 2018/858'
- Member of the National Type Approval and Market Surveillance Forum
- Chair of the 'Market Surveillance' subgroup of the National Type Approval and Market Surveillance Forum
- Member of European Market Surveillance Authorities Meeting in the Motor Vehicle Sector
- Member of the Forum for the Exchange of Information on Enforcement of the EUR Legislation on the Approval and Market Surveillance of Motor Vehicles (Regulation (EU) 2018/858) and its subgroups

In this connection, the Fundamental Affairs section coordinates activities to meet market surveillance and reporting obligations, such as those that are standardised by Article 8 of Regulation (EU) 2018/858. Amongst other things, it requires the market surveillance authorities to regularly carry out inspections, to determine whether vehicles, systems, components and separate technical units meet the relevant requirements. In addition, a defined minimum number of tests must be performed by each member state of the European Union, with this number being equal to one inspection per 40,000 of the new vehicles registered in a given member state in the preceding year. Twenty per cent of these tests must focus on emissions. The European Commission must be informed each year about the scope of tests performed. Every two years, each member state must also submit a report to the European Commission on the findings what has been learnt from these tests.

The Fundamental Affairs section is also responsible for chairing the advisory board that was created at the KBA in 2018. The advisory board's purpose is to advise and support the KBA for

- adjusting inspection activities in response to technological innovations,
- basing the inspection activities that the KBA performs in connection with issuing type approvals and monitoring the market on an even more comprehensive body of knowledge,
- increasing the transparency of the KBA's work, and
- discussing consumer, environmental and economic issues arising in connection with issuing type approvals and monitoring the market and making recommendations to the KBA for dealing with them.

This section also processes inquiries from residents, technical services, offices of foreign governments and other interested parties. In this context, on 1 November 2018 an information service was created to reply to questions related to diesel emissions and recall campaigns.

II. Field Monitoring

The Field Monitoring section carries out tests of vehicles on the basis of the national market surveillance plan. In the short term, it is mainly focusing on performing real driving emissions tests and the establishment of an appropriate testing lab. Looking ahead, there are plans to also test vehicles equipped with new technologies such as advanced driver-assistance and lane centring systems. Tests related to vehicle safety are also carried out. Besides emission tests, varying test focuses are selected on an annual basis. Tests are carried out on type-approved vehicles, components and systems independently of the approval authority that granted the type approval (which can be the KBA or its equivalent in another country), as opposed to the checks for conformity of production described in Section B, Part III below.

The Field Monitoring section also receives information or requests for vehicle tests from other KBA sections. Information from other authorities and third parties (clubs, associations and residents) is also received and processed.

The section thus conducts three kinds of activities:

- Emissions-related tests
- Measurements of various kinds, the focus of which changes from year to year
- Activities in response to information and test requests received from third parties

Which vehicles are tested?

Which vehicles are chosen for tests depends on a plan which is drawn up on an annual basis, information received from other authorities and third parties (clubs, associations and residents) and information related to vehicle type approvals. Article 8 of Regulation (EU) 2018/858 specifies that all drive types (diesel, petrol and electric) must be regularly subjected to random sample checks. Due to concerns about diesel emissions, in recent years greater attention has focused on vehicles with diesel engines, which accounted for the majority of those tested in 2019. The vehicles checked are selected in a certain manner, to yield a representative picture of the vehicles that are actually in use.

What is studied and which procedures are applied?

The selected vehicles undergo a testing programme at the KBA, which is designed to comply with the currently applicable legal requirements. It mainly consists of measurements performed on chassis dynamometers and while actually driving on roads in order to determine the real driving emissions (RDE).

Primarily to eliminate defects that might otherwise influence the tests, the selected vehicles undergo a general technical inspection beforehand.

To see whether the vehicles' pollutant emission levels correspond to the relevant type approvals, measurements are carried out in accordance with Regulation (EC) 715/2007 ('type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles [Euro 5 and Euro 6]') – including the associated implementation regulations – with the corresponding test cycles. To obtain comparable test results, the defined cycles are performed on a chassis dynamometer under reproducible conditions (barometric pressure, air temperature, speed profile). Within the scope of type approval, vehicles falling under Regulation (EC) 715/2007 have been tested to determine their tailpipe emissions in accordance with the specifications of either Regulation (EC) 692/2008 while applying the New European Driving Cycle (NEDC) or Regulation (EU) 2017/1151 while applying the Worldwide Harmonised Light Vehicles Test Procedure (WLTP). This will continue to be done by contracted technical service providers under the supervision of KBA staff until the KBA's own test lab has been completed.

RDE measurements are carried out by the KBA with PEMS.

Measurements performed under actual road driving conditions can reveal prohibited defeat devices as defined by Article 5 of Regulation (EC) 715/2007 and are therefore always included, even if older vehicles did not have to meet any requirements under actual road driving conditions.

New European Driving Cycle

A driving cycle is defined by a speed vs. time profile. During the test, the vehicle must be driven on a chassis dynamometer on this so-called driving curve (extended by a narrow tolerance band). Besides the speed, gear changing points are also defined. The speed vs. time profile of the NEDC, which is required for the European type approval procedure, is depicted in Figure 2.

The NEDC has a total duration of 1180 seconds and is divided into two parts. Part 1 is called the Urban Driving Cycle (UDC) and is intended to represent typical driving conditions within a town or city with a maximum speed of 50 km/h and frequent stops. The following Part 2, the Extra-Urban Driving Cycle (EUDC), has the speed profile of a cross-country trip including a brief stretch on a motorway.

On the chassis dynamometer, the NEDC first simulates straight-ahead driving over a distance of about 11 km with moderate acceleration (a_{max} = 0.8 – 1 m/s²), an average speed of $v_{Ø}$ = 33.6 km/h and, briefly, a top speed of v_{max} = 120 km/h.

The temperature range prescribed by EC Regulation 715/2007 for the NEDC on a chassis dynamometer is 20 – 30°C.

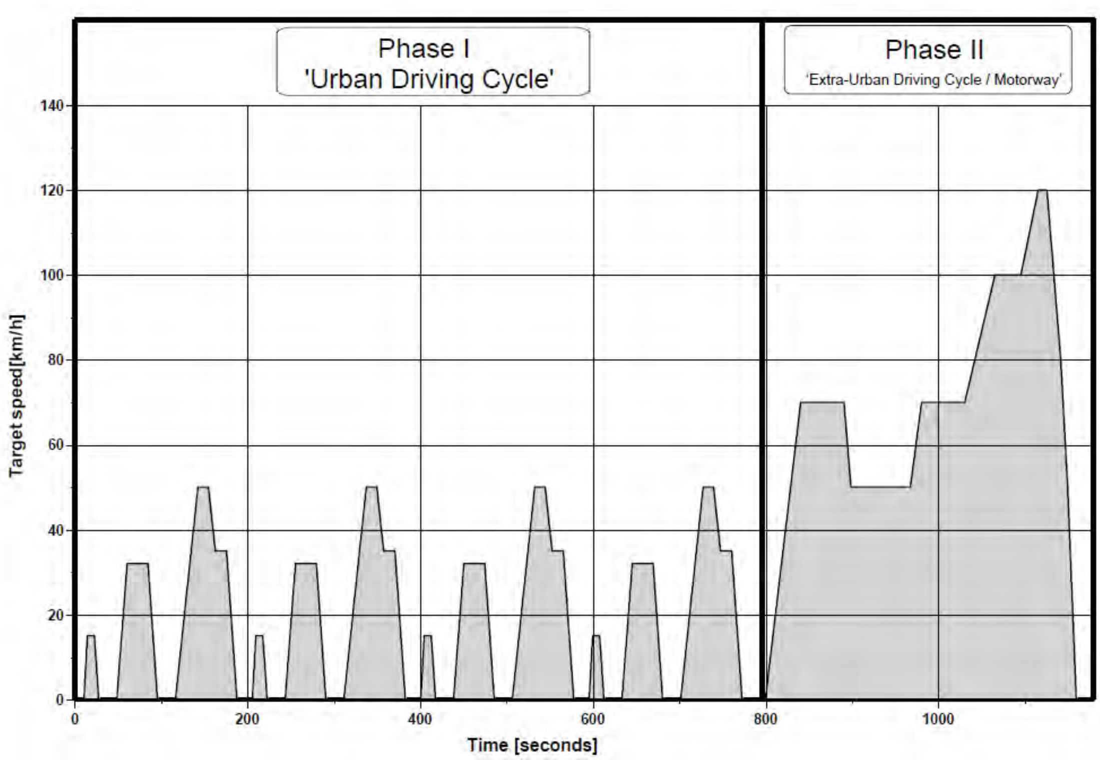


Figure 2: Driving profile of the New European Driving Cycle (NEDC)

Worldwide Harmonised Light Vehicles Test Procedure (WLTP)

The WLTP is subdivided into four parts, each of which has a different top speed (1 = low, 2 = medium, 3 = high, 4 = extra-high).

The first part (low) simulates driving in urban traffic at speeds up to 56.5 km/h.

The second (medium) and third (high) parts represent driving on suburban and rural highways with maximum speeds of 76.6 km/h and 97.4 km/h, respectively.

The fourth part (extra-high) corresponds to driving on a motorway at up to 131.3 km/h.

The following diagram illustrates the driving profiles of parts 1 to 3 of the WLTP, referred to as WLTP123.

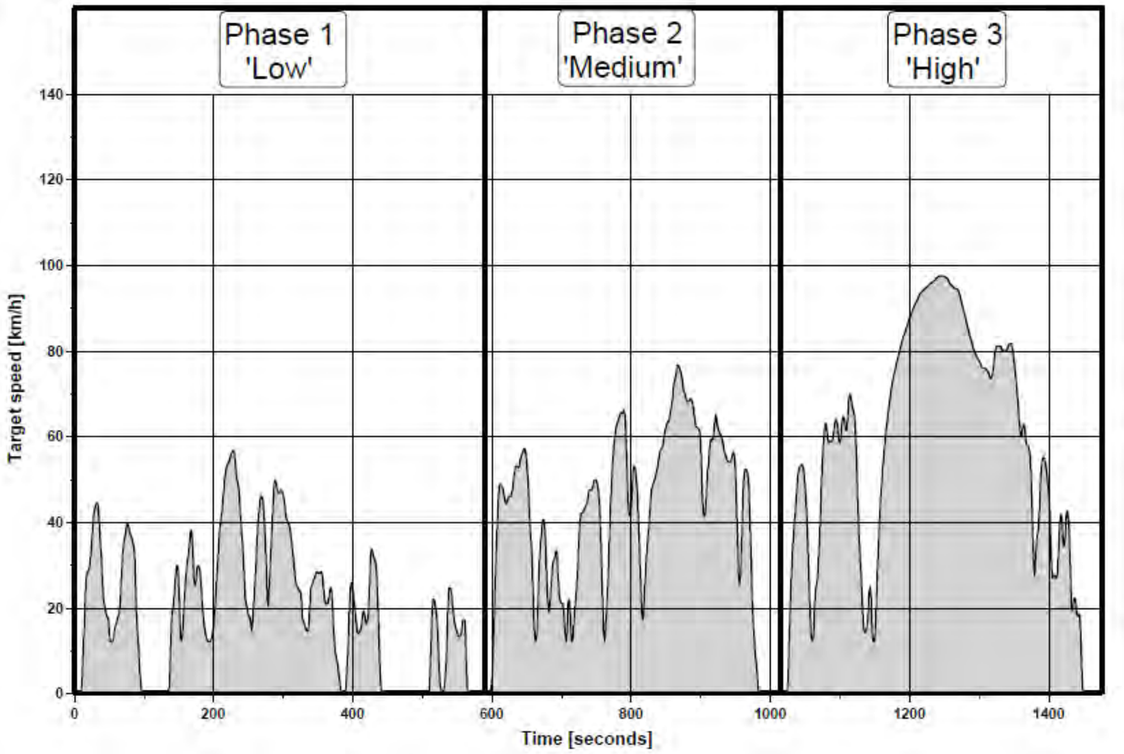


Figure 3: Driving profiles of the Worldwide Harmonised Light Vehicles Test Procedure (WLTP123)

WLTP123 has a total duration of about 25 minutes (1477 seconds), subdivided into three parts. With a top speed of 97.4 km/h, it corresponds to the driving conditions that predominate in urban, suburban and rural traffic.

WLTP123 is simulated on a chassis dynamometer over a total distance of about 15 km with a dynamic driving profile, moderate acceleration of a_{max} = 1.6 m/s² (typical of actual road traffic) and an average velocity of $v_{Ø}$ = 36.58 km/h.

For testing software updates that subsequently received a national type approval from the KBA, WLTP123 was used to demonstrate the associated improvement in pollutant emissions in urban and rural traffic.

The temperature specified by Regulation (EU) 2018/1832 for chassis dynamometer testing with the WLTP is 23°C ± 2°C. In the test series conducted by the KBA, reduced ambient temperatures were used in order to assess emissions at low outdoor temperatures. Three staggered temperatures were applied: 5°C, 10°C and 15°C.

Real Driving Emissions (RDE)

The RDE test procedure with Portable Emission Measurement Systems (PEMS) was defined in Regulation (EU) 2016/427 and specified in greater detail with regard to certain boundary conditions by Regulations (EU) 2016/646, 2017/1151 and 2017/1154.

As testing with RDE is carried out while actually driving and not on a chassis dynamometer, the measurements and findings can be influenced by a variety of environmental conditions (e.g. air temperature, altitude and barometric pressure), driving conditions (e.g. high or low traffic density), driving dynamics (acceleration and delays) and vehicle-related factors (e.g. vehicle mass and any additional loads). The aforementioned regulations define these boundary conditions in such a way as to largely account for the normal range of operating conditions, including cold starts. The principal boundary conditions within which RDE testing is valid include temperatures in the range from -7°C to 35°C and elevations up to 1300 m above sea level. Ambient temperatures are subject to seasonal and weather-dependent fluctuations. When making comparative measurements, an effort is also made to perform them at similar ambient temperatures.

An RDE test drive must last between 90 and 120 minutes and consists to about 34% of urban driving, to about 33% of rural driving and to roughly 33% of motorway driving. Each of these is characterised by a different vehicle speed range. For passenger cars, they are: urban driving up to 60 km/h, driving on rural roads between 60 and 90 km/h and driving on motorways between 90 and 145 km/h with peaks up to 160 km/h.

Under these boundary conditions, a speed profile can look like that Figure 4.

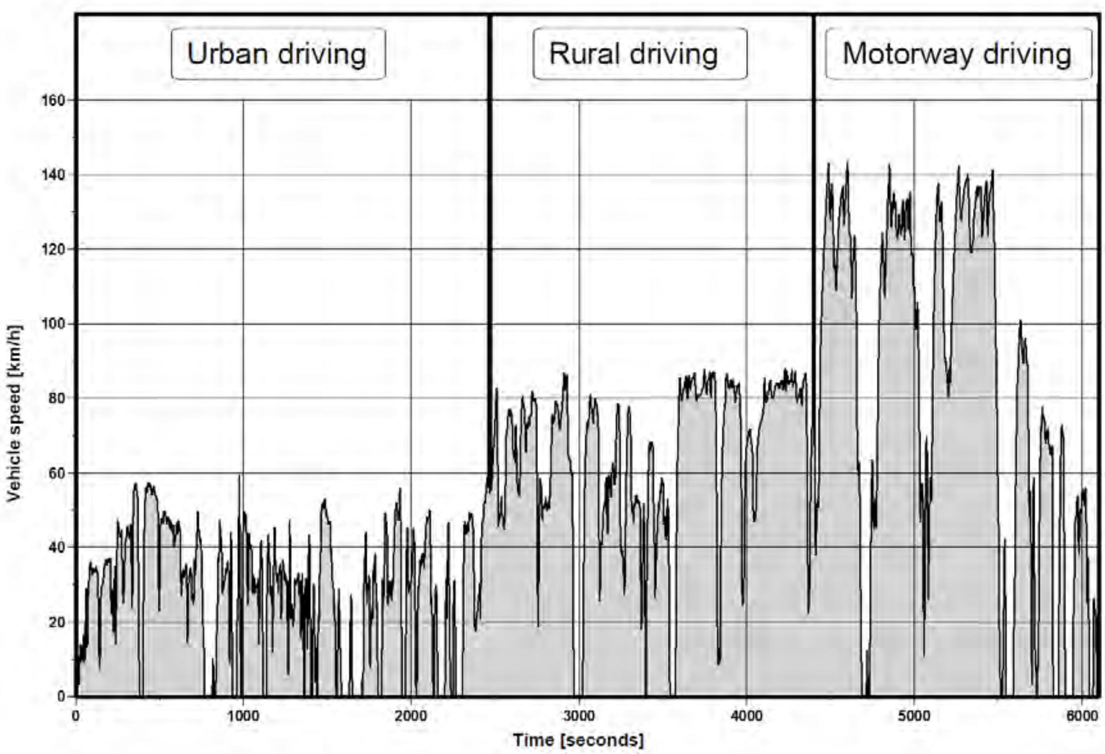


Figure 4: Example profile of an RDE test drive

Annex 1 contains additional explanations related to engine combustion and pollutant formation.

III. Conformity of Production

When an approval body issues a type approval, it authorises the corresponding manufacturer to produce and sell vehicles and/or vehicle components in series in accordance with the granted type approval without the need for them to pass a final inspection by a government agency. The manufacturer must take steps to ensure that the approved products, when manufactured in series, continue to match the product submitted for type testing. Monitoring by the approval body consists of checking the conformity of production (CoP).

At the KBA, the Conformity of Production section is divided into two sections with different focuses. One is responsible for ascertaining the conformity of products (CoP-P) and the other for checking conformity with the manufacturer's production processes and quality management system (CoP-Q).

The CoP-Q section performs on-site checks of manufacturers' quality management systems, to verify whether the manufacturer is able to produce in compliance with the approvals received from the KBA. The methods and processes used are assessed, to determine whether they meet the prerequisites for granting type approval, and if this is the case they are then certified. Further monitoring is carried out at three-year intervals by a certification partner designated by the KBA as a technical service provider or by CoP-Q itself. The tests and checks performed by or on behalf of CoP-Q focus on products that are relevant in terms of safety and/or their environmental impacts, or else are carried out in response to field events, which call the attention of other KBA departments engaged in surveillance.

Conformity of product (CoP-P) checks involve physically testing them. The planned checks can involve assessing various aspects that can include:

- The approved object itself (paying particular attention to how it affects traffic safety and the environment);
- The results of preceding conformity checks;
- Anomalies in driving situations;
- Information provided by authorised bodies or other approval authorities.

Thematic focuses are defined, when planning the active CoP-P checks for each year. If there is concrete information about non-conformant vehicles or products or other urgent cases requiring action, investigations are also initiated without delay.

To check production, the KBA or contracted experts remove vehicles or vehicle components from factories or warehouses, to determine whether they are identical with the approved type in each case.

For proper execution of the procedure for ensuring conformity in the event of deviations, the manufacturers or importers involved are ordered to take all required steps.

If major deviations are identified in production series that could pose a significant risk to traffic safety, health or the environment, the associated approvals are revoked. This also generally casts doubt on the manufacturer's reliability.

Another important task is monitoring vehicles that are in use (in-service conformity of ISC) in accordance with the relevant testing procedures of Regulation (EU) 715/2007, which was amended by Commission Regulation (EU) 2018/1832. Every manufacturer with an 'e1' type approval must be checked at least once every year. The approval mark 'e1' or 'E1' stands for a type approval issued by the KBA. Each year, a report is prepared with the findings of all ISC checks performed out during the preceding year; these reports are also intended for publication.

IV. Product Safety and Recalls

The Product Safety and Recalls section is responsible for issues related to the safety of vehicles and vehicle components in public road traffic (with some exceptions, including rail-mounted vehicles).

The primary basis for this is the German Product Safety Act (ProdSG). This comes into play whenever a product is first made available in the market, exhibited or used within the scope of a business operation. Other rules and regulations apply when selling products that are expected to be designed and produced in such a way as to avoid causing harm to consumers, public health, the environment or other persons or things that merit protection in the interests of the public.

The Product Safety Act requires manufacturers to notify the KBA whenever there is reason to suspect that products placed in circulation by them pose risks. Information on faulty and dangerous products is also collected by consumers, government agencies, insurers and the press.

If, in the course of investigating such a report, a serious risk to health, safety, the environment or other public interests is identified, the KBA orders the economic operator to issue a recall and may also take other action as required (for example, warning the public). The rate of compliance with recalls is also monitored by the KBA. The manufacturer concerned is required to submit this information at intervals specified by the KBA.

When serious risks are involved, the EU member states exchange information on them using so-called RAPEX reports and the information and communication system on market surveillance (ICSMS) and inform the corresponding authorities in other countries as well as consumers. The goal is to inform all affected owners in order to ensure complete elimination of the defects involved.

If the complete elimination of a defect is prevented by the failure of individual owners to participate in the recall campaign, the KBA notifies the responsible motor vehicle registration offices, which then take steps that they deem appropriate for preventing further use of the vehicles concerned.

Recalls

Manufacturers carry out recalls, in order to remedy product defects. But as product defects can pose greatly varying risks, not all recalls are equivalent.

When a serious risk is involved, from the responsible authority's perspective a recall is usually the most effective way to counter it. To completely eliminate serious risks, it is essential for vehicle manufacturers to use the owner addresses listed in the KBA's central vehicle register (CVR).

The KBA and manufacturer always work together to eliminate risks that have prompted recalls and increase motor vehicle and traffic safety. To support the systematic elimination of hazardous products, the KBA has prepared a Codex for the execution of recall campaigns for collaborating with manufacturers within Germany.

A systematic and thorough approach is needed to completely eliminate a problem. Vehicle owners also play an important role: they must take their vehicles to a workshop to have them fixed. Otherwise the risk, or the inconformity persists. When vehicle owners fail to take required action within the scope of a recall campaign, they are reminded of their obligation to do so. And if the actions taken by manufacturers and the KBA to eliminate particularly dangerous defects do not have the desired effect, because vehicle owners continue to neglect their duty even after receiving multiple reminders, they can have their vehicle registration revoked as a final resort.

V. Offences and Sanctions

The Offences and Sanctions section is responsible for levying fines for offering unapproved vehicles or vehicle components for sale. Fine proceedings are initiated on the basis of evidence collected by ongoing market monitoring, for example checks of online shops, physical shops and car dealerships or trade fairs, or information submitted by residents, companies or other government agencies.

In the interests of motor vehicle safety, only approved models or types of many vehicles and vehicle components may be put up for sale in Germany. The KBA monitors compliance with these legal constraints within the scope of its general monitoring activities, among other things in connection with fine proceedings on the basis of the Road Traffic Act (StVG).

This concerns, on the one hand, the vehicle components mentioned in Section 22 a, Paragraph 1 of the Road Traffic Licensing Regulations (StVZO) and on the other, various vehicles and vehicle components that require type approval under various European regulations (according to Section 27, Paragraph 2 of the Regulation on the EC approval of motor vehicles (EG-FGV)).

This mainly concerns vehicle components that are relevant to safety. In the interests of motor vehicle safety, these sales prohibitions are intended to prevent the sale of unapproved and possibly defective vehicle components.

Fines are levied on the basis of Section 23, Paragraph 1 of the Road Traffic Act and Section 23, Paragraph 2 in conjunction with Section 37 of the Regulation on the EC approval of motor vehicles.

Violations can be punished with fines of up to 5,000 euros. Even larger fines can also be imposed in order to prevent the profitability of such sales.

In addition, fines can be levied on businesses that fail to meet obligations under product safety or type approval laws (e.g. reporting obligations) or do not comply with orders issued in this connection (e.g. recall orders)

This section also processes control notifications received from customs offices on imported goods. The customs offices suspend release of a product for free circulation on the EU internal market when the product displays characteristics which give cause to believe that the product, when properly installed, maintained and used, presents a serious risk to health, safety, the environment or any other public interest. The same applies if documents required by the harmonised standards of the European Union are missing or if the product designations required by these standards are lacking or dubious.

In these cases, the customs authorities inform the KBA, to the extent that it is responsible, and request a decision on whether the merchandise may be admitted for free circulation under the relevant provisions or must be re-exported or destroyed. Most of these requests culminate in a decision that the products concerned may not be allowed in for free circulation.

C. Market Surveillance Activities in 2019

I. Fundamental Affairs

To deal with the large number of inquiries received on diesel engine emissions, on 1 November 2018 an information service was created within the Fundamental Affairs section. This information service answered all questions relating to diesel vehicle recalls, voluntary measures taken by manufacturers within the scope of the National Diesel Forum, the German federal government's package of measures for the '2017-2020 Immediate Action Programme for Clean Air' for improving air quality in cities and, from February 2019 onwards, other recall campaigns that mainly addressed safety issues. In 2019, a total of 24,156 inquiries were answered. A detailed breakdown is shown in Figure 5.

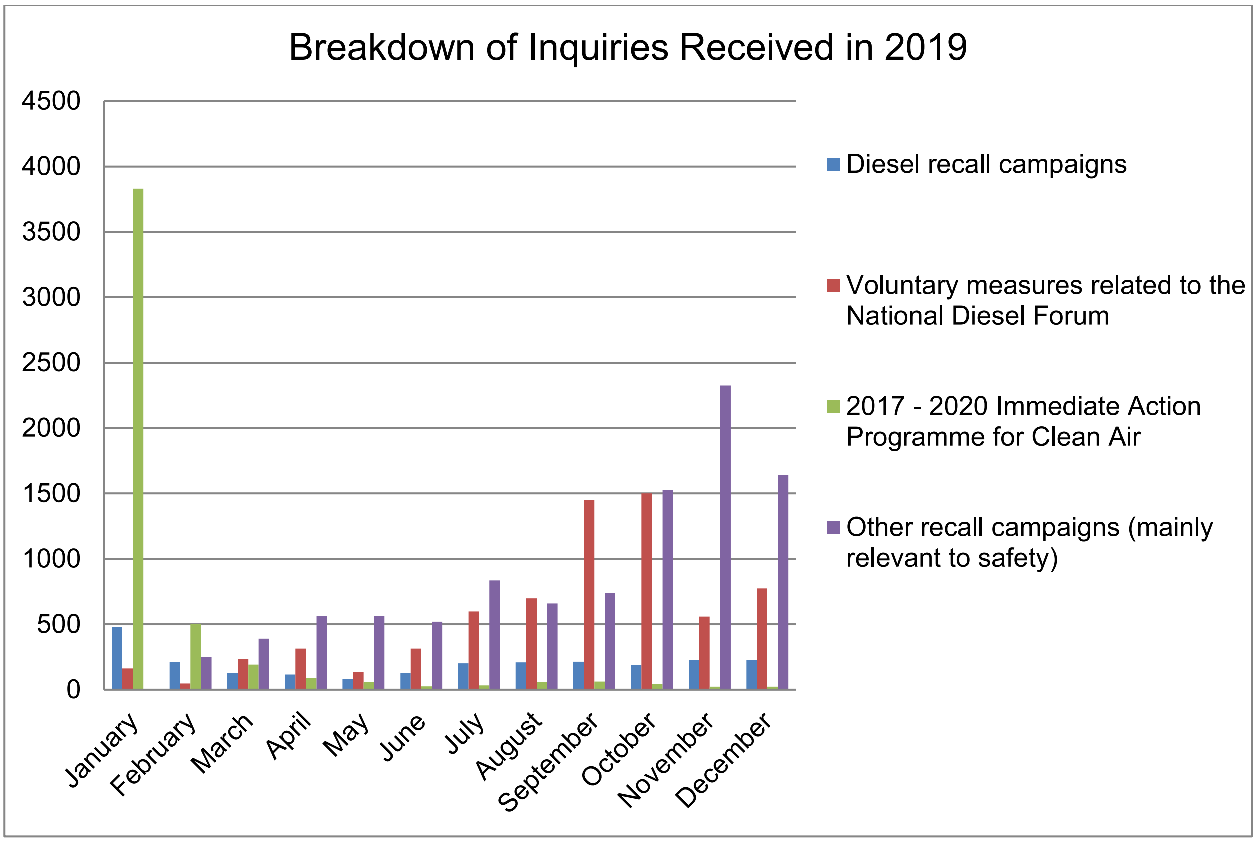


Figure 5: Breakdown of inquiries received from residents in 2019

The Fundamental Affairs section also processes inquiries concerning freedom of information rights in connection with market surveillance. The Figure 6 shows a breakdown of the questions received. The total increased considerably from 105 in 2018 to 385 in 2019.

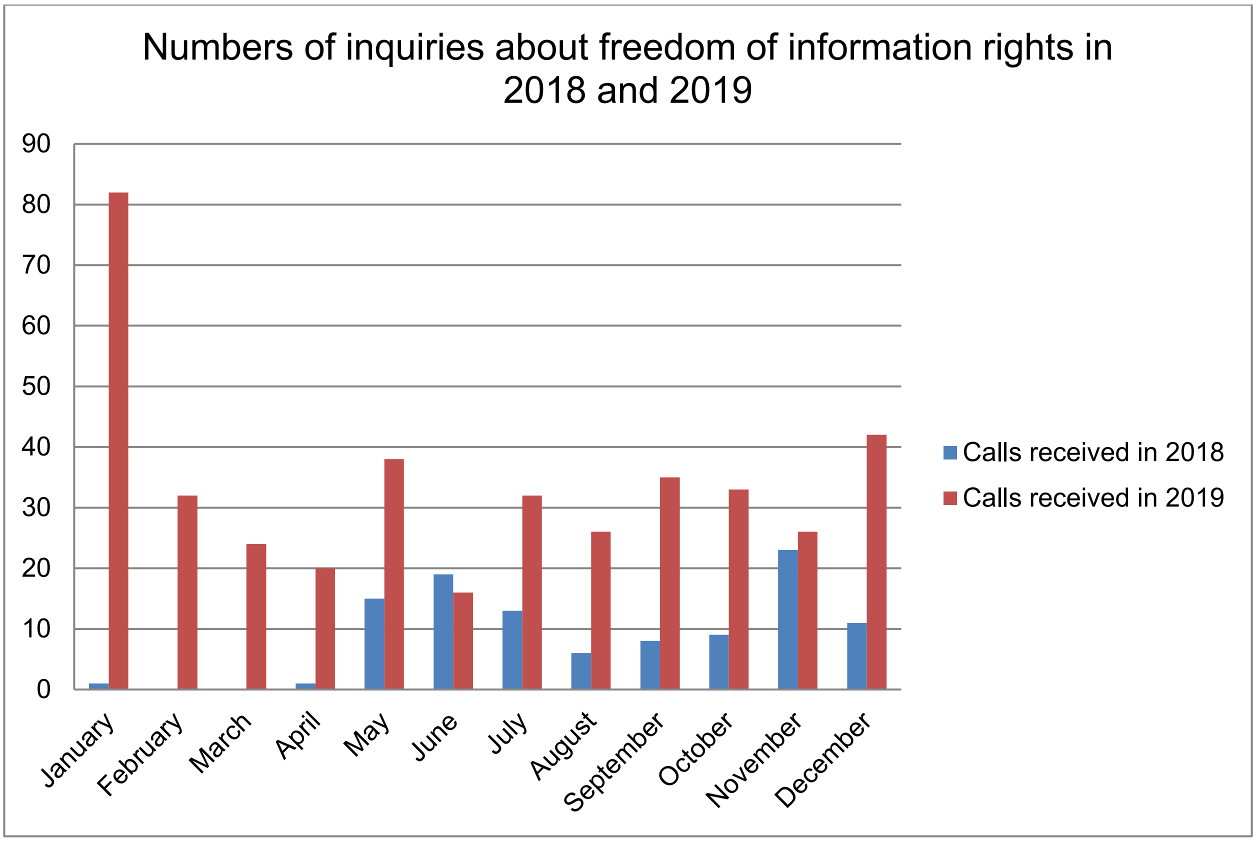


Figure 6: Breakdown of inquiries on freedom of information rights in 2019

II. Field Monitoring

In 2019, tests were carried out on 85 vehicles and vehicle applications. A breakdown by drive types is shown in Figure 7. Of the total, 57 tests took the form of field tests. Vehicles chosen on the basis of the attributes discussed in Section B II 'Field Monitoring' were measured while actually driving in road traffic, in order to determine the real driving emissions (RDE), and on chassis dynamometers. The RDE measurements were carried out by the KBA itself using a portable emissions measurement system (PEMS), while the chassis dynamometer measurements were performed by designated technical services under the supervision of KBA staff. Each vehicle was subjected to a Type 1 test (NEDC/WLTC), to ensure that it was in technically flawless condition. Then test programs developed on the basis of the information available on each vehicle were carried out. The majority of these involved varying the load setting of the chassis dynamometer and the ambient temperature.

The baseline data were obtained from RDE tests or third parties.

Sixteen tests were conducted to verify software upgrades, which had been submitted by manufacturers in connection with mandatory recalls or by the National Diesel Forum. Three of them were carried out as software-only test without an actual vehicle, as the upgrades did not alter the maximum permissible NO_x emission levels. In one case, an SCR retrofit system for buses was examined. In addition, seven other tests were carried out with a scope different to that of the usual field tests under actual driving conditions and on the chassis dynamometer. In another case, a defect was identified in the vehicle, thus making it impossible to use the test results. Vehicle defects also prevented four other tests from being carried out, and these are therefore also not included in the statistics presented here.

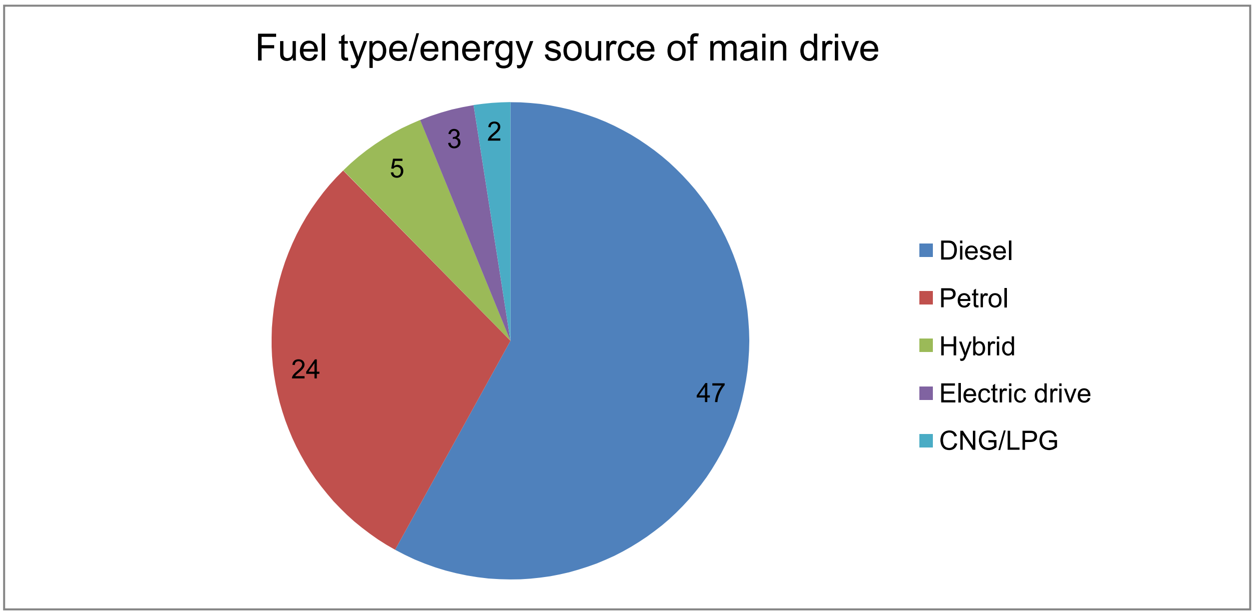


Figure 7: Breakdown of studied vehicles by fuel type/energy source of main drive

Reflecting the diesel emissions subject, the tests focused on diesel vehicles (to an extent surpassing their share of total registered vehicles). Figure 8 shows a breakdown of the studied vehicles with regard to the applicable emission standard.

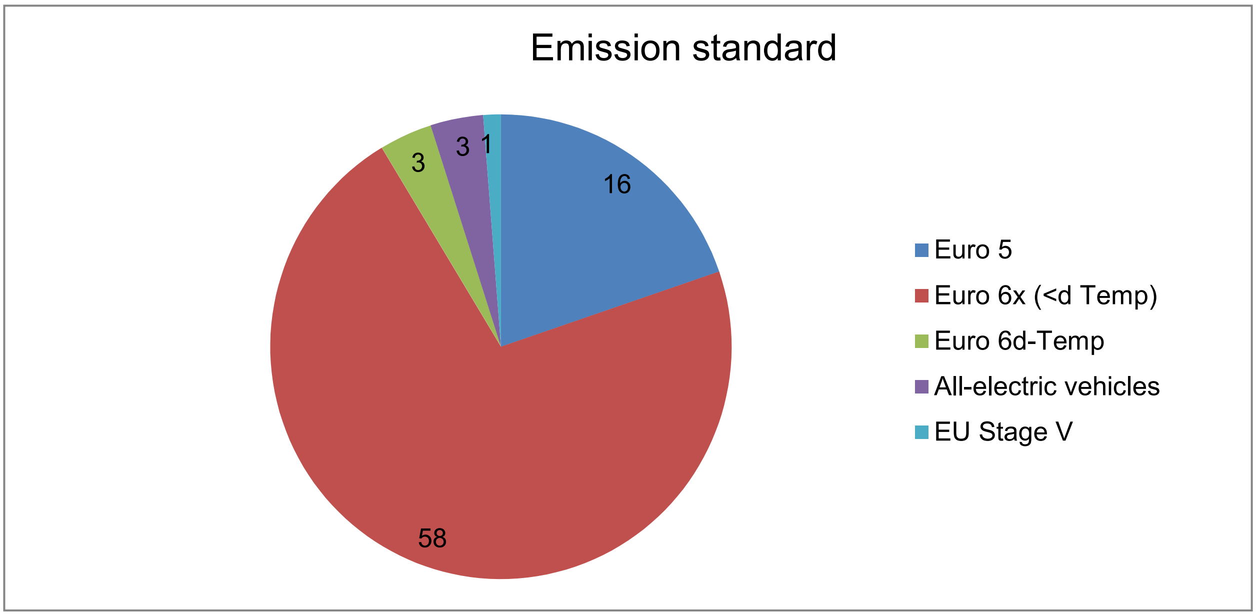


Figure 8: Breakdown of studied vehicles by emission standard

In 40 cases, the findings of the vehicle tests were either unremarkable or led to a recommendation to approve the new engine control software. These also included cases in which the vehicle manufacturer was able to satisfactorily justify the measured emissions by the need for protection of the engine against damage or accident and for safe operation of the vehicle. The emissions measured for eight vehicles were conspicuous. In the cases of vehicles that had type approvals from other EU member states, the authorities that had approved them were notified. The others are now being targeted by recall campaigns. Twenty-eight tests have not yet been completed (as of 25 March 2020). The five tests that could not be carried out or assessed were postponed to 2020. Four tests were exclusively software analyses without any investigation of the vehicles themselves. The findings of the 48 concluded emissions tests are shown in **Annex 2**.

The vehicles, for which high emissions were measured, do not yet need to meet any RDE requirements owing to their age. Despite this, RDE measurements were performed on them to provide a basis for identifying any prohibited defeat devices. If significant discrepancies were found between the Type 1 and the RDE test results, however – analogously to the classification system used in the report by the Volkswagen commission of inquiry– the vehicle's manufacturer was questioned to shed light on the suspicion that a prohibited defeat device had been installed in it.

In connection with the findings, it should be taken into account that the RDE test procedure developed, to check real pollutant emissions, is not designed to determine representative CO_2 emission values.

Looking ahead, the European Commission intends to introduce a test procedure for validating the CO_2 emissions of vehicles that are in use. Regulation (EU) 2018/1832 has already established a basis for issuing type approvals for devices for monitoring fuel and/or electric power consumption. In future, it will be possible, for example, to use information thus obtained on average consumption levels in real-world road operation to establish whether the current testing procedures for approval processes adequately reflect actual average CO_2 emissions.

III. Conformity of Production

The principal criteria for deciding which products to check are:

- Emissions
    - Pollutants (ISC, RDE)
    - Noise
    - CO_2 / driving range on electric power (hybrids)
- Safety
    - Brakes (including automated systems)
    - Steering (including automated systems)
- Parts and components
    - Wheel rims, child seats, helmets
    - Lighting (including adaptive front lighting systems (AFS) acc. to Regulation 123 of the Economic Commission for Europe of the United Nations)
    - Reaction to fire behaviour of interior fittings
    - Connections and couplings
    - Replacement catalytic converters, replacement diesel particulate filters

The regular checks, and the intervals at which they must be performed, are described in the corresponding regulations.

In addition, products must often be checked when there are doubts regarding their conformity. Such doubts can arise, for example, on the basis of information received from:

- consumers,
- other European approval agencies,
- investigative agencies or accident reports or
- system checks by the KBA (CoP-Q).

Based on the current national regulations on NO_x post-treatment systems, in 2019 the CoP-P section checked a retrofit system for buses in collaboration with the Field Monitoring section. The results are given in **Annex 2**. Plans have also been made to check systems of these kinds in class M1 vehicles; they are scheduled to take place in the KBA’s own facilities in early 2020.

Eleven different models of Personal Light Electric Vehicles were studied.

Tests of special wheels for lorries, which had attracted attention by developing cracks, and of child seats for which the contracted technical service had misinterpreted the test findings culminated in the withdrawal of type approvals, recalls and public warnings.

In addition, preparations have been made to begin the yearly ISC checks required by Regulation (EU) 2018/1832 on 1 January 2020.

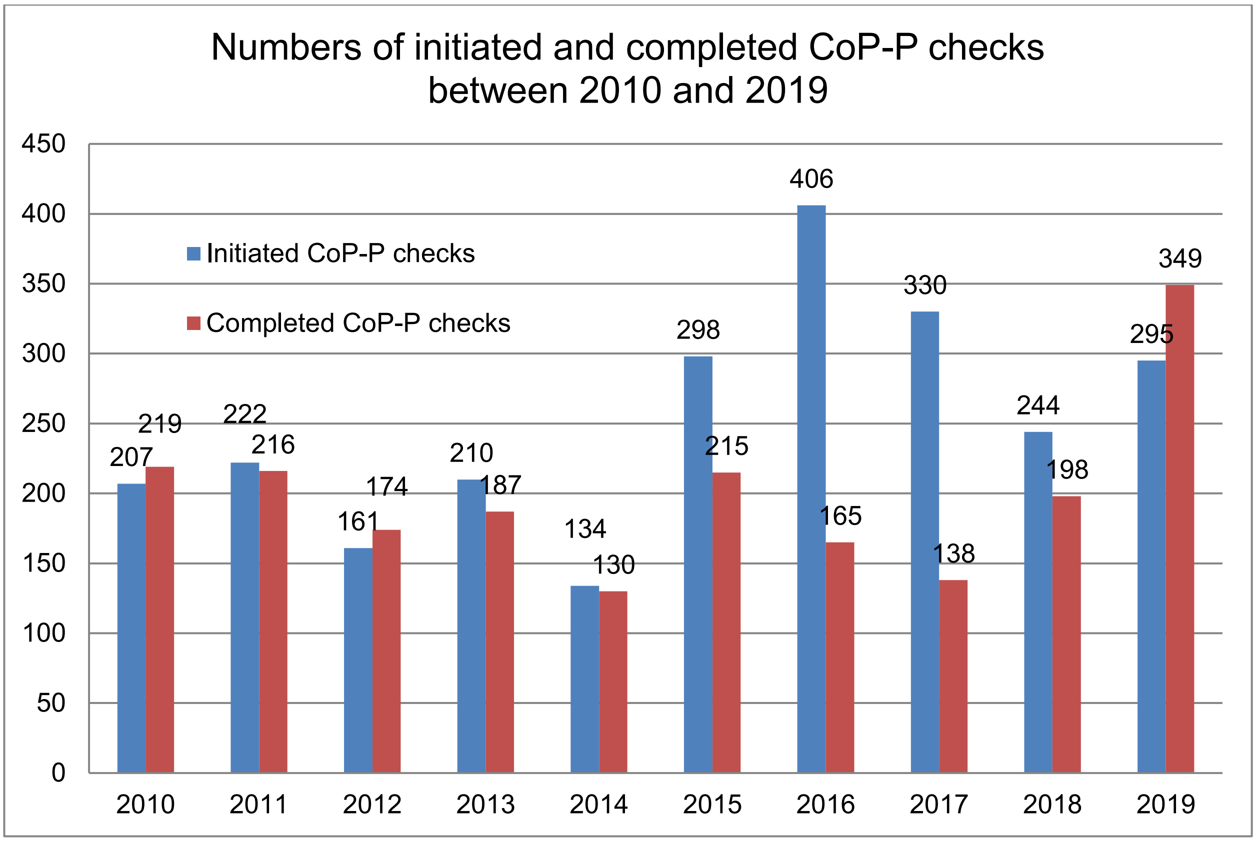


Figure 9: Numbers of initiated and completed CoP-P checks from 2010 to 2019

IV. Product Safety and Recalls

Of the more than 1,000 investigations carried out in 2019 (see Figure 10)), 628 led to recalls (Figure 11), continuing a rising trend over the last several years. 2019 thus had more recalls than any other year since statistics on them have been kept. In all 628 cases, the defects identified were so serious that the database of the Central Vehicle Register (CVR) was used to contact all affected vehicle owners in Germany.

In these numbers, vehicle components whose installation cannot be reliably narrowed down to certain vehicles (thus ruling out the use of vehicle owner data from the CVR) were left out of account. It is frequently impossible to determine the current whereabouts of all of them. However, this only affects a very small share of recall campaigns.

In 2018, the numbers of letters written to vehicle owners and bans on using vehicles set new records. This was due to recalls related to diesel emission strategies, most of which have meanwhile been concluded, and of defective airbags from the company of Takata that had been installed by various vehicle manufacturers. In Takata airbags that do not use dried phase-stabilised ammonium nitrate as the propellant, the propellant can change its structure in hot, humid weather with temperature fluctuations. In the event of an accident, it can then ignite with explosive force and cause uncontrolled deployment of the airbag. The crash can also rupture the inflator housing, spraying metal shards throughout the passenger cabin and severely injuring vehicle occupants.

In 2019 the figures declined again to around 2.5 million letters sent to vehicle owners (Figure 12) and just under 57,000 operating bans (Figure 13).

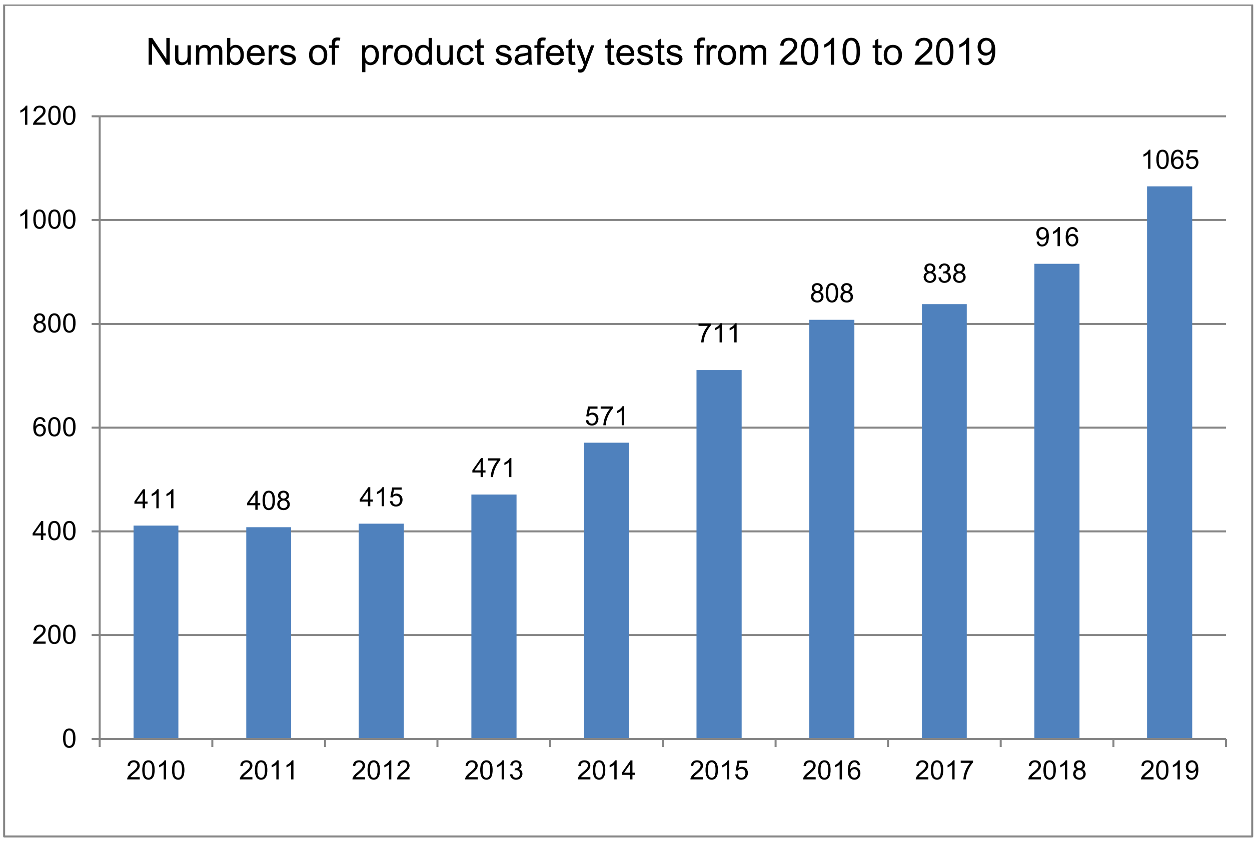


Figure 10: Numbers of product safety tests from 2010 to 2019

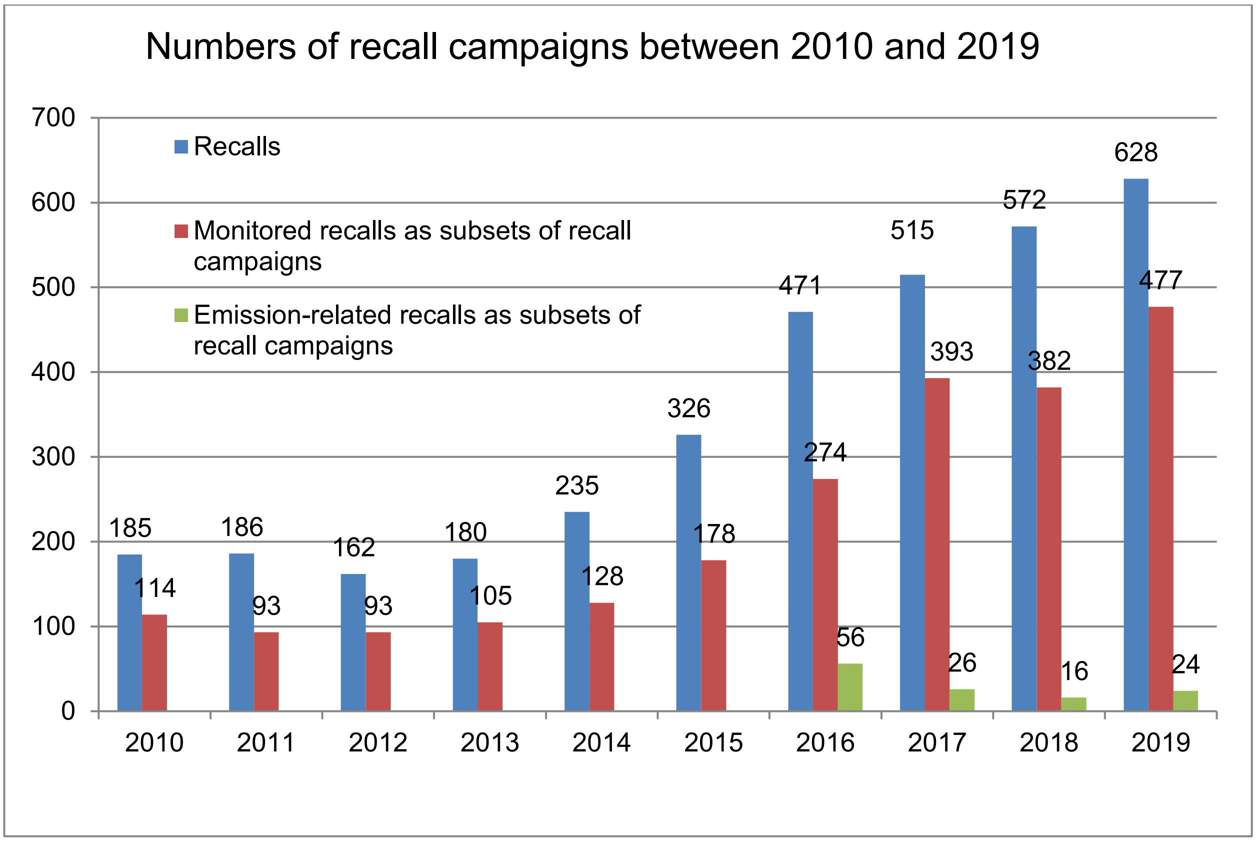


Figure 11: Numbers of recall campaigns between 2010 and 2019

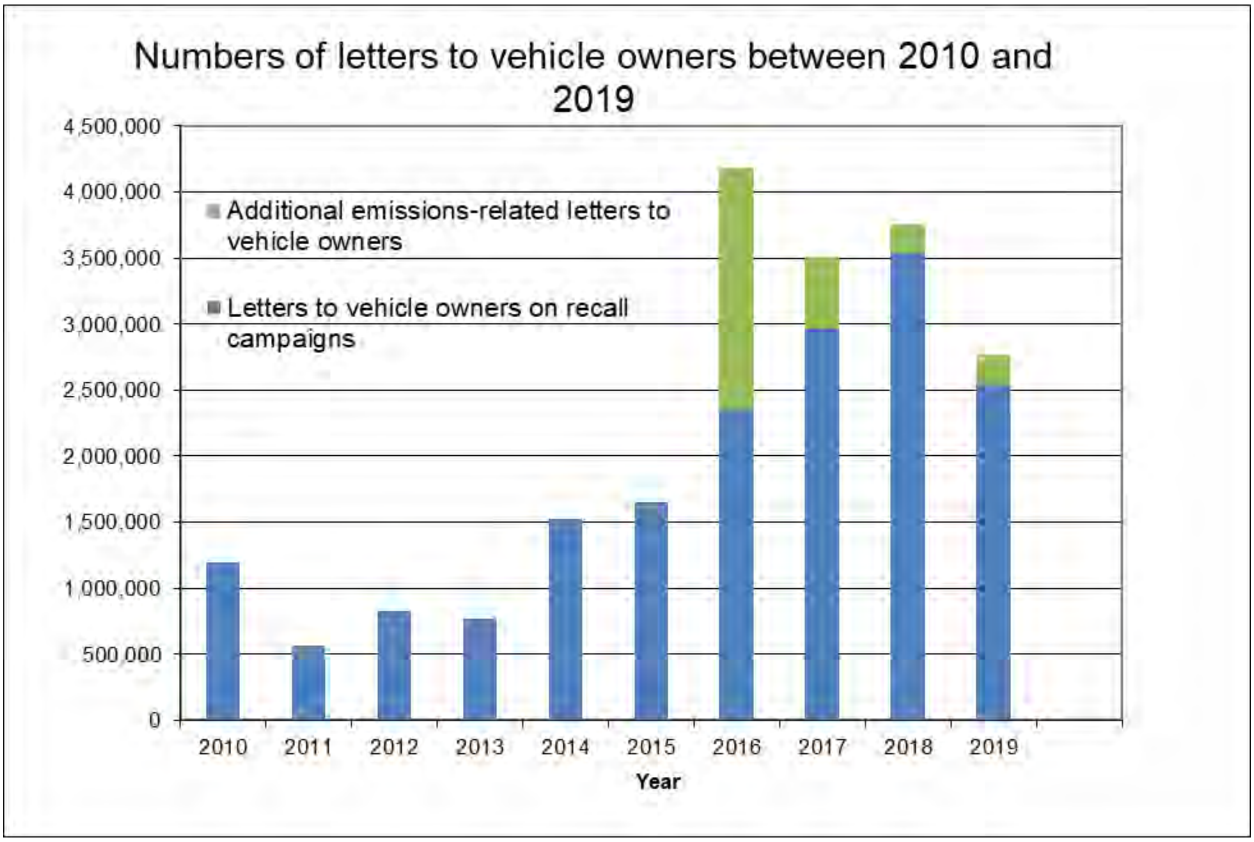


Figure 12: Numbers of letters written to vehicle owners from 2010 to 2019

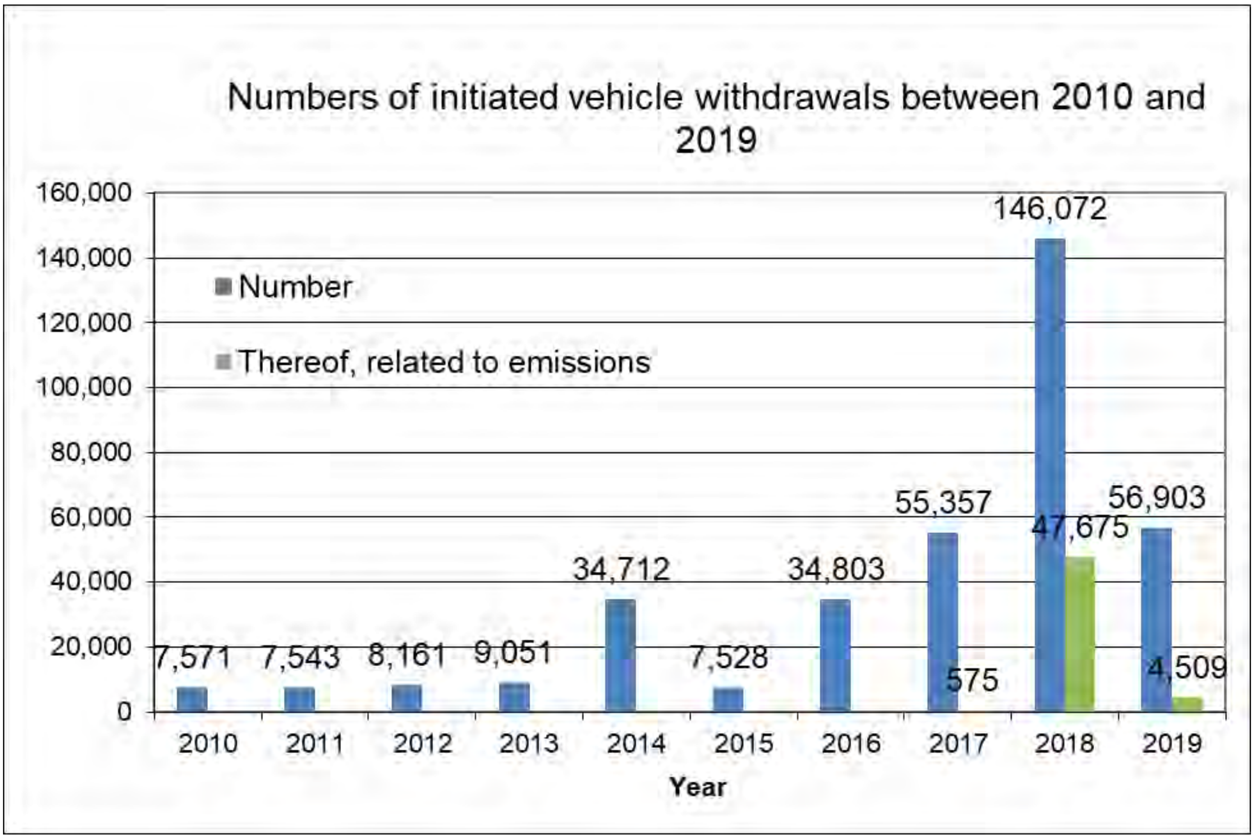


Figure 13: Numbers of initiated vehicle withdrawals from operation from 2010 to 2019

V. Offences and Sanctions

Fines were also imposed in 2019 for offering a variety of vehicle components, for which required approvals had not been obtained. Lighting equipment was a hotspot here, especially lamps for motor vehicles and bicycles that lacked the required approvals.

Talks conducted in connection with checks, carried out in physical outlets and at trade fairs, have shown that these cases have significantly boosted awareness of existing trade restrictions.

Various fines have also been imposed for infractions committed in recall campaigns. These have also significantly reduced the number of cases.

In contrast, the number of inquiries from the customs service related to import controls once again rose noticeably in 2019 (Figure 14).

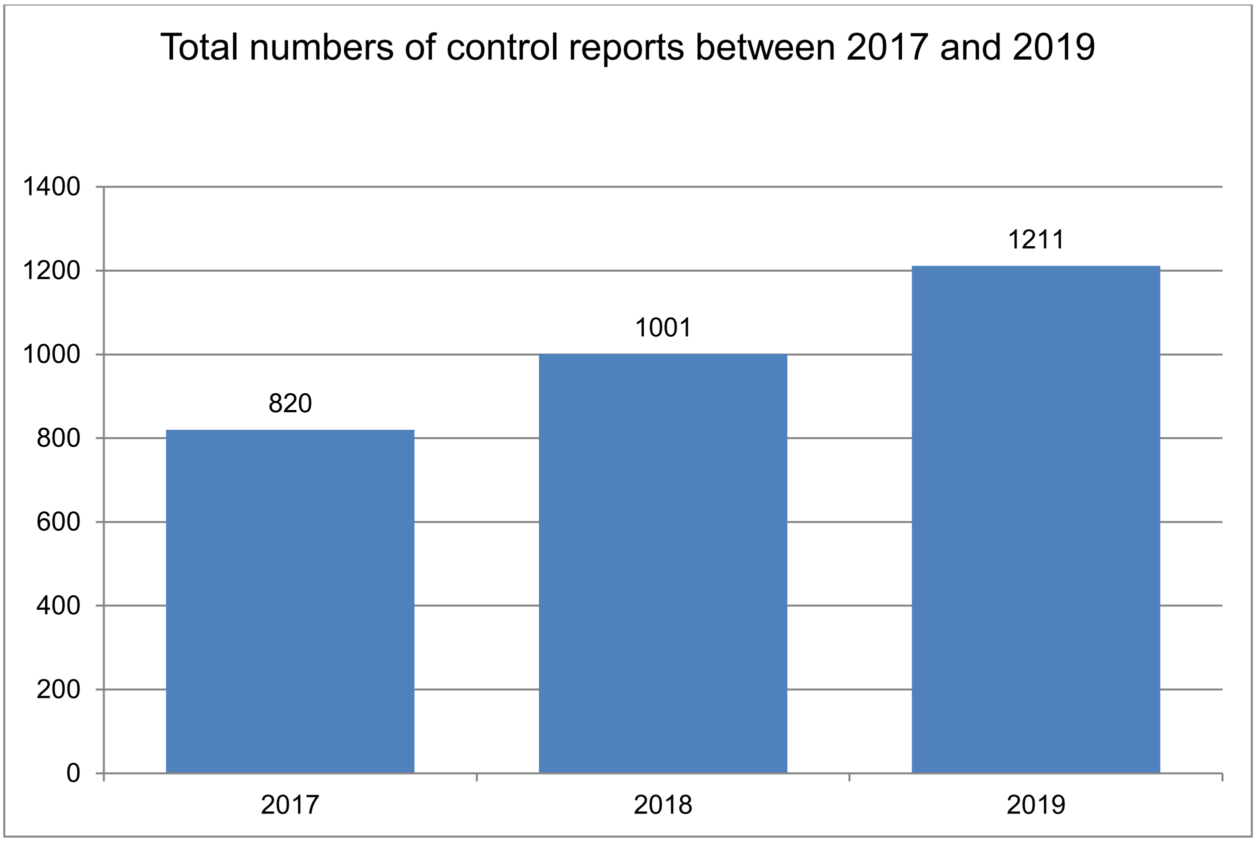


Figure 14: Total numbers of control reports from 2017 to 2019

D. Market Surveillance Planning for 2020

As a consequence of Regulation (EU) 2018/858, going forward the **Field Monitoring** section will have a wider range of tasks. For example, in addition to checking emissions as in the past, it will also carry out tests of vehicle systems relevant to approvals (as per Annex II to Regulation (EU) 2018/858). These include, for example, inspections of lighting systems, automated driving systems and brakes. For these purposes, the KBA will provide a testing area close by the town of Leck in the German federal state of Schleswig-Holstein from 2 January 2020.

The number of tests carried out will be based on the vehicle registration volumes, with one being performed per 40,000 new vehicle registrations in the relevant EU member state during the preceding year. In 2019, approximately 3.61 million new type-approved passenger vehicles and trailers were registered, as well as 345,000 vehicles and 275,000 trailers for transporting goods. This yields a total 4.23 million new motor vehicles registered in the sense of Article 8, Paragraph 2 of Regulation (EU) 2018/858, calling for 106 tests. Article 8, Paragraph 3 of Regulation (EU) 2018/858 stipulates that at least 20% of these, or 21, must be emissions-related tests. However, as Regulation (EU) 2018/858 does not enter into force until 1 September 2020, only a third of the number of tests called for by the formula, namely 36, must be carried out for the year 2020. 2021 will thus be the first year in which the full number of tests is performed. Despite this, it is expected that the tests actually carried out in 2020 will exceed the required minimum.

In addition, agricultural and forestry vehicles as well as two- and three-wheeled vehicles and quadricycles are tested.

The **Conformity of Production** section will continue to focus on emissions, safety and components.

The **Product Safety and Recalls** section expects the number of recalls to increase further in the following year.

E. Summary

With this report on the year 2019, the KBA – as the German market surveillance authority responsible for road vehicles – is launching a regular series of annual reports on the results of its work. One of its main focuses is, and will continue to be, testing the pollutant emissions of motor vehicles. It also conducts other conformity verification and monitoring activities while paying special attention to vehicle safety issues. This report briefly sketches the regulatory foundation of the KBA's market surveillance activities and then, in Part B, describes its organisational structure with five constituent sections.

The Fundamental Affairs section handles coordination and reporting for the four sections that do the actual surveillance work, answers questions received from residents and communicates with organisations, associations and other government agencies in national and international bodies. The Field Monitoring section has a core role; that is where KBA engineers test vehicles and other products and perform measurements on roads and test benches. It is currently installing its own chassis dynamometers for emissions testing and building its own test-driving course. Until their completion, the testing facilities of designated technical services will continue to be used. While the Field Monitoring section is basically able to test all vehicles, the Conformity of Production section only inspects products that have received type approval from the KBA itself. With the aid of designated technical services, it checks whether serially produced products also have the properties for which their type approvals had been issued on the basis of prototypes. In respect of pollutant emissions, older vehicles up to an age of five years and 160,000 km travelled are checked to verify that their emissions are still within acceptable limits.

The Product Safety section targets conspicuously defective and/or dangerous vehicles and products in road traffic, initiating official action such as recalls as required. The Offences and Sanctions section investigates cases of misconduct and violations of the law by manufacturers and dealers that, for example, introduce illegal or prohibited products such as noncompliant light sources to the German market.

Part C presents the results of the individual sections in 2019. Compared to the preceding years, the Fundamental Affairs section received an unusually large number of inquiries from residents on freedom of information rights and questions about other matters: mainly recalls of prohibited defeat devices on the one hand and the measures proposed by the National Diesel Forum for significantly reducing the nitrogen oxide emissions of motor vehicles on the other. Emissions were also a focus of the Field Monitoring section, which checked those of additional vehicles, especially in real-world operation, and tested vehicle manufacturers' software updates. For the first time, the conformity tests carried out targeted a NO_x reduction system for retrofitting buses, and checks of Personal Light Electric Vehicles, were initiated to determine whether they comply with the corresponding ordinance. Although the Product Safety and Recalls section had to write to fewer vehicle owners and issue fewer bans on the use of noncompliant vehicles after processing recalls related to diesel exhaust emissions issues and a large number of airbag systems related recalls from various manufacturers, the number of product safety checks and recalls continued to increase. In addition to processing a larger number of control notifications, the Offences and Sanctions section achieved successes in preventing the sale of car and bicycle lamps that lacked the required approvals.

Part D presents the market surveillance planning for the year 2020.

The new framework regulation (EU) 2018/858, which shall apply from 1 September 2020, primarily expands the tasks of market surveillance and thereby the tasks of the Field Monitoring section. Overall, the KBA enjoys a larger range of market surveillance infrastructure and relevant resources in 2020. A test-driving course has also been available since 2 January 2020 on the site of a former military airfield close

by the town of Leck. Work to build two chassis dynamometers for measuring tail-pipe emissions and a laboratory is making good progress, with the expectation that they will be able to begin operating by the end of this year.

Currently 73 persons are engaged in market surveillance, and their number is expected to increase in response to new developments.

Annex 1 Explanations in Connection with Internal Combustion Engines and Pollutants

Combustion Products

When liquid hydrocarbons burn in an engine, the main by-products of complete combustion of the fuel are water vapour (H_2O) and carbon dioxide (CO_2). In addition, however, a number of harmful substances can result from incomplete combustion. The principal ones are nitrogen oxides (NO_x), soot, carbon monoxide (CO) and unburnt hydrocarbons (HCs, also THC), which by law may not exceed certain levels. Other so-called unlimited combustion products also result to a lesser extent, but are not addressed by legislation and are therefore left out of account here.

Diesel engines, which are characterised by direct injection and a lean air/fuel ratio ($\lambda > 1$) with a surplus of oxygen for oxidising the hydrocarbons in the fuel, emit nitrogen oxides and particulate matter (soot) as the chief pollutants.

HC and CO used to be the critical components of tailpipe emissions from petrol engines with intake-manifold fuel injection. But thanks to the nearly universal adoption of direct-injection engine designs, soot and CO have taken their places as the dominant pollutants. How these arise is explained in the following.

Nitrogen oxides (NO_x)

All nitrogen oxide compounds (NO, NO_2, NO_3, N_2O, N_2O_3 and N_2O_5) are collectively designated as NO_x. The emitted by-products of engine combustion include significant amounts of NO and NO_2, which are mainly derived from nitrogen released from air during combustion in the form of free radicals.

Nitric oxide (NO) is one such free radical, i.e. it has an unpaired electron. Its formation depends on high temperatures above 2,200 K and a local abundance of air. The principal requirement for reducing raw emissions is therefore a lower combustion temperature. This can be achieved with optimised intercooling, i.e. use of a device to cool the gas after compression, appropriately adjusted control timing – e.g. closing the inlet early in a so-called Miller cycle – and an improved injection strategy. But the best approach for slashing raw NO_x is exhaust gas recirculation.

Another constituent of NO_x emissions is nitrogen dioxide (NO_2). It forms as a by-product of diesel combustion, mainly as a result of NO reacting with peroxy and/or oxy radicals such as HO_2 and OH. In the ambient air, when exposed to light NO reacts in turn with ozone to form NO_2. Nitrogen dioxide is a respiratory irritant, and in the atmosphere undergoes further chemical reactions to cause the phenomenon known as acid rain (www.hlnug.de).

Soot/particulate matter

Combustion in diesel and direct-injection petrol engines is characterised by a so-called turbulent diffusion flame. This type of flame results from keeping the fuel and oxidiser (air) separate prior to burning and then combining them to form a highly enriched mixture at the combustion point. Under these conditions, various processes take place: particle formation, surface growth, coagulation and agglomeration. A portion of the resulting particles oxidises right in the combustion chamber. Continual improvements to combination processes have already succeeded in greatly reducing the particle emissions of combination engines. They have included optimising injectors and charge movement and increasing the fuel pressure. The goal of all of these measures is an improved, i.e., more homogeneous fuel-air mixture.

Carbon monoxide (CO)

Carbon monoxide results from incomplete combustion of carbon or hydrocarbon compounds. What exactly happens depends on the overall fuel/air mixture. If there is an oxygen deficit ($\lambda < 1$), the CO cannot oxidise into CO_2. CO is typically formed during transient high-load manoeuvres during which λ inadvertently drops below 1. In petrol engines, a rich mixture can be used to protect parts like outlet valves and turbochargers. Due to the air surplus that is characteristic of diesel combustion, CO is less dominant there. The only exception is when regenerating a NO_x storage catalyst (NSC).

Unburnt hydrocarbons (HCs)

The source of HC emissions from engines is incomplete combustion of hydrocarbons. This happens when the flame is quenched in the combustion chamber, which occurs when it approaches the wall of the combustion chamber during a cold start or as a consequence of combustion in gaps. It has been possible to reduce unburnt hydrocarbons in the raw exhaust gases by introducing direct-injection engines and optimising the design of the combustion chamber.

Measures to reduce emissions

Two strategies are applied for diminishing harmful emissions. One is to modify and improve the internal design of engines to prevent them from forming in the first place. The other involves the use of exhaust after-treatment systems, in other words devices downstream of the engine. The former takes precedence, however, so as to reduce the costs of exhaust after-treatment systems and the overall complexity of the vehicle as far as possible.

Measures inside diesel engines

As already mentioned, exhaust gas recirculation is the most important instrument for reducing raw NO_x emissions. The idea is to lower the combustion temperature in order to inhibit the formation of NO. This is achieved by two means: reducing the oxygen content of the fresh air drawn in from outside and increasing the specific heat-storage capacity of the recirculated exhaust gas components. The exhaust gas recirculation rate is limited by what is known as the 'particle-NO_x trade-off' or target conflict between NO_x emissions and particulate matter. Particle formation increases with the share of recirculated exhaust gases.

Another approach is to adjust the valve control times. One widely used method exploits the so-called Miller cycle. This is a valve control strategy in which the intake valve is closed early in the intake cycle (before bottom dead center BDC is reached). This reduces the air mass in the cylinder and the expansion of the fresh charge also reduces the compression start temperature. Together, these two effects result in a lower peak temperature inside the combustion chamber, which in turn inhibits NO formation.

Other approaches seek to improve the charge movement with swirl and tumble motions and optimised fuel injection. The goal is to homogenise the mixture as much as possible to achieve more uniform heat release and shorten the delay until the mixture ignites. The result is to reduce both the maximum pressure and consequently also the peak temperature in the combustion chamber. Optimised mixing also helps to lower particle emissions.

Modifications of petrol engines

In the case of petrol engines, efforts have focused on reducing the formation of CO and HC by achieving a more homogeneous fuel-air mixture. The shift to direct-injection engines, however, has altered the priorities here. While intake-manifold fuel injection leaves quite a bit of time for homogenising the mixture, direct injection makes it essential to achieve an ignitable, highly homogeneous mixture very rapidly. For this reason, and also to counteract a tendency to greater particle emissions, attention has focused on increasing the fuel pressure. Now the use of so-called common-rail systems is also state-of-the-art in petrol engines (which meanwhile feature fuel pressures up to 350 bars). These consist of a high-pressure pump, a high-pressure fuel accumulator and multiple injectors which are all supplied from this 'common rail'. This arrangement makes it possible to adjust injection timing and quantity depending on the load condition of the engine.

Other things that can be done inside the engine to reduce exhaust emissions include improving the charge movement, the geometry of the combustion chamber, the timing of fuel injection and the valve control times (e.g. with the Miller cycle).

Exhaust after-treatment in diesel engines

Oxidation catalytic converters

After-treatment of exhaust gases from diesel engines requires an oxidation catalytic converter. Diesel exhaust contains, among other things, the harmful pollutants CO and HC. In the catalytic converter, these react with oxygen that has not participated in the combustion process to form carbon dioxide and water ($\lambda > 1$). The exothermic reaction in the converter can also be taken advantage of to achieve more quickly the light-off (minimum required temperature) for subsequent exhaust after-treatment components.

NOx adsorber catalytic converters

NO_x adsorber catalysts are used to control nitrogen oxide emissions. These feature a catalytic coating (usually consisting of barium compounds) for extracting nitrogen oxides from the exhaust gas, which is subsequently catalytically converted into nitrogen (N_2) and CO_2.

To convert the accumulated nitrogen oxides, the system is purged by briefly (for about two to ten seconds) running the engine with a rich air-fuel mix ($\lambda < 1$). The CO in the exhaust gas reacts with the NO_x to form N_2 and CO_2. During this process, the catalytic layer is regenerated by oxidation and can then resume binding nitrogen oxides. CO emissions can increase during the regeneration phase.

Selective catalytic reduction (SCR)

Another approach taken to reduce nitrogen oxide emissions is the use of an SCR system. This exhaust after-treatment system consists of an SCR catalyst inserted in the exhaust stream, a tank holding a urea water solution (UWS) as the reductant and a dosing unit.

The UWS is injected into the exhaust stream and converted by hydrolysis and thermolysis into NH_3 (ammonia) and CO_2. The NH_3 then adheres to the coating of the catalyst chamber and begins converting the NO_x in the exhaust into N_2 and H_2O.

SCR systems employ two different strategies for converting NO_x. In storage mode, priority is attached to ensuring a sufficient NH_3 level. This strategy also maximises NO_x conversion during transient engine states. Up to a certain temperature range, the SCR catalyst readily stores excess NH_3 to prevent it from being released into the ambient air (a phenomenon called ammonia slip). The amount of stored NH_3 drops when the amount of NO_x in the stream suddenly increases.

When high temperatures occur inside the SCR, its storage capacity diminishes, thus increasing the risk of ammonia slip. In this situation it goes into so-called online mode. With this strategy, the storage level is reduced sufficiently to prevent slip. NO_x conversion then takes place to the required extent using directly converted NH_3. Experience has shown that in this operating mode, in contrast to storage mode, typically lower NO_x conversion rates are achieved. Here the focus is on preventing ammonia slip instead.

Diesel particulate filters (DPFs)

Diesel engines universally use so-called DPFs to curb particulate emissions. They consist of an extruded monolithic catalyst support (or monolith for short) with thousands of parallel channels or holes, separated by thin walls, that alternately open. The exhaust gas flows into the channels and is forced through the porous walls into opposing channels, leaving particulate matter behind. Owing to their principle of operation, accumulating soot makes it necessary to regularly regenerate the particulate filters. This involves burning off (oxidising) the soot by introducing very hot gas into the exhaust system. The carbon-containing particles react with oxygen in the exhaust gas. Regeneration temporarily increases fuel consumption and (raw) NO_x emissions.

Exhaust gas treatment in petrol engines

Three-way catalytic converters

The three-way catalytic converter, also known as an oxidation-reduction catalytic converter, is used in petrol engines with the air-fuel ratio at parity ($\lambda = 1$). It consists of a support, whose surface is coated with precious metals (the ‘washcoat’). It converts the pollutants CO, HC and NO_x, which are by-products of combustion, into nontoxic H_2O, N_2 and CO_2 by reduction/oxidation. The use of a three-way catalytic converter requires λ to stay at 1, as its catalysing surface only has a limited storage capacity. For many years, special so-called binary lambda sensors, which can detect whether $\lambda < 1$ or $\lambda > 1$, were used in petrol engines to maintain air-fuel equivalence. They are unable, however, to determine precise values.

Wideband sensors are needed to comply with today's emission standards. For example, it is necessary to 'flush' the oxygen stored in a catalytic converter during acceleration phases and immediately replace it with a rich air-fuel mixture. Otherwise it would be impossible to comply with the stringent emissions limits of the worldwide harmonised light vehicles test procedure (WLTP) and RDE.

Petrol particulate filters (PPF)

Petrol particulate filters have become a must for complying with the Euro 6d-Temp limits on particulates. They essentially work the same as their diesel counterparts, with the only real difference being how they regenerate. Since petrol engines maintain $\lambda = 1$, during normal operation no oxygen is available for oxidising particulates. In addition to using strategies to ensure that engines run hot, it is therefore also necessary to create a lean air-fuel mix, which in turn calls for the use of a broadband lambda sensor. Due to how PPFs are regenerated, petrol engines can also spew out significant NO_x emissions.

Emission limits

Figure 15 shows the limit values for petrol and diesel engines stipulated by the standards Euro 1 to Euro 6d-Temp. What stands out above all is a steady reduction in the NO_x and PM/PN limits for diesel vehicles since Euro 3 and the introduction of PM/PN limit values for petrol engines since Euro 5a and Euro 6b. Up till Euro 6c, the limits only applied to the type approval process (initially NEDC, then WLTC) with chassis dynamometer measurements under laboratory conditions. European Regulation (EC) 715/2007 lowered the corresponding limit in the NEDC and empowered the European Commission, in the so-called regulatory procedure with parliamentary scrutiny, to define the individual requirements, also at low ambient temperatures. These requirements were then defined by Commission Regulation (EC) 692/2008. Whereas a special test was introduced for petrol engines at low ambient temperatures, initially no tests were stipulated for diesel engines.

This was then done with the RDE rules, which could be applied for monitoring purposes to new vehicles registered on or after 1 September 2017. The limit values on pollutants established by Euro 6d-Temp have applied to all newly registered passenger cars since 1 September 2019. It introduced, for the first time, a limit value on nitrogen oxides measured while driving on roads according to the RDE rules, which is currently set at 168 mg/km. So-called 'conformity factors' (C_F) of 2.1 for NO_x and 1.5 for particulates are additionally applied.

Standard	Letter	Introduction date (type approval)	Introduction date (initial registration)	Driving cycle/ test method	CO mg/km	HC (NMHC) mg/km	NOx mg/km	(HC + NO_x) mg/km	PM mg/km	PN 1/km
Petrol										
Euro 1		01. Jul 92	01. Jan 93	NEDC	2.720	—	—	970	—	—
Euro 2		01. Jan 96	01. Jan 97	NEDC	2.200	—	—	500	—	—
Euro 3		01. Jan 00	01. Jan 01	NEDC	2.300	200	150	—	—	—
Euro 4		01. Jan 05	01. Jan 06	NEDC	1.000	100	80	—	—	—
Euro 5a		01. Sep 09	01. Jan 11	NEDC	1.000	100 (68)	60	—	5	—
Euro 5b		01. Sep 11	01. Jan 13	NEDC	1.000	100 (68)	60	—	4.5	—
Euro 6b		01. Sep 14	01. Sep 15	NEDC	1.000	100 (68)	60	—	4.5	$6 \cdot 10^{11}$
Euro 6c	ZD	—	—	NEDC	1.000	100 (68)	60	—	4.5	$6 \cdot 10^{11}$
Euro 6c	AD	—	01. Sep 18	WLTP	1.000	100 (68)	60	—	4.5	$6 \cdot 10^{11}$
Euro 6d-TEMP	AG	01. Sep 17	—	WLTP	1.000	100 (68)	60	—	4.5	$6 \cdot 10^{11}$
Euro 6d-ISC-FCM	AP	01. Jan 20	01. Jan 21	WLTP	1.000	100 (68)	60	—	4.5	$6 \cdot 10^{11}$
Diesel										
Euro 1		01. Jul 92	01. Jan 93	NEDC	2.720	—	—	970	140	—
Euro 2		01. Jan 96	01. Jan 97	NEDC	1.000	—	—	700	80	—
Euro 3		01. Jan 00	01. Jan 01	NEDC	660	—	500	560	50	—
Euro 4		01. Jan 05	01. Jan 06	NEDC	500	—	250	300	25	—
Euro 5a		01. Sep 09	01. Jan 11	NEDC	500	—	180	230	5	—
Euro 5b		01. Sep 11	01. Jan 13	NEDC	500	—	180	230	4.5	$6 \cdot 10^{11}$
Euro 6b		01. Sep 14	01. Sep 15	NEDC	500	—	80	170	4.5	$6 \cdot 10^{11}$
Euro 6c	ZD	—	—	NEDC	500	—	80	170	4.5	$6 \cdot 10^{11}$
Euro 6c	AD	—	01. Sep 18	WLTP	500	—	80	170	4.5	$6 \cdot 10^{11}$
Euro 6d-TEMP	AG	01. Sep 17	—	WLTP	500	—	80	170	4.5	$6 \cdot 10^{11}$
Euro 6d	AJ	—	—	WLTP	500	—	80	170	4.5	$6 \cdot 10^{11}$

Figure 15: Emission limit values

The introduced limit values on particulates as shown in Figure 15 only apply to vehicles with internal air/fuel mixing (direct injection).

Annex 2 Results of Emission Measurements in 2019

1. SUBARU Outback

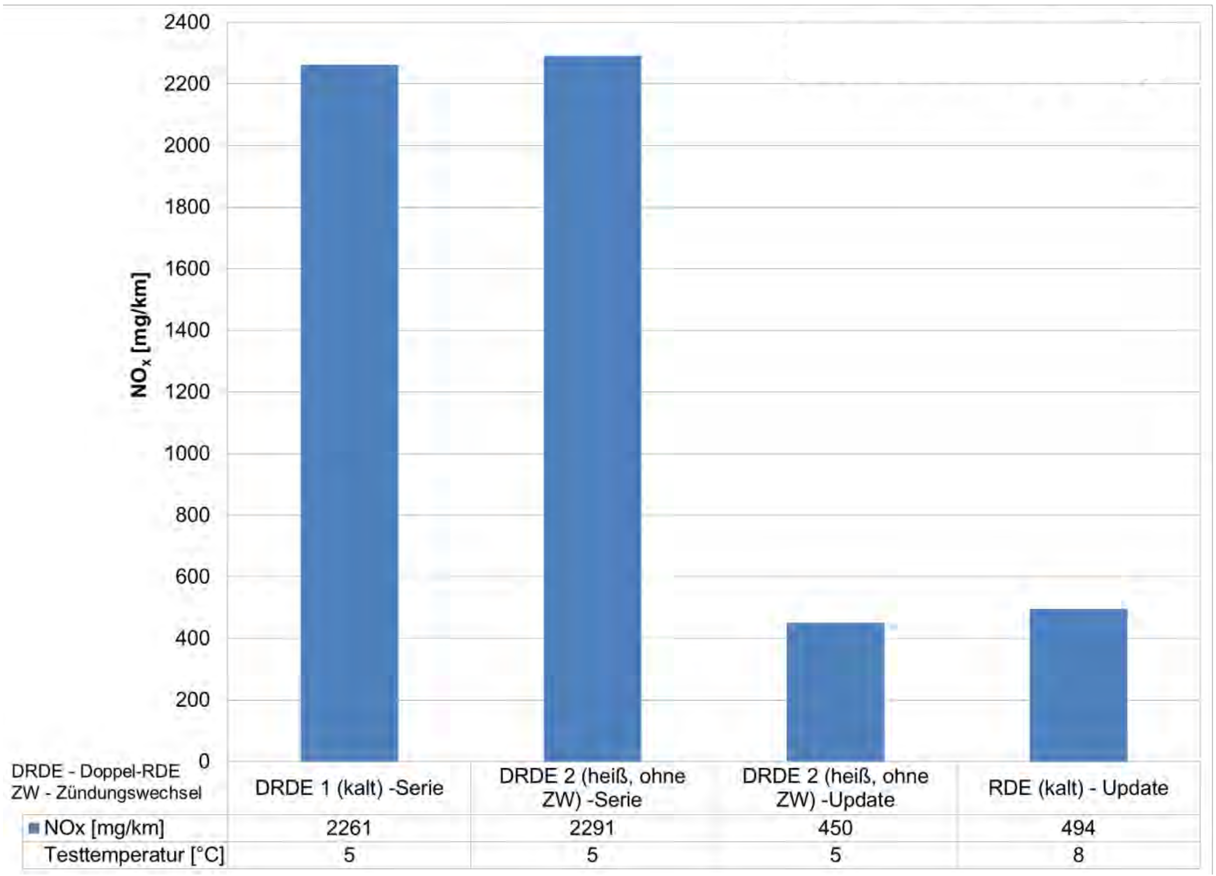
Vehicle data:

Manufacturer	SUBARU
Commercial name	Outback
Vehicle category	M1
WVTA	e1*2007/46*1320*00
Emission standard	Euro 6b (NEDC)
Type/variant/version	B6 / BSD /C8L
Engine design	4-cylinder boxer
Engine code	EE20
Displacement [ccm]	1998
Engine power [kW]	110
Mileage [km]	98375
Fuel type	Diesel
Transmission	CVT
CO_2 acc. to CoC [g/km]	159 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	DOC
DPF/PPF	DPF
EGR	HD-EGR, ND-EGR

Evaluation and further actions:

The effect on exhaust emissions of a software upgrade for the SUBARU Outback 110 kW EU 6 was tested under real driving conditions (RDE). Compared to the standard software version, the upgrade significantly reduced NO_x emissions by about 75%. The associated greater effectiveness in reducing NO_x emissions was confirmed in a double RDE test without changing the ignition at ambient temperatures around 5°C.

Test results:



	Test temperature [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
DRDE 1 (cold) - series	5	2261	5	-	-
DRDE 2 (hot, w/o IC) -series	5	2291	5	-	-
DRDE 2 (hot, w/o IC) -upgrade	5	450	15	-	-
RDE (cold) - upgrade	8	494	52	-	-

This vehicle is subject to an official recall.

2. Porsche Panamera 4S

Vehicle data:

Manufacturer	Porsche
Commercial name	Panamera 4S Diesel
Vehicle category	M1
WVTA	e13*2007/46*0971*04
Emission standard	Euro 6c (NEDC)
Type/variant/version	971 / GJ22 / 1644100
Engine design	V8
Engine code	DBU
Displacement [ccm]	3956
Engine power [kW]	310
Mileage [km]	5710
Fuel type	Diesel
Transmission	Automatic, 8-speed
CO_2 acc. to CoC [g/km]	176 (NEDC)
SCR/NSC	SDPF*/ NSC
Oxi-cat/3-way cat	-
DPF/PPF	SDPF*
EGR	HD-EGR

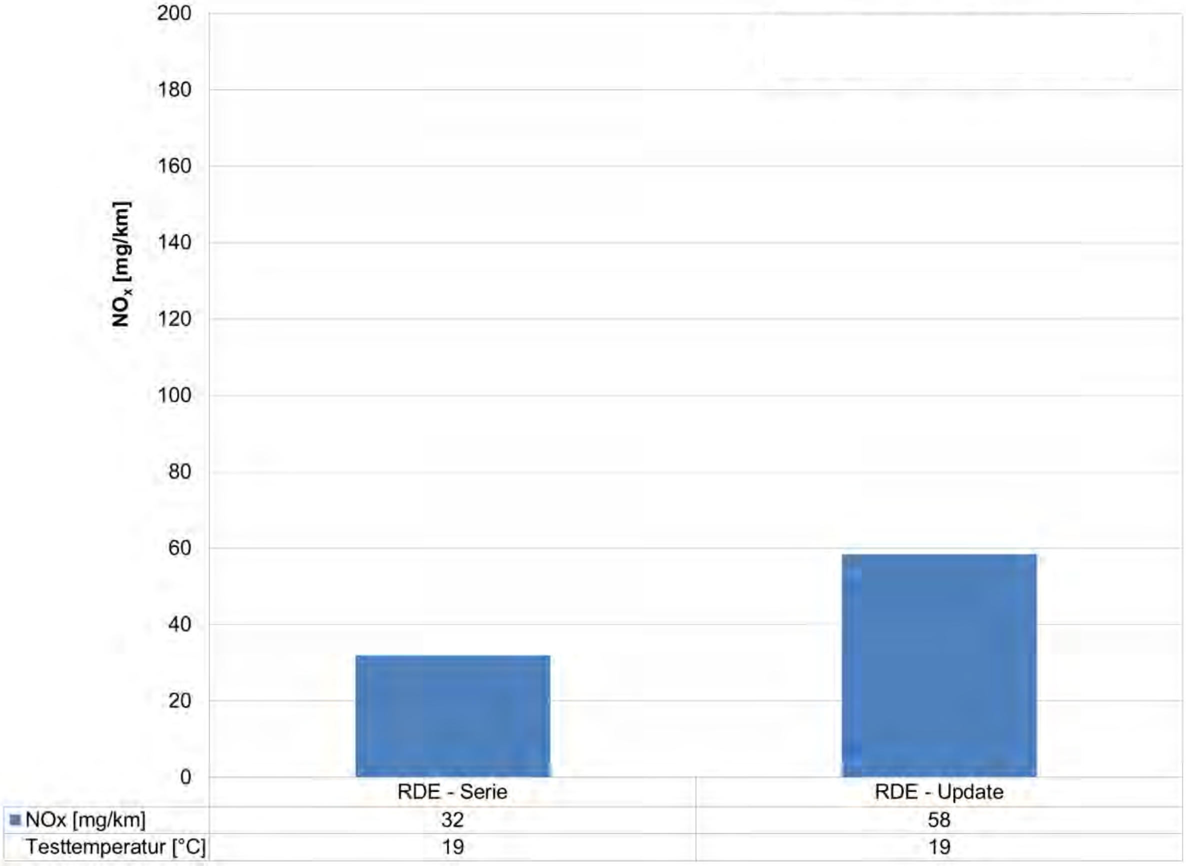
*SDPF – DPF with SCR coating

Evaluation and further actions:

The effect on exhaust emissions of the software upgrade for the Porsche Panamera was tested under real driving conditions (RDE). The standard engine control software used ambient pressure-dependent EGR reduction, which had been determined to be impermissible. Within the scope of RDE measurements at the KBA, both the standard software and the upgrade kept NO_x emissions at or below the maximum permissible level of 8 mg/km. While performing the RDE measurements, it was not possible to reproduce the impermissible levels owing to the height profile. The measurements showed that the software upgrade it can keep the emissions within the permissible range. A software analysis performed parallel to the engine tests confirmed that the problem had been fixed.

The measured difference in real driving emission levels was due to external factors such as the weather, driver behaviour and traffic conditions and does not mean that the emissions are worse with the software upgrade.

Test results:



	Test temperature [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
RDE - standard	19	32	-	-	8.00E10
RDE - upgrade	19	58	-	-	1.00E11

This vehicle is subject to an official recall.

3. Alpina D5 (Euro 5b)

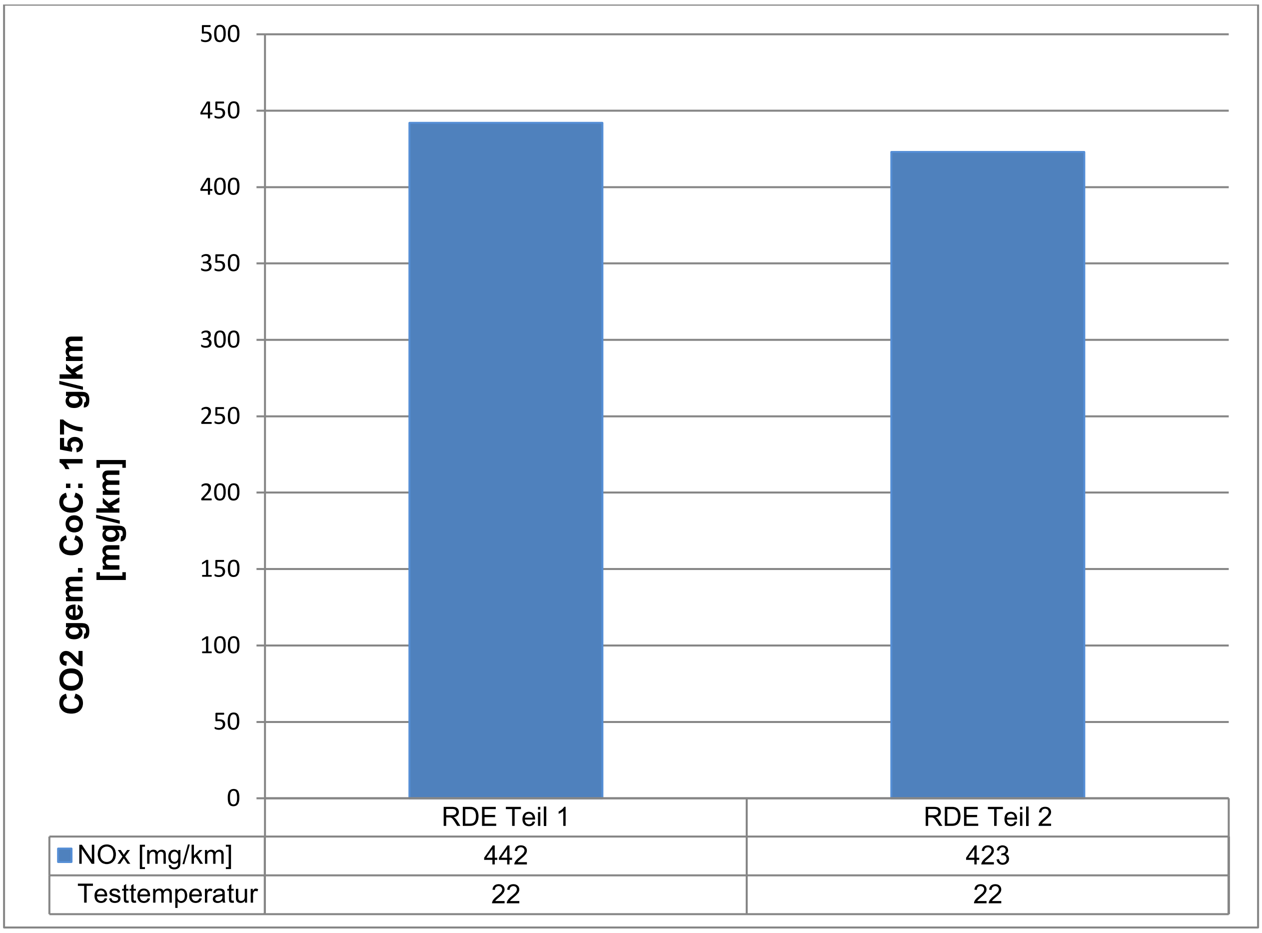
Vehicle data:

Manufacturer	**Alpina**
Commercial name	D5 Biturbo Touring EU5
Vehicle category	M1
WVTA	e1*KS07/46*0011*05
Emission standard	Euro 5b (NEDC)
Type/variant/version	Alpina 5 / 5161TL / 0
Engine design	Straight-6
Engine code	N57D30
Displacement [ccm]	2993
Engine power [kW]	257
Mileage [km]	40715
Fuel type	Diesel
Transmission	Automatic, 8-speed
CO_2 acc. to CoC [g/km]	163 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	Oxi-cat
DPF/PPF	DPF
EGR	EGR

Evaluation and further actions:

The Alpine D5 Biturbo Touring was investigated in the light of what had been learnt from checking a BMW 750d xDrive in which the effectiveness of the emission reduction system had been impermissibly reduced by faulty software. The vehicle was subjected to a double RDE test to determine its emissions behaviour. The RDE measurement results did not reveal anything significant, however; moreover, no upper limit is defined for RDE in Euro 5 vehicles and consequently there was no reference point for determining whether or not the emissions were excessive.

Test results:



	Test temperature [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
RDE part 1	22	442	-	-	-
RDE part 2	22	423	-	-	-

The RDE NO_x emissions measured for this vehicle were approx. 2.4 times the upper limit for the Type 1 test. However, this may not be taken as the basis for evaluating the real driving emissions of Euro 5 vehicles.

4. Opel Grandland X

Vehicle data:

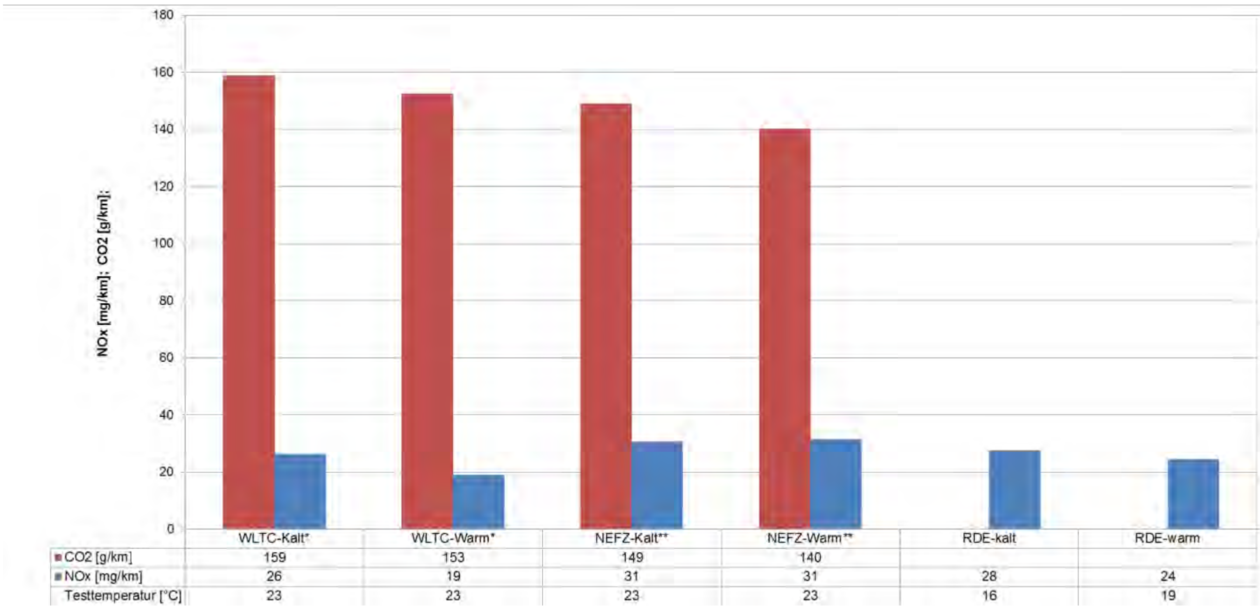
Manufacturer	Opel
Commercial name	Grandland X 2.0 Diesel
Vehicle category	M1
WVTA	e2*2007/46*0597*04
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	Z / J / EHZR-C2B000
Engine design	Straight-4
Engine code	AH01
Displacement [ccm]	1997
Engine power [kW]	130
Mileage	471
Fuel	Diesel
Transmission	Automatic, 8-speed
CO_2 emissions [g/km]	128 (NEDC)
SCR/NSC	SCR
EGR	Yes
Oxi-cat/3-way cat	Oxi-cat
DPF/PPF	DPF

Evaluation and further actions:

Emissions measurements performed on the chassis dynamometer and in the NEDC (cold and hot starts) and WLTC (cold and hot starts) test cycles did not reveal anything significant. No values exceeded the regulatory limits. The tested vehicle was type-approved under the Euro 6d Temp standard.

With double RDE testing, which is the standard for market surveillance purposes, the measured emissions of the Opel Grandland 2.0 D were well below the limit value for the Type 1 test. The increased CO_2 emissions measured in the WLTC and NEDC test cycles were the result of driving the vehicle against increased resistance (road load coefficients).

Test results:



*incl. K_i and D_F, ** w/o K_i and D_F						
	Test tempera-ture [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)*	**23**	**159**	**26**	**30**	**-**	**2.33E+10**
WLTC (hot)*	23	153	19	27	-	3.66E+10
NEDC (cold)**	23	149	31	20	-	1.76E+10
NEDC (hot)**	23	140	31	3	-	4.60E+09
RDE (cold)	16		28		-	-
RDE (hot)	19		24		-	-

No violations were ascertained in this vehicle. The emission reduction system performed well.

5. Porsche Cayenne

Vehicle data:

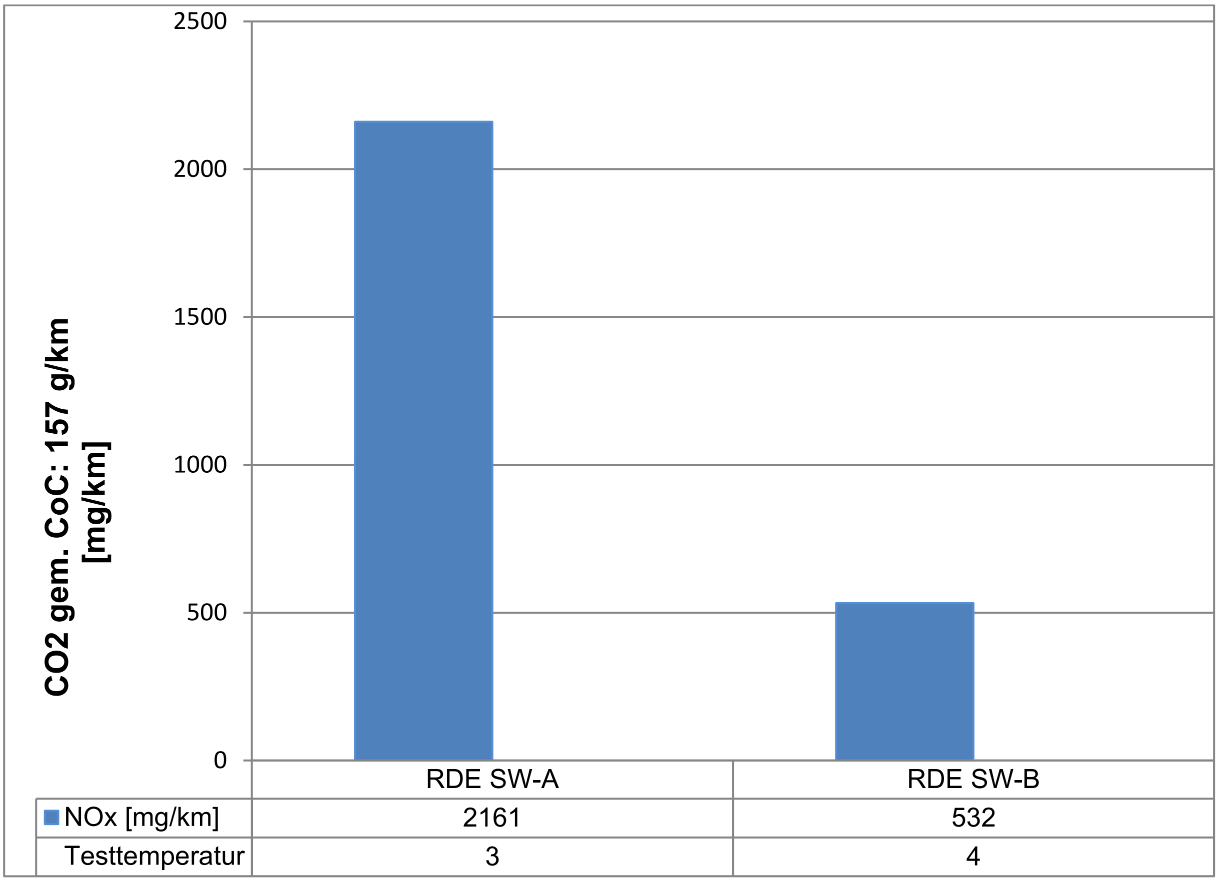
Manufacturer	Porsche
Commercial name	Cayenne S 4.2 TDI (E2/I)
Vehicle category	M1
WVTA	e13*2007/46*1085*08
Emission standard	Euro 5b (NEDC)
Type/variant/version	92A / EJ22 / 02
Engine design	V8
Engine code	CUDB
Displacement [ccm]	4134
Engine power [kW]	281
Mileage [km]	97840
Fuel type	Diesel
Transmission	Automatic
CO_2 acc. to CoC [g/km]	218 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	-
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

Within the scope of a mandatory recall and associated verification of a software upgrade, the real driving emissions of a Porsche Cayenne 4.2 TDI (EU 5) were measured with the last standard software version (SW-A) and an upgrade (SW-B).

The tests revealed that the upgrade had significantly improved the vehicle's average NO_x emissions. SW-A resulted in a NO_x value of 2160.78 mg/km, which was reduced by 75.39% to 531.86 mg/km with SW-B. For analysing the software, functions implemented in SW-A but missing in SW-B were simulated.

Test results:



	Test-temperature. [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
RDE SW-A	3	2161	144	-	$4.77*10^{9}$
RDE SW-B	4	532	113	-	$2.53*10^{11}$

The software upgrade reduces this vehicle's NO_x emissions by 75.39%. This demonstrates the upgrade's effectiveness.

6. Alpina D5 (Euro 6b)

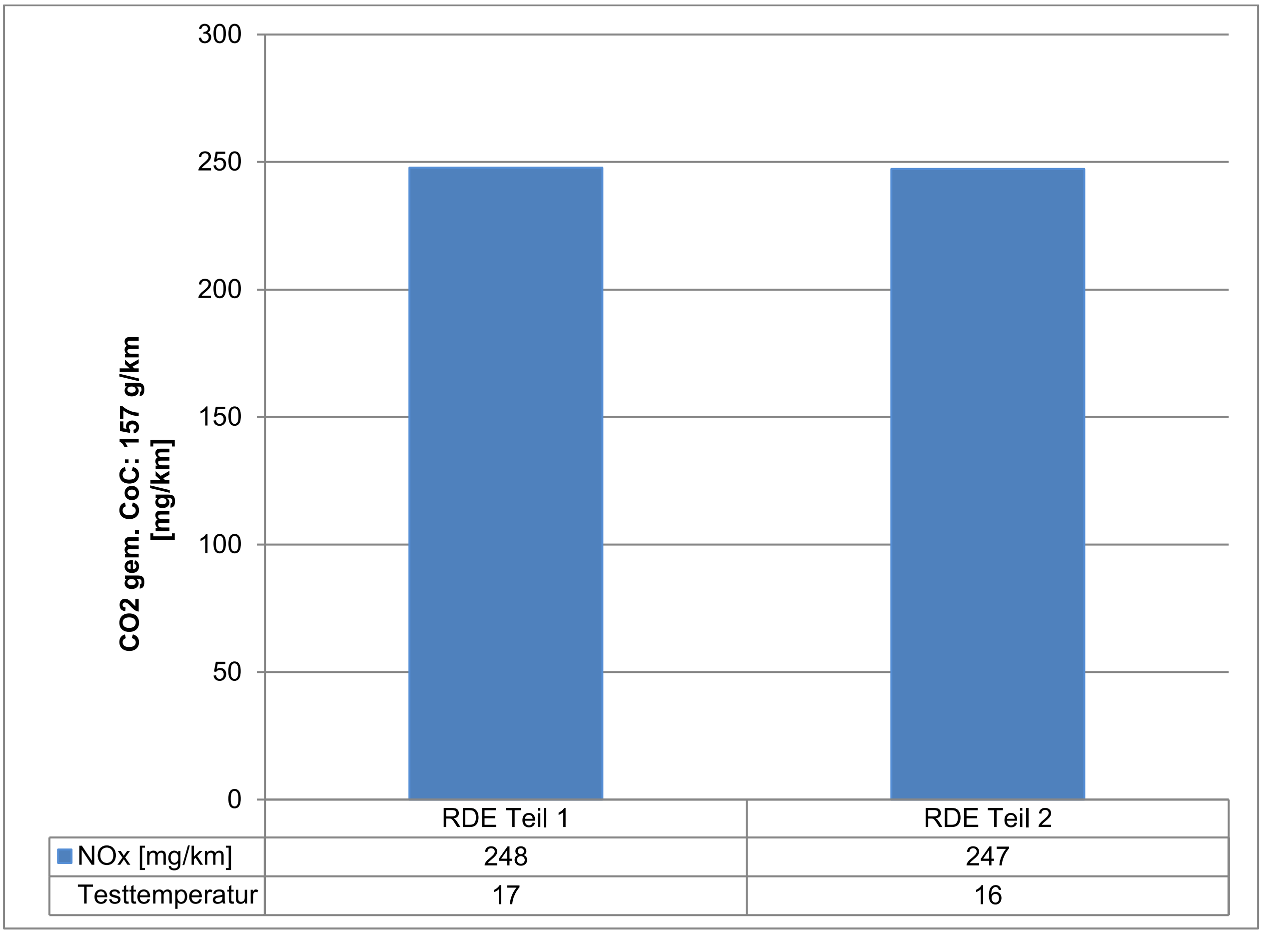
Vehicle data:

Manufacturer	Alpina
Commercial name	D5 Biturbo Touring
Vehicle category	M1
WVTA	e1*KS07/46*0011*07
Emission standard	Euro 6b (NEDC)
Type/variant/version	Alpina 5 / 5161TL / 0
Engine design	Straight 6
Engine code	N57D30
Displacement [ccm]	2993
Engine power [kW]	257
Mileage [km]	60834
Fuel type	Diesel
Transmission	Automatic, 8-speed
CO_2 acc. to CoC [g/km]	163 (NEDC)
SCR/NSC	NSC
Oxi-cat/3-way cat	Oxi-cat
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

The Alpina D5 Biturbo Touring was investigated in the light of what had been learnt from testing a BMW 750d xDrive in which the effectiveness of the emission reduction system had been impermissibly reduced by faulty software. The vehicle was subjected to a double RDE test to determine its emissions behaviour. It was observed that no $DeNO_x$ purges took place at driving speeds above 130 km/h and that the EGR switched off at engine speeds above 3,200 rpm. The manufacturer was asked to respond to these observations. Alpina attributed the missing $DeNO_x$ purges to increased sulphur content in the NSC, explaining that this, in conjunction with hotter exhaust gases while driving on the motorway, can suppress the purges. Another look at the test results confirmed an increased sulphur content in the NSC. In conjunction with the measured exhaust gas temperatures, we concluded that suppression of the $DeNO_x$ event is physically plausible. The EGR cut-out was described by Alpina as being dependent on the torque and essential for protecting components when it exceeds 500 Nm. The KBA has accepted this as a valid explanation.

Test results:



	Test-temperature [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
RDE part 1	17	248	-	-	-
RDE part 2	16	247	-	-	-

There were no grounds to criticise this vehicle's emissions.

7. Volkswagen Sharan

Vehicle data:

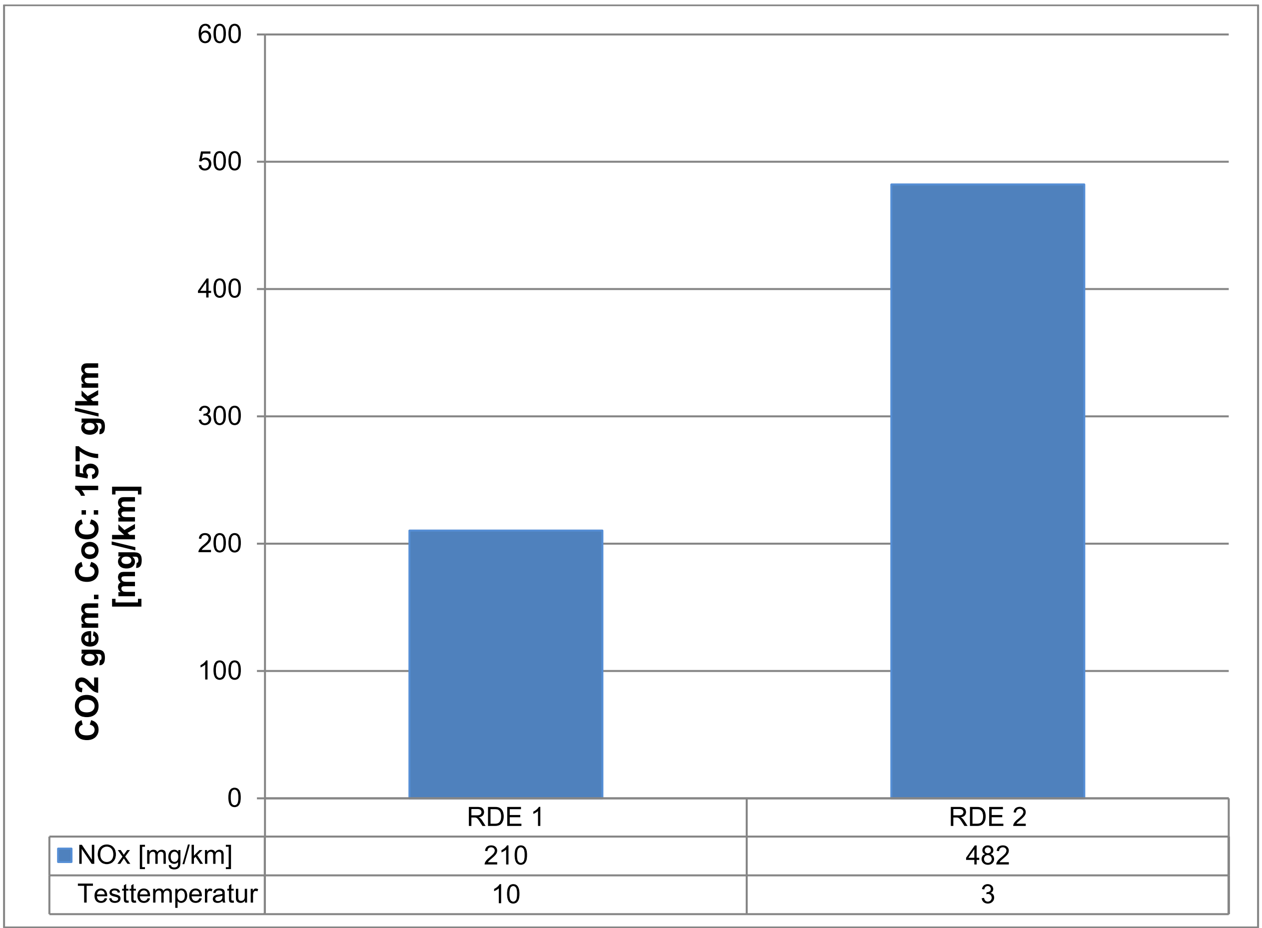
Manufacturer	Volkswagen
Commercial name	Sharan
Vehicle category	M1
WVTA	e1*2007/46*0401*09
Emission standard	Euro 5
Type/variant/version	7N / CFGCX0AF / FD6FD62E029Mj7VR2VWO
Engine design	Straight-4
Engine code	CFGC
Displacement [ccm]	1968
Engine power [kW]	130
Mileage [km]	80401
Fuel type	Diesel
Transmission	Automatic
CO_2 acc. to CoC [g/km]	154 (NEDC)
SCR/NSC	SCR
Oxi-cat/3-way cat	DOC
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

The VW Sharan was studied to determine its NO_x emissions while actually driving (RDE) at different outdoor temperatures.

Driving at temperatures of 10°C and 3°C resulted in increased NO_x emissions, which were attributable to reduced EGR at low outdoor temperatures. According to the manufacturer, this protects the engine.

Test results:



	Test-temperature. [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
RDE 1	10	210	17	-	-
RDE 2	3	482	0	-	-

According to the manufacturer, the differing measurements are the result of a lower EGR rate which is required to protect the engine.

8. Mercedes Sprinter

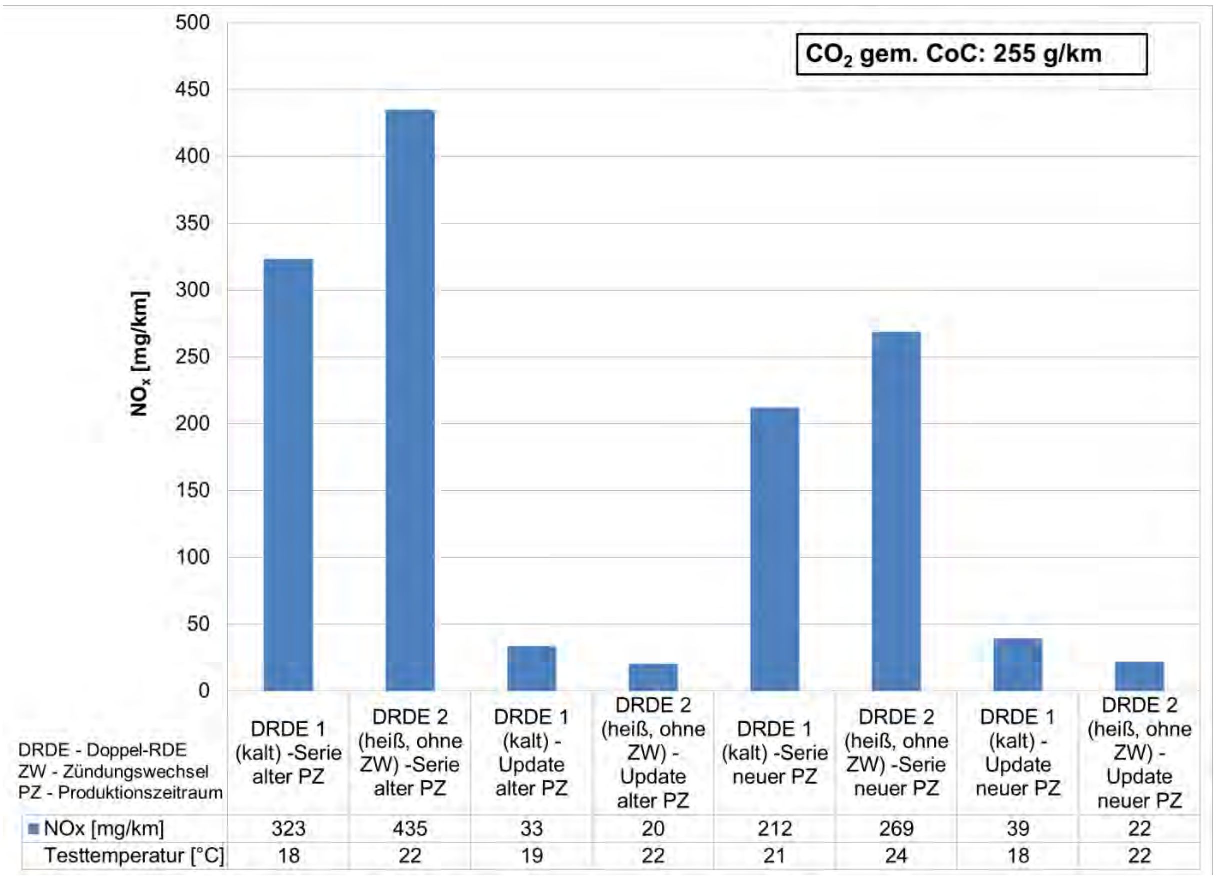
Vehicle data:

Manufacturer	**Mercedes Benz**
Commercial name	Sprinter 120 kW EU6
Vehicle category	M1
WVTA	e1*2001/116*0354*20
Emission standard	Euro 6b (NEDC)
Type/variant/version	906AC35 / KNMD1350N / NEB27VA9
Engine design	Straight-4
Engine code	OM651
Displacement [ccm]	2143
Engine power [kW]	120
Mileage [km]	3170
Fuel type	Diesel
Transmission	Manual, 6-speed
CO_2 acc. to CoC [g/km]	255 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	DOC
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

A software upgrade for the Mercedes Sprinter M1 120 kW OM651 EU 6 (for vehicles manufactured during an early time period from July 2016 to September 2016 and the more recent period since September 2016) was tested to determine how it affects real driving emissions (RDE). A comparison with the original standard software revealed a significant improvement in NO_x emissions on the order of 90-95% for the older production period and 80-90% for the more recent period. The effectiveness of the software upgrade for reducing NO_x emissions was demonstrated by double RDE tests (starting with a cold and hot engine, without an ignition change) and by analysis of the software itself.

Test results:



	Test-temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
DRDE 1 (cold) -older production period	18	-	323	-	-	-
DRDE 2 ((hot), w/o ignition change) -older production period	22	-	435	-	-	-
DRDE 1 (cold) upgrade, older production period	19	-	33	-	-	-
DRDE 2 (hot, w/o ignition change) upgrade, older production period	22	-	20	-	-	-
DRDE 1 (cold) standard, newer production period	21	-	212	-	-	-
DRDE 2 (hot, w/o ignition change) newer production period	24	-	269	-	-	-
DRDE 1 (cold) upgrade, newer production period	18	-	39	-	-	-
DRDE 2 (hot), w/o upgrade, newer production period	22	-	22	-	-	-

This vehicle is subject to an official recall.

9. Proventia NOX-Buster-City – MAN Lion's City GL

Vehicle data:

Manufacturer	**MAN**
Commercial name	Lion's City GL
Vehicle category	M3
WVTA	e4*2007/46*0250*10
Emission standard	EEV
Type/variant/version	B.2007.46.012 / A4018A53BA / 50485800653203Y9ABE
Engine design	Straight-6
Engine code	D2066LUH48
Displacement [ccm]	10518
Engine power [kW]	265
Mileage [km]	278090
Fuel type	Diesel
Transmission	Automatic
CO_2 acc. to CoC [g/km]	-
SCR/NSC	SCR
Oxi-cat/3-way cat	-
DPF/PPF	cDPF
EGR	HD-EGR

Conclusions:

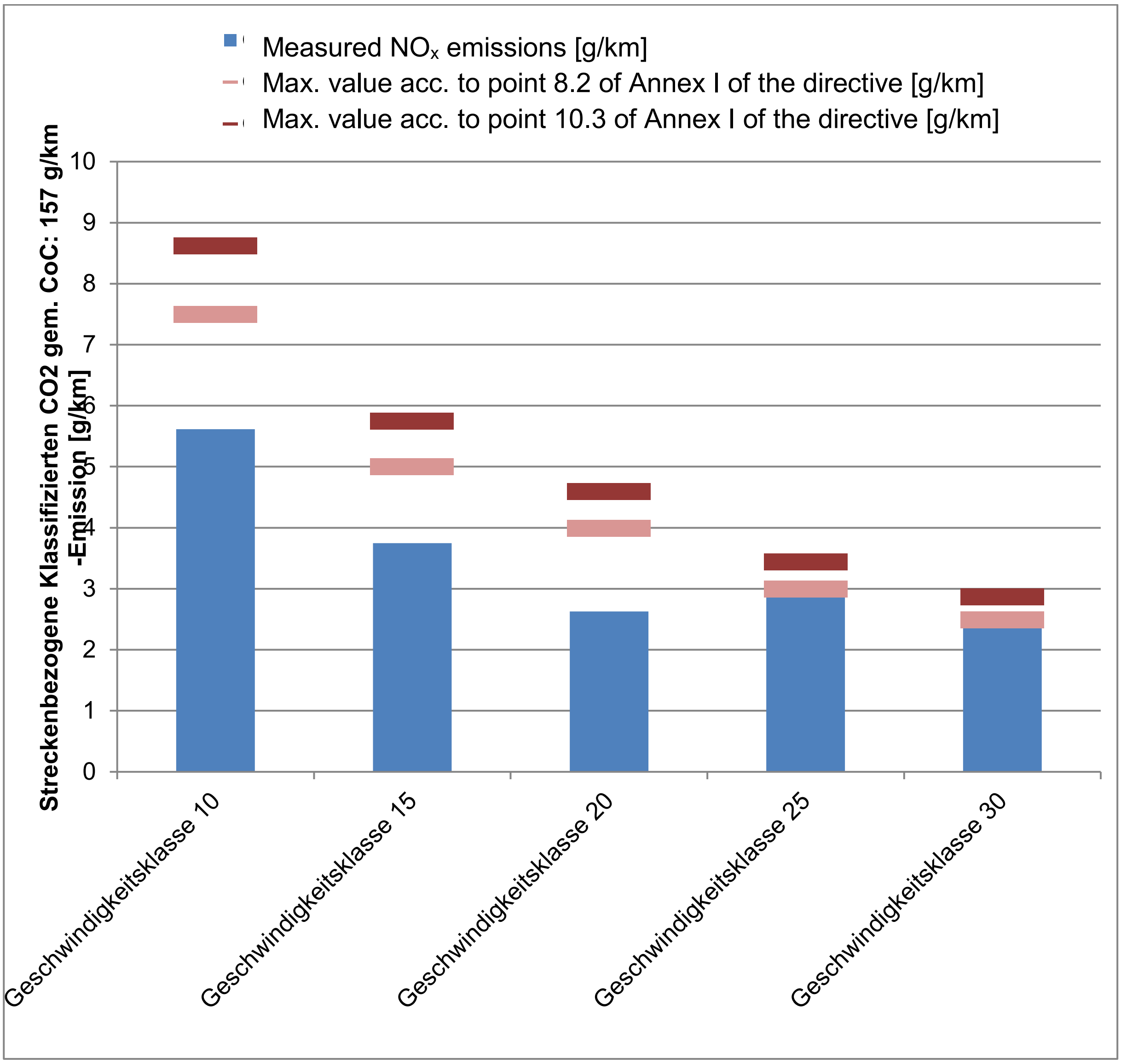
The exhaust emissions of an urban bus retrofitted with the NO_x reduction system (NO_xMs) 'NO_xBuster City F35120' from the firm of Proventia Oy were checked. The goal was to ascertain whether it meets the criteria of the German Subsidisation Guideline for Retrofitting Diesel Buses of Emissions Classes Euro II, IV, V and EEV Used in Public Transport.

The rate at which NO_xMs r_{NOxMs} is reduced is assessed in accordance with point 8.1 of Annex I of the guideline. On the basis of a test drive carried out on 20 March 2019, it was shown that the NO_xMs achieved the required NO_x reduction rate of 85% with a calculated rate of 85.16%.

Applying the speed-based classes defined in point 8.2 of Annex I to the guideline, an assessment of the NO_x emissions during the test drive on 20 March 2020 showed that the system complies with the requirements.

The system did produce measurable NH_3 emissions, presumably due to NH_3 slip caused by a high reducing agent feed rate. However, this pollutant is currently not limited by either the guideline or any laws.

Test results:



Test drive on 20 March 2019	Temp. [°C]	Speed class 10 km/h	Speed class 15 km/h	Speed class 20 km/h	Speed class 25 km/h	Speed class 30 km/h
NO_x emissions [g/km]	7.3 – 12.6	5.6	3.7	2.6	2.9	2.4

The retrofitted NO_x reduction system reduces the vehicle's NO_x emissions by 85.16%. It therefore meets the test criteria of the guideline.

10. Renault Twingo

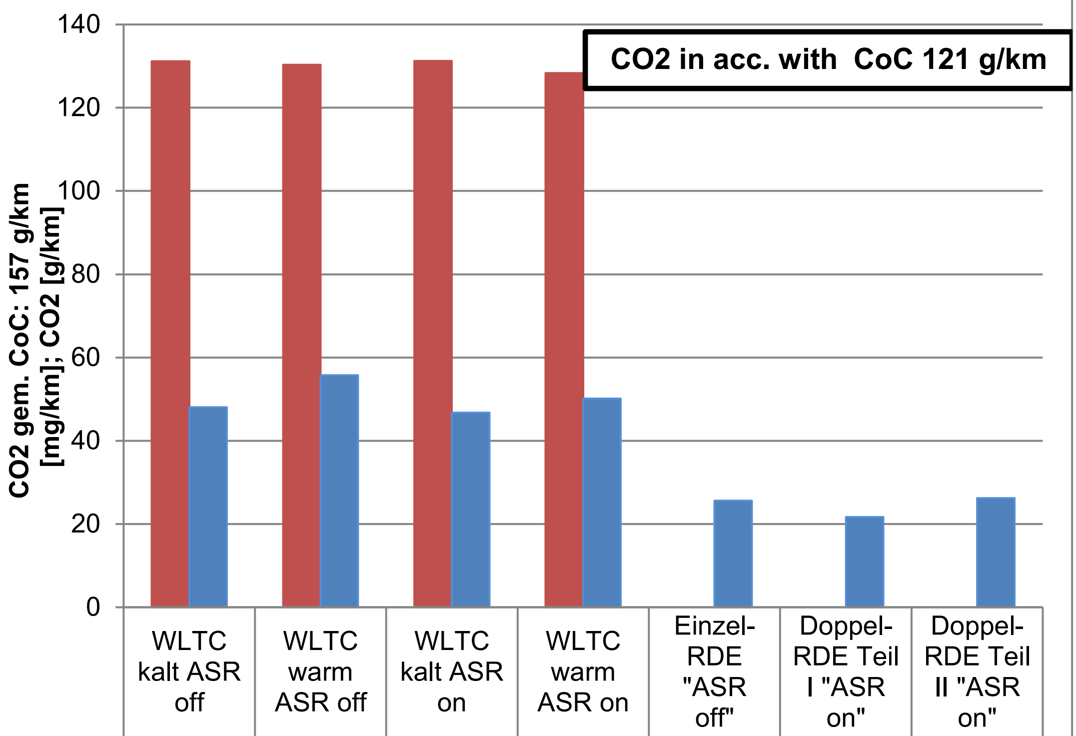
Vehicle data:

Manufacturer	Renault
Commercial name	Twingo SCe 70
Vehicle category	M1
WVTA	e2*2007/46*0457*11
Emission standard	Euro 6c (WLTP)
Type/variant/version	AH / OBE2 / M7ASA0300000
Engine design	Straight-3
Engine code	H4D A4
Displacement [ccm]	999
Engine power [kW]	52
Mileage [km]	1106
Fuel type	Petrol
Transmission	Automatic
CO_2 acc. to CoC [g/km]	121 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way-catalytic converter
DPF/PPF	-
EGR	-

Evaluation and further actions:

The Renault Twingo SCe 7 is a subcompact petrol car with rear engine and drive. In addition to road measurements with PEMS, its tailpipe emissions were also measured on the chassis dynamometer. Attention focused on comparing the measured levels with the ASR activated and deactivated in order to determine the influence of the ASR deactivation process. Specifically, a single RDE (with the ASR off) and a double RDE (with the ASR on) were performed at the KBA. In addition, a defined test programme was run through on the chassis dynamometer. The NO_x emissions of the examined vehicle were below the Euro 6c limit value of 60 mg/km. The solid particle emissions (SPN), by contrast, were high both after a cold start on the chassis dynamometer and in the RDE measurements. The limit of 6.00E+11 #/km only applies to direct-injection engines and is therefore irrelevant in the case of this vehicle, with uses intake-manifold fuel injection.

Test results:



	WLTC kalt ASR off	WLTC warm ASR off	WLTC kalt ASR on	WLTC warm ASR on	Einzel-RDE "ASR off"	Doppel-RDE Teil I "ASR on"	Doppel-RDE Teil II "ASR on"
CO2 [g/km]	131	130	131	128			
NOx [mg/km]	48,02	55,76	46,75	50,16	26	22	26
Testtemperatur	23	23	23	23	08	11	11

*Incl. D_F, **CO_2 results available, ***driving curve deviations lasting longer than 1 s						
	Test temp. [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold), ASR off *	23	131	48	588	-	$6.01*10^{11}$
WLTC (hot), ASR off*	23	130	56	868	-	$1.46*10^{11}$
WLTC (cold), ASR on*	23	131	47	764	-	$5.68*10^{11}$
WLTC (hot), ASR on *	23	128	50	674	-	$1.38*10^{11}$
RDE (cold), ASR off	8	**	26	602	-	$5.52*10^{11}$
RDE (cold), ASR on	11	**	22	1299	-	$5.19*10^{11}$
RDE (hot), ASR on	11	**	26	2311	-	$3.88*10^{11}$

Based on the chassis dynamometer test results, there are no significant differences in emissions between ‘ASR on’ and ‘ASR off’.

11. Opel Mokka

Vehicle data:

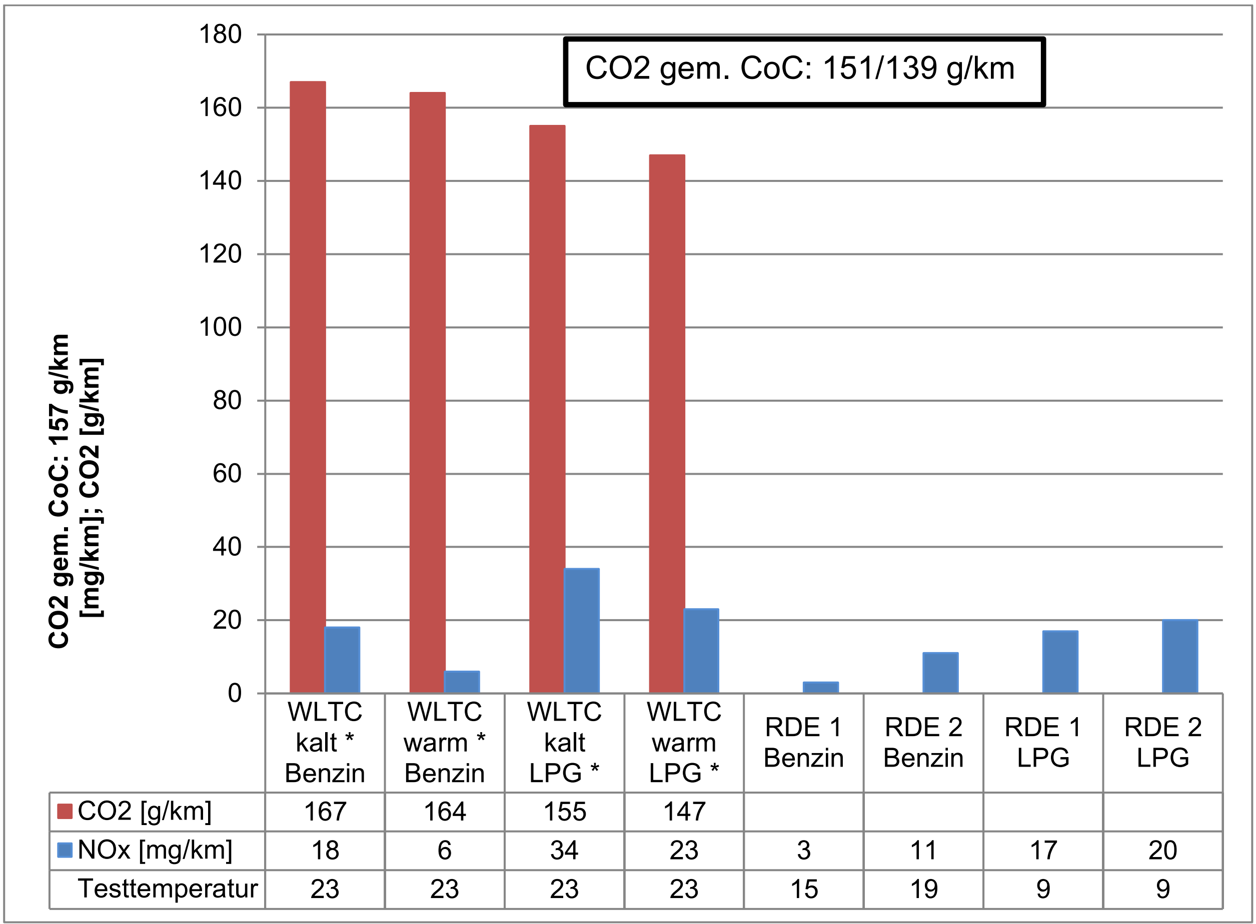
Manufacturer	Opel
Commercial name	Mokka 1,4l LPG
Vehicle category	M1
WVTA	e4*2007/46*0537*21
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	J-A / JMXXFXX / 41LA54T5CB
Engine design	Straight-4
Engine code	C1E
Displacement [ccm]	1364
Engine power [kW]	104
Mileage	417
Fuel	Petrol / LPG
Transmission	Manual, 6-speed
CO_2 emissions [g/km]	151 petrol / 139 LPG (WLTC)
SCR/NSC	-
EGR	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-

Evaluation and further actions:

None of the emissions measured on the chassis dynamometer with WLTC cold vs hot and during RDE test drives exceeded the legislated limits. The test vehicle was type-approved under the Euro 6d-Temp Emission standard.

The double RDE tests revealed no excessive NO_x emissions. The particle emissions were relatively high, but these are not limited by law for petrol engines with intake-manifold fuel injection.

Test results:



incl. D_F *						
	Test temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)*, petrol	23	167	18	666	-	1.38E+12
WLTC (hot)*, petrol	23	164	6	291	-	9.33E+11
WLTC (cold)*, LPG	23	155	34	742	-	4.69E+11
WLTC (hot)*, LPG	23	147	23	350	-	9.40E+11
RDE 1, petrol	15		3	137	-	4.46E+11
RDE 2, petrol	19		11	109	-	3.30E+11
RDE 1, LPG	9		17	170		3.52E+10
RDE 2, LPG	9		20	264		5.99E+09

No violations were identified in this vehicle. The particle emissions are conspicuously high compared to the limits on direct-injection petrol engines, but these are not regulated for intake-manifold fuel injection engines.

12. Nissan Navara

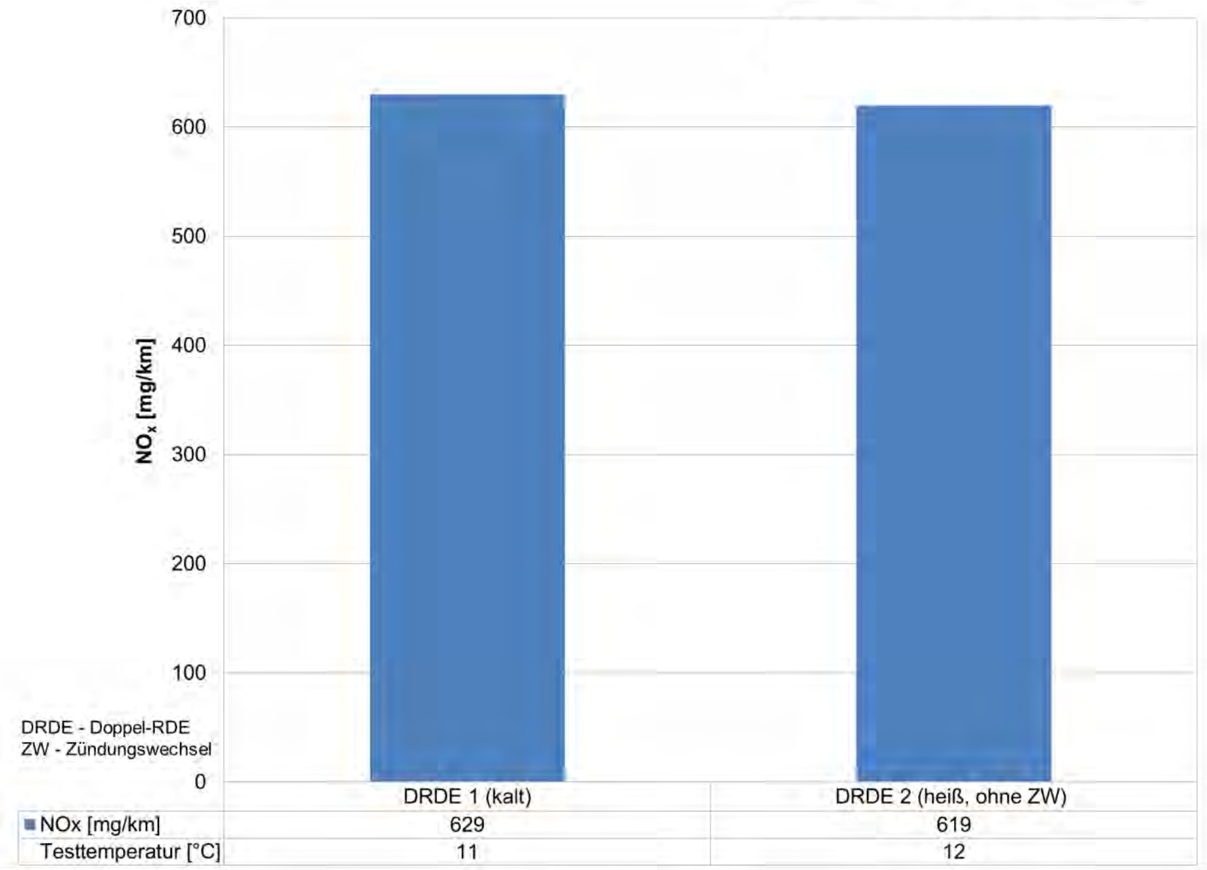
Vehicle data:

Manufacturer	**Nissan**
Commercial name	Navara
Vehicle category	N1 class 3, N2
WVTA	e9*2007/46*6364*05
Emission standard	Euro 6b (NEDC)
Type/variant/version	D231 / CDB4 / C6M1YC5J
Engine design	Straight-4
Engine code	YS23
Displacement [ccm]	2298
Engine power [kW]	140
Mileage [km]	8660
Fuel type	Diesel
Transmission	Manual, 6-speed
CO_2 acc. to CoC [g/km]	167 (NEDC)
SCR/NSC	SCR
Oxi-cat/3-way cat	DOC
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

The Nissan Navara was checked to determine its exhaust gas emissions under real driving conditions (RED). During double RDE (cold start + hot running without ignition change) at ambient temperatures of about 11°C, increased NO_x emissions were measured. After evaluating the test data, it was established by these were due to a combination of reduced SCR effectiveness while driving on the motorway and a reduced HD-EGR rate dependent on the engine’s rotational speed and torque. Due to the suspicion that the engine had been fitted with a prohibited defeat device as defined by Article 5 of Regulation (EC) 715/2007, the responsible type approval authority was requested to initiate steps in accordance with Article 3, Paragraph 3 of Directive 2007/46/EC.

Test results:



	Test temperature [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
DRDE 1 (cold)	11	629	-	-	-
DRDE 2 (hot start, w/o ignition change)	12	619	-	-	-

After inspecting the vehicle and ascertaining the situation, a violation was ascertained. The responsible type approval authority was notified and requested to take appropriate action as per Article 3, Paragraph 3 of Directive 2007/46/EC.

13. Hyundai Tucson

Vehicle data:

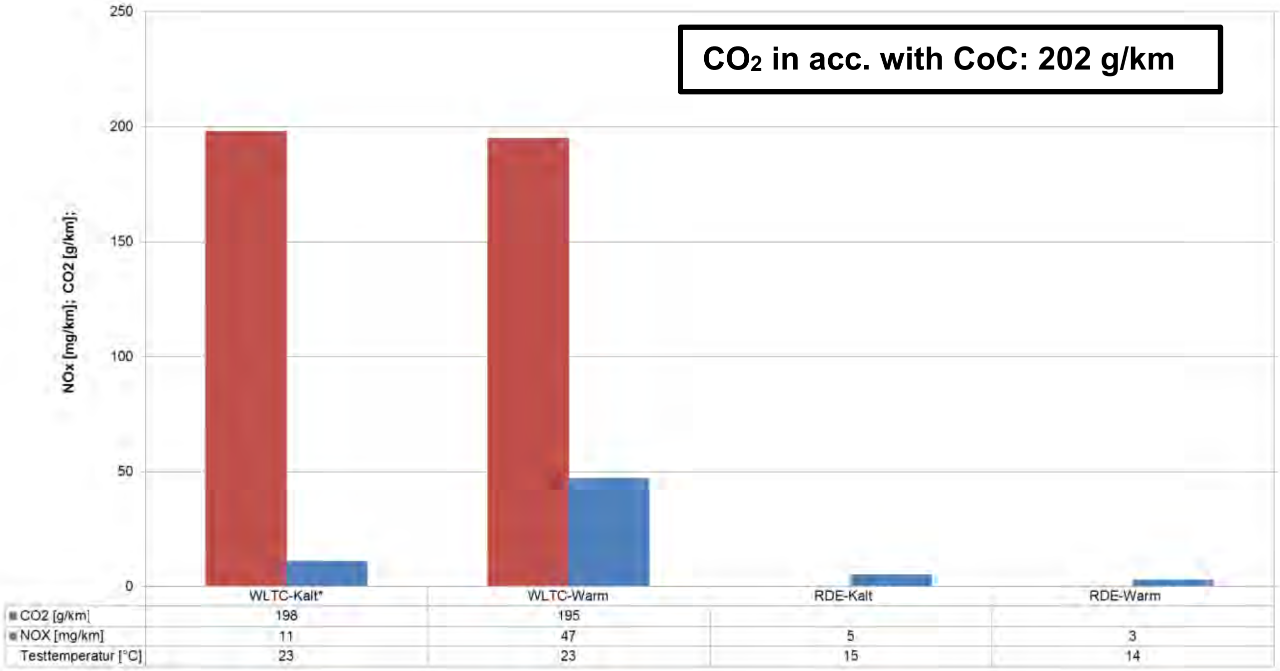
Manufacturer	Hyundai
Commercial name	Tucson 1,6 l
Vehicle category	M1
WVTA	e11*2007/46*2724*07
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	TLE / F5P24 / M621Z1
Engine design	Straight-4
Engine code	G4FJ
Displacement [ccm]	1591
Engine power [kW]	130
Mileage [km]	1618
Fuel	Petrol
Transmission	Manual, 6-speed
CO_2 emissions [g/km]	202 (WLTC)
SCR/NSC	-
EGR	No
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	PPF

Evaluation and further actions:

The emissions measured on the chassis dynamometer with WLTC (cold and hot start) test cycles revealed nothing out of the ordinary. All legislated limits underlying the Type 1 test were complied with. The tested vehicle is type-approved in accordance with the Euro 6d-Temp exhaust Emission standard.

In the double RDE test carried out within the scope of this market surveillance study, the Hyundai Tucson exhibited no impermissible emission levels.

Test results:



*incl. D_F						
	Test tempera-ture [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)*	23	198	11	561	-	-
WLTC (hot)	23	195	47	258	-	-
RDE (cold)	15		5	310	-	4.13E+11
RDE (hot)	14		3	241	-	4.43E+11

No evidence of violations was found in connection with the tests performed.

14. Toyota C-HR

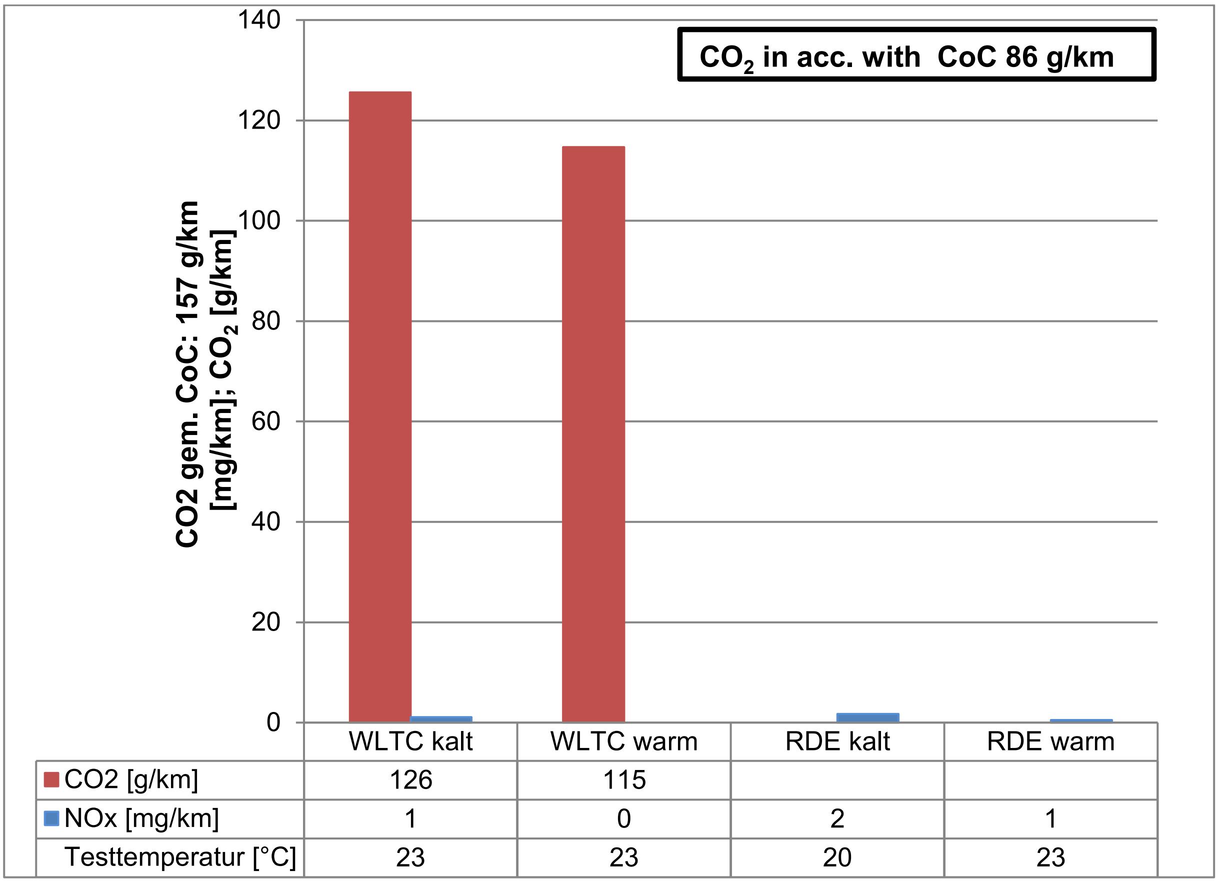
Vehicle data:

Manufacturer	Toyota
Commercial name	C-HR 1.8 VVT-i Hybrid
Vehicle category	M1
WVTA	e11*2007/46*3641*01
Emission standard	Euro 6AG (WLTP)
Type/variant/version	AX1T(EU,M), ZYX10(H), ZYX10L-AHXNBW(1B)
Engine design	Straight-4 / electric
Engine code	2ZR-FXE
Displacement [ccm]	1798
Engine power [kW]	72 kW internal combustion 53 kW electric
Mileage [km]	19502
Fuel type	Petrol/hybrid
Transmission	Automatic
CO_2 acc. to CoC [g/km]	86 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	High-pressure

Evaluation and further actions:

This vehicle was tested on the chassis dynamometer with WMTC (hot and cold) and also under actual driving conditions (RDE hot and cold). No limits were exceeded in any of the tests. The CO_2 value acc. to the vehicle's CoC was exceeded in every test, however. The battery pack had not been charged as prescribed by the manufacturer in preparation for the Type 1 test, which accounts for the increased CO_2 emissions.

Test results:



*incl. D_F, ***with deviations from the driving curve lasting longer than one second						
	Test temp. [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)*	23	126	1	86	0.05	-
WLTC (hot)*,***	23	115	0	47	0.14	-
RDE (cold)	20	-	2	27	-	-
RDE (hot)	23	-	1	29	-	-

The vehicle was categorised as unproblematic with regard to its regulated exhaust emissions. The measured increased CO_2 emissions cannot be criticised, as the manufacturer's instructions for charging the battery had not been followed prior to the test. The vehicle is therefore regarded as problematic with caveats (see above).

15. Toyota Yaris 1,5l Hybrid

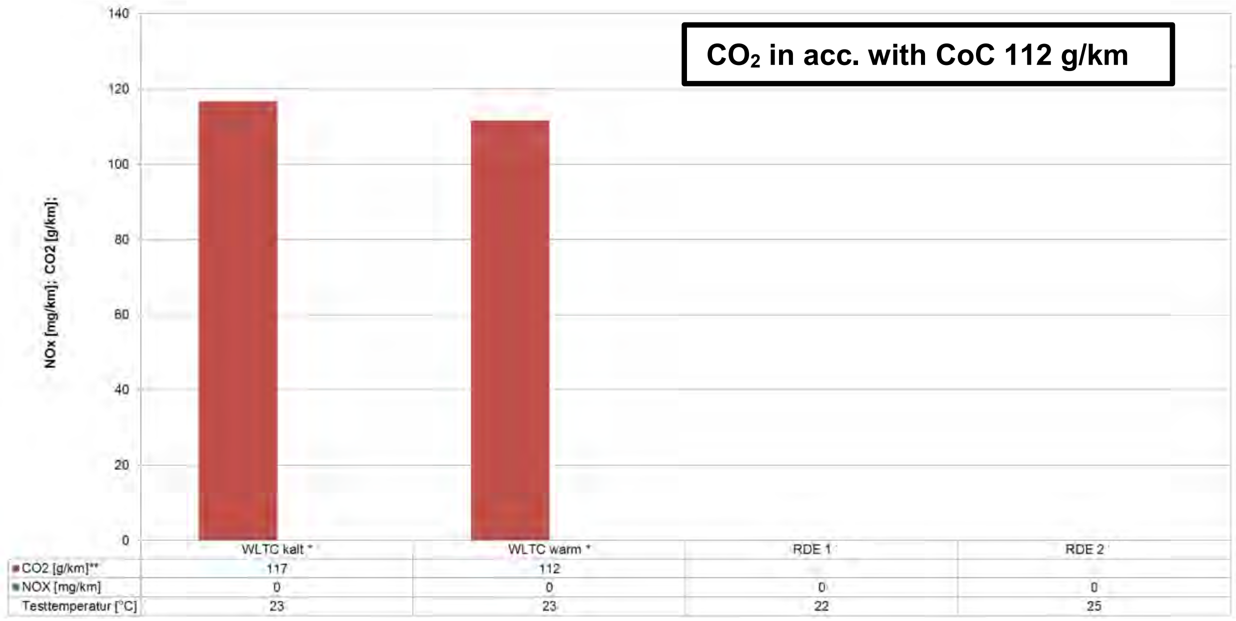
Vehicle data:

Manufacturer	**Toyota**
Commercial name	1,5l Hybrid
Vehicle category	M1
WVTA	e11*2007/46*0152*11
Emission standard	Euro 6b
Type/variant/version	XP13M(a) / NHP13 (MH) / NHP130L-CHXNBW(1M)
Engine design	Straight-4
Engine code	1NZ
Displacement [ccm]	1497 cm³
Engine power [kW]	54
Mileage [km]	11238
Fuel type	Petrol
Transmission	CVT Automatic
CO_2 emissions [g/km]	112 (WLTC) 89 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
EGR	
DPF/PPF	-

Evaluation and further actions:

Emissions measurements carried out on the chassis dynamometer with NEDC (cold and hot start) and WLTC (cold and hot start) test cycles did not reveal any problems. All legislated limits were complied with. The tested vehicle had received type approval in accordance with the Euro 6b emission standard, which does not require RDE measurements. The corresponding CO_2 emissions were confirmed in the WLTC test cycles (with cold and hot starting conditions) with only minimal deviations.

Test results:



* incl. D_F						
	Test temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)*	**23**	**117**	**0**	**228**	**-**	**-**
WLTC (hot) *	23	112	0	92	-	-
RDE 1	22		0	68	-	-
RDE 2	25		0	72	-	-

No violations were identified in the vehicle. Without exception, the exhaust emission levels measured in the WLTC and RDE test cycles were compliant.

16. Volvo XC60

Vehicle data:

Manufacturer	**Volvo**
Commercial name	XC60 D4
Vehicle category	M1
WVTA	e4*2007/46*1220*04
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	U / UZA8 / UZA8VD0?
Engine design	Straight-4
Engine code	D4204T14
Displacement [ccm]	1969
Engine power [kW]	140
Mileage [km]	4749
Fuel type	Diesel
Transmission	Automatic, 8-speed, front-wheel drive
CO_2 acc. to CoC [g/km]	158 (WLTC)
SCR/NSC	Yes / yes
Oxi-cat/3-way cat	Yes / -
DPF/PPF	Yes (cDPF) / -
EGR	HD-EGR

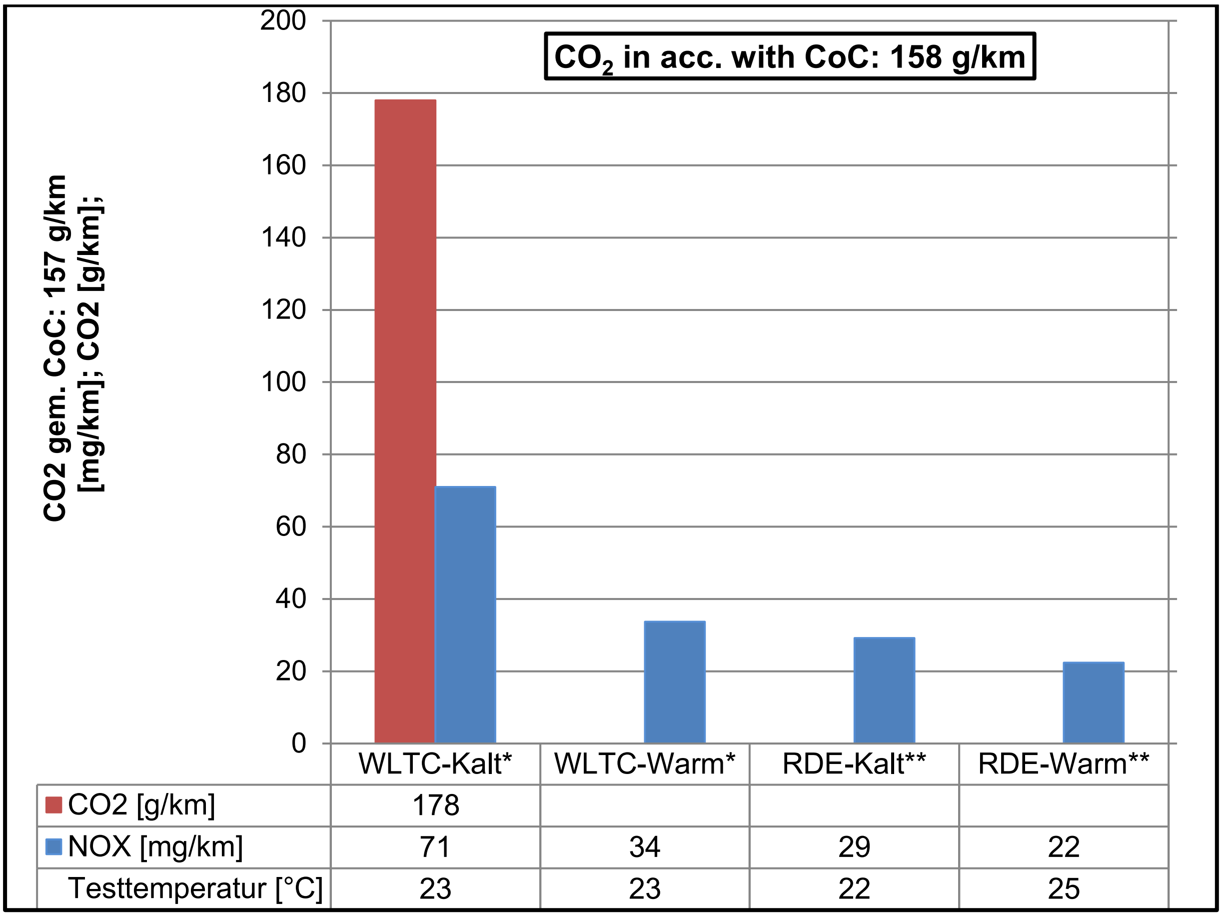
Evaluation and further actions:

This vehicle did not significantly exceed any of the applicable emissions caps. The final CO_2 result obtained in the WLTC (cold) test cycle (incl. K_i and D_F) was 178 g/km or roughly 12.7% above the manufacturer's figure. Analysis of the causes revealed five minor driving curve deviations, the longest of which lasted 0.9 seconds, i.e. within the maximum allowed duration of one second.

As per the requirements for WLTC vehicles, no battery charging took place in the soak test. The CO_2-reducing start-stop functionality did not work in the WLTC tests carried out. This was presumably due to an insufficient initial battery charge, as the battery was not charged beforehand in accordance with the rules for WLTC vehicles.

In contrast, the CO_2 levels measured in the RDE (cold) and hot-start tests (166 and 159 g/km, respectively), which included K_i but not D_F, were close to the manufacturer's WLTC figures.

Test results:



* incl. K_i and D_F, ** incl. K_i w/o D_F						
	Test temperature [°C]	CO_2 [g/km]***	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)*	23	178	71	203	-0.06	6.55E+10
WLTC (hot)*	23		34	234	0.15	-
RDE (cold)**	22		29	8	-	7.33E+09
RDE (hot)**	25		22	-4	-	5.51E+09

The vehicle's exhaust emissions were acceptable.

17. Audi A4 1.4 TFSI

Vehicle data:

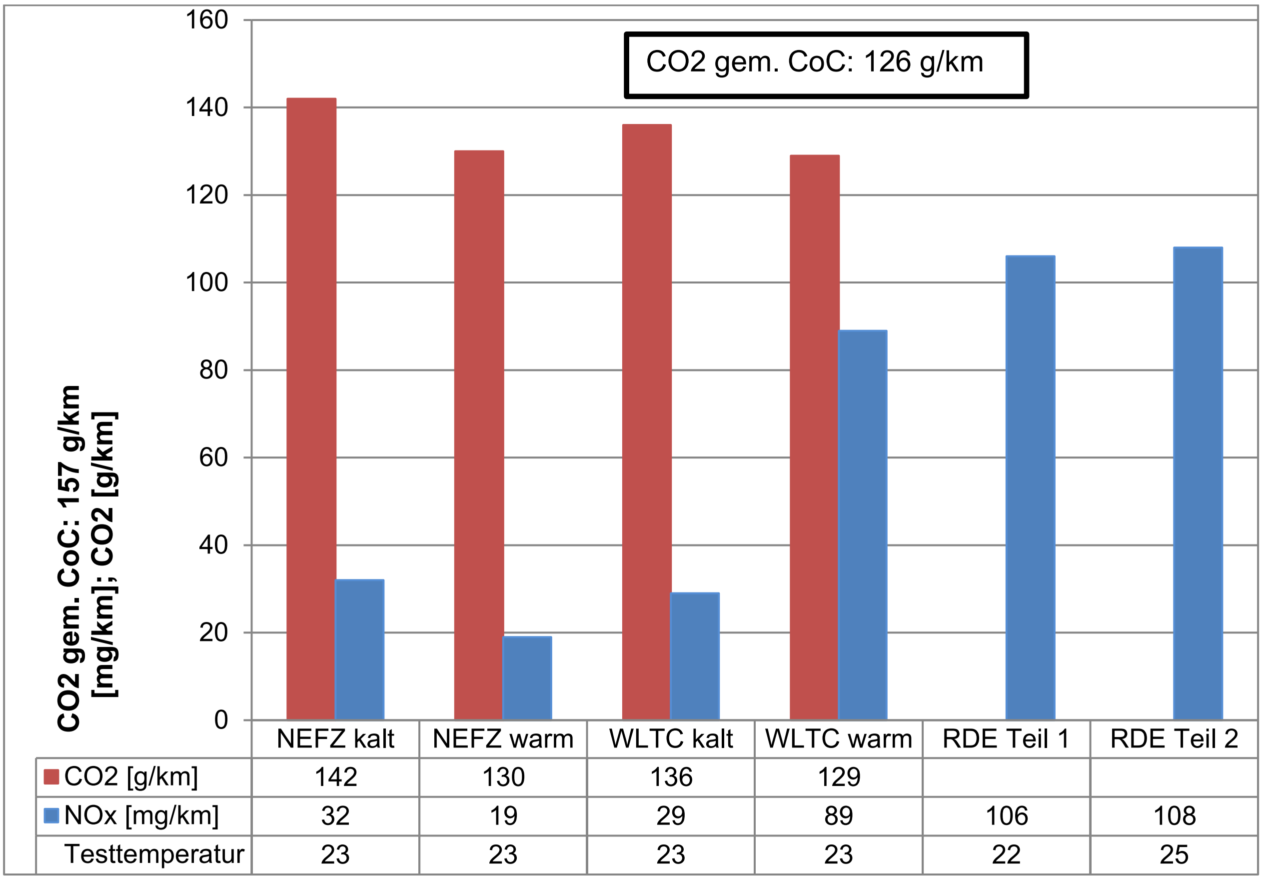
Manufacturer	**Audi**
Commercial name	A4 1.4 TFSI
Vehicle category	M1
WVTA	e1*2001/116*04630*50
Emission standard	Euro 6b (NEDC)
Type/variant/version	B8 / L2CVNAF1 / FM6FM6 DJ007P8W05S57MMEM1
Engine design	Straight-4
Engine code	HRA2
Displacement [ccm]	1395
Engine power [kW]	85
Mileage [km]	8782
Fuel type	Petrol
Transmission	Manual, 6-speed
CO_2 acc. to CoC [g/km]	126 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	-

Evaluation and further actions:

The Audi A4 1.4 TFSI was subjected to a test programme consisting of a double RDE test carried out at the KBA in Flensburg plus measurements on the chassis dynamometer (NEDC cold + hot and WLTC cold + hot).

The vehicle exhibited acceptable emissions behaviour in the Type 1 test. In the RDE tests, the NO_x emissions were 1.78 times the limit for a Type 1 test, but this was still within the acceptable range. The particle emissions exceeded the limit for RDE-certified vehicles, but this did not apply to the vehicle at the time when it was placed in circulation. The measured CO_2 emissions exceeded the CoC value due to driving curve deviations on the chassis dynamometer.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)	**23**	**142**	**32**	**73**	**0.16**	**-**
NEDC (hot)	23	(130)	19	25	0.81	-
WLTC (cold)	23	(136)	29	95	0.27	-
WLTC (hot)	23	(129)	89	56	0.21	-
RDE part 1	22	-	106	18	-	7.62E11
RDE part 2	25	-	108	76	-	7.70E11

The emissions measured in the tests were unproblematic.

18. Opel Corsa

Vehicle data:

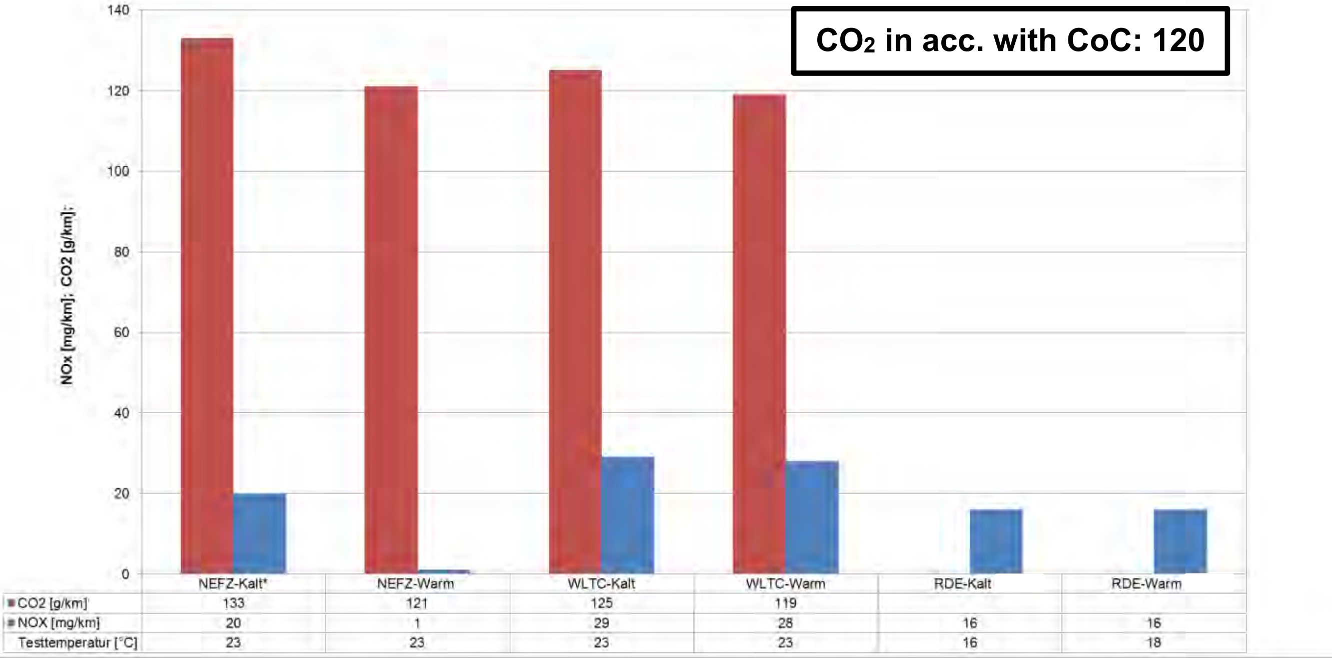
Manufacturer	Opel
Commercial name	Corsa 1,4 l
Vehicle category	M1
WVTA	e1*2001/116*0379*41
Emission standard	Euro 6b
Type/variant/version	S-D / CADRA12 / BX2D6EHLJ5
Engine design	Straight-4
Engine code	B14XER
Displacement [ccm]	1398
Engine power [kW]	66
Mileage [km]	17214
Fuel	Petrol
Transmission	Manual, 5-speed
CO_2 emissions [g/km]	120 (NEDC)
SCR/NSC	-
EGR	No
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-

Evaluation and further actions:

The emissions tests carried out on the chassis dynamometer with cold- + hot-start NEDC and WLTC test cycles did not produce any problematic results. All of the pollutant caps associated with the Type 1 test were complied with. The test vehicle has type approval under the Euro 6b emission standard.

In the double RDE test that is routinely carried out within the scope of our market surveillance activities, the emission levels of the Open Corsa 1.4L were acceptable.

Test results:



*incl. D_F (interpolated)						
	Test temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)*	23	133	20	812	-	-
NEDC (hot)	23	121	1	257	-	-
WLTC (cold)	23	125	29	595	-	-
WLTC (hot)	23	119	28	333	-	-
RDE (cold)	16		16	458	-	3.29E+11
RDE (hot)	18		16	770	-	2.04E+11

The exhaust emission tests performed did not reveal any issues.

19. VW Up! 1.0 MPI

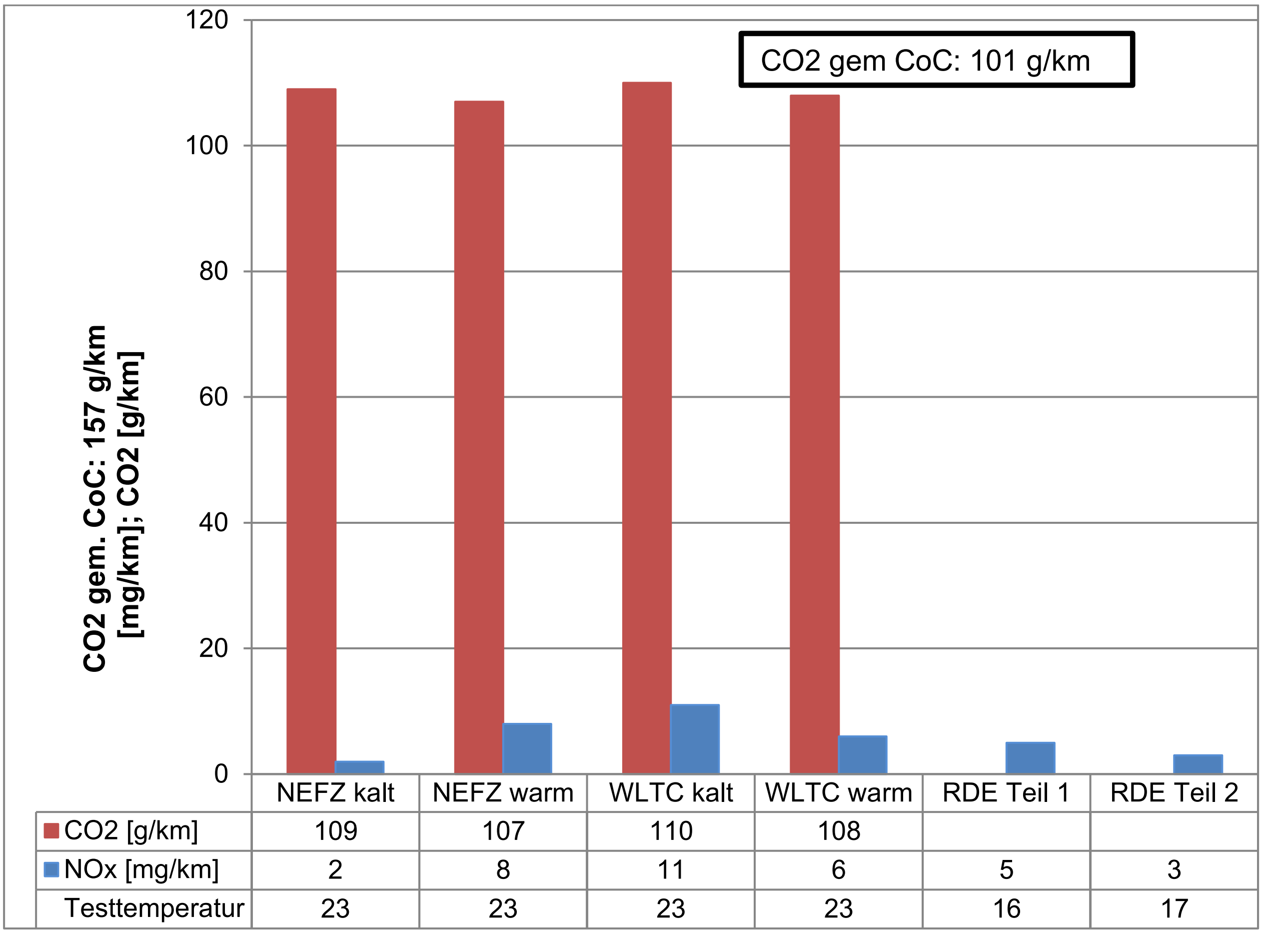
Vehicle data:

Manufacturer	**VW**
Commercial name	Up! 1.0 MPI
Vehicle category	M1
WVTA	e13*2007/46*1167*20
Emission standard	Euro 6b (NEDC)
Type/variant/version	AA / ABCHYA/ FM5FM5CF0117MMVR0N1SV W61
Engine design	Straight-3
Engine code	CHYA
Displacement [ccm]	999
Engine power [kW]	44
Mileage [km]	4925
Fuel type	Petrol
Transmission	Manual, 5-speed
CO_2 acc. to CoC [g/km]	101 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	-

Evaluation and further actions:

The VW Up! 1.0 MPI was subjected to a test programme consisting of a double RDE, which was performed at the KBA, and measurements on the chassis dynamometer (cold- and hot-start NEDC and WLTC). The results yielded a thoroughly compliant emissions profile. Both on the chassis dynamometer and while driving in road traffic, the vehicle achieved levels of regulated emissions that were significantly below the permissible limit values.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)	**23**	**109**	**2**	**434**	**-**	**-**
NEDC (hot)	23	107	8	152	-	-
WLTC (cold)	23	(110)	11	348	-	-
WLTC (hot)	23	(108)	6	173	-	-
RDE part 1	16	-	5	246	-	-
RDE part 2	17	-	3	206	-	-

This vehicle’s emission profile was compliant.

20. VW Tiguan 2.0 TDI

Vehicle data:

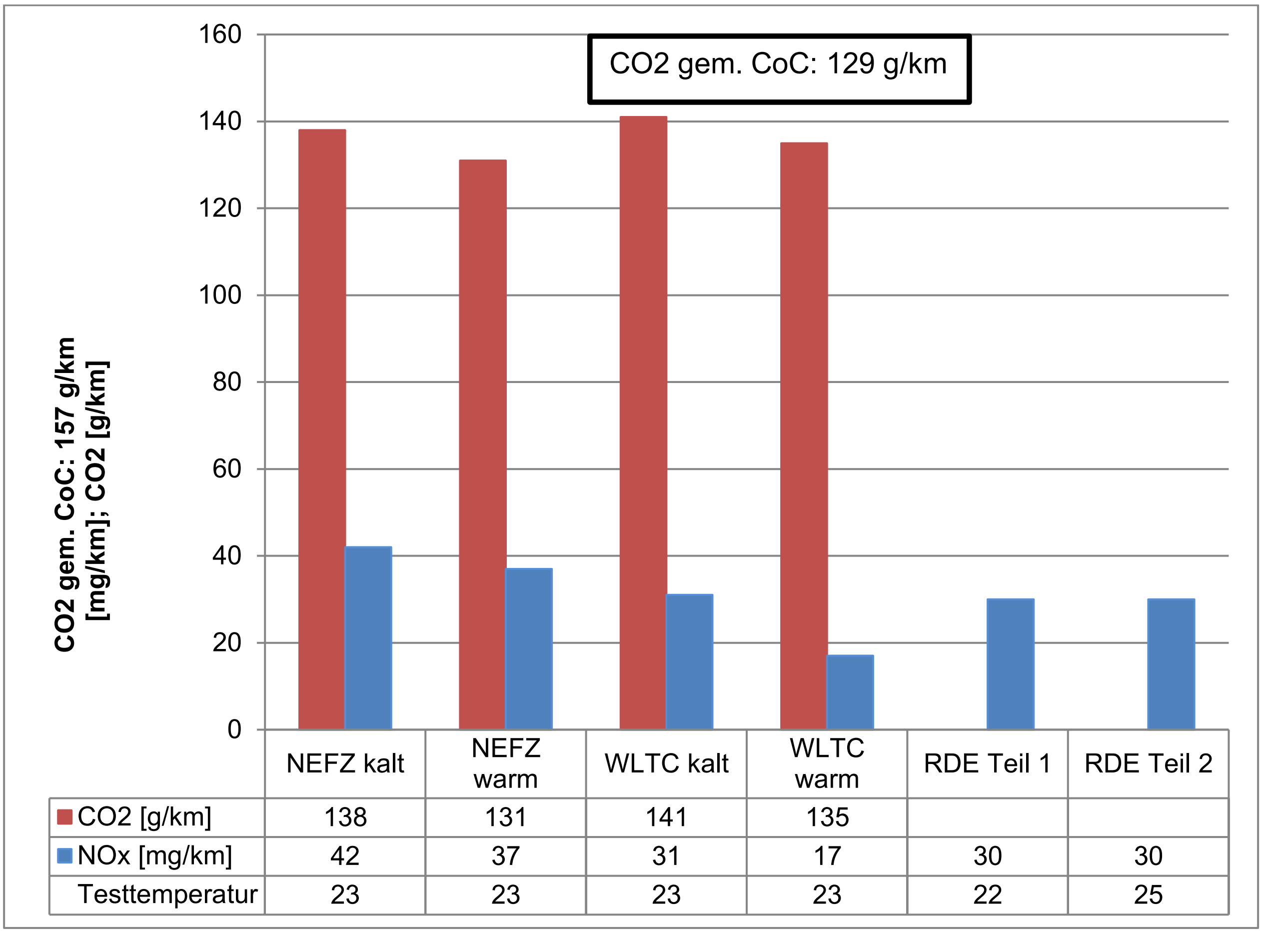
Manufacturer	VW
Commercial name	Tiguan 2.0 TDI
Vehicle category	M1
WVTA	e1*2007/46*0450*30
Emission standard	Euro 6b (NEDC)
Type/variant/version	5N / ACDFGAX0 / NFD7FD7DL001GN4TVR27M M61
Engine design	Straight-4
Engine code	DFGA
Displacement [ccm]	1968
Engine power [kW]	110
Mileage [km]	23538
Fuel type	Diesel
Transmission	DSG, 6-speed
CO_2 acc. to CoC [g/km]	129 (NEDC)
SCR/NSC	SCR
Oxi-cat/3-way cat	Oxi-cat
DPF/PPF	DPF
EGR	ND EGR

Evaluation and further actions:

The VW Tiguan 2.0 TDI was subjected to a test programme consisting of a double RDE performed at the KBA in Flensburg and measurements on the chassis dynamometer (cold- and hot-start NEDC and WLTC).

Summing up, this vehicle’s emission behaviour is thoroughly compliant. Its emissions remained below the acceptable limits both on the chassis dynamometer and when driving on roads, in part significantly so.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)	**23**	**138**	**42**	**114**	**-**	**-**
NEDC (hot)	23	131	37	44	-	-
WLTC (cold)	23	(141)	31	63	-	-
WLTC (hot)	23	(135)	17	35	-	-
RDE part 1	22	-	30	-	-	3.56E+9
RDE part 2	25	-	30	-	-	2.05E+9

This vehicle's emissions were within acceptable limits.

21. Opel Mokka X

Vehicle data:

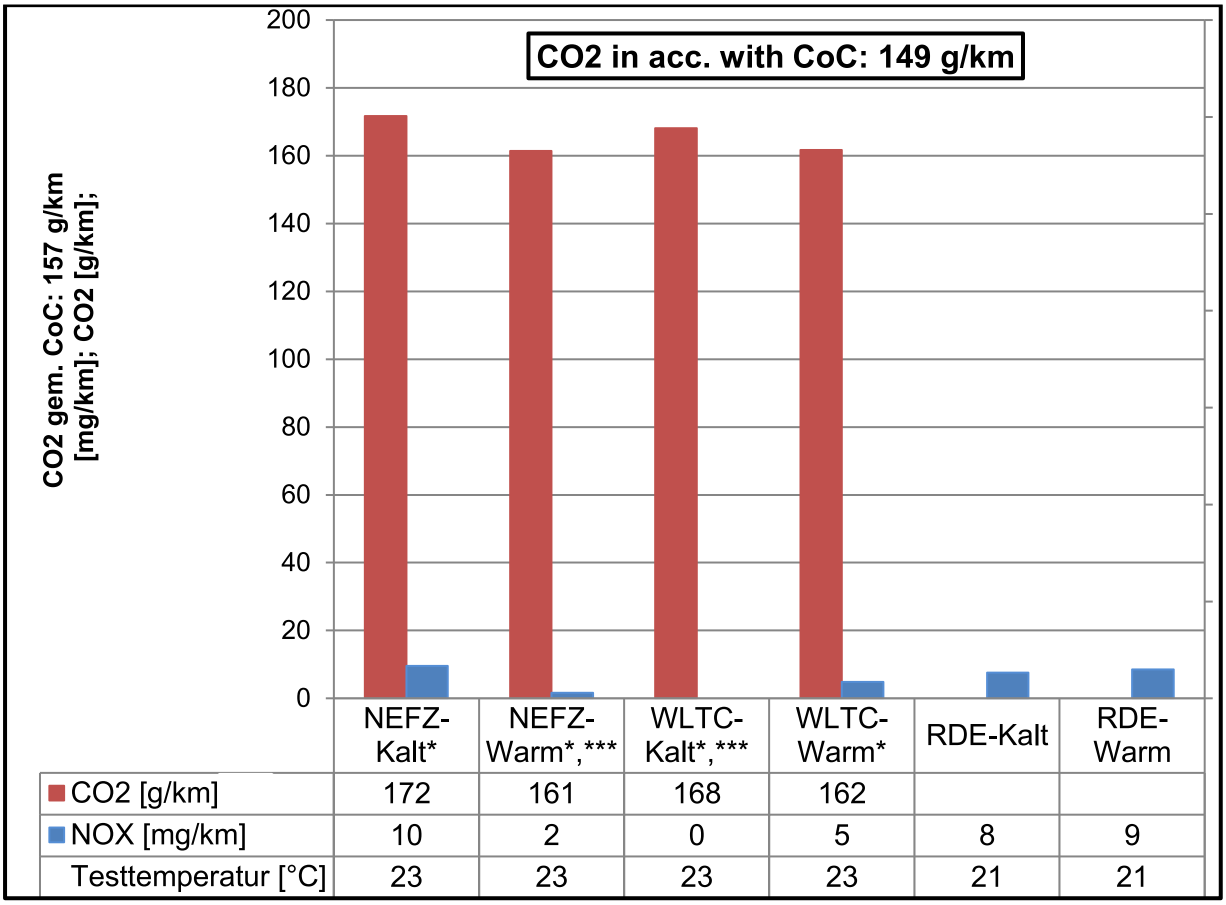
Manufacturer	Opel
Commercial name	Mokka X 1.4
Vehicle category	M1
WVTA	e4*2007/46*0537*19
Emission standard	Euro 6b (NEDC)
Type/variant/version	J-A / JMXXFXX / N44PDXHYUUB
Engine design	Straight-4
Engine code	A14NET / B14NET
Displacement [ccm]	1364
Engine power [kW]	103
Mileage [km]	9302
Fuel type	Petrol
Transmission	Automatic, 6-speed, front-wheel drive
CO_2 acc. to CoC [g/km]	149 (NEDC)
SCR/NSC	- / -
Oxi-cat/3-way cat	- / Yes
DPF/PPF	- / -
EGR	-

Evaluation and further actions:

None of the measured emissions exceeded the limits (in the cold-start NEDC test). Both after a cold engine start and with an increased load (the motorway portion of the RDE test), the vehicle's CO emissions were close to the limit. The final CO_2 level in the NEDC test after a cold start was, at 171.65 g/km, about 15.2% above the manufacturer's specification. Two driving curve deviations occurred in the cold-start NEDC test, the longer of which lasted 0.7 seconds.

The vehicle was driven with a pressure of 2.2 bars in all four tyres (appropriate for a light load). The 'eco' pressures recommended by the manufacturer, namely 2.7 bars for the front tyres and 2.8 bars for the rear tyres, were not set. The load was adjusted (to compensate for the chassis dynamometer loads) in compliance with all legislated requirements and just within the easily rolling range. At the speeds of 60 and 40 km/h, which are required by law for the NEDC, the tested vehicle rolled slightly too easily. It was not possible to adjust the distance of the fan, which was about 100 cm away instead of the required approx. 30 cm. Due to these factors, the measured CO_2 emissions cannot be used for evaluation purposes. The measured particulate matter (no limit is defined for vehicles with manifold injection engines) was in the range of 1E+12.

Test results:



*incl. D_F, *** with driving curve deviations > 1 s						
	Test temperature [°C]	CO_2 [g/km]**	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC-(cold)*	23	172	10	800	-	-
NEDC-(hot)*,***	23	161	2	153	-	-
WLTC-(cold)*,***	23	168	0	656	-	-
WLTC-(hot)*	23	162	5	201	-	-
RDE-(cold)	21		8	717	-	3.18E+12
RDE-(hot)	21		9	993	-	2.13E+12

This vehicle complied with all of the legislated limit values. Its CO emissions were close to, but did not exceed, the limit.

22. Peugeot 2008

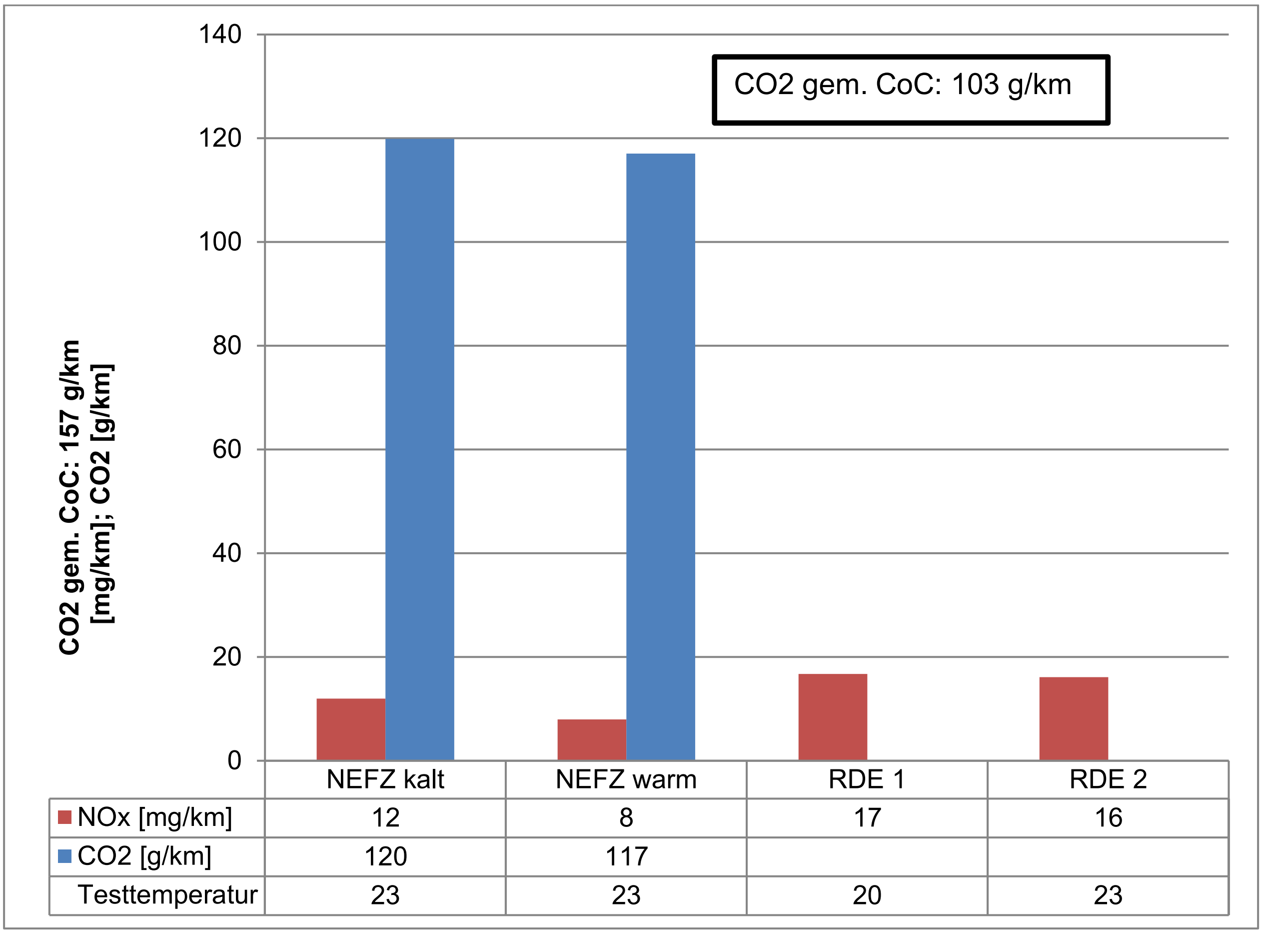
Vehicle data:

Manufacturer	Peugeot
Commercial name	2008 1.2 PureTech 110
Vehicle category	M1
WVTA	e2*2007/46*0070*37
Emission standard	Euro 6b (NEDC)
Type/variant/version	C / UHNZ / 6/S
Engine design	Straight-3
Engine code	UHNZ
Displacement [ccm]	1199
Engine power [kW]	81
Mileage [km]	23726
Fuel type	Petrol
Transmission	Manual, 5-speed
CO_2 acc. to CoC [g/km]	103 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	-

Evaluation and further actions:

The Peugeot 2008 1.2 PureTech 110 was subjected to a test programme comprising a double RDE carried out at the KBA in Flensburg and measurements performed on the chassis dynamometer (cold- and hot-start WLTC). Both in the test cycles on the chassis dynamometer and in the RDE road tests, the vehicle remained below the limit, although it only applies to the Type 1 test. The discrepancy between the measured CO_2 and the CoC value is due to driving curve deviations on the chassis dynamometer. The particulate matter (PM) measured under actual driving conditions exceeded $6x10^{11}$ #/km, but this limit only applies to newer vehicles. When this vehicle was approved, the limit was still $6x10^{12}$ #/km and only applied to the Type 1 test on the chassis dynamometer (NEDC). Consequently, this result may be considered acceptable.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)	**23**	**120**	**19**	**434**	**2.13**	**-**
NEDC (hot)	23	117	13	57	0.78	-
RDE 1	17	-	27	242	-	1.66E12
RDE 2	18	-	26	162	-	1.11E12

The Peugeot 2008 1.2 PureTech 110 exhibited compliant emissions in all tests performed.

23. Opel Insignia Sports Tourer

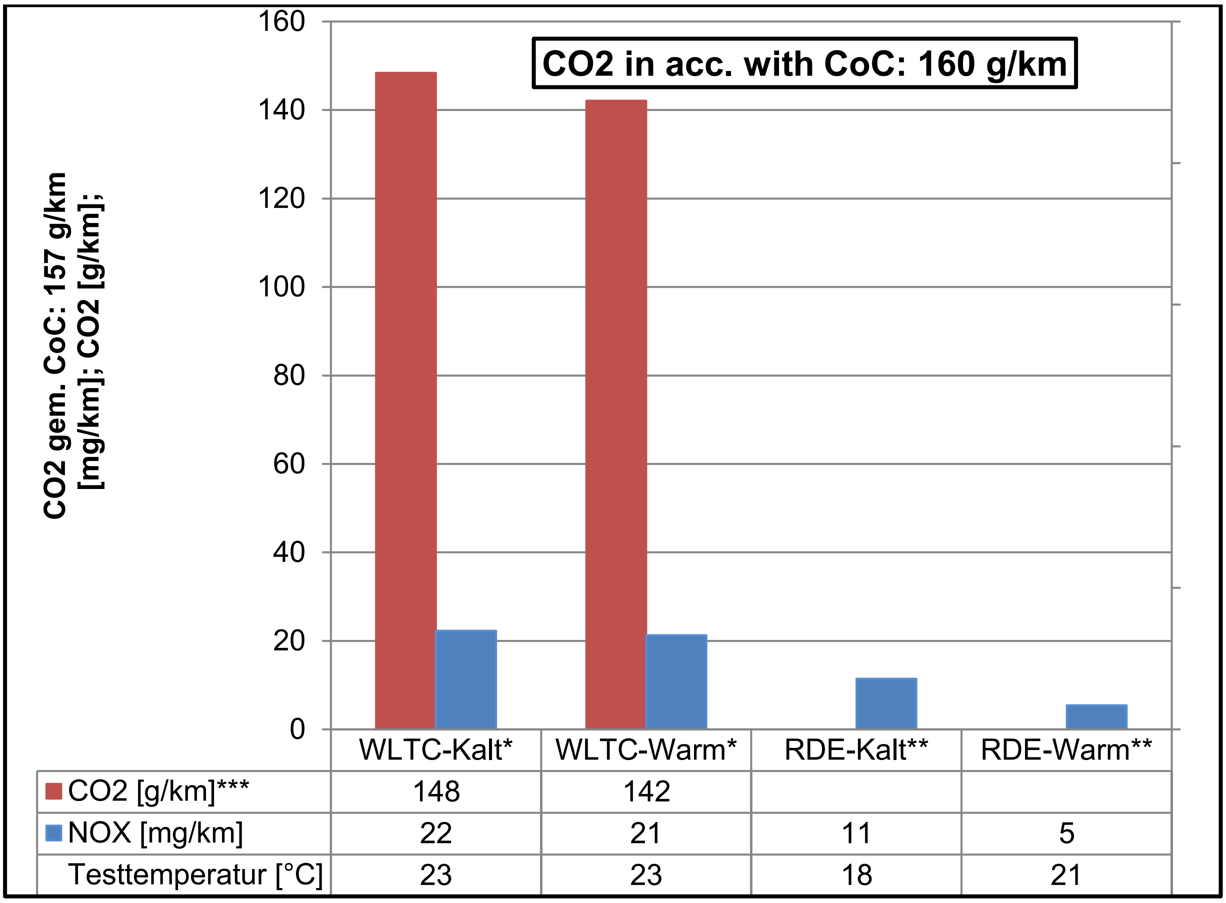
Vehicle data:

Manufacturer	Opel
Commercial name	Insignia Sports Tourer 1.6
Vehicle category	M1
WVTA	e4*2007/46*0264*08
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	Z-B / DA064CB12 / BA1ZADACE15
Engine design	Straight-4
Engine code	LVL
Displacement [ccm]	1598
Engine power [kW]	100
Mileage [km]	14212
Fuel type	Diesel
Transmission	Automatic, 6-speed, front-wheel drive
CO_2 acc. to CoC [g/km]	160 (WLTC)
SCR/NSC	Yes / -
Oxi-cat/3-way cat	Yes / -
DPF/PPF	Yes / -
EGR	HD-EGR

Evaluation and further actions:

This vehicle's pollutant emissions were acceptable. The final CO_2 level in the WLTC Type 1 test (incl. K_i and D_F) was 148.37 g/km and therefore below the CoC value. The CO_2 results were about 151 g/km in the cold-start RDE test and about 158 g/km in the hot-start RDE test, both of which were below the values provided by the manufacturer. The slight increase was due to having selected slightly less inertia than for the chassis dynamometer test.

Test results:



*incl. K_i and D_F, ** incl. K_i w/o D_F						
	Test temperature [°C]	CO_2 [mg/km]***	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC-(cold)*	23	148	22	110	0.27	-
WLTC-(hot)*	23	142	21	8	0.20	-
RDE-(cold)**	18		11	21	-	8.91E+09
RDE-(hot)**	21		5	11	-	4.27E+09

This vehicle's exhaust emissions were compliant.

24. Tesla Model X

Vehicle data:

Manufacturer	**Tesla Motors**
Commercial name	Model X
Vehicle category	M1
WVTA	e4*2007/46*0667*12
Emission standard	- (electric)
Type/variant/version	002 / 90X / B20B6T
Engine design	-
Engine code	-
Displacement [ccm]	-
Engine power [kW]	158
Mileage [km]	-
Fuel type	-
Transmission	-
CO_2 acc. to CoC [g/km]	-
SCR/NSC	- / -
Oxi-cat/3-way cat	- / -
DPF/PPF	- / -
EGR	-

Conclusions:

The purpose of this test was to assess the assisted lane change feature. The vehicle was equipped with a rear radar. No critical situations arose when performing permitted lane changes with the Tesla X on the motorway. Trailing vehicles were not impeded, and a safety clearance (equal to at least approximately half the number of meters as the vehicle's speed in kilometres per hour) was ensured. If the driver attempted a prohibited lane change, the vehicle reacted very quickly and smoothly guided the vehicle back into the original lane while compensating for the steering impulse.

No problems were ascertained in connection with the vehicle's lane change assistant.

25. Tesla Model S

Vehicle data:

Manufacturer	Tesla Motors
Commercial name	Model S
Vehicle category	M1
WVTA	e4*2007/46*0667*06
Emission standard	- (electric)
Type/variant/version	002 / 85D / B19B5
Engine design	-
Engine code	-
Displacement [ccm]	-
Engine power [kW]	158
Mileage [km]	-
Fuel type	-
Transmission	-
CO_2 acc. to CoC [g/km]	-
SCR/NSC	- / -
Oxi-cat/3-way cat	- / -
DPF/PPF	- / -
EGR	-

Conclusions:

The goal in this case was to study the vehicle’s lane change assistant. This vehicle was **not** equipped with a rear radar.

When driving the Tesla S just forward of another vehicle in the adjacent lane, or even partly overlapping it, it was necessary for the driver to actively take control and thus manually abort the automatic lane change in order to prevent a collision. As the Tesla S equipped with first-generation hardware lacks a rear radar system, only being equipped with parking sensors, it is unable to adequately sense distances from vehicles behind it. Because the automated lane change assistant also permits lane changes without checking traffic towards the rear, it must be categorised as critical. Some kind of rear-facing sensing system (radar and/or a camera system) is essential.

However, a dangerous situation can only arise with the tested vehicle, if the driver irresponsibly ignores the warnings given in the owner manual and fails to adequately monitor the lane change assistant. Under current legislation, the driver is fully responsible for the vehicle he or she is driving. There are no grounds to assume a serious risk in the sense of the Product Safety Act if the owner manual warns of possible functional constraints and describes possibilities for overriding a system of this kind.

The vehicle was found to be compliant with regard to the functionality of its lane change assistant as long as the driver responsibly pays attention to traffic at the rear and meets the requirements described in the manual.

26. Volkswagen Caddy (DSG)

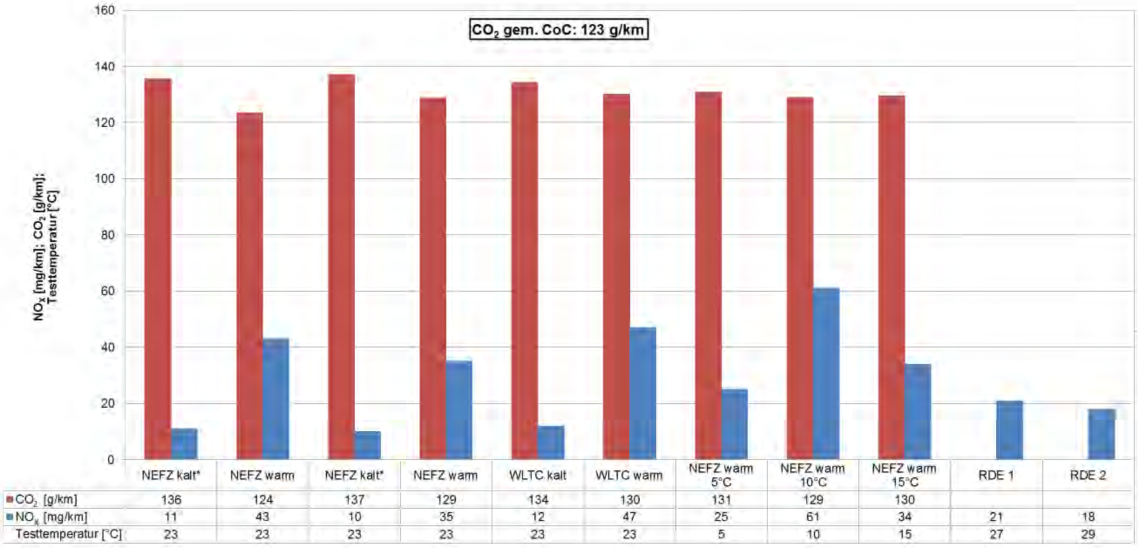
Vehicle data:

Manufacturer	**Volkswagen**
Commercial name	Caddy
Vehicle category	M1
WVTA	e1*2001/116*0252*50
Emission standard	Euro 6b (NEDC)
Type/variant/version	2K/ACCPWAX0/N0J2FD6FD6 2E027N1GBVR27MMLL582
Engine design	Straight-4
Engine code	CPW
Displacement [ccm]	1395
Engine power [kW]	81
Mileage [km]	12000
Fuel type	Natural gas (CNG) / petrol
Transmission	Automatic (DSG)
CO_2 acc. to CoC [g/km]	123
SCR/NSC	No / no
Oxi-cat/3-way cat	Yes / no
DPF/PPF	No / No
EGR	Yes

Evaluation and further actions:

The emissions of the Volkswagen Caddy EU 6b were tested within the scope of the KBA's market surveillance activities, both under actual driving conditions (RDE) and on the chassis dynamometer. The results showed that the vehicle complies with the legislated caps on nitrogen oxide emissions. Evaluation of the cold- and hot-start RDE measurements revealed that the nitrogen oxide emissions in road traffic were below the chassis dynamometer limit value of 60 mg/km (Type 1 test).

Test results:



*inkl. K_i und D_F, ** ohne. K_i ohne D_F						
	Test temperature [°C]	CO_2 [g/km]***	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)*	23	136	11	149	-	-
NEDC (hot)**	23	124	43	75	-	-
NEDC (cold)*	23	137	10	245	-	-
NEDC (hot)**	23	129	35	138	-	-
WLTC (cold)**	23	134	12	187	-	-
WLTC (hot)**	23	130	47	16	-	-
NEDC (hot) 5°C**	5	131	25	161	-	-
NEDC (hot) 10°C**	10	129	61	145	-	-
NEDC (hot) 15°C**	15	130	34	140	-	-
RDE 1**	27	-	21	158	-	2.10E+10
RDE 2**	29	-	18	164	-	8.47E+10

Tests of the natural gas- and petrol-fuelled Caddy made by Volkswagen showed that its emissions did not exceed any of the legislated limits, either on the chassis dynamometer or in actual road traffic.

27. Audi Q5 2.0 TDI

Vehicle data:

Manufacturer	**Audi**
Commercial name	Q5 2,0 TDI
Vehicle category	M1
WVTA	e1*2007/46*1550*05
Emission standard	Euro 6b (NEDC)
Type/variant/version	FY / XDETAQ1 / QD7AD7*
Engine design	Straight-4
Engine code	DETA
Displacement [ccm]	1.968
Engine power [kW]	140
Mileage [km]	17.848
Fuel type	Diesel
Transmission	Automatic, 6-speed
CO_2 acc. to CoC [g/km]	132 (NEDC)
SCR/NSC	SCR
Oxi-cat/3-way cat	Oxi-cat
DPF/PPF	DPF
EGR	HD-EGR

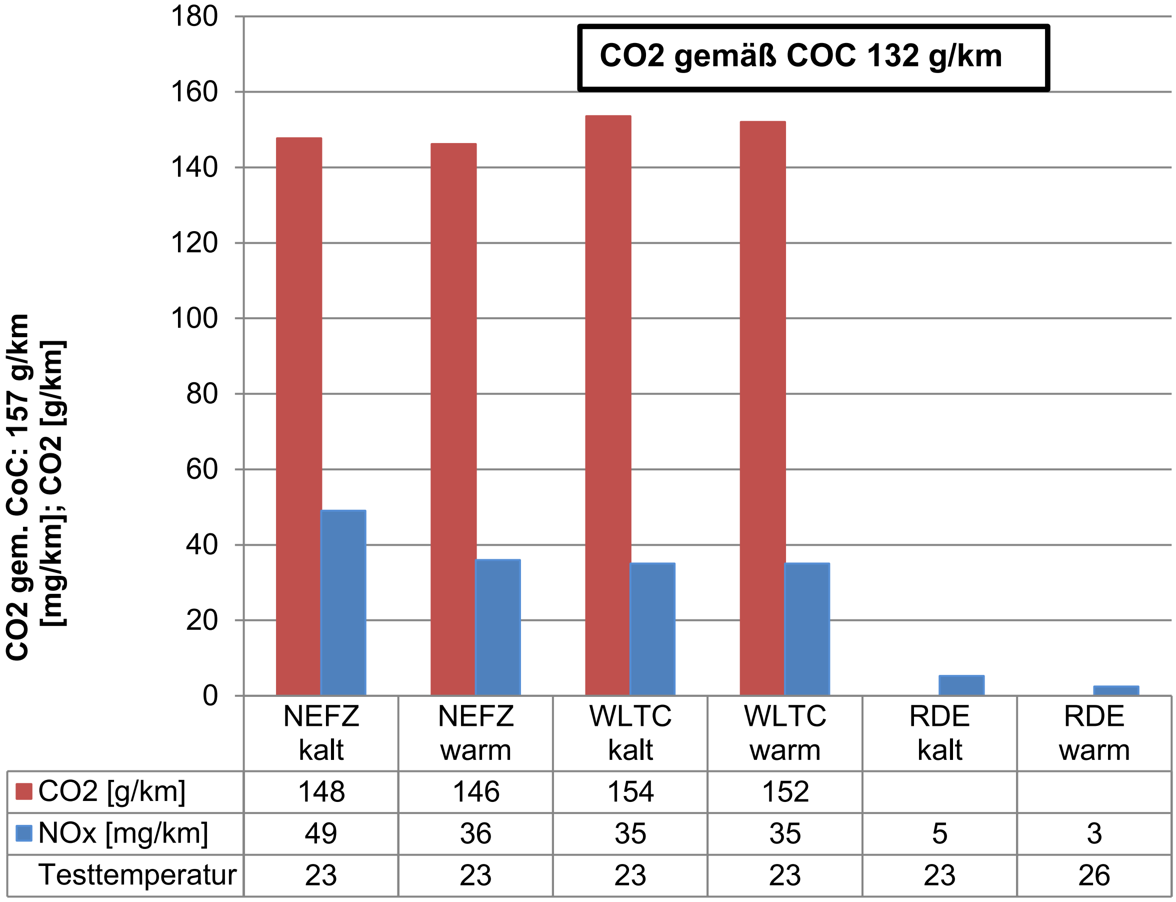
Evaluation and further actions:

The Audi Q5's emissions were measured while driving in road traffic (RDE) and on the chassis dynamometer (NEDC and WLTC). This Euro 6b-compliant vehicle is equipped with high-pressure exhaust gas recirculation to reduce nitrogen oxide emissions and an active emissions control system with selective catalytic reduction (SCR).

The tests focused on measuring NO_x emissions. The RDE measurements were made at average ambient temperatures of 22.5°C (RDE (cold)) and 26°C (RDE (hot)).

The emissions of the tested Audi Q5 2.0 TDI were unremarkable. Only the manufacturer's figure for CO_2 emissions was exceeded, by 12%. There were no grounds to suppose that the effectiveness of the emission control system was reduced under environmental conditions outside the range relevant to type approval. In view of the acceptable emission results, no further tests are required.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)	23	**148**	**49**	**37**	-	-
NEDC (hot)	23	146	36	2	-	-
WLTC (cold)	**23**	154	**35**	15	**-**	**-**
WLTC (hot)	23	152	35	2	-	-
RDE 1	22,5	-	5	94	-	-
RDE 2	26	-	3	130	-	-

This vehicle's exhaust emissions were classified as compliant.

28. Fiat Panda

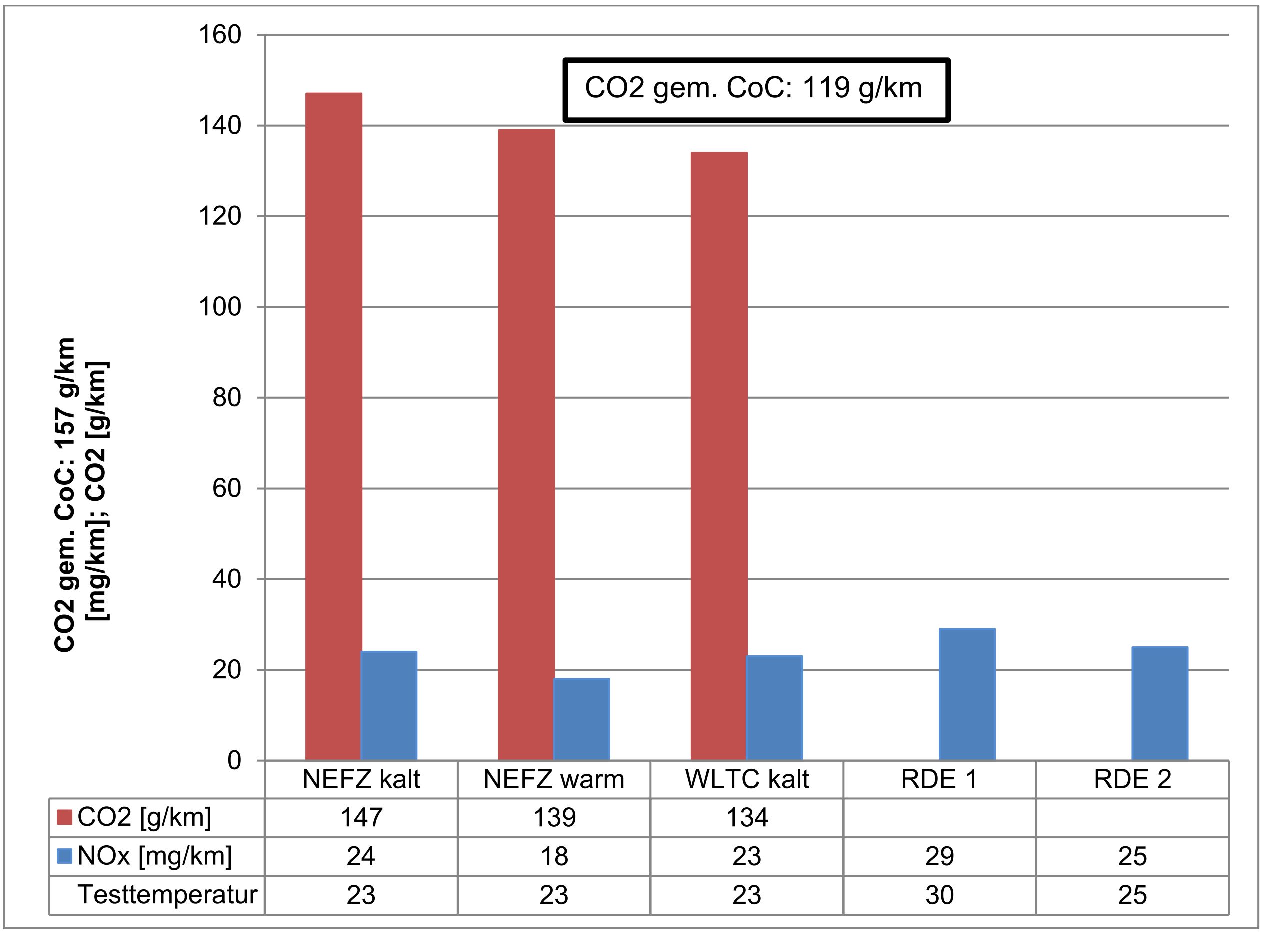
Vehicle data:

Manufacturer	Fiat
Commercial name	Panda 1,2 8V
Vehicle category	M1
WVTA	e3*2007/46*0064*33
Emission standard	Euro 6b (NEDC)
Type/variant/version	J11 / D / D73
Engine design	Straight-4
Engine code	168A4000
Displacement [ccm]	1242
Engine power [kW]	51
Mileage [km]	13640
Fuel type	Petrol
Transmission	Manual, 5-speed
CO_2 acc. to CoC [g/km]	119 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	-

Evaluation and further actions:

The emissions measured both in the test cycles on the chassis dynamometer and under actual driving conditions were below the limit values applicable to Type 1 approval. The high CO emissions measured while driving were due to a defective CO analyser and therefore cannot be used for evaluation purposes. As the emissions remained below the maximum allowed levels, the vehicle passed muster. The deviations of the measured CO_2 emissions from the CoC figure were caused by a slightly increased driving resistance in the chassis dynamometer tests.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)	**23**	**147**	**24**	**280**	**0.07**	**5.8E11**
NEDC (hot)	23	139	18	196	0.11	3.5E11
WLTC (cold)	23	134	23	316	0.23	3.1E11
RDE 1	30	-	29	(>3000)	-	-
RDE 2	25	-	25	(1902)	-	-

This vehicle’s exhaust emissions were classified as compliant.

29. VW UP! GTI

Vehicle data:

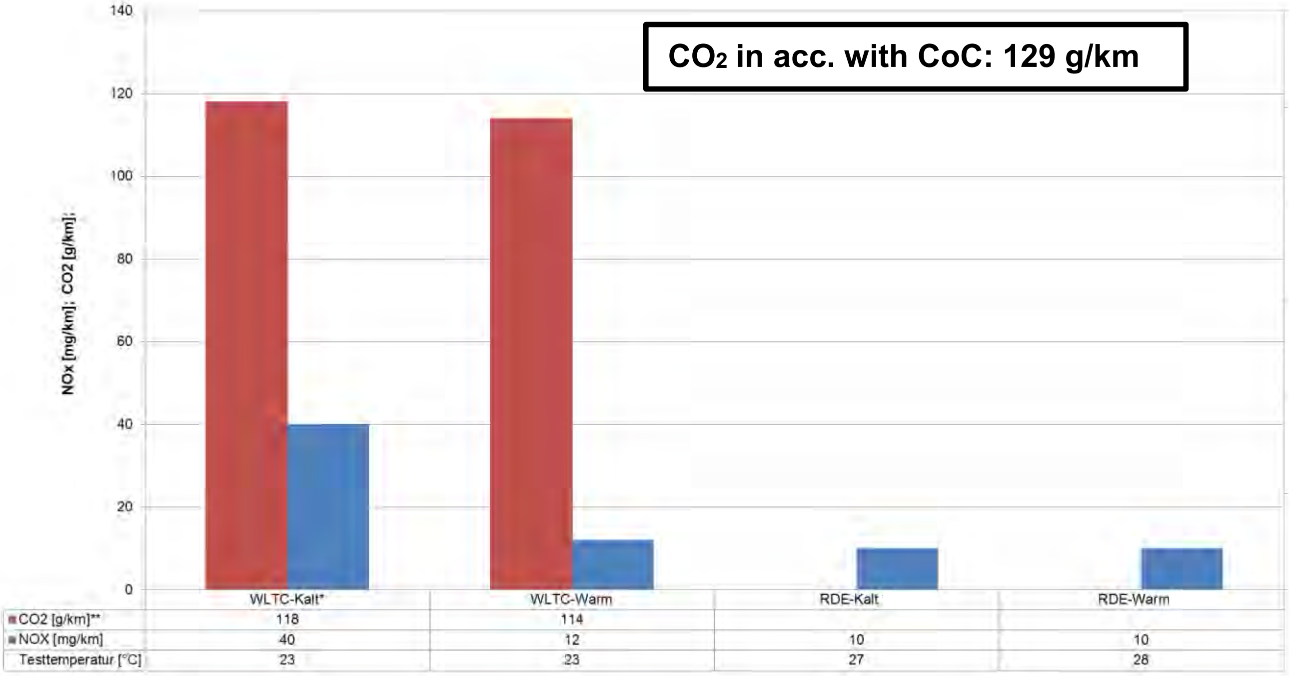
Manufacturer	VW
Commercial name	UP! GTI 1 1.0l
Vehicle category	M1
WVTA	e13*2007/46*1167*21
Emission standard	Euro 6 d-TEMP (WLTC)
Type/variant/version	AA/ABDKRA/ FM6FM6DQ0037CPVR2N1 RVW1B
Engine design	Straight-3
Engine code	DKR
Displacement [ccm]	999
Engine power [kW]	85
Mileage [km]	11562
Fuel	Petrol
Transmission	Manual, 6-speed
CO_2 emissions [g/km]	129 (WLTC)
SCR/NSC	-
EGR	No
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	PPF

Evaluation and further actions:

The emissions measurements on the chassis dynamometer with WLTC (cold- and hot-start) test cycles were all within an acceptable range. All legislated limits applicable to the Type 1 tests were complied with. This vehicle has Euro AG (6d-Temp) type approval.

In the double RDE test, the VW UP! GTI exhibited compliant emission levels.

Test results:



*incl. K_i and D_F						
	Test temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)*	23	118	40	212	0.08-	4.80E+09
WLTC (hot)	23	114	12	79	0.06-	1.18E+09
RDE (cold)	27	-	10	37	-	6.75E+08
RDE (hot)	28	-	10	12	-	4.88E+08

The tests performed revealed no violations with regard to its exhaust emission levels.

30. Ford Fiesta

Vehicle data:

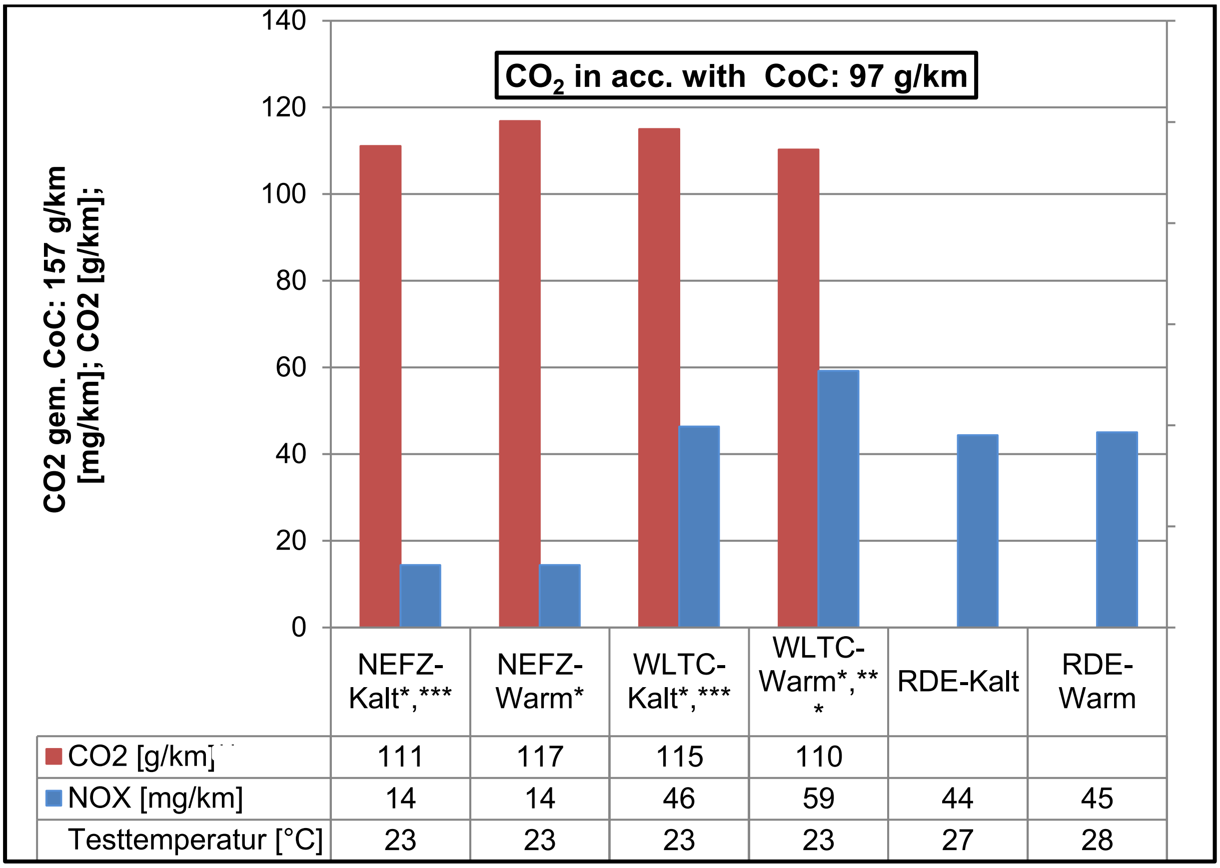
Manufacturer	Ford
Commercial name	Fiesta 1.0 EcoBoost
Vehicle category	M1
WVTA	e9*2007/46*3142*01
Emission standard	Euro 6b (NEDC)
Type/variant/version	JHH / SFJK1JX / 5CDPZN00KAW
Engine design	Straight-3
Engine code	SFJK
Displacement [ccm]	998
Engine power [kW]	73.5
Mileage [km]	7680
Fuel type	Petrol
Transmission	Manual, 6-speed, front-wheel drive
CO_2 acc. to CoC [g/km]	97 (NEDC)
SCR/NSC	- / -
Oxi-cat/3-way cat	- / Yes
DPF/PPF	- / -
EGR	-

Evaluation and further actions:

This vehicle's pollutant emissions were unremarkable. The CO level was high in parts of the chassis dynamometer tests but overall remained below the limit.

The final CO_2 result in the NEDC (cold) test was 111.09 g/km or about 14.5% above the manufacturer's specification. The measurements on the chassis dynamometer showed that overall its resistance was set slightly high and too high (below the -10% limit) for the 20 km/h phase that is required by law for the NEDC, which accounts for the increased CO_2 emissions. The start-stop function was not active the whole time. This was presumably due to inadequate generator management and the fact that one of the test bench fan was not optimally positioned. The particulates were within the acceptable range.

Test results:



*incl. D_F, ***with driving curve deviations > 1 s						
	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC-(cold)*,***	23	111	14	546	1.66	2.16E+11
NEDC-(hot)*	23	117	14	276	0.95	-
WLTC-(cold)*,***	23	115	46	650	1.81	2.33E+11
WLTC-(hot)*,***	23	110	59	678	1.28	1.59E+11
RDE-(cold)	27	-	44	321	-	2.17E+12
RDE-(hot)	28	-	45	321	-	1.74E+12

The vehicle's emissions were acceptable.

31. Mercedes-Benz C180

Vehicle data:

Manufacturer	**Daimler**
Commercial name	Mercedes-Benz C180
Vehicle category	M1
WVTA	e1*2007/46*0457*42
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	204 K / R231T0 / CZAA052D
Engine design	Straight-4
Engine code	M 274 910
Displacement [ccm]	1.596
Engine power [kW]	115
Mileage [km]	2.603
Fuel type	Petrol
Transmission	Automatic
CO_2 acc. to CoC [g/km]	155 (WLTC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	PPF
EGR	-

Evaluation and further actions:

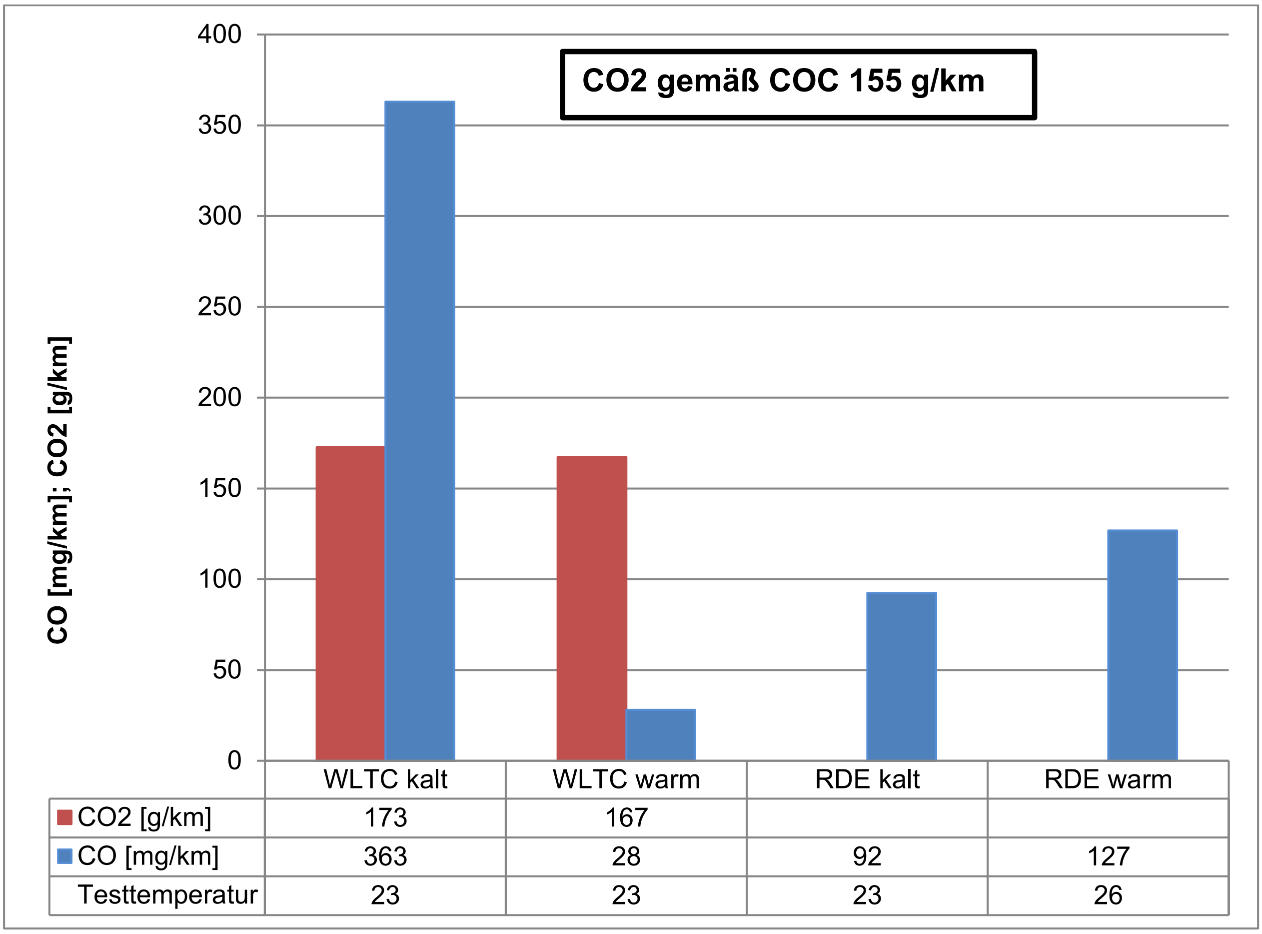
RDE tests were carried out on a Mercedes-Benz C180 within the scope of the KBA's market surveillance activities. This Euro 6d-Temp vehicle is equipped with a petrol particulate filter to reduce emissions of particulate matter. CO, HC and NO_x are removed by a three-way catalytic converter.

The RDE tests were performed at average ambient temperatures of 22.5°C and 26°C.

During the WLTC (cold) test, slightly increased CO- and CO_2 emissions part of the time indicated that the particulate filter was being regenerated. Despite this, all regulated emissions remained below the relevant caps.

In the relevant measurements, the CO_2 emissions varied by between 4% and 8% above the manufacturer's specification. The emission behaviour of the tested Mercedes-Benz C180 may be considered to be acceptable. There are no grounds to suspect that the effectiveness of the emission control systems is reduced under conditions other than those relevant to type approval.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)	**23**	**173**	**27**	**545**	-	-
WLTC (hot)	23	167	15	42	-	-
RDE 1	**23**	**161**	**8**	**139**	-	-
RDE 2	26	162	5	190	-	-

This vehicle's exhaust emissions are compliant.

32. VW T-Roc 1.6 TDI

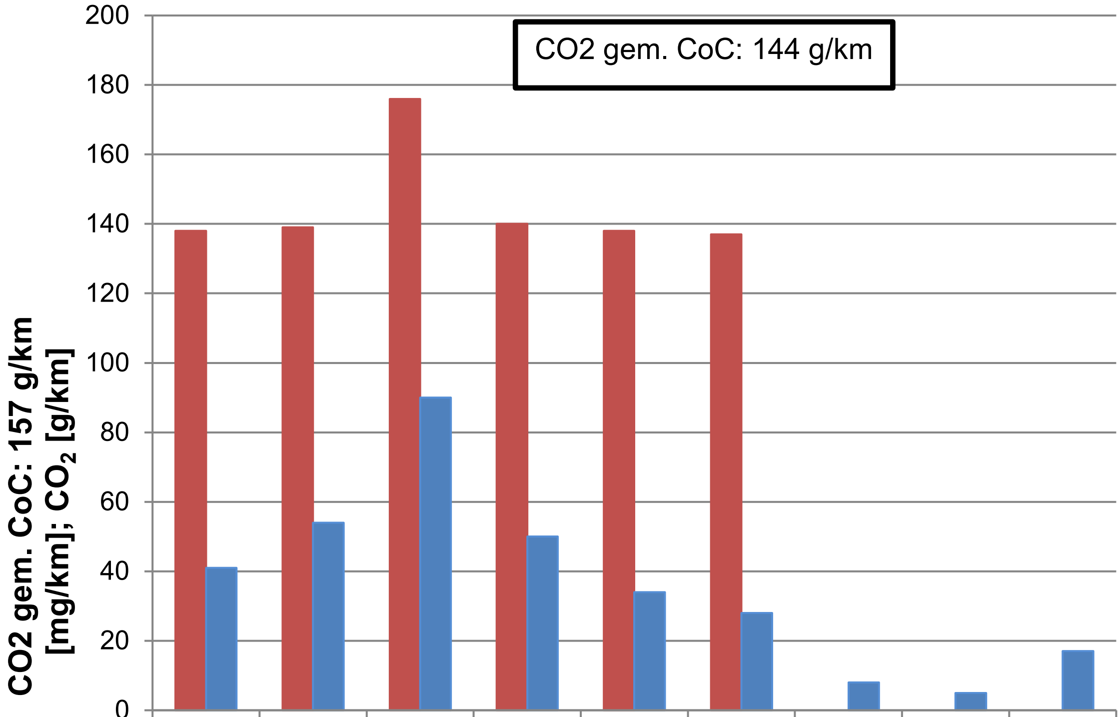
Vehicle data:

Manufacturer	**VW**
Commercial name	T-Roc 1.6 TDI
Vehicle category	M1
WVTA	e13*2007/46*1845*08
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	J11 / D / D73
Engine design	Straight-4
Engine code	DGTE
Displacement [ccm]	1598
Engine power [kW]	85
Mileage [km]	1215
Fuel type	Diesel
Transmission	Manual, 6-speed
CO_2 acc. to CoC [g/km]	144 (WLTC)
SCR/NSC	SCR
Oxi-cat/3-way cat	Oxi-cat
DPF/PPF	DPF
EGR	HD+ND-EGR

Evaluation and further actions:

The Volkswagen T-Roc 1.6 TDI was subjected to a test programme comprising a double RDE and a single RDE, both of which were performed at the KBA in Flensburg, as well as measurements on the chassis dynamometer (WLTS cold- and hot-start plus temperature measurements), which were carried out by a technical service provider. Both on the chassis dynamometer and while actually driving, the vehicle's average pollutant emissions were below the relevant limit values, in part considerably so. The CO_2 emissions during the -7°C tests cannot be compared with the value indicated in the CoC.

Test results:



	WLTC kalt	WLTC warm	WLTC	WLTC	WLTC	WLTC	RDE Teil 1	RDE Teil 2	RDE back
CO2 [g/km]	138	139	176	140	138	137	0	0	0
NOx [mg/km]	41	54	90	50	34	28	8	5	17
Testtemperatur	23	23	-7	5	10	15	13	13	17

	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)	**23**	**138**	**41**	**102**	**-**	**4.79E11**
WLTC (hot)	23	139	54	17	-	7.48E07
WLTC	-7	(176)	90	321	-	1.57E9
WLTC	5	(140)	50	16	-	2.60E7
WLTC	10	(138)	34	18	-	2.83E7
WLTC	15	(137)	28	17	-	4.95E7
RDE part 1	13	-	8	-		1.26E9
RDE part 2	13	-	5	-		1.20E9
RDE back	17	-	17	-		1.27E9

The emissions of the Volkswagen T-Roc 1.6 TDI are thoroughly compliant.

33. Hyundai Kona

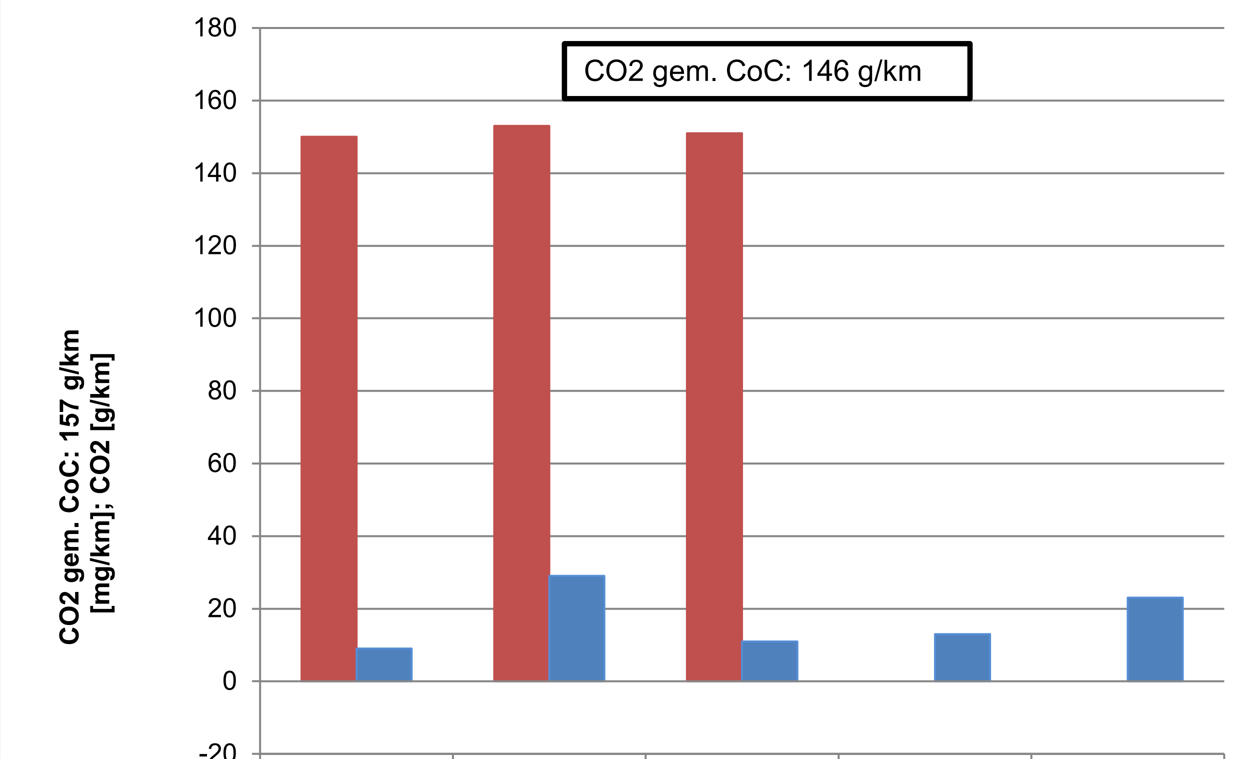
Vehicle data:

Manufacturer	**Hyundai**
Commercial name	Kona 1.0 T-GDI
Vehicle category	M1
WVTA	e4*2007/46*1259*02
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	OS / F5P11 / M61A11
Engine design	Straight-3
Engine code	G3LC
Displacement [ccm]	998
Engine power [kW]	88,3
Mileage [km]	1234
Fuel type	Petrol
Transmission	Manual, 6-speed
CO_2 acc. to CoC [g/km]	146 (WLTC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	-

Evaluation and further actions:

The Hyundai Kona 1.0 T-GDI was subjected to a testing programme consisting of a double RDE at the KBA in Flensburg and measurements on the chassis dynamometer (WLTC cold- and hot-start and WLTC -7°C) at a technical service provider. Both on the chassis dynamometer and when driving on roads, the vehicle exhibited average values for the regulated emissions that were in part significantly below the relevant limit values. The discrepancy between the measured CO_2 and the value given in the CoC was within the permissible tolerance. In connection with the double RDE, a defect developed in the CO analyser and for this reason a result is only available for the first part of the RDE test.

Test results:



	WLTC kalt	WLTC warm	WLTC	RDE Teil 1	RDE Teil 2
CO2 [g/km]	150	153	151		
NOx [mg/km]	9	29	11	13	23
Testtemperatur	23	23	-7	16	17

	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)	**23**	**150**	**9**	**95**	**-**	**2.27E11**
WLTC (hot)	23	153	29	42	-	3.86E11
WLTC	-7	151	11	252	-	1.26E11
RDE Teil 1	16	-	13	18	-	2.49E11
RDE Teil 2	17	-	23	-	-	2.41E11

The Hyundai Kona 1.0 T-GDI exhibited thoroughly compliant emissions.

34. Ford Focus 1,0 Eco Boost

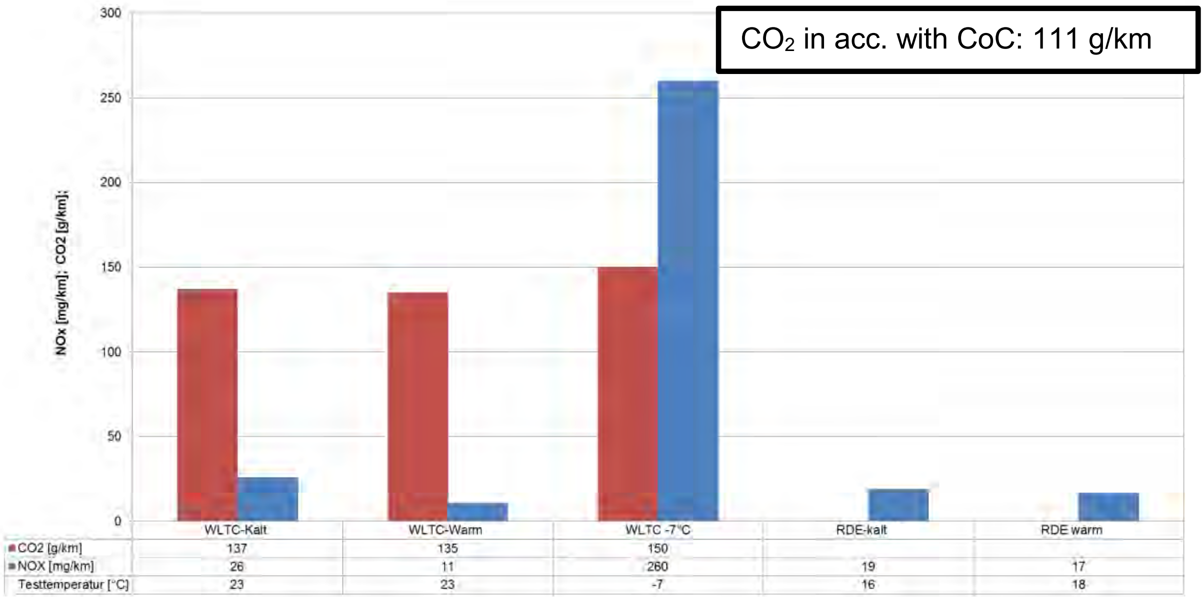
Vehicle data:

Manufacturer	Ford
Commercial name	1,0 Eco Boost
Vehicle category	M1
WVTA	e13*2007/46*1911*03
Emission standard	Euro 6d Temp (WLTC)
Type/variant/version	DEH / B7DA1PX / 5APBZ6A7AT
Engine design	Straight-4
Engine code	B7DA
Displacement [ccm]	999
Engine power [kW]	92
Mileage	12202
Fuel	Petrol
Transmission	Manual, 6-speed
CO_2 emissions [g/km]	111 (WLTC)
SCR/NSC	-
EGR	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-

Evaluation and further actions:

On the chassis dynamometer, all of the regulated emissions were at or below the caps for the Ford Focus 1.0 EcoBoost with 92 kW. The value in the WLTC cycle at -7°C is not subject to the limit values for Type 1 testing but shows that the exhaust post-treatment system attains its operating temperature within 400 seconds. Low NO_x emissions were measured during the double RDE and on the chassis dynamometer.

Test results:



*incl. D_F						
	Test temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC-(cold) *	**23**	**137**	**26**	**637**	**-**	**2.37E+07**
WLTC-(hot) *	23	135	11	624	-	1.97E+07
WLTC -7°C *	-7	150	260	960	-	3.03E+06
RDE-(cold)	16		19	556	-	
RDE (hot)	18		17	483	-	

No relevant discrepancies in exhaust emissions were ascertained in the tests performed.

35. Opel Astra

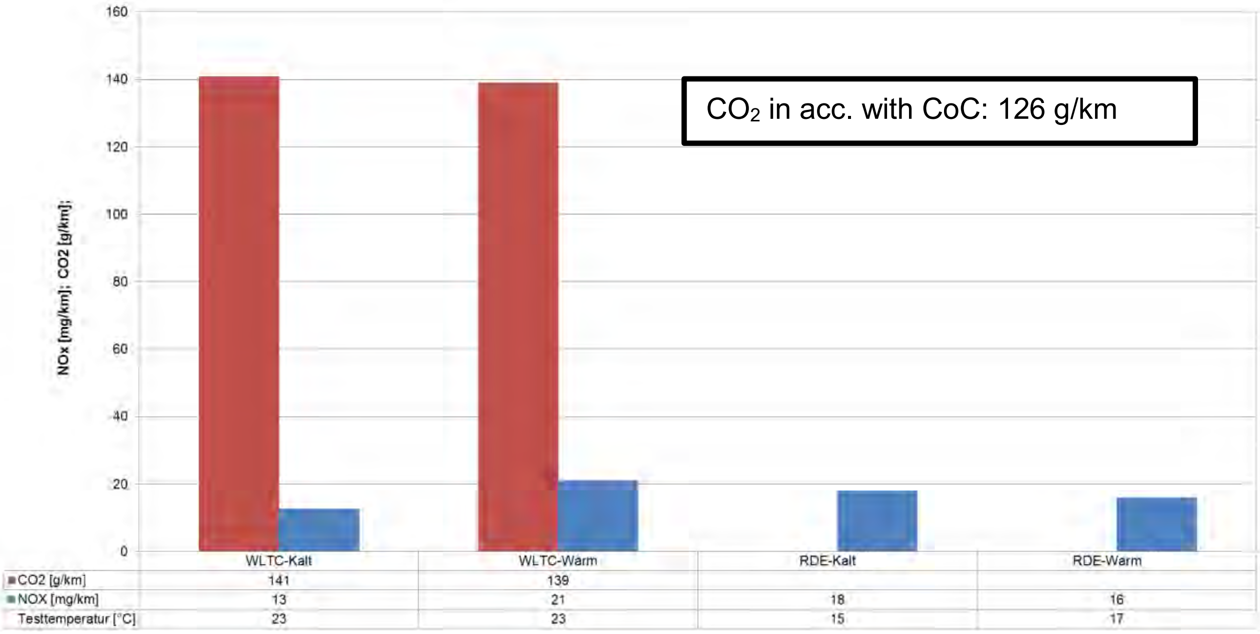
Vehicle data:

Manufacturer	**Opel**
Commercial name	Astra 1,4l
Vehicle category	M1
WVTA	e4*2007/46*0996*15
Emission standard	Euro 6b
Type/variant/version	B-K / CA042CB12 / BK1BAFKHG15
Engine design	Straight-4
Engine code	LE2
Displacement [ccm]	1399
Engine power [kW]	110
Mileage	14717
Fuel	Petrol
Transmission	Manual, 6-speed
CO_2 emissions [g/km]	126 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-

Evaluation and further actions:

The Opel Astra 1.4L exhibited emissions at or below the regulatory limit values on the chassis dynamometer, and these results were confirmed during the RDE drive.

Test results:



*incl. D_F						
	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC-(cold)	23	141	13	356	-	1.32E+07
WLTC-(hot)	23	139	21	426	-	1.84E+05
RDE-(cold)	15		18	266	-	-
RDE-(hot)	17		16	249	-	-

No violations were ascertained in this vehicle. The exhaust emissions were compliant on the chassis dynamometer and during the RDE drive.

36. Renault Captur

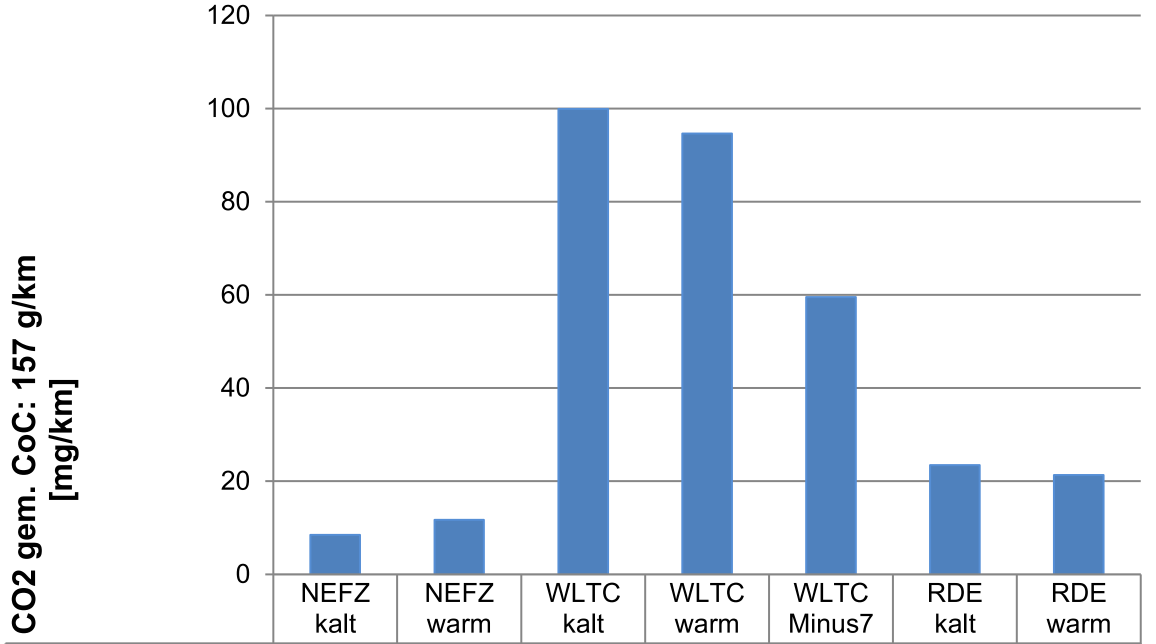
Vehicle data:

Manufacturer	Renault
Commercial name	Captur
Vehicle category	M1
WVTA	e2*2001/116*0327*83
Emission standard	Euro 6b (NEDC)
Type/variant/version	R / 2RA5 / 2RA515
Engine design	Straight-3
Engine code	H4B B4
Displacement [ccm]	898
Engine power [kW]	66
Mileage [km]	16892
Fuel type	Petrol
Transmission	Manual
CO_2 acc. to CoC [g/km]	114
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	-

Evaluation and further actions:

Overall, the vehicle complied with the emission limits in the cold- and hot-start NEDC tests. The results of the CO_2 emission measurements cannot be regarded as valid, however, as the tested vehicle had a defective generator. The WLTC tests revealed a slightly highly emission level but these results may not be applied for assessing the emissions of Euro 6b vehicles. During the RDE drives, the vehicle's CO and NO_x emissions remained below the regulatory limits for the Type 1 test. Due to the vehicle's design (it uses intake-manifold fuel injection), there is no limit on its particulate emissions.

Test results:



	NEFZ kalt	NEFZ warm	WLTC kalt	WLTC warm	WLTC Minus7	RDE kalt	RDE warm
NOx [mg/km]	9	12	100	95	60	23	21
Testtemperatur [°C]	23	23	23	23	-7	18	21

*incl. D_F, *** with driving curve deviations > 1 s					
	Test temp. [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)*, ***	23	9	412	0.03	$2.7*10^{11}$
NEDC (hot)*	23	12	113	0.03	$3.1*10^{11}$
WLTC (cold)*, ***	23	100	399	0.63	$2.6*10^{11}$
WLTC (hot)*, ***	23	95	310	0.01	$2.3*10^{11}$
WLTC (minus7)*, ***	-7	60	1402	5.52	$6.4*10^{11}$
RDE (cold)	18	23	264	**	$4.7*10^{12}$
RDE (hot)	21	21	222	**	$4.4*10^{12}$

This vehicle complied with the limits in the Type 1 test. Due to technical problems, it was not possible to consider the CO_2 emissions for evaluation purposes.

37. Mazda CX-3 2.0 SKYACTIV

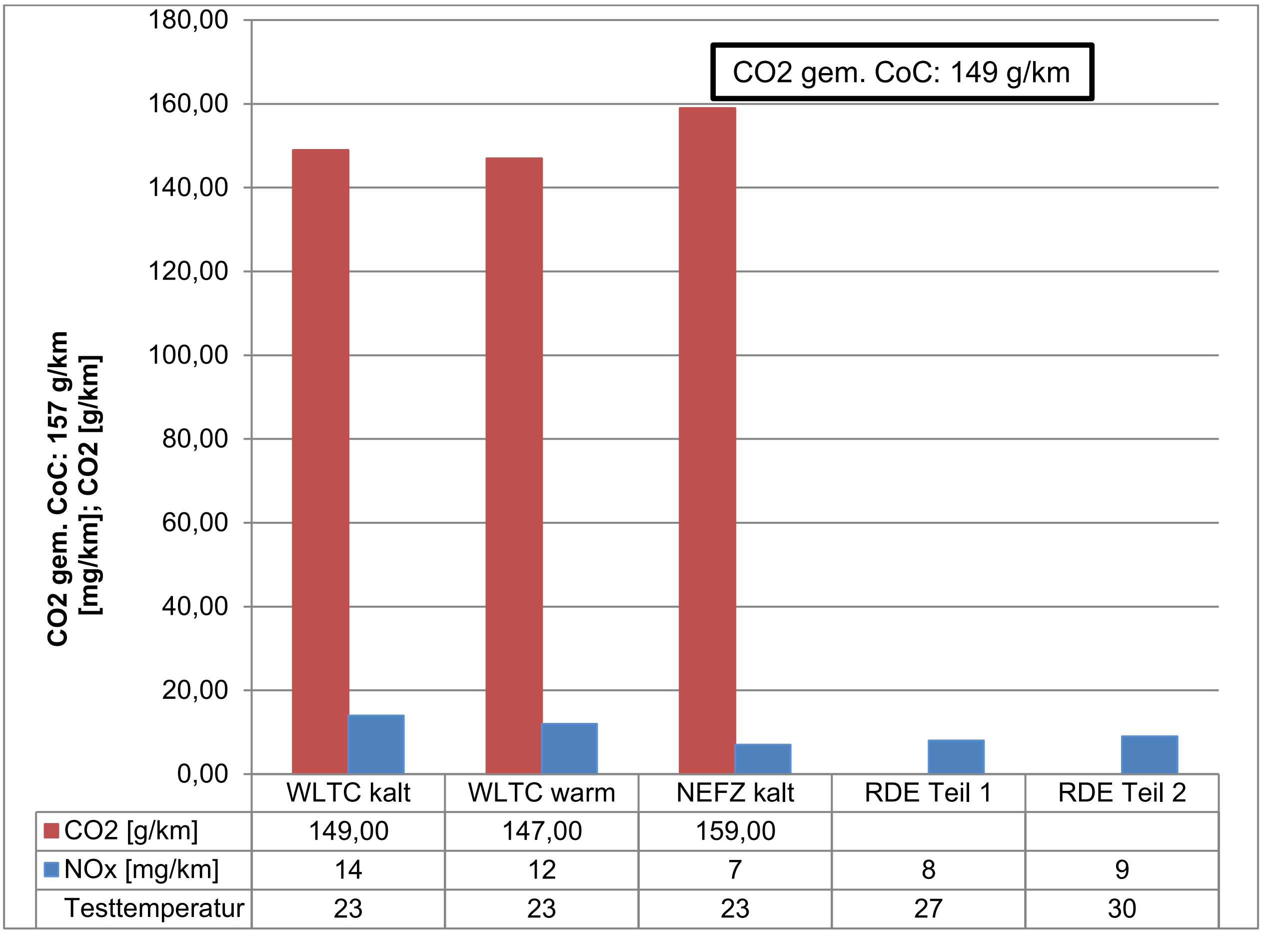
Vehicle data:

Manufacturer	**Mazda**
Commercial name	CX-3 2.0 SKYACTIV
Vehicle category	M1
WVTA	e1*2007/46*1335*19
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	DJ1 / 6W7 / 6AW00
Engine design	Straight-4
Engine code	PE
Displacement [ccm]	1998
Engine power [kW]	89
Mileage [km]	14164
Fuel type	Petrol
Transmission	Manual, 6-speed
CO_2 acc. to CoC [g/km]	149 (WLTC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	-

Evaluation and further actions:

The Mazda CX-3 2.0 SKYACTIV was subjected to a testing programme comprising a double RDE at the KBA in Flensburg and measurements on a chassis dynamometer (WLTC cold + hot and NEDC cold) at a technical service provider. The vehicle was found to have thoroughly compliant emission levels. Both on the chassis dynamometer and during the RDE drives, it had average emission levels that complied with and in part were well below the legislated limit values. The CO_2 emissions were within the permissible tolerance.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)	**23**	**149**	**14**	**146**	**-**	**8.44E10**
WLTC (hot)	23	147	12	47	-	5.94E10
NEDC (cold)	23	(159)	7	119	-	7.46E10
RDE part 1	27	-	8	118	-	-
RDE part 2	30	-	9	59	-	-

The Mazda CX-3 2.0 SKYACTIV had compliant emission levels.

38. Mazda 6 Skyactiv

Vehicle data:

Manufacturer	Mazda
Commercial name	Mazda 6 Skyactiv Diesel
Vehicle category	M1
WVTA	e1*2001/116*0448*31
Emission standard	EURO 6d-TEMP (WLTP)
Type/variant/version	GH / 692 / 8BW01
Engine design	Straight-4
Engine code	SH
Displacement [ccm]	2.191
Engine power [kW]	135
Mileage [km]	14.950
Fuel type	Diesel
Transmission	Automatic
CO_2 acc. to CoC [g/km]	155 (WLTP)
SCR/NSC	SCR
Oxi-cat/3-way cat	Oxi-cat
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

Within the scope of the KBA's market surveillance activities, a Mazda 6 with a 2.2-litre diesel engine and Euro 6d-Temp emissions approval was tested to determine its emissions.

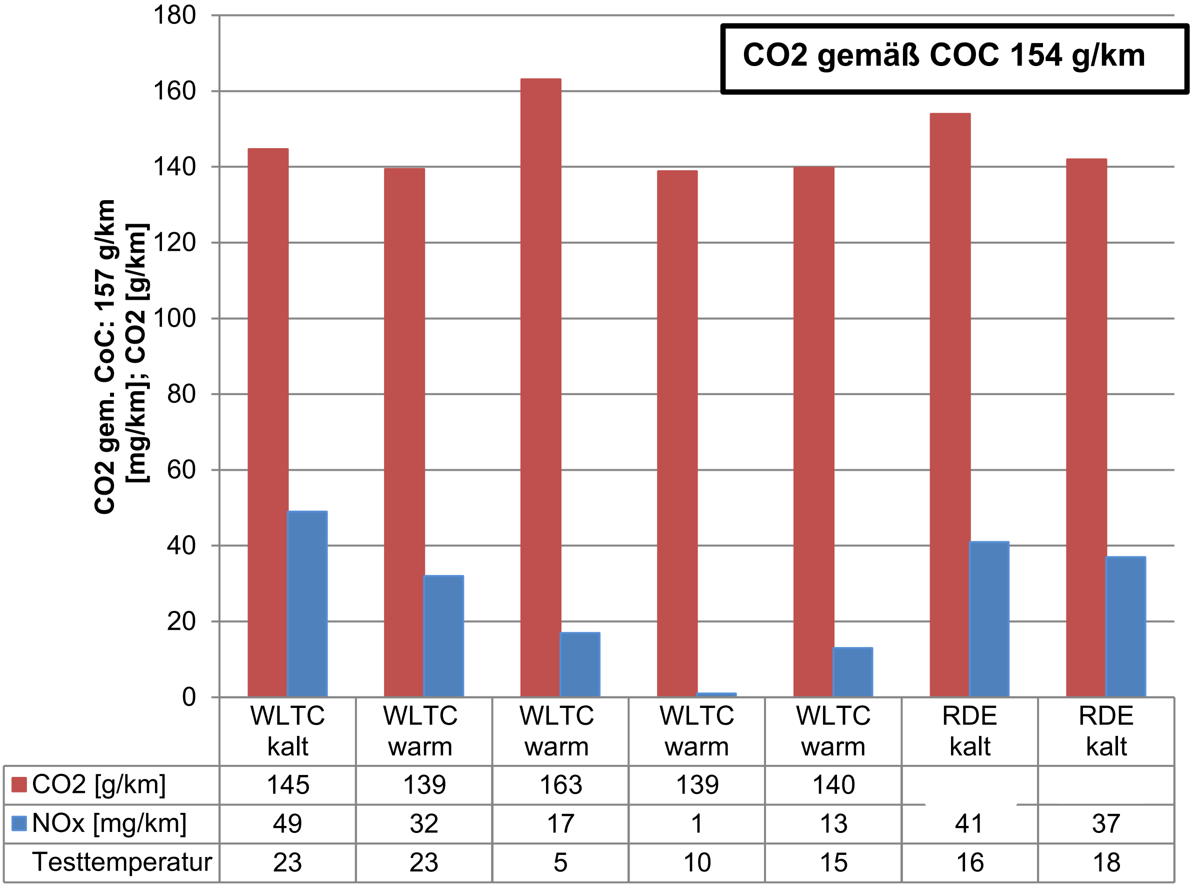
RDE measurements were taken while driving, and test cycles (WLTC) were performed on a chassis dynamometer. The latter were carried out at ambient temperatures of 23°C, 15°C, 10°C and 5°C. The RDE measurements were taken at average ambient temperatures of 16°C and 18°C (RDE (hot)).

The measured emissions of all relevant pollutants, as well as CO_2 emissions, were within the regulatory limits. The manufacturer's declared CO_2 emission level of 155 g/km was not exceeded by any measurement.

The relevant regulatory limits for the Type 1 test were met by the RDE (cold) measurements of all emissions except particulate matter; the excessive PM level was due to a particulate filter regeneration.

The emissions of the tested Mazda 6 2.2L Skyactiv Diesel Euro 6d Temp may therefore be classified as compliant. There are no grounds to suspect that the effectiveness of the emission control system is reduced in ambient conditions outside those relevant to type approval. No further studies are necessary.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)	**23**	**146**	**49**	**38**	**-**	**3.16E+08**
WLTC (hot)	23	140	32	2	-	0.31E+08
WLTC (hot)	5	143	17	2	-	0.45E+08
WLTC (hot)	10	146	1	2	-	1.09E+09
WLTC (hot)	15	144	13	1	-	0.63E+08
RDE (cold) **(DPF-Reg.)**	**16**	**-**	**41**	**0**	**-**	**1.48E+12**
RDE (hot)	18	-	37	0	-	1.2E+09

This vehicle's exhaust emissions are compliant.

39. Audi Q7 3.0 TDI clean diesel quattro

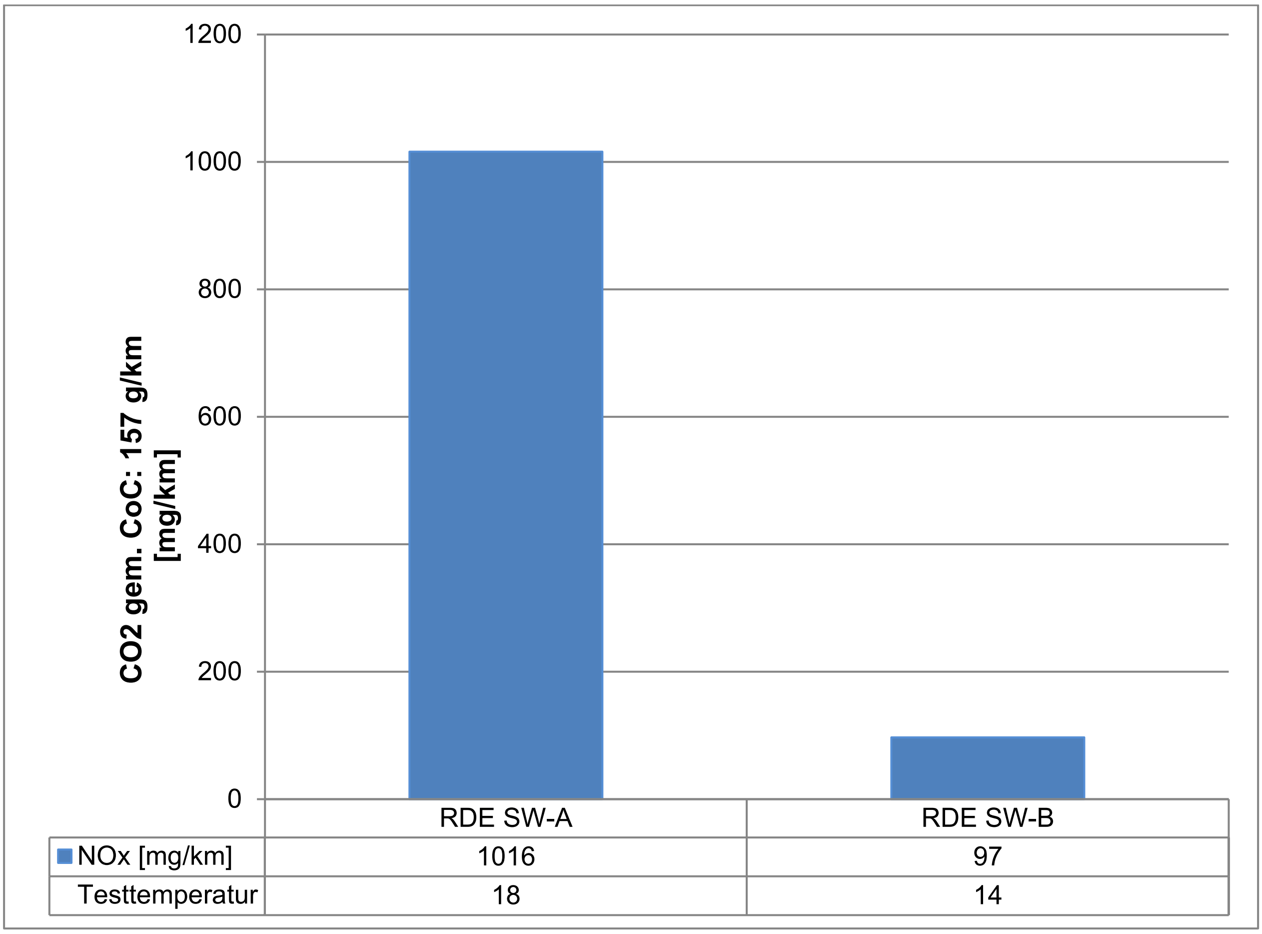
Vehicle data:

Manufacturer	Audi
Commercial name	Q7 3.0 TDI clean diesel quattro
Vehicle category	M1
WVTA	e1*2001/116*0350*12
Emission standard	Euro 6a (NEDC)
Type/variant/version	J11 / D / D73
Engine design	Straight-6
Engine code	CCMA
Displacement [ccm]	2967
Engine power [kW]	176
Mileage [km]	183510
Fuel type	Diesel
Transmission	Automatic, 6-speed
CO_2 acc. to. CoC [g/km]	129 (NEDC)
SCR/NSC	SCR
Oxi-cat/3-way cat	Oxi-cat
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

In connection with a mandatory recall, RDE measurements were made on a latest-model (SW A) Audi Q7 3.0 TDI (cluster #6 EU 6) with the available software upgrade. This Euro 6a vehicle was equipped with NO_x reduction, high-pressure EGR and . an SCR system. The measurements taken verified the effectiveness of the software upgrade. With software B the RDE nitrogen oxide emissions were more than 90% lower than with software A.

Test results:



	Test temperature [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
RDE SW-A	18	1016	-	-	-
RDE SW-B	14	97	-	-	-

This vehicle has been recalled.

40. Mercedes A200

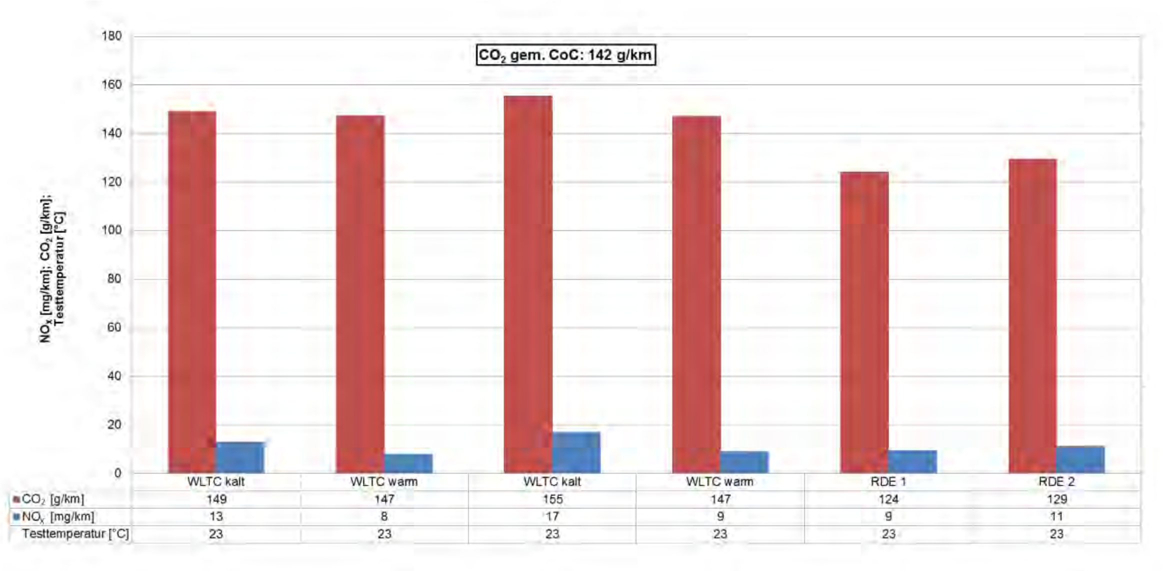
Vehicle data:

Manufacturer	Mercedes
Commercial name	A200
Vehicle category	M1
WVTA	e1*2007/46*1829*01
Emission standard	Euro 6d-TEMP (WLTC)
Type/variant/version	F2A/ X2H7T2/ FZAA151B
Engine design	Straight-4
Engine code	282914
Displacement [ccm]	1332
Engine power [kW]	120
Mileage [km]	13000
Fuel type	Petrol
Transmission	Automatic
CO_2 acc. to CoC [g/km]	142 (WLTC)
SCR/NSC	No / No
Oxi-cat/3-way cat	Yes / No
DPF/PPF	No / Yes
EGR	No

Evaluation and further actions:

Within the scope of the KBA's market surveillance activities, the A200 EU 6d-Temp was tested under actual road driving conditions, to determine its emissions. The measurements on the chassis dynamometer could not be carried out without errors, unless ESP was deactivated. Despite these problems, the emissions were acceptable – the vehicle remained below the regulatory limits for NO_x and CO. At 124.2 g/km the CO_2 emissions were 12.5% below the level given in the CoC and 8.8% lower at 129.42 g/km. The emissions of regulated pollutants were also below the legislated limit values. The vehicle is therefore unproblematic when actually driving.

Test results:



*incl. K_i and D_F, ** w/o K_i and D_F						
	Test temperature [°C]	CO_2 [g/km]***	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)*	23	149	13	165	-	-
WLTC (hot)**	23	147	8	100	-	-
WLTC (cold)*	23	155	17	151	-	-
WLTC (hot)**	23	147	9	82	-	-
RDE 1**	23	124	9	66	-	-
RDE 2**	23	129	11	83	-	-

When driving on roads, the emission of regulated pollutants stayed below the allowed maximum levels. No problems were identified with exhaust gas post-treatment.

41. Opel Corsa 1,2l

Vehicle data:

Manufacturer	Opel
Commercial name	Corsa-E
Vehicle category	M1
WVTA	e1*2001/116*0379*44
Emission standard	EURO 6d-TEMP (WLTC)
Type/variant/version	S-D / BA021CA12 / BA1SAAEHN25
Engine design	Straight-4
Engine code	B12XER/LDC
Displacement [ccm]	1.229
Engine power [kW]	51
Mileage [km]	2.338
Fuel type	Petrol
Transmission	Manual
CO_2 acc. to. CoC [g/km]	154 (WLTC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	-

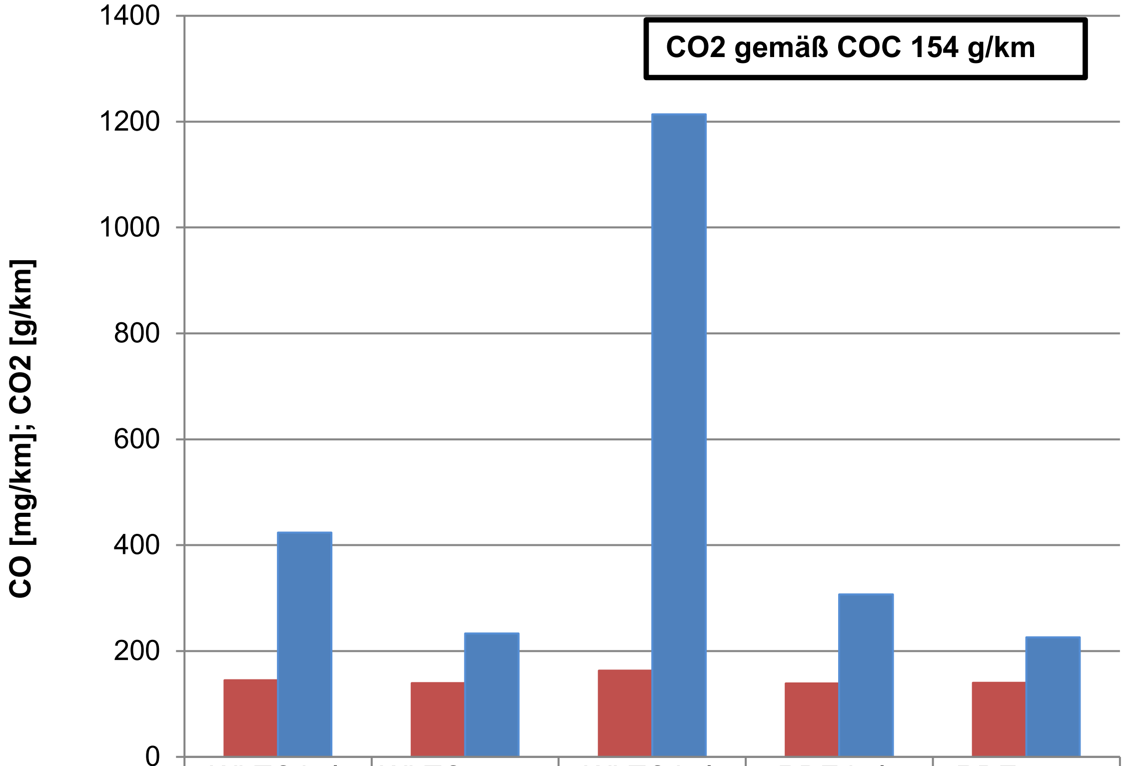
Evaluation and further actions:

Within the scope of the KBA's market surveillance activities, an Opel Corsa with 1.2-litre petrol engine and the Euro 6d-Temp emission standard was tested to determine its emissions of regulated exhaust gas components and whether its actual CO_2 emissions matched those declared by the manufacturer. Measurements were made on the chassis dynamometer and while driving on roads. On the chassis dynamometer, the measurements were taken at ambient temperatures of 23°C and -7°C. The RDE measurements were carried out at average ambient temperatures of 14°C (RDE cold) and 15°C (RDE hot). The levels of all regulated pollutants and CO_2 emissions were compliant.

The measurements at an ambient temperature of -7°C after cold-starting the engine revealed increased CO_2, CO, THC and NMHC emissions that may be attributed to light-off, a phenomenon that commonly affects catalytic converters at low temperatures. It was possible to demonstrate, as is required, that the emission reduction system becomes effective within 400 seconds after a cold start. The RDE measurements showed particulate emissions of up to 9.54E+1 #/km. Under current legislation, the particulate emissions of petrol engines with manifold-intake fuel injection are not subject to any constraints.

In conclusion, the emissions of the tested Opel Corsa 1.2L EURO 6d-Temp are acceptable.

Test results:



	WLTC kalt	WLTC warm	WLTC kalt	RDE kalt	RDE warm
CO2 [g/km]	145	139	163	139	140
CO [mg/km]	424	233	1214	307	226
Testtemperatur	23	23	-7	14	15

	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
WLTC (cold)	**23**	**145**	**37**	**424**	0.0027	2.85E+11
WLTC (hot)	23	139	3	233	0.0009	2.98E+11
WLTC (cold)	-7	163	3	1214	0.035	3.77E+11
RDE (cold)	**14**	**139**	**34**	**307**		9.54E+11
RDE (hot)	15	140	37	226		9.01E+11

This vehicle’s exhaust gas emissions were deemed to be acceptable.

42. Mercedes Sprinter

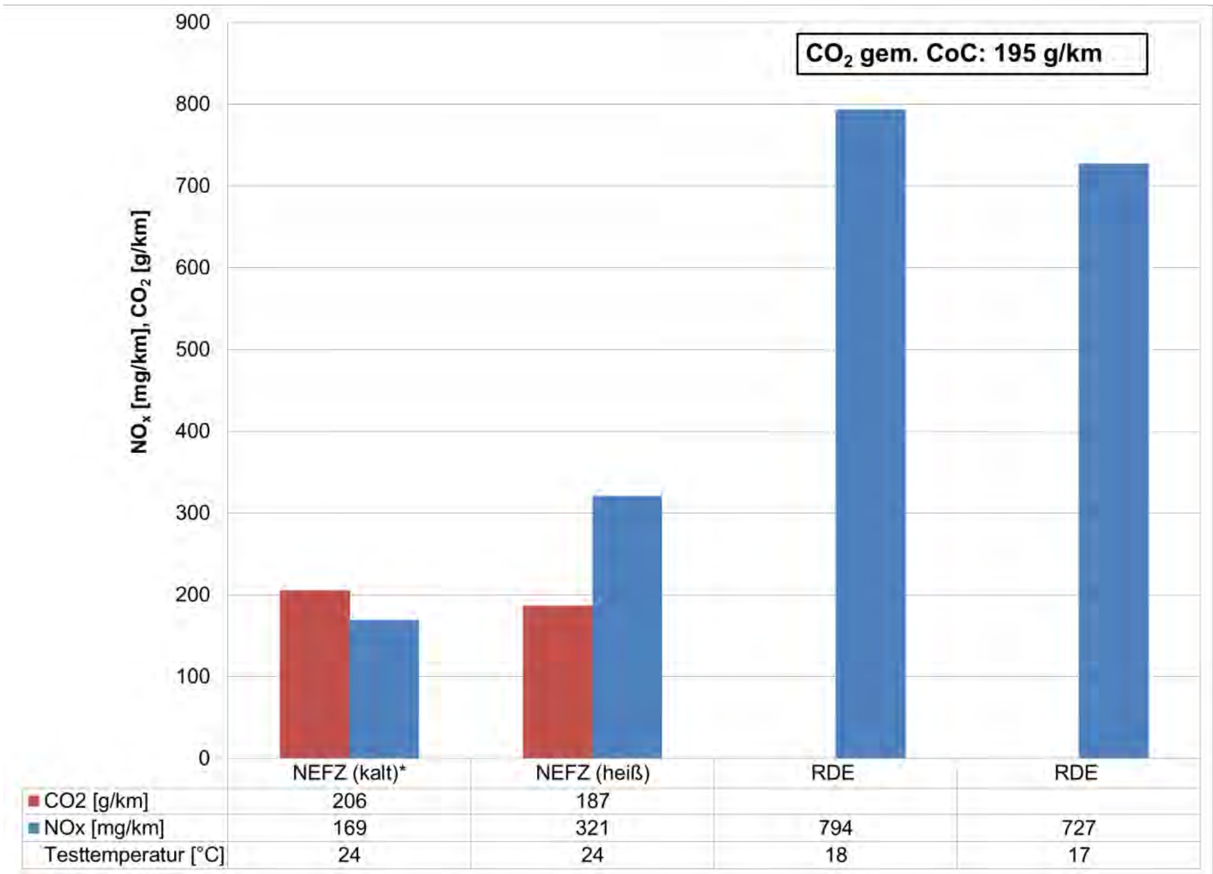
Vehicle data:

Manufacturer	Mercedes Benz
Commercial name	Sprinter 120 kW M1 EU5
Vehicle category	M1
WVTA	e1*2001/116*0354*16
Emission standard	Euro 5 (NEDC)
Type/variant/version	906 AC 35 / KNMD1350E / NEB24UA9
Engine design	Straight-4
Engine code	OM651
Displacement [ccm]	2143
Engine power [kW]	120
Mileage [km]	52237
Fuel type	Diesel
Transmission	Manual, 6-speed
CO_2 acc. to CoC [g/km]	195 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	DOC
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

The Mercedes Sprinter M1 EU 5 was checked to assess its EGR control strategy and the effectiveness of its ‘regulated coolant thermostat’. No excessively high emissions were measured. Elevated NO_x levels were measured in both the NEDC (hot) tests and under actual driving conditions at temperatures around 18°C; these are attributable to reduced EGR when the engine is hot. However, the regulatory limit was not exceeded in the crucial Type 1 test despite this approach, which is generally regarded as problematic. There is therefore no reason to criticise it.

Test results:



	Test temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)*	24	206	169	613	1.80	1.70E+11
NEDC (hot)	27	187	321	0	-	4.70E+08
RDE	18	-	794	152	-	3.50E+11
RDE	17	-	727	177	-	3.30E+09

*Type 1 test incl. K_i and D_F

In tests with the ‘regulated coolant thermostat’ function disabled, the maximum permitted value of 280 mg/km for passing the Type 1 test was not exceeded. According to the manufacturer, the reduced EGR measured in the NEDC (hot) and RDE tests serves to protect the engine.

43. Mercedes Sprinter

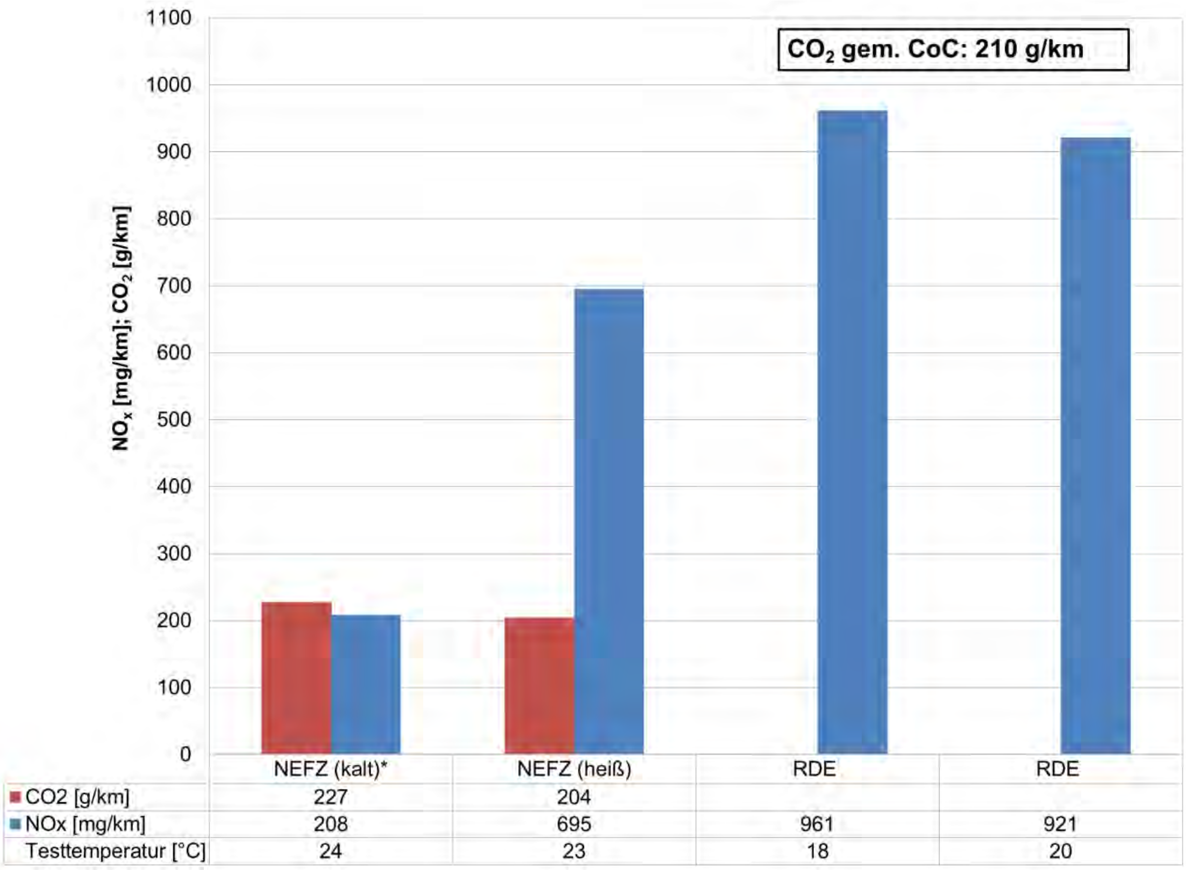
Vehicle data:

Manufacturer	Mercedes Benz
Commercial name	Sprinter 120 kW N1 EU5
Vehicle category	N1
WVTA	e1*2007/46*0279*05
Emission standard	Euro 5 (NEDC)
Type/variant/version	906BB30 / LNMD1300N / MEB14UA3
Engine design	Straight-4
Engine code	OM651
Displacement [ccm]	2143
Engine power [kW]	120
Mileage [km]	84184
Fuel type	Diesel
Transmission	Manual, 6-speed
CO_2 acc. to CoC [g/km]	210 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	DOC
DPF/PPF	DPF
EGR	HD-EGR

Conclusions:

The Mercedes Sprinter N1 EU 5 was checked to determine the effect of its EGR control strategy and ‘regulated coolant thermostat’ function. There were increased NO_x emissions in the NEDC (hot) test and under real driving conditions (RDE) at temperatures around 18°C, which may be attributed to reduction of the EGR when the engine was hot.

Test results:



	Test temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)*	24	227	208	564	0.60	7.30E+08
NEDC (hot)	23	204	695	0	-	5.00E+08
RDE	18	-	961	-	-	-
RDE	20	-	921	-	-	-

*Type 1 test incl. K_i und D_F

A violation was discovered that causes NO_x emissions far in excess of the maximum permissible level for the Type 1 test, namely 280 mg/km. The vehicle is now subject to an official recall.

44. Mercedes Sprinter

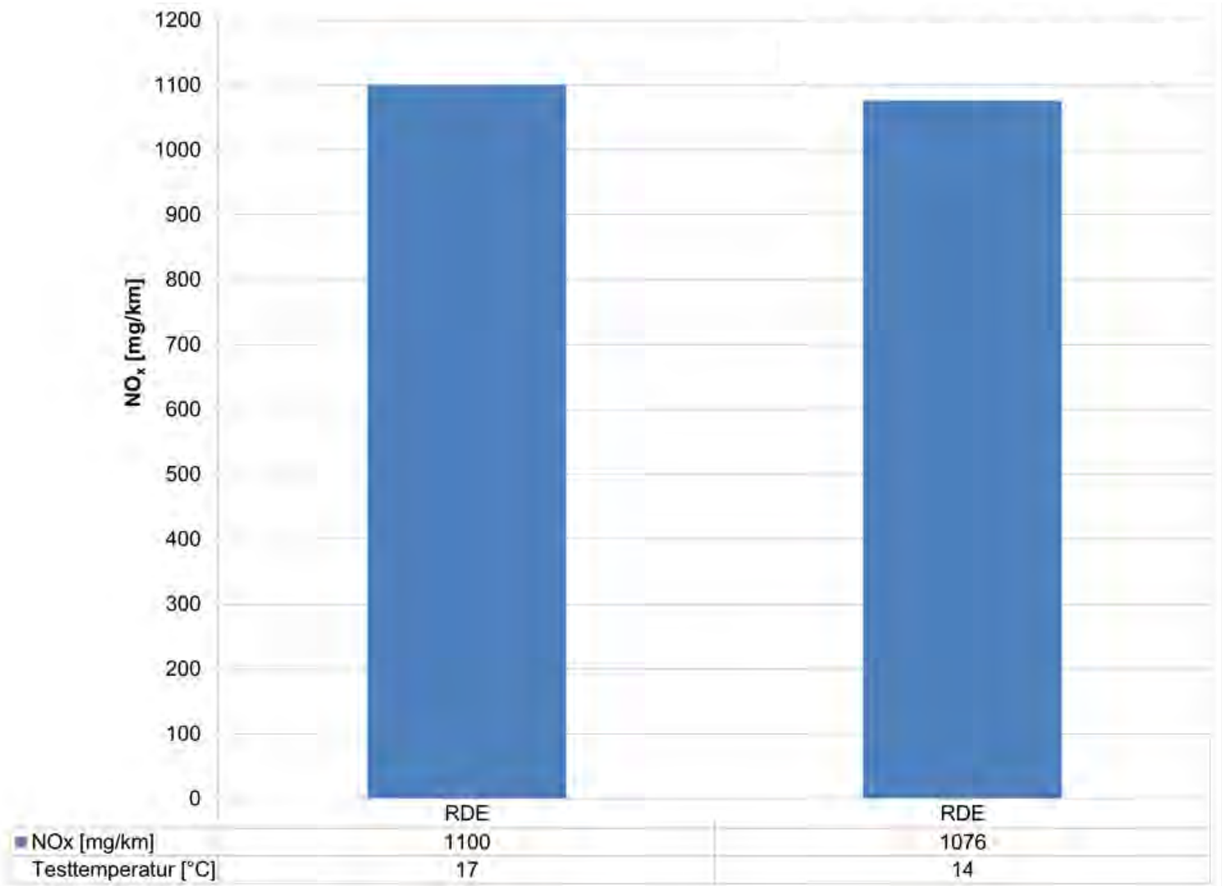
Vehicle data:

Manufacturer	Mercedes Benz
Commercial name	Sprinter 120 kW N1 EU5
Vehicle category	N1
WVTA	e1*2007/46*0301*11
Emission standard	Euro 5 (NEDC)
Type/variant/version	906BB35 / LMMD1350E / MED24UB3
Engine design	Straight-4
Engine code	OM651
Displacement [ccm]	2143
Engine power [kW]	120
Mileage [km]	50472
Fuel type	Diesel
Transmission	Manual, 6-speed
CO_2 acc. to. CoC [g/km]	229 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	DOC
DPF/PPF	DPF
EGR	HD-EGR

Conclusions:

The exhaust gas recirculation control strategy of the Mercedes Sprinter N1 EU 5 was checked. Both in the NEDC (hot) test and while driving (RDE) at ambient temperatures around 15°C, increased NO_x emissions resulted from reduced EGR when the engine was hot.

Test results:



	Test temperature [°C]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
RDE	17	1100	-	-	-
RDE	14	1076	-	-	-

A violation was identified that results in NO_x emissions far above the limit of 280 mg/km for passing the Type 1 test. The vehicle is now subject to an official recall.

45. Mercedes C 220 CDI

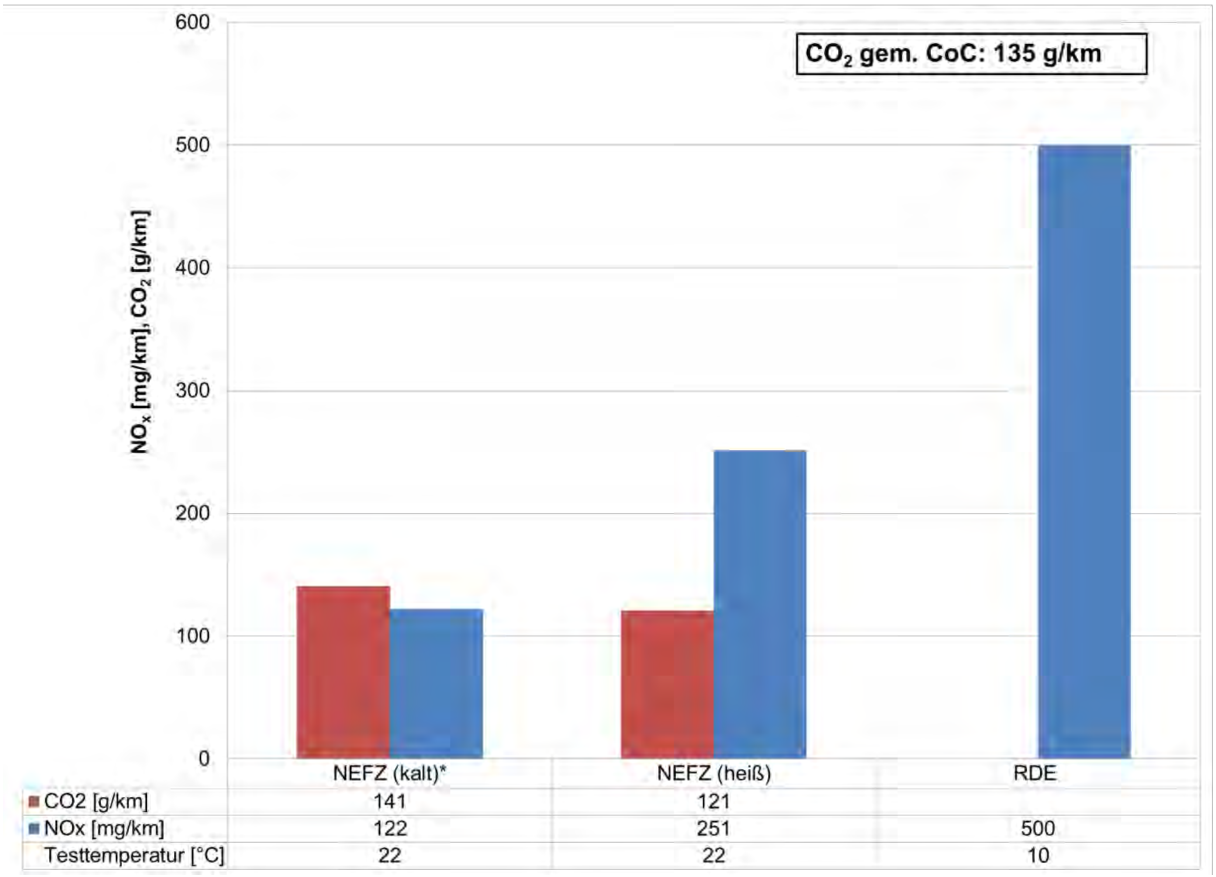
Vehicle data:

Manufacturer	Mercedes Benz
Commercial name	C 220 CDI EU5
Vehicle category	M1
WVTA	e1*2001/116*0457*24
Emission standard	Euro 5 (NEDC)
Type/variant/version	204 K / H2S2M0 / NZAAA502
Engine design	Straight-4
Engine code	OM651
Displacement [ccm]	2143
Engine power [kW]	125
Mileage [km]	69062
Fuel type	Diesel
Transmission	Automatic, 7-speed
CO_2 acc. to CoC [g/km]	135 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	DOC
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

The Mercedes C 220 CDI EU 5 was tested to assess its exhaust gas recirculation (EGR) control strategy and 'regulated coolant thermostat' function. Both in the NEDC (hot) test and when driving (RDE) at ambient temperatures of around 10°C, increased NO_x emissions resulted from scaling back EGR when the engine was hot.

Test results:



	Test temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)*	22	141	122	268	-	4.40E+10
NEDC (hot)	22	121	251	1	-	2.50E+10
RDE	10	-	500	24	-	2.10E+10

*Type 1 test incl. K_i und D_F

When testing with the ‘regulated coolant thermostat’ function disabled, the NO_x emissions did not exceed the maximum of 180 mg/km for the Type 1 test. The manufacturer justified the reduced EGR in the NEDC (hot) and RDE by citing a need to protect engine components.

46. Mercedes ML 350 CDI 4MATIC EU5

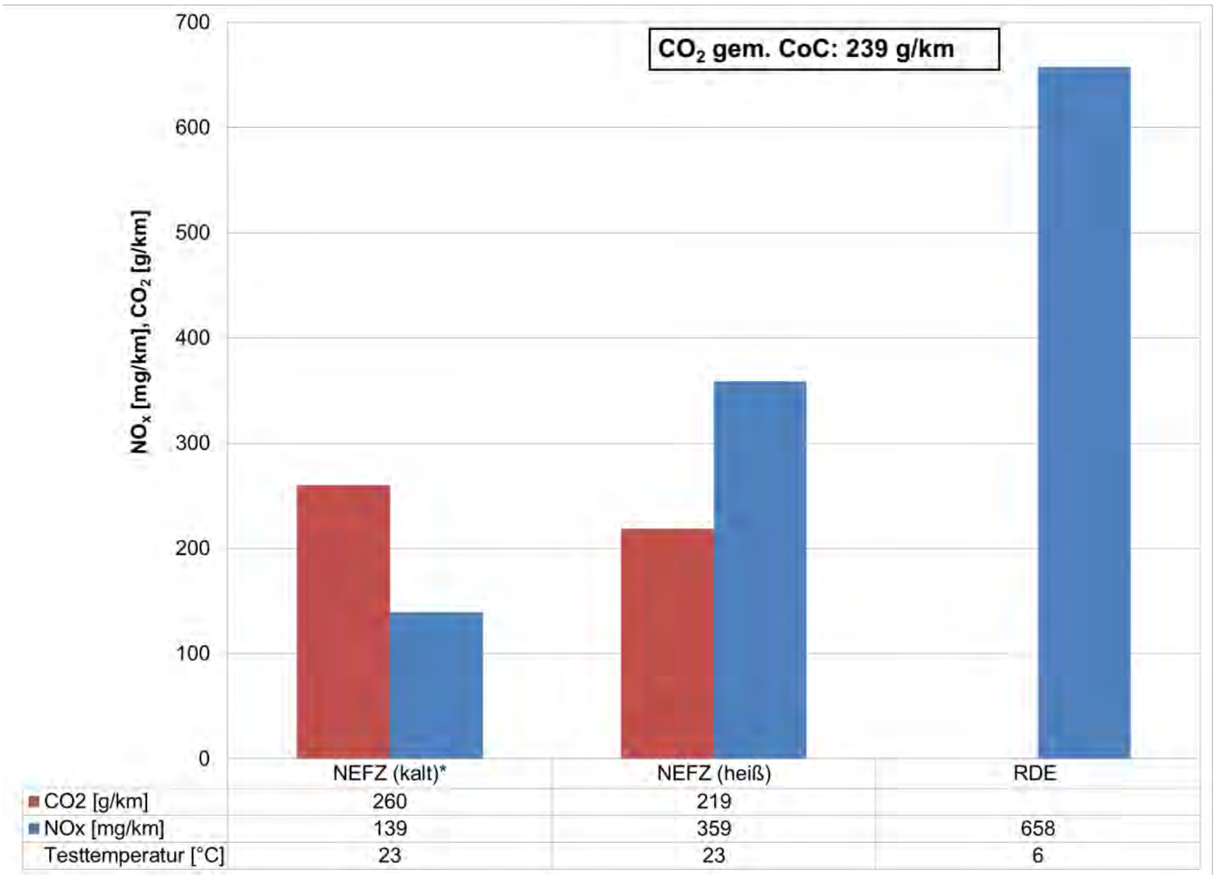
Vehicle data:

Manufacturer	Mercedes Benz
Commercial name	ML 350 CDI 4MATIC
Vehicle category	M1
WVTA	e1*2001/116*0315*15
Emission standard	Euro 5 (NEDC)
Type/variant/version	164 / B225M1 / NZABB502
Engine design	V6
Engine code	OM642
Displacement [ccm]	2987
Engine power [kW]	170
Mileage [km]	126998
Fuel type	Diesel
Transmission	Automatic, 7-speed
CO_2 acc. to CoC [g/km]	239 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	DOC
DPF/PPF	DPF
EGR	HD-EGR

Evaluation and further actions:

The Mercedes ML 350 CDI 4MATIC EU 5 was tested, to assess its exhaust gas recirculation (EGR) control strategy and 'regulated coolant thermostat' function. Both in the NEDC (hot) test and when driving (RDE) at ambient temperatures of around 5°C, increased NO_x emissions resulted from reducing EGR when the engine was hot. The manufacturer justified the reduced EGR in the NEDC (hot) and RDE by citing a need to protect engine components.

Test results:



	Test temperature [°C]	CO_2 [g/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)*	23	260	139	488	1.00	5.40E+09
NEDC (hot)	23	219	359	3	2.40	1.70E+08
RDE	6	-	658	-	-	7.10E+10

*Type 1 test incl. K_i und D_F

When testing with the ‘regulated coolant thermostat’ function disabled, the NO_x emissions did not exceed the maximum of 180 mg/km for the Type 1 test. The manufacturer justified the reduced EGR in the NEDC (hot) and RDE by citing a need to protect engine components.

47. Audi A4 Avant 2.0 TFSI

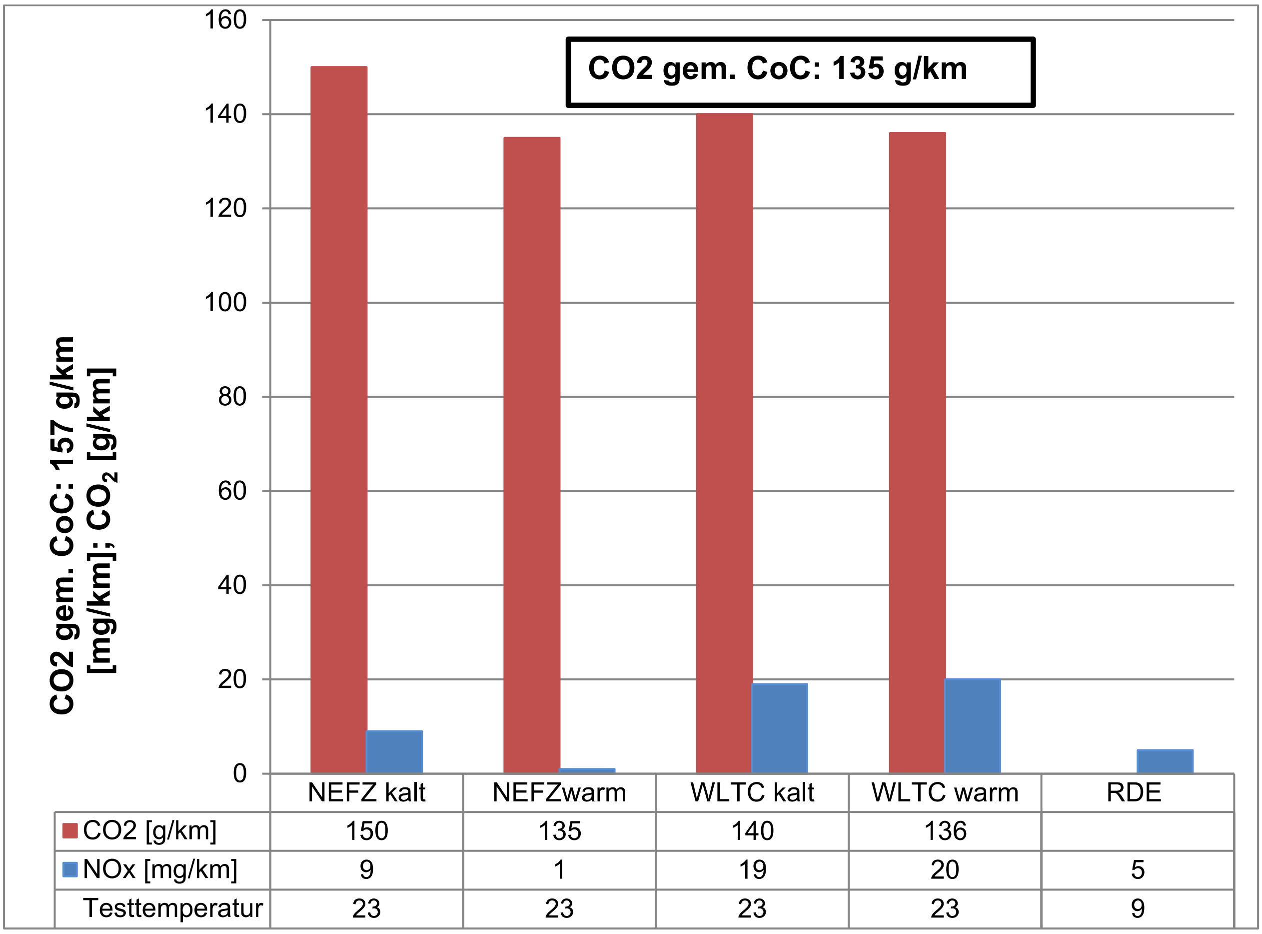
Vehicle data:

Manufacturer	**Audi**
Commercial name	A4 Avant 2.0 TFSI
Vehicle category	M1
WVTA	e1*2001/116*0430*43
Emission standard	Euro 6b (NEDC)
Type/variant/version	B8 / A2CVKBF1 / FM6FM6D J0005P8W07S57MMEM1K
Engine design	Straight-4
Engine code	CVKB
Displacement [ccm]	1984
Engine power [kW]	140
Mileage [km]	73614
Fuel type	Petrol
Transmission	Manual, 6-speed
CO_2 acc. to CoC [g/km]	135 (NEDC)
SCR/NSC	-
Oxi-cat/3-way cat	3-way catalytic converter
DPF/PPF	-
EGR	-

Evaluation and further actions:

The Audi A4 Avant 2.0 TFSI was subjected to a testing programme consisting of a single RDE performed at the KBA in Flensburg and measurements on the chassis dynamometer (NEDC cold + hot, WLTC cold + hot) at a technical service provider. The results revealed acceptable emission levels. Both on the chassis dynamometer and during the real-world driving tests, the vehicle achieved average levels of regulated emissions that were compliant and in part significantly lower than the caps. The discrepancy between the measured CO_2 emissions and the figure given in the CoC was due to driving curve deviations during the Type 1 test. This was evident both in the NEDC (hot) and the WLTC (cold + hot) tests. In these cases, the difference was smaller than the accepted tolerance.

Test results:



	Test temperature [°C]	CO_2 [mg/km]	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)	**23**	**150**	**9**	**646**	**-**	**3.00E11-**
NEFC (hot)	23	135	1	295	-	6.33E11
WLTC (cold)	23	140	19	913	-	7.04E11
WLTC (hot)	23	136	20	578	-	4.09E11
RDE	9	-	5	580	-	5.26E11

The measured emissions of the Audi A4 Avant 2.0 TFSI were thoroughly compliant.

48. Mercedes-Benz C200 4MATIC

Vehicle data:

Manufacturer	**Mercedes-Benz**
Commercial name	C200 4MATIC
Vehicle category	M1
WVTA	e1*2001/116*0431*45
Emission standard	Euro 6b (NEDC)
Type/variant/version	204 / R032P1 / CLAA1522
Engine design	Straight-4
Engine code	274920
Displacement [ccm]	1991
Engine power [kW]	135
Mileage [km]	27615
Fuel type	Petrol
Transmission	Automatic, 8-speed, four-wheel drive
CO_2 acc. to CoC [g/km]	157 (NEDC)
SCR/NSC	- / -
Oxi-cat/3-way cat	- / Yes
DPF/PPF	- / -
EGR	-

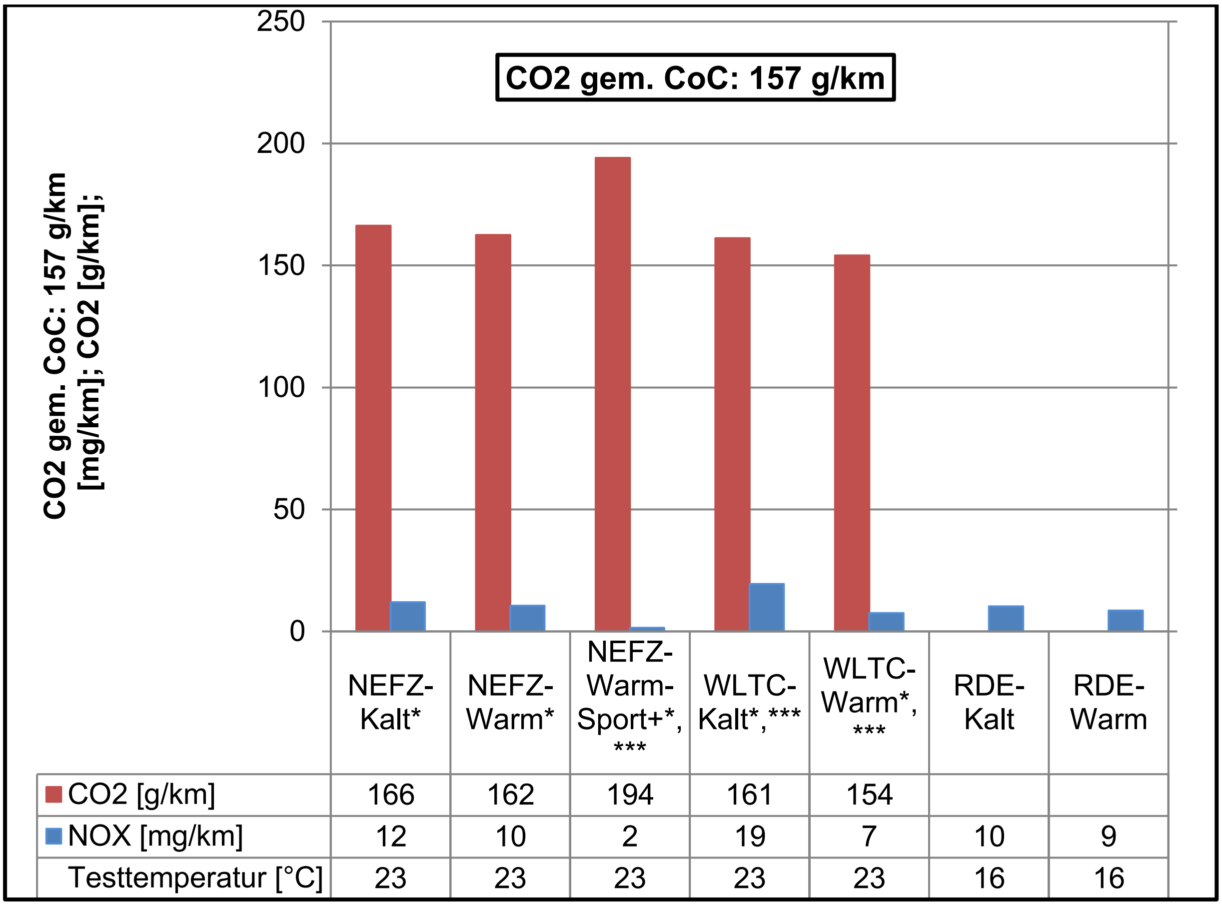
Evaluation and further actions:

The vehicle's levels of regulated pollutant emissions were acceptable.

The CO_2 result in the NEDC (cold) test, at 166.25 g/km, was 5.9% higher than the CoC figure and therefore within the permissible tolerance. This result was achieved in the 'Comfort' gearbox mode, which is automatically activated when starting the vehicle. After activating the Sport+ mode, CO_2 emissions rose to 194 g/km in the NEDC (cold) test. This increase was the result of the automatic transmission switching to a different gear changing strategy, to increase rpm for more dynamic driving. As the fuel consumption of an internal combustion engine also depends on its rotational speed, it is clear that the choice of gear changing mode has a major influence on CO_2 emissions and therefore also fuel consumption. The standard gear changing mode (Comfort) does not constitute an impermissible violation.

During the RDE drives, the future limits on RDE emissions of NO_x, CO and PM were not exceeded at any time.

Test results:



*incl. D_F, ***with driving curve deviations > 1 s

	Test temperature [°C]	CO_2 [g/km]**	NO_x [mg/km]	CO [mg/km]	PM [mg/km]	PN [#/km]
NEDC (cold)*	23	166	12	177	0.02	-
NEDC (hot)*	23	162	10	191	0.03	1.76E+11
NEDC (hot) Sport+*,***	23	194	2	277	0.03	1.00E+11
WLTC (cold)*,***	23	161	19	205	0.12	7.97E+10
WLTC (hot)*,***	23	154	7	247	0.09	1.67E+11
RDE (cold)	16		10	138	-	1.16E+11
RDE (hot)	16		9	175	-	6.87E+10

This vehicle exhibited compliant pollutant emission levels.

Figures

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