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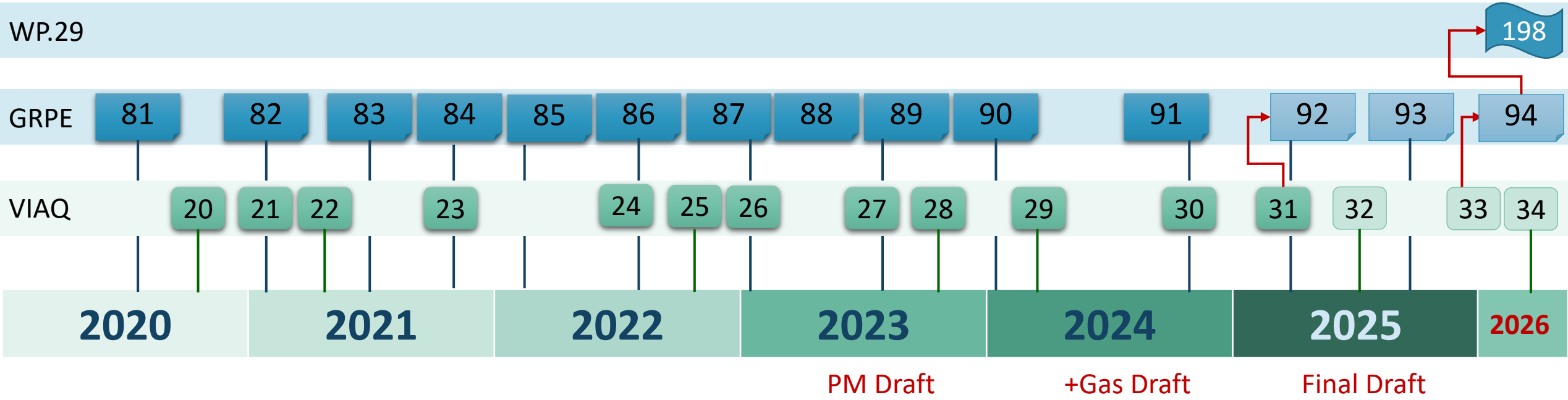
Agenda item 12

Proposal for an Amendment 2 to Mutual Resolution (M.R.3) concerning Vehicle Interior Air Quality

Geneva, 17 – 19 March, 2026

Expert from Russian Federation: Andrey KOZLOV

Timeline of the Third Stage



Data collection → Analysis of existing test procedures → Tests by VIAQ IWG members → **Developing of harmonized test procedure**

Stage 3. Phase 1

Stage 3. Phase 2

Proposal for an Amendment 2 to M.R.3 on VIAQ

Proposal for an Amendment [2] to Mutual Resolution (M.R.3) of the 1958 and the 1998 Agreements concerning Vehicle Interior Air Quality (VIAQ)
ECE/TRANS/WP.29/GRPE/2026/27

Key changes:

- ✓ Part I was updated
- ✓ New Part IV was added
- ✓ New Annexes VII, VIII and IX were added

United Nations ECE/TRANS/WP.29/GRPE/2026/27

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Item 12 of the provisional agenda
Vehicles Interior Air Quality (VIAQ)

Proposal for an Amendment [2] to Mutual Resolution (M.R.3) of the 1958 and the 1998 Agreements concerning Vehicle Interior Air Quality (VIAQ)

Submitted by the Informal Working Group on Vehicles Interior Air Quality (VIAQ) *

The text reproduced below was prepared by the Informal Working Group on Vehicles Interior Air Quality (VIAQ). The Informal Working Group on VIAQ presented a first draft of this proposal (GRPE-92-42) at the ninety second session of GRPE (see report ECE/TRANS/WP.29/GRPE/92, para. 75).

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IV. Test method for interior air quality and outside air pollutants entering the vehicle cabin

1. Purpose

The part IV of the Mutual Resolution contains the provisions and harmonized test procedure for the measurement of interior air quality concerning the protection of the driver and passengers from harmful emissions entering the vehicle cabin with outside air pollutants.

2. Scope and application

This part of Mutual Resolution applies to category 1-1 vehicle, as defined in the Special Resolution No. 1.[3]

In scope are standardized methods of sampling vehicle inside and outside air pollutants as well as necessary specification of testing equipment.

Out of scope are limits of inside and outside air pollutants. Measurements results according to this mutual resolution will vary depending on outside conditions and are therefore not suitable to compare different vehicles.

3. Definitions

For the purpose of this part, the following definitions apply:

3.1. "*Test vehicle*" means the new vehicle from series production to be tested, mileage from 3,000 – 15,000 km;

3.2. "*Test substances*" means the substances to be measured and are fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2) carbon dioxide (CO_2);

3.3. "*Background concentration*" means the test substance concentration at the vehicle air intake at the start of the test;

3.4. "*Real driving test*" refers to the test in which test substances are sampled from the outside and interior air of a test vehicle driven on urban roads;

3.5. "*Sampling point*" means a point where the test substances are sampled;

3.6. "*HVAC systems with automatic control*" means the system in which the temperature value could be set manually whilst other parameters are controlled automatically;

3.7. "*HVAC systems with manual control*" means the system in which all parameters could only be set manually.

4. Abbreviations

4.1. General abbreviations

VIAQ	Vehicle Interior Air Quality
HVAC	Heating, Ventilation and Air Conditioning

4.2. Chemical symbols and abbreviations

$PM_{2.5}$	Fine particulate matter
NO_2	Nitrogen dioxide [CAS#: 10102-44-0]
CO_2	Carbon dioxide [CAS#: 124-38-9]

5. General provisions

5.1. When instructed to include this test procedure in national standards, Contracting Parties are invited to adopt this part of Mutual Resolution regarding the measurement of air pollutants entering into the cabin and measurement of pollutants in outside air.

5.2. This part of the Mutual Resolution does not hold regulatory status within Contracting Parties. Contracting Parties refer to the VIAQ recommendation when used for the assessment on vehicle interior air quality with the technical prescriptions of their own standards or regulations.

5.3. There are several test methods available for assessing vehicle interior air quality and this Mutual Resolution takes into account these existing standards.

5.4. This part of Mutual Resolution will encourage the improvement of vehicle body and air cleaning and heating, ventilation and conditioning system design to increase air quality inside the passenger cabin.

5.5. Due to the different levels of development, different regional cultures, and the costs associated with interior air quality control technology, the regulatory stringency is expected to be different from region to region for the foreseeable future. The setting of interior pollutant concentration limit values, therefore, is not part of this recommendation for the time being.

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6. Normative references

6.1. ISO 16000-1:2004 Indoor air – Part 1: General aspects of sampling strategy.

6.2. UN Regulation No. 83 - Rev.5 – Uniform provisions concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirements (Annex 4a - Appendix 7).

6.3. UN Regulation No. 168 Uniform Provisions Concerning the Approval of light duty passenger and commercial vehicles with regards to real driving emissions (RDE).

6.4. Global technical regulation No. 15 - Worldwide harmonized Light vehicles Test Procedure.

7. Requirements for the test vehicle

7.1. Test vehicles should only be vehicles from serial production. Used vehicles are not included. The selection of vehicles should be based on a worst case to minimize testing cost. For the purpose of emissions entering into the cabin with outside air, equipment for air purification is only allowed in the test cars if it is serial equipment.

7.2. The new vehicle should have been run in for between 3000 and 15000 km and have an age of more than one month.

7.3. General inspection of the test vehicle should be performed before testing.

7.4. The vehicle should not be tested if any of listed below items is true:

(a) The vehicle is not in overall safe operating condition.

(b) A malfunction indicator lights up on the vehicle instrument panel.

(c) Any part of the vehicle's heating and ventilation system has been replaced with a non-original one.

(d) The vehicle has not a full service history.

(e) The vehicle has had unauthorized repairs.

(f) There are any damages of ventilation system relevant components or obstructions of the vehicle air intake path, through visual inspection of the vehicle.

(g) The body of the vehicle, including but not limited to doors, windows and the rear has any damage.

7.5. The test vehicle should be equipped with new OEM-approved cabin air filter. Filter type needs to be documented. If the model of vehicle of the OEM has no filter in its definition, the vehicle shall be tested with this procedure without an additional filter.

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8. Requirements for the test apparatus, instrument and equipment

8.1. Test substances. During the tests, concentrations of the substances listed below should be measured during the same test drive inside and outside vehicle cabin in parallel:

(a) Fine particulate matter ($PM_{2.5}$) inside and outside vehicle cabin;

(b) Nitrogen dioxide (NO_2) inside and outside vehicle cabin;

(c) Carbon dioxide (CO_2) inside vehicle cabin only.

8.2. Sampling points and lines requirements.

8.2.1. The interior sampling point should be at head-height between the front headrestraints. Sampling tube should be directed to the rear of the vehicle to avoid driver and passenger breathing affecting the CO_2 measurement.

8.2.2. The external sampling point should be as close as reasonably possible to the ventilation air intake, see an example in Annex VII.

8.2.3. The sampling lines to the analyser should be:

(a) as short as possible;

(b) line lengths must be identical and not more than 2 m;

(c) as straight as possible;

(d) with few bendings as possible;

(e) with no sharp bendings;

(f) made of antistatic materials for particles measurement;

(g) made of PTFE for gases measurement;

(h) with diameter compatible to measurement equipment, usually 6 mm or 8 mm (outer diameter);

(i) the probe inlet for $PM_{2.5}$ sampling should be isokinetic and isoaxial.

8.3. Test substance concentration measurement methods.

8.3.1. For fine particles ($PM_{2.5}$): optical particle counter.

8.3.2. For nitrogen dioxide (NO_2): non-dispersive ultra-violet chemiluminescent detector or iterative cavity-enhanced differential optical absorption spectroscopy.

8.3.3. For carbon dioxide (CO_2): Non-dispersive infra-red detector.

8.4. Test substance concentration measurement limits.

8.4.1. The measuring equipment should provide the lower and upper limits of measurable concentrations of the test substances at the presence of other components as in the table below.

Test substance	*Detection limit of measurement, equal or lower than*	*Accuracy of measurement, not more than*
Fine particles $PM_{2.5}$	1.0 $\mu g/m^3$	±3 $\mu g/m^3$
Nitrogen dioxide NO_2	2 ppb	±1ppb
Carbon dioxide CO_2	100 ppm	±3.0% of reading or ±50 ppm

8.5. Time resolution of measurement equipment should be less than 5 seconds and measurement data during the test should be saved on internal or external memory.

8.6. Test equipment should be suitable for mobile application.

8.7. Test equipment should fulfil common safety regulations.

8.8 For substances concentration measurement it is essential that the same test instrument with equivalent calibration for inside and outside measurement is used. Only measurements with the same instrument can be compared.

8.9. Additional measurement equipment.

8.9.1. For tests using additional measurement equipment the following are to be used: thermometer, relative humidity meter, barometer. Limit of permissible basic error for the above-mentioned equipment is presented in the table.

Parameter	*Limit of permissible basic error*
Temperature	±1°C
Relative humidity	±2.5%
Atmospheric pressure	±0.1 kPa

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9. Test procedure, test mode, and test conditions

9.1. The preparation procedure.

9.1.1. Take out the cabin air filter and replace with a new OEM approved filter. Check correctness of air flow direction of the filter when replacing.

9.1.2. Check vehicle for tightness (sealings, windows, doors, trunk, roof). A vehicle with defective components should not be tested.

9.1.3. Ensure exhaust pipe is representative of serial production. Visually check exhaust pipe for tightness.

9.1.4. Before testing substance concentration, the measurement equipment and sampling system should be placed inside the test vehicle and warmed up ahead of the test start time in accordance with the equipment manual.

9.1.5 Measurement devices should be time synchronized within ±5 s.

9.2. Meteorological conditions.

9.2.1. Ambient temperature in the range from +5°C to +35°C.

9.2.2. Relative humidity from 40% to 80%.

9.2.3. Atmospheric pressure from 85 to 110 kPa.

9.2.4. Weather condition should be:

(a) no rain;

(b) no standing water on the road;

(c) no fog;

(d) no snow.

9.3. Test conditions.

9.3.1. The measurement of interior air quality shall be conducted by testing vehicles on the road, operated over their normal driving patterns, conditions and payloads. The test shall be conducted on paved roads (e.g. off-road operation is not permitted).

9.3.2. Background air pollution level:

(a) fine particles $PM_{2.5}$ concentration should be not less than 15 µg/m^3 and not more than 300 µg/m^3;

(b) NO_2 concentration should be not less than 15 ppb and not more than 100 ppb;

(c) CO_2 concentration should be not less than 300 ppm and not more than 500 ppm.

9.3.3. Windows, doors, sunroof or convertible soft top should be closed during the test. Heaters or coolers of the seats should not be switched on.

9.3.4. The vehicle's interior such as seats or carpets should be clean. Only a damp cloth should be used for cleaning the vehicle prior the testing. Fragrances and air fresheners should not be used as well as during cleaning and during the test.

9.3.5. During the test only the driver and one passenger should be present in the vehicle and no other people inside. Clothing should be clean and cover arms and legs.

9.3.6. The driver and the passenger should avoid applying any fragrances or perfumes prior to or during the test, moreover, they should not have smoked before and during the test.

9.3.7. The length of the test run should be 25 km on urban roads and 25 km on expressways (deviation ±10%). The time for the full test run and exact milage should be documented. The speed should be monitored via vehicle reading or GPS logging.

9.3.8. Urban part is characterized by speed limits lower than or equal to 60 km/h.

9.3.9. Expressway part is characterized by speed limits above 60 km/h and up to 100 km/h.

9.3.10. Local speed limits remain in force during a test, notwithstanding other legal consequences.

9.4. Vehicle conditioning.

9.4.1. Before testing, the vehicle shall be preconditioned in the following way: The vehicle shall be driven, preferably on the same route as the planned real driving testing, or for at least 10 min for urban operation or 30 minutes with a minimum average velocity of 30 km/h. The vehicle shall subsequently be parked with doors and bonnet closed and kept in engine-off status within moderate or extended altitude and temperatures, in accordance with paragraph 9.2. Exposure to extreme atmospheric conditions (such as heavy snowfall, storm, hail) and excessive amounts of dust or smoke should be avoided.

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9.4.2. Before the test start, the vehicle and equipment shall be checked for damages and the presence of warning signals that may suggest malfunctioning. In the case of a malfunction the source of the malfunctioning shall be identified and corrected or the vehicle shall be rejected.

9.5. HVAC system settings.

9.5.1. For all types of HVAC systems:

air conditioning: switched ON;

ventilation outlets: fully open and directed straight ahead.

9.5.2. For HVAC systems with automatic control:

HVAC auto mode switched on;

temperature 22°C;

if possible, adjust manually fan speed 50%/medium.

9.5.3. For HVAC systems with manual control:

fresh air mode on (no recirculation air mode);

temperature 50%/medium;

fan speed 50%/medium.

9.6. Real driving test procedure.

9.6.1. Measure ambient air temperature, relative humidity, pressure and background air pollutants concentration listed at 9.3.2.

9.6.2. Initiate the vehicle startup procedure, adjust HVAC operation mode in accordance with paragraph 9.5, switch on the $PM_{2.5}$, NO_2 and CO_2 analysers. Ensure stabilization of instrument readings in accordance with their operating instructions. Drive for at least 10 min.

9.6.3. Drive to the beginning of the test route, start $PM_{2.5}$, NO_2 and CO_2 analysers, GPS logger.

9.6.4. To equalize the internal and external concentrations, keep the doors opened with the vehicle stationary for at least 10 minutes.

9.6.5. Drive on the route urban and expressway parts.

9.6.6. Park the car, stop the $PM_{2.5}$, NO_2 and CO_2 measurement, GPS logger.

9.6.7. Switch off the vehicle.

9.6.8. Save the measurement protocols from $PM_{2.5}$, NO_2 and CO_2 analysers and GPS track from the logger to the computer.

9.6.9. Take another background measurement according to paragraph 9.6.1.

9.6.10. Switch off $PM_{2.5}$, NO_2 and CO_2 analysers. Vehicle real driving test is complete.

9.7. In addition to test vehicle requirements, test conditions and test procedure, described in part IV of this Mutual Resolution, some optional test parameters could be applicable during the test and always must be clearly documented. Optional test parameters are presented in Annex VIII.

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10. Calculation, presentation of results, precision and uncertainty

10.1. Calculation of results.

Calculate the test substances average, minimal and maximal concentration during the test for $PM_{2.5}$ and NO_2 inside and outside the vehicle and for CO_2 inside the vehicle for the whole test.

10.2. Data reporting shall use the format in Annex IX. Additions to the report should be agreed on between the client and the laboratory.

11. Performance characteristics

11.1. Calibration should be done according to GTR 15.

11.2. Calibration intervals are listed in the table below.

Instrument checks	*Interval*	*Criteria*
Gas analyser linearization (calibration)	Every 6 months	±2 per cent of reading
Mid span	Every 6 months	±2 per cent
Particle analyser	See paragraph 11.5.1.	±10 per cent

11.3. Analyser calibration procedures.

11.3.1. Each analyser shall be calibrated as specified by the instrument manufacturer or at least as often as described in Table in paragraph 11.2.

11.3.2. Each normally used operating range shall be linearized by the following procedure.

11.3.2.1. The analyser linearization curve shall be established by at least five calibration points spaced as uniformly as possible. The nominal concentration of the calibration gas of the highest concentration shall be not less than 80 per cent of the full scale.

11.3.2.2. The calibration gas concentration required may be obtained by means of a gas divider, diluting with purified N_2 or with purified synthetic air.

11.3.2.3. The linearization curve shall be calculated by the least squares method. If the resulting polynomial degree is greater than 3, the number of calibration points shall be at least equal to this polynomial degree plus 2.

11.3.2.4. The linearization curve shall not differ by more than ±2 per cent from the nominal value of each calibration gas.

11.3.2.5. From the trace of the linearization curve and the linearization points, it is possible to verify that the calibration has been carried out correctly. The different characteristic parameters of the analyser shall be indicated, particularly:

(a) scale;

(b) sensitivity;

(c) zero point;

(d) date of the linearization.

11.4. Analyser zero and calibration verification procedure.

11.4.1. Each normally used operating range shall be checked prior to each test in accordance with the following subparagraphs.

11.4.1.1. The calibration shall be checked by use of a zero gas and by use of a calibration gas. The calibration curves of the analysers shall be set by means of calibration gases of nominal concentrations of 70 to 100 per cent of the range.

11.4.1.2. After testing, zero gas and the same calibration gas shall be used for re-checking. The zero settings of the analysers shall then be rechecked: if any reading differs by more than 2 per cent of the range from that set in paragraph 11.4.1.1. above, the procedure shall be repeated for that analyser.

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11.5. Calibration of the particle analyser.

11.5.1. The responsible authority shall ensure the existence of a calibration certificate for the particle analyser demonstrating compliance with a traceable standard within a 13-month period prior to the emissions test. Between calibrations either the measuring accuracy of the particle analyser should be monitored for deterioration every 6 months. Particle analyser measuring accuracy may be monitored against a reference particle analyser or against at least two other measurement particle analysers. If the particle analyser reports particle concentrations within ±10 per cent of the average of the concentrations from the reference particle analyser, or group of two or more particle analyser, then the particle analyser shall be considered stable, otherwise maintenance of the particle analyser is required.

11.5.2. The particle analyser shall also be recalibrated and a new calibration certificate issued following any major maintenance.

11.5.3. Calibration shall be traceable to a standard calibration method by comparing the response of the particle analyser under calibration with that of:

(a) a calibrated particle analyser when simultaneously sampling electrostatically classified calibration particles; or

(b) a second particle analyser which has been directly calibrated by the above method.

12. Quality assurance/quality control

12.1. The tests proceeded in accordance to paragraph 9. of part IV are valid if all quality requirements listed in this paragraph are fulfilled.

12.2. Quality control requirements for real driving test are listed in the table below.

Subclauses	*Description*	*Criterion*	*Frequency*	*Comments*
9.2.1	Ambient temperature	+5 to +35°C	Each test	Control at the beginning and at the end of each test
9.2.2	Relative humidity	40 to 80%	Each test	Control at the beginning and at the end of each test
9.2.3	Atmospheric pressure	85 to 110 kPa	Each test	Control at the beginning and at the end of each test
9.3.2	Background PM_{25} concentration	15 to 300 µg/m^3	Each test	Control at the beginning and at the end of each test
9.3.2	Background NO_2 concentration	15 to 100 ppb	Each test	Control at the beginning and at the end of each test
9.3.2	Background CO_2 concentration	300 to 500 ppm	Each test	Control at the beginning and at the end of each test

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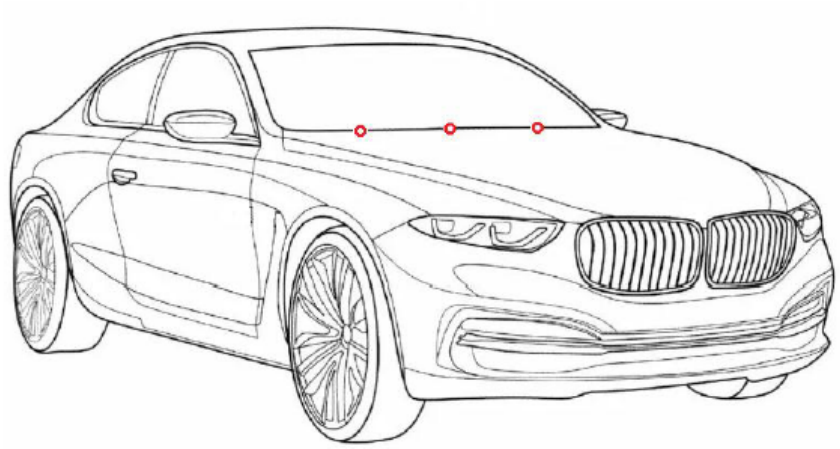
Annex VII

External sampling point



External sampling point is located near ventilation inlet below windshield. On the picture above possible locations of a sampling point marked as red circles.

Annex VIII

Optional test parameters list

Optional test parameters could be used during the test regarding test procedure described in part IV. Optional test parameters always must be clearly documented.

Optional test parameters are:

1. Older vehicle with mileage more than 15 000 km can be tested.
2. Outside air conditions different from those defined in subclause 9 are acceptable and need to be documented.
3. HVAC can be additionally operated in fresh air and recirculation mode.
4. Calculation of average concentrations of measured substances inside and outside the vehicle can additionally be done for parts of the test track like urban or expressway.

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Annex IX

Test report of emissions entering to the vehicle cabin from outside air pollutants

Reporting Format and Data Exchange

The data exchange file shall be constructed as follows. Test substance concentrations as well as any other relevant parameters shall be reported and exchanged as a csv-formatted data file. Parameter values shall be separated by a comma, ASCII-Code #h2C. The decimal marker of numerical values shall be a point, ASCII-Code #h2E. Lines shall be terminated by carriage return, ASCII-Code #h0D. No thousand separators shall be used.

Headers of the Reporting and Data Exchange File

Line #	*Parameter*	*Basic Data Type [A=Alpha or N=Numeric (max length, fractional digits)]*	*Data Type [Enumeration String, Decimal, Integer]*	*Total Digits*	*Fractional Digits*	*Minimum Value*	*Maximum Value*	*Allowed Values for: Enumeration or Description or Units*
1	Process Code	N(2)	Integer			0	99	Version of Test Report. 1st dataset is N=0, highest value is the latest correction of existing dataset
2	Name of Witness	A(250)	String					Only if applicable. Full name of witness, company name and contact information for certification of test. Use "Self-Certified" if no witness is required.
3	Test ID Code	A(50)	String					Serial Test Identification
4	Name of Vehicle Test Operator(s)	A(50)	String					Given (First) and Family (Last) Names
5	Name of Analytical Test Operator(s)	A(50)	String					First and last name of test operator
6	Vehicle Laboratory and Address	A(200)	String					Name of Vehicle Test Laboratory, Street, City, State, Country, Postal (ZIP) Code
7	Analytical Laboratory and Address	A(200)	String					Name of Sample Test Laboratory, Street, City, State, Country, Postal (ZIP) Code

Line #	*Parameter*	*Basic Data Type [A=Alpha or N=Numeric (max length, fractional digits)]*	*Data Type [Enumeration String, Decimal, Integer]*	*Total Digits*	*Fractional Digits*	*Minimum Value*	*Maximum Value*	*Allowed Values for: Enumeration or Description or Units*
12	Analytical Test Date	A(10)	String					Ref. ISO 8601 (e.g. YYYY-MM-DD)
13	Manufacturer Name	A(50)	String					Original Equipment Manufacturer (OEM)
14	Factory Name	A(50)	String					Place of Manufacturer
15	Vehicle Identification Number	A(17)	String					17-character vehicle identification number (VIN)
16	Vehicle Class (Category 1-1 Vehicle Only)	A(1)	Enumeration					A = Mini Vehicle B = Small Vehicle C = Medium Vehicle D = Large Vehicle E = Executive Vehicle F = Luxury Vehicle J = Sport Utility Vehicle (including off-road vehicles) M = Multi-Purpose Vehicle S = Sports Vehicle P = Small Pickup Truck T = Standard Pickup Truck
17	Model Name	A(50)	String					Manufacturer's Model Name
18	Powertrain Type	A(50)	String					Description of Powertrain Type
19	Fuel Type	A(3)	String					P = Petrol D = Diesel CNG = Compressed Natural Gas LNG = Liquid Natural Gas LPG = Liquid Petrol Gas H2 = Hydrogen E = Electricity
20	Exterior Colour	A(50)	String					Paint Colour

Interlaboratory Tests

Carried out tests, by:

- **OICA (Germany)**
- **CLEPA (Germany, India)**
- **KAIA (Korea)**
- **NAMI (Russian Federation)**

Short Summary

- Outside PM2.5 concentrations in Europe frequently fall below the minimum concentration of 15 µg/m³.
- Other regions, such as India, are also capable of meeting these baseline conditions.
- Comprehensive documentation of the test vehicle, filtration systems, devices is essential to ensure accurate interpretation of results.
- The sampling location for outside air may differ from the specified position due to variations in HVAC fresh-air inlet design.

Overall, the group has established a sound and practical procedure for conducting VIAQ test-drive measurements. The next step is to gather experiences in practise.

VIAQ-34-02

VIAQ IWG: Future Steps

Possible future directions of work are:

- **Collecting new test data in different countries and conditions, improvement of developed test procedure.**
- **Starting work on stage 4 (interior air quality on-board monitoring systems).**
- **Development of equipment and test procedure for vehicle interior air quality assessment in the test chamber in stationary and fully controlled conditions.**

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