

## Proposal for a new supplement to the 02 series of amendments to UN Regulation No. 138

The text reproduced below was prepared by the experts from OICA in order to clarify the original intent of the Task Force on Quiet Road Transport Vehicles (TF QRTV) conclusion. The modifications to the current text of the UN Regulation are marked in bold for new or strikethrough for deleted characters.

### I. Proposal

*Paragraph 2.2.*, amend to read:

"2.2. *"Natural sound"* means sound coming from the vehicle and its components as a result of e.g. providing propulsion, braking, steering, cooling, or any other function.

An exterior sound enhancement system, as defined in UN Regulation No. 51, ~~Annex 9, paragraph 2.2.~~ **paragraph 2.29.** does not produce natural sound."

*Justification/Notation:*

(Editorial) With working document GRBP/2024/22 the definition of Exterior Sound Enhancement System would move from Annex 9 to the main text.

*Paragraphs 2.11. and 2.12.*, amend to read:

"2.11. *"Mandatory speed range"*: **means** the speed range where an AVAS shall emit sound (AVAS sound) to fulfil the requirements of this Regulation.

2.12. *"Lowest frequency of interest"*: **means** the frequency below which there is no signal content relevant to the measurement of sound emission for the vehicle under test."

*Justification*

(Editorial) Aligned language with the other definitions.

*Paragraph 2.13.*, amend to read:

"2.13. Symbols and abbreviated terms and the paragraph in which they are first used.

Table 1  
**Symbols and Abbreviations**

| <i>Symbol</i> | <i>Unit</i> | <i>Paragraph</i> | <i>Explanation</i>  |
|---------------|-------------|------------------|---|
| Method (A)    | -           | <b>8.2</b>       | Test of the complete vehicle in motion on an outdoor test track, <del>limit values of paragraph 6.2.8.</del> <b>means measuring</b> the whole vehicle sound |

| <i>Symbol</i>   | <i>Unit</i> | <i>Paragraph</i>              | <i>Explanation</i>  |
|-----------------|-------------|-------------------------------|---|
| Method (B)      | -           | 8.2                           | Test of the complete vehicle without movement in standstill condition on an outdoor test track with simulation of the vehicle movement to the AVAS by an external signal generator; <del>limit values of paragraph 6.2.8. means</del> <b>measuring primarily the AVAS sound</b> |
| Method (C)      | -           | Annex 3 para. 3.1             | Test of the complete vehicle without movement with turning wheels in an indoor facility on a chassis dynamometer; <del>limit values of paragraph 6.2.8. means</del> <b>measuring the whole vehicle sound</b>  |
| Method (D)      | -           | 8.2                           | Test of the complete vehicle without movement in an indoor facility with simulation of the vehicle movement to the AVAS by an external signal generator; <del>limit values of paragraph 6.2.8. means</del> <b>measuring primarily AVAS sound</b>                                |
| ICE             | -           | 6.2.1.1.3                     | Internal Combustion Engine  |
| AA'             | -           | Annex 3 para.3.3.2.1          | Line perpendicular to vehicle travel which indicates the beginning of the zone to record sound pressure level during test   |
| BB'             | -           | Annex 3 para.3.3.2.1          | Line perpendicular to vehicle travel which indicates end of the zone to record sound pressure level during test   |
| PP'             | -           | Annex 3 para 3.1              | Line perpendicular to vehicle travel which indicates location of microphones  |
| CC'             | -           | Annex 3 para.3.1              | Centreline of vehicle travel  |
| $v_{test}$      | km/h        | Annex 3 para.3.3.2.1          | Target vehicle test velocity  |
| $i$             | -           | Annex 3 para. 3.1             | Index for left or right microphone locations  |
| $j$             | -           | Annex 3 para.3.4              | Index for single test run within standstill or constant speed test conditions   |
| $L_{reverse}$   | dB(A)       | Annex 3 para.3.5              | Vehicle A-weighted sound pressure level for reversing test  |
| $L_{crs,10}$    | dB(A)       | Annex 3 para.3.5              | Vehicle A-weighted sound pressure level for constant speed test at 10 km/h.   |
| $L_{crs,20}$    | dB(A)       | Annex 3 para.3.5              | Vehicle A-weighted sound pressure level for constant speed test at 20 km/h.   |
| $L_{test,j}$    | dB(A)       | Annex 3 para.2.3.2-3.4        | A-weighted sound pressure level result of $j^{th}$ test run   |
| $L_{bgn}$       | dB(A)       | Annex 3 para.2.3.1            | Background A-weighted sound pressure level.   |
| $L_{bgn\_BAND}$ | dB(A)       | Annex 3 paragraph para. 2.3.1 | Background noise one-third octave A-weighted sound pressure level.  |
| $v_{ref}$       | km/h        | Annex 3 para.4.5.1            | Reference vehicle velocity used for calculating frequency shift percentage.   |
| $f_{j, speed}$  | Hz          | Annex 3 para.4.5.             | Single frequency component at a given vehicle speed per sample segment, e.g. $f_{1, 5}$   |
| $f_{ref}$       | Hz          | Annex 3 para.4.5.1            | Single frequency component at reference vehicle speed   |
| $f_{speed}$     | Hz          | Annex 3 para.4.5.1            | Single frequency component at a given vehicle speed, e.g. $f_5$   |

| <i>Symbol</i>              | <i>Unit</i> | <i>Paragraph</i>    | <i>Explanation</i>  |
|----------------------------|-------------|---------------------|---|
| $l_{veh}$                  | m           | Annex 3, Appendix   | Length of vehicle   |
| $MicLeft_i$                | ---         | Annex 3 para. 3.1.  | $i$ th Microphone situated at left side of vehicle  |
| $MicRight_i$               | ---         | Annex 3 para. 3.1.  | $i$ th Microphone situated at right side of vehicle   |
| $MicLeft_1$                | ---         | Annex 3 para. 3.1.  | Microphone situated at left side of vehicle, with height of 0,8 m above ground  |
| $MicLeft_2$                | ---         | Annex 3 para. 3.1.  | Microphone situated at left side of vehicle, with height of 1,0 m above ground  |
| $MicLeft_3$                | ---         | Annex 3 para. 3.1   | Microphone situated at left side of vehicle, with height of 1,2 m above ground  |
| $MicLeft_4$                | ---         | Annex 3 para. 3.1.  | Microphone situated at left side of vehicle, with height of 1,4 m above ground  |
| $MicLeft_5$                | ---         | Annex 3 para. 3.1.  | Microphone situated at left side of vehicle, with height of 1,6 m above ground  |
| $MicRight_1$               | ---         | Annex 3 para. 3.1.  | Microphone situated at right side of vehicle, with height of 0,8 m above ground   |
| $MicRight_2$               | ---         | Annex 3 para. 3.1.  | Microphone situated at right side of vehicle, with height of 1,0 m above ground   |
| $MicRight_3$               | ---         | Annex 3 para. 3.1.  | Microphone situated at right side of vehicle, with height of 1,2 m above ground   |
| $MicRight_4$               | ---         | Annex 3 para. 3.1.  | Microphone situated at right side of vehicle, with height of 1,4 m above ground   |
| $MicRight_5$               | ---         | Annex 3 para. 3.1.  | Microphone situated at right side of vehicle, with height of 1,6 m above ground   |
| $L_{MicLeft_i_{OA}, j}$    | dB(A)       | Annex 3 para. 3.4.1 | Maximum overall sound pressure level result over the entire measurement interval for each $MicLeft_i$ location for the $j$ th measurement run                         |
| $L_{MicRight_i_{OA}, j}$   | dB(A)       | Annex 3 para. 3.4.1 | Maximum overall sound pressure level result over the entire measurement interval for each $MicRight_i$ location for the $j$ th measurement run                        |
| $L_{MicLeft_{OA}, j}$      | dB(A)       | Annex 3 para. 3.4.4 | Maximum overall sound pressure level result over the entire measurement interval for all $MicLeft_i$ locations for the $j$ th measurement run                         |
| $L_{MicRight_{OA}, j}$     | dB(A)       | Annex 3 para. 3.4.4 | Maximum overall sound pressure level result over the entire measurement interval for all $MicRight_i$ locations for the $j$ th measurement run                        |
| $L_{MicLeftOA}$            | dB(A)       | Annex 3 para. 3.5.2 | Maximum overall sound pressure level result over the entire measurement interval for all $MicLeft_i$ locations  |
| $L_{MicRightOA}$           | dB(A)       | Annex 3 para. 3.5.2 | Maximum overall sound pressure level result over the entire measurement interval for all $MicRight_i$ locations   |
| $L_{MicLeft_i_{BAND}, j}$  | dB(A)       | Annex 3 para. 3.4.1 | Maximum one-third-octave sound pressure level result for each band over the entire measurement interval for each $MicLeft_i$ location for the $j$ th measurement run  |
| $L_{MicRight_i_{BAND}, j}$ | dB(A)       | Annex 3 para. 3.4.1 | Maximum one-third-octave sound pressure level result for each band over the entire measurement interval for each $MicRight_i$ location for the $j$ th measurement run |

| <i>Symbol</i>                  | <i>Unit</i> | <i>Paragraph</i>      | <i>Explanation</i>  |
|--------------------------------|-------------|-----------------------|---|
| $L_{\text{MicLeft\_BAND}, j}$  | dB(A)       | Annex 3 para. 3.5.1.2 | Maximum one-third octave results for each band over the entire measurement interval for all $\text{MicLeft}_i$ locations for the $j$ th measurement run                             |
| $L_{\text{MicRight\_BAND}, j}$ | dB(A)       | Annex 3 para. 3.5.1.2 | Maximum one-third octave results for each band over the entire measurement interval for all $\text{MicRight}_i$ locations for the $j$ th measurement run                            |
| $L_{\text{MicLeftBAND}}$       | dB(A)       | Annex 3 para. 3.5.3   | Maximum one-third octave sound pressure level over the entire measurement interval for all <del>MicLeft</del> $\text{MicLeft}_i$ locations averaged over all $j$ measurement runs   |
| $L_{\text{MicRightBAND}}$      | dB(A)       | Annex 3 para. 3.5.3   | Maximum one-third octave sound pressure level over the entire measurement interval for all <del>MicRight</del> $\text{MicRight}_i$ locations averaged over all $j$ measurement runs |

*Justification*

The table frames have been completed for the first four rows. The symbols have been corrected to be consistent across the document. References to requirements have been deleted. The references to the first appearance in the document have been checked and updated when needed. A short dash has been applied in the column for those symbols that have no unit. (The changed dashes do not show well in the table.)

Paragraph 6.2., amend to read:

"6.2. Acoustics characteristics

The sound emitted by the vehicle type submitted for approval shall be measured by the methods described in Annex 3 to this Regulation.

The specifications of this Regulation are applicable ~~in forward and reverse to~~ **the** driving condition for the mandatory speed range of greater than 0 km/h up to and inclusive 20 km/h **in forward motion and from 0 km/h up to and inclusive 20 km/h in reverse**. Operation of an AVAS is permitted at vehicle speeds outside the mandatory speed range. ~~The, the~~ maximum sound pressure levels for the AVAS sound specified in this Regulation in Table 2a and Table 2b of paragraph 6.2.8. apply. An AVAS sound is only allowed in forward driving direction of the vehicle in the speed range mentioned in Table 2a and for all speeds in reverse direction.

...

*Justification*

Clarification of the mandatory speed ranges and that they differ between forward motion and reverse.

...

AVAS characteristics beside the tested vehicle speeds during type approval **in accordance with Annex 3**, can be declared either by manufacturer declaration in Annex 4 or by additional tests. These tests shall be **defined and** agreed between the manufacturer and the type approval authority.

...

*Justification*

Clarifies that sound characteristics in the control speed range shall be declared by the manufacturer as described in Annex 4, if not tested during type approval witness tests as specified in Annex 3. In case additional tests are needed, those

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tests shall be *defined* and agreed to between the manufacturer and the type approval authority.

...

If a vehicle in scope of UN Regulation No. 165 is equipped with an “**Audible reverse warning device**” (paragraph 2. of UN Regulation no. 165) ~~audible reverse warning system, providing~~ emitting an audible signal that exceeds the minimum overall levels as specified in Table 2b of this regulation, the audible reverse warning signal is deemed to fulfil this regulation in reverse driving, without the sound from an AVAS. ”

*Justification*

Clarifies that **an Audible reverse warning device (paragraph 2.1. of UN Regulation no. 165) or a Multiple audible reverse warning system (paragraph 2.1.4 of UN Regulation no. 165)** that is fitted to the vehicle and is *emitting* a sound that complies to UN Regulation 165. is deemed to fulfil the requirements for a reversing vehicle, as specified in this regulation.

*Paragraphs 6.2.1.*, amend to read:

"6.2.1. Constant speed tests for forward driving

~~6.2.1.1.1.~~**6.2.1.1.** The test speeds for approval tests are 10 km/h and 20 km/h. Compliance with other speeds covered by Table 2a of paragraph 6.2.8. ~~shall~~ **can** be given by a manufacturer declaration (Annex 4) **or confirmed by additional test. These tests shall be defined and agreed between the manufacturer and the type approval authority.**

*Justification*

Correction of paragraph number and the redundant repetition of “tests”. The provisions for declaration of compliance to this regulation have been aligned with the mother paragraph 6.2.

~~6.2.1.1.1.~~**6.2.1.2.** When tested under the conditions of Annex 3 paragraph 3.3.2., the vehicle shall emit a sound

- (a) That has ~~a minimum~~ **an** overall sound pressure level for the specified speed range according to Table 2a of paragraph 6.2.8.;
- (b) That has at least two of the one-third octave bands according to Table 3 of paragraph 6.2.8. At least one of these bands shall be below or within the 1,600 Hz one-third octave band;
- (c) With minimum sound pressure levels in the chosen bands for the applicable test speeds according to Table 3 of paragraph 6.2.8.;

...

*Justification*

(Technical) This change clarifies that not only minimum but also maximum sound pressure level requirements shall be verified through the measurement methods in Annex 3, paragraph 3.3.2., towards the Table 2a in paragraph 6.2.8. Thus, the reference to Table 2a, Table 2b and Table 3 do not have to be repeated in paragraphs 6.2.5 and 6.2.6. (Similar change is proposed for 6.2.2.)

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~~6.2.1.1.2-~~**6.2.1.3.** If after a vehicle is tested in accordance with Annex 3 paragraph 3.3.2., for ten consecutive times within a series of measurements without recording a valid measurement because the vehicle's internal combustion engine (ICE) remains active or restarts and interferes with the measurements, the vehicle is exempted from this particular test. "

*Justification*

(Editorial) Paragraph numbering has been corrected in chapter 6.2.1., 6.2.2. and 6.2.3.

*Paragraphs 6.2.2., amend to read:*

"6.2.2. Reversing test

6.2.2.1. When tested under the conditions of Annex 3 paragraph 3.3.3. the vehicle must emit a sound that has ~~minimum~~ **an** overall sound pressure level according to Table 2b of paragraph 6.2.8. Compliance with other speeds covered by Table 2b of paragraph 6.2.8. ~~shall~~**can** be given by a manufacturer declaration (Annex 4) **or confirmed by additional test. These tests shall be defined and agreed between the manufacturer and the type approval authority.**

~~6.2.2.1.1-~~ **6.2.2.2.** If after a vehicle is tested in accordance with Annex 3, paragraph 3.3.3., for ten consecutive times within a series of measurements without recording a valid measurement because the vehicle's ICE remains active or restarts and interferes with the measurements, the vehicle is exempted from this particular test."

*Justification*

(Technical) The change in paragraph 6.2.2.1. clarifies that not only minimum but also maximum sound pressure level requirements shall be verified through the measurement methods in Annex 3, paragraph 3.3.2., towards the Table 2a in paragraph 6.2.8. Thus, the reference to Table 2a, Table 2b and Table 3 do not have to be repeated in paragraphs 6.2.5 and 6.2.6. (Similar change is proposed for 6.2.1.)

The provisions for declaration of compliance to this regulation have been aligned with the mother paragraph 6.2.

The second subparagraph numbering has been corrected.

*Paragraphs 6.2.3., amend to read:*

"6.2.3. Frequency shift to signify acceleration and deceleration

~~6.2.3.1.1-~~ **6.2.3.1.** The intention of frequency shift is to acoustically inform road users about the change in vehicle speed.

~~6.2.3.1.2-~~ **6.2.3.2.** When tested under the conditions of Annex 3 paragraph 4, at least one tone within the frequency range as specified in paragraph 6.2.8. emitted by the vehicle shall vary proportionally with speed within each individual gear ratio by an average of at least 0.8 % per 1 km/h in the speed range from 5 km/h to 20 km/h inclusive when driving in forward direction. In case more than one frequency is shifted, only one frequency shift needs to fulfil the requirements."

*Justification*

The second subparagraph numbering has been corrected.

*Paragraphs 6.2.5. and 6.2.6., amend to read:*

"6.2.5. Driver selectable AVAS sounds

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The vehicle manufacturer may define alternative sounds which can be selected by the driver; each of these sounds shall be in compliance and approved with the provisions in paragraphs 6.2.1. to 6.2.4.

The compliance with paragraph 6.2.8., Tables 2a, ~~and Table 2b and Table 3~~ of non-tested sound modes during type approval in respect to Annex 3, paragraph 3.2.3. shall be confirmed by the manufacturer declaration (Annex 4).

6.2.6. AVAS Sound Level Variation

If fitted, an AVAS may operate at different sound levels either automatically managed by the control unit or manually selected by the driver. Each selected sound level shall be in compliance with the specifications outlined in paragraphs 6.2.1. to 6.2.4. and paragraph 6.2.8.

The compliance with paragraph 6.2.8., Tables 2a, ~~and Table 2b and Table 3~~ of non-tested sound modes during type approval in respect to Annex 3, paragraph 3.2.3. shall be confirmed by the manufacturer declaration (Annex 4).

All combinations of AVAS sound level variations and AVAS sound shall fulfil the requirements of paragraph 6.2.8., Table 2a, Table 2b and Table 3. "

*Justification*

(Technical) With this clarification, the original intention of UN R138.01 is maintained – all available sounds should comply to *full package* of requirements in paragraphs 6.2.1 6.2.2. and 6.2.3. as well as 6.2.4. (Same change and justification for par. 6.2.6.). Obviously the final subparagraph provides no additional information and could be deleted, however stays in this gentle revision.

*Paragraph 6.2.7., amend to read:*

"6.2.7. Pause function

In the mandatory speed range as defined in the second ~~sentence~~ **sub-paragraph** of paragraph 6.2. ~~the AVAS a sound as prescribed in paragraph 6.2.~~ shall always be emitted."

Any pause function as defined in paragraph 2.8. shall be allowed only outside the mandatory speed range."

*Justification*

(Editorial) Clarification how to read paragraph 6.2. with regards to the mandated use of AVAS and those situations an AVAS sound is not required, that is outside the mandatory speed range or when a sound inherent of the vehicle exceeds the minimum sound level requirements by more than 3 dB(A) or if an audible reverse warning system (complying to UN R 165) is fitted.

*Paragraph 6.2.8., amend to read:*

"6.2.8 Specifications on minimum and maximum sound level for AVAS sound

When tested under the conditions of Annex 3 paragraph 3.3.2, a vehicle which is equipped with an AVAS shall fulfil the requirements of Table 2a, ~~Table 2b~~ and Table 3.

**When tested under the conditions of Annex 3 paragraph 3.3.3, a vehicle which is equipped with an AVAS shall fulfil the requirements of Table 2b.**

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The sound emission of the vehicle under typical on-road driving conditions, which are different from those under which the type approval test set out in Annex 3 was carried out, shall not deviate from the test result in a significant manner.

...

*Justification:*

(Editorial) This correction clarifies which requirements that applies to the paragraph 3.3.2. (forward motion) and paragraph 3.3.3. (reverse motion) in Annex 3.

In the speed range of Table 2a ~~and Table 2b~~ and when tested under the conditions of Annex 3 paragraph 3.3.2., a vehicle which is equipped with an AVAS, shall not emit an AVAS overall sound level of more than 75 dB(A) **at both front and rear plane of the vehicle**, if driving in forward direction. This test can be stated by manufacturer declaration.

...

*Justification:*

This sub-paragraph specifies the maximum sound requirements for forward motion (compare with the original paragraph 6.2.8 in UN R138.01.). Therefore, the Table 2b shall be deleted while it refers to reversing conditions. The second correction confirms that the maximum sound requirements applies both to the front and rear plane of the vehicle.

During measurement in reverse the maximum level requirement ~~in the frontline at the front plane~~ of the vehicle for forward driving ~~has to~~ **shall** be fulfilled in addition to the requirement at the rear plane. **The maximum level requirement at the front plane of the vehicle at standstill condition in reverse shall be equal to the maximum level requirement in motion.** This can be stated by manufacturer declaration.

..."

*Justification:*

In order to improve readability “in the frontline” and “for forward driving” was replaced by “at the front plane”, and “has to” with “shall”.

A sentence was added that clarifies that the front plane requirements shall be the same at commencing reversing (standing still) as under motion. This makes it possible to use a loudspeaker fitted at the front part of the vehicle for producing enough sound at the rear of the vehicle. See the justification of the working document GRBP/2024/20.

*Paragraph 8.2., amend to read:*

"8.2 The authority which has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be one every two years.

In case of Conformity of Production tests, only tests according to paragraph 6.2. shall be performed.

If the sound level of the vehicle tested pursuant to paragraphs 3.3.2. and 3.3.3. of Annex 3 does not exceed by more than 1 dB(A) ~~the maximum sound pressure level limit value and without a tolerance to~~ **equals or exceeds** the minimum sound pressure level limit value prescribed in paragraph 6.2.8., Tables 2a and 2b of this Regulation,

the vehicle type shall be considered to conform to the requirements of this Regulation.



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If Conformity of Production is performed using Method (A) and the original Type Approval was conducted using Methods (B) or (D), an additional 1 dB(A) tolerance is applied only for maximum overall sound pressure level requirements. "

*Justification:*

(Editorial) This correction will add clarity to the requirements of Conformity of Production. The carriage return applied after "... this Regulation, " should be removed.

*Paragraph 11.*, amend to read:

**"11 Transitional provisions**

...

- 11.3. As from 1 September 2026, Contracting Parties applying this Regulation shall not be obliged to accept type approvals to this Regulation as amended by ~~the~~ **01 any of the preceding** series of amendments, first issued after 1 September 2026.
- 11.4. Until 1 September 2028, Contracting Parties applying this Regulation shall accept type approvals to this Regulation in its **01** series of amendments, first issued before 1 September 2026.
- 11.5. As from 1 September 2028, Contracting Parties applying this Regulation shall not be obliged to accept type approvals to this Regulation in ~~its~~ **01 any of the preceding** series of amendments.
- 11.6. Notwithstanding the transitional provisions above, Contracting Parties whose application of this Regulation comes into force after the date of entry into force of the **02** series of amendments are not obliged to accept type approvals which were granted in accordance with this Regulation in ~~its earlier~~ **any of the preceding** series of amendments and are only obliged to accept type approval granted in accordance with the **02** series of amendments.
- ~~11.6-~~**11.7.** Contracting Parties applying this Regulation shall not refuse to grant type approvals, or extensions thereof, under this Regulation in its **01** series of amendments. "

*Justification:* (Editorial) This correction is following the new guidelines WP29/2024/76.

*Justification:* The subparagraph number has been corrected.

*Annex 1*, amend to read:

"...

**Addendum to the communication form No ...**

**Technical Information**

...

2. Test results
- 2.1. Sound level of moving vehicle: ..... dB(A) at 10 km/h **according to Method ( ... )**

- 2.2. Sound level of moving vehicle: ..... dB(A) at 20 km/h **according to Method ( ... )**
- 2.3. Sound level of moving vehicle: ..... dB(A) at 6km/h in reversing **according to Method ( ... )**
- 2.4. Sound level of the vehicle: ..... dB(A) at standstill condition in reverse direction
- 2.5. Frequency shift: ..... % /km/h **according to Method ( ... )**
- 3. ~~Remark~~ **Microphone settings:-Number of microphones used:**
- 3.1. **Number of microphone used in Forward testing: (1) ..... (5) ....**
- 3.2. **Number of microphone used in Reverse testing: (1) ..... (5) ....**
- 3.3. **Number of microphone used in Standstill condition: (1) ..... (5) ....**
- 4. **Remarks**
- ..."

*Justification*

(Editorial) This text has been added to allow reporting which test method of A, B, C or D, and what microphone set-up that has been used during the type approval testing. The last paragraph numbering has been updated accordingly.

Annex 3, paragraphs 1.1.1. to 1.1.3., amend to read:

"1.1.1. General

The apparatus used for measuring the sound pressure level shall be a sound level meter or equivalent measurement system meeting the requirements of Class 1 instruments (inclusive of the recommended windscreen, if used). These requirements are described in IEC 61672-1:2013.

The entire measurement system shall be checked by means of a sound calibrator that fulfils the requirements of Class 1 sound calibrators in accordance with IEC 60942-4:2017.

Justification (Editorial) IEC 60942:2017 is the latest available issue.

1.1.2. ~~Calibration~~ **Daily verification and adjustment**

At the beginning of every measurement session, the entire acoustic measurement system shall be checked and adjusted by means of a sound calibrator as described in 1.1.1., **and – if necessary – adjusted to the reference value given by the calibrator.**

At the end of every measurement session, the entire acoustic measurement system shall be **re-checked by the same calibrator that has been used for the calibration in the beginning.** ~~means of a sound calibrator as described in 1.1.1.~~

Without any further adjustment, the difference between the readings at the beginning and the end shall be less than or equal to 0,5 dB. **If the difference is greater than 0.5 dB this value is exceeded,** the results of the **whole measurements session** ~~obtained after the previous satisfactory check~~ shall be discarded."

*Justification:*

(Editorial) This topic is not related to the prime intention of this Supplement. However, ambiguity has been raised on the way how to calibrate, as the calibration is specified as a check of the system.

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However, due to changes of ambient condition, the data acquisition system may naturally drift and lead to values moving out of the calibration tolerance.

1.1.3. Compliance with requirements

Compliance of the sound calibrator with the requirements of IEC 60942-1:2017 shall be verified once a year. Compliance of the instrumentation system with the requirements of IEC 61672-3:2013 shall be verified at least every 2 years. All compliance testing shall be conducted by a laboratory which is authorized to perform calibrations traceable to the appropriate standards. "

*Justification* (Editorial) Corrected typo – 60942-1 is replaced by 60942).

*Annex 3, Paragraphs 2.1.2. and 2.1.3., amend to read:*

"2.1.2. Outdoor testing

For the measurement of vehicles in motion, the test track construction and surface shall meet the requirements of ISO 10844:2021.

For the measurement of vehicles at a standstill, the test area shall be either:

- (a) ~~ISO 10844:2014~~ or ISO 10844:2021; or

..."

*Justification* (Editorial) The supplement 3 to UN R138.01 (published at UN website 22 December 2023) already removed the older standard with common transitional provisions. The 2014 version can be used until 24 September 2028.

2.1.3. Indoor hemi anechoic or anechoic testing

This paragraph specifies conditions applicable when testing a vehicle, either operating as it would on the road with all systems operational, or operating in a mode where only the AVAS is operational.

The test facility shall meet requirements of ISO 26101:2012 **or ISO 26101:2017 or ISO 26101-1:2021** with the following qualification criteria and measurement requirements appropriate to this test method. "

*Justification* (Editorial) The previous issues ISO 26101:2012 are sufficient for the purpose of this regulation. However recognizing the assumed intention of the TF-QRTV, it should be understood that the later issues up to 2021 can also be used. If only the latest issue of the required standard could be accepted, then such change should be accompanied by common transitional provisions to avoid unnecessary cost for redoing compliance assessments.

*Annex 3, paragraph 3.1., amend to read:*

"3.1. Microphone positions

The distance from the microphone positions on the microphone line PP' to the perpendicular reference line CC' as specified in Figure 1 and 2 of the Appendix to this annex on the test track or in an indoor test facility shall be  $2,0\text{ m} \pm 0,05\text{ m}$ .

**The manufacturer can choose to use 1 or 5 microphones per side. In case of using one microphone per side, the** microphones shall be located  $1,2\text{ m} \pm 0,02\text{ m}$  above the ground level. In case of a 5 microphone array, the microphones shall be located  $1,6\text{ m} \pm 0,02\text{ m}$ ,  $1,4\text{ m} \pm 0,02\text{ m}$ ,  $1,2\text{ m} \pm 0,02\text{ m}$ ,  $1,0\text{ m} \pm 0,02\text{ m}$ ,  $0,8\text{ m} \pm 0,02\text{ m}$  above the ground level. The reference direction for free field conditions as specified in IEC 61672-1:2013 shall be horizontal and directed perpendicularly towards the path of the vehicle line

CC'. Table 1 provides definitions of ~~MicLeft<sub>i</sub>~~, ~~MicLeft<sub>j</sub>~~ (**MicLeft<sub>1</sub> to MicLeft<sub>5</sub>**) and ~~MicRight<sub>i</sub>~~, ~~MicRight<sub>j</sub>~~ (**MicRight<sub>1</sub> to MicRight<sub>5</sub>**). "

*Justification* (Editorial) The added sentence clarifies that the use of 1 microphone or an array of 5 microphones can be decided by the manufacturer, however already implicitly understood by reading the whole paragraph 3.1.

Correction of typos whereas the underscores between MicLeft/MicRight and i were missing. The explanation of microphone symbols MicLeft<sub>1</sub>, etc. have been added for clarification.

*Annex 3, paragraph 3.1.*, amend to read:

"3.2.3. Multi-mode operation

If the vehicle is equipped with multiple driver selectable operating modes, the mode which provides the lowest sound emission during the test conditions of paragraph 3.3. shall be selected. The lowest sound emission shall include both the overall sound pressure level and the minimum of all one-third octave bands of interest.

When the vehicle provides multiple operating modes that are automatically selected by the vehicle, it is the responsibility of the manufacturer to determine the correct manner of testing to achieve the minimum sound emission.

In cases where it is not possible to determine the vehicle operating mode providing the lowest sound emission, all modes shall be tested and the mode giving the lowest test result shall be used to report the vehicle sound emission in accordance with this regulation.

Determination of lowest sound emission will likely require testing of all operating modes to confirm that the one-third octave spectra is the lowest for each ~~and every~~ band of interest at both left and right microphone locations."

*Justification* (Editorial) More concise language is considered more clear, by Microsoft.

*Annex 3, paragraph 3.3.1.*, amend to read:

"3.3.1 General

For each operating condition, the vehicle can be tested either indoor or outdoor.

For constant speed and reversing tests the vehicle may be tested either in motion or in simulated operating condition. For simulated vehicle operation, signals shall be applied to the vehicle to simulate actual in-use operation.

If the vehicle is equipped with an internal combustion engine, it shall be turned off.

**One of the test methods below shall be used. This shall be agreed between the manufacturer and the type approval authority. "**

*Justification*

(Technical) However implicit and according to the intention, the added sentence makes it clear that the choice of test method can be determined by the manufacturer, with regards to the adequacy of the available test facilities – for example consideration of ambient noise at the outdoor test track or the purpose of the test, that is assessment of minimum sound requirement of the complete vehicle, or the maximum sound requirement of the AVAS (see Table 1).

*Annex 3, paragraph 3.3.2.1.*, amend to read:

"3.3.2.1. Constant speed tests in forward motion

Method (A): For a vehicle tested in an outdoor facility, the path of the centreline of the vehicle shall follow line CC' as closely as possible with

constant speed  $v_{\text{test}}$  throughout the entire test. The front plane of the vehicle shall pass from the line AA' at the start of the test and the rear plane of the vehicle shall pass ~~from~~ the line BB' at the end of the test, as shown in Figure 1a of the Appendix to this annex. Any trailer, which is not readily separable from the towing vehicle, shall be ignored when considering the crossing of the line BB'.

Method (C): ~~For a~~ **A** vehicle tested in an indoor facility, shall be located with the front plane **and the rear plane** of the vehicle on the PP' line as shown in **Figures 2a and 2b respectively 2a** of the Appendix to this annex. The vehicle shall maintain a constant test speed,  $v_{\text{test}}$  for at least 5 seconds.

For constant speed test condition of 10 km/h, the test speed  $v_{\text{test}}$  shall be 10 km/h  ~~$\pm 1$~~  + 2 km/h. The measured values are valid for the nominal speed of 10 km/h.

For constant speed test condition of 20 km/h, the test speed  $v_{\text{test}}$  shall be 20 km/h  ~~$\pm 1$~~  + 2 km/h. The measured values are valid for the nominal speed of 20 km/h.

For automatic transmission vehicles, the gear selector shall be placed as specified by the manufacturer for normal driving.

For manual transmission vehicles, the gear selector shall be placed in the highest gear which can achieve the target vehicle speed with constant engine speed. "

#### *Justification*

*Annex 3, paragraph 3.3.2.1.* The text "Method (C): For a vehicle ..." has been replaced by "Method (C): A vehicle ..." to achieve a grammatically correct sentence. The corresponding comma, ",", has been deleted. The same editorial change has been applied in the paragraphs 3.3.2.2., 3.3.3.1., 3.3.3.2. of Annex 3.

For the purpose of demonstrating compliance with maximum sound level requirements as given by paragraph 6.2.8. Table 2a and Table 2b, microphones shall be located as shown in Figures 2a and 2b of the Appendix to Annex 3. The recording position when measuring according to Method (A) are located on both sides of CC' in the plane embracing PP' and perpendicular to the direction of the vehicle. When Method (C) is used for forward driving, measurements are needed not only at the front plane (Figure 2a) but also at the rear plane (Figure 2b). The intention can be derived from the reference to Table 2b in paragraph 6.2.8 – to validate the maximum sound requirement at both front and rear planes of the vehicle. In Method (A) the sound level at the rear plane is captured at the moment when the full vehicle length pass BB' – this coincide with when the recording is seized. The proposed change makes the intention more clear.

Correction of typos: delete " $\pm 1$ ".

*Annex 3, paragraph 3.3.2.2.,* amend to read:

"3.3.2.2. Constant speed tests simulated by an external signal to the AVAS with the vehicle in standstill condition

Method (B) or (D): ~~For a~~ **A** vehicle tested in an indoor or outdoor facility, shall be located with the front plane **and the rear plane** of the vehicle on the PP' line as shown in **Figure s 2a and 2b respectively 2b** of the Appendix to this annex. The vehicle shall maintain a constant simulated test speed,  $v_{\text{test}}$  for at least 5 seconds.

For constant speed test condition of 10 km/h, the simulated test speed  $v_{\text{test}}$  shall be 10 km/h  ~~$\pm 1$~~   $\pm 0$  km/h.

---

For constant speed test condition of 20 km/h, the simulated test speed  $v_{\text{test}}$  shall be 20 km/h +1,0 km/h"

*Justification*

*Annex 3, paragraph 3.3.2.2.* (Editorial) – “For a vehicle ...” has been replaced by “A vehicle ...” to achieve a complete, grammatically correct sentence. The corresponding comma, “;”, has been deleted. The same editorial change has been applied in the paragraphs 3.3.2.1., 3.3.3.1., 3.3.3.2. of Annex 3.

When Method (B) or (D) is used for forward driving, measurements are needed not only at the front plane (Figure 2a) but also at the rear plane (Figure 2b). See the justification for Annex 3, paragraph 3.3.2.2.

The TF-QRTV agreed to move the tolerance of 1 km/h from +/- 0.5 to +1 km/h but mistakenly changed the significant figure from the integer to the first decimal. With this correction the tolerance in paragraph 3.3.2.2. is the same as in paragraph 3.3.2.1.

*Annex 3, paragraphs 3.3.3.1. to 3.3.3.3.,* amend to read:

"3.3.3.1 Reversing test in motion

Method (A): For a vehicle tested in an outdoor facility, the path of the centreline of the vehicle shall follow line CC' as closely as possible with constant speed  $v_{\text{test}}$  throughout the entire test. The rear plane of the vehicle shall pass from the line AA' at the start of the test and the front plane of the vehicle shall pass from the line BB' at the end of the test, as shown on Figure 1b of the Appendix to this annex. Any trailer, which is not readily separable from the towing vehicle, shall be ignored when considering the crossing of the line BB'.

Method (C): ~~For a~~ A vehicle tested in an indoor facility, shall be located with the rear plane **and the front plane** of the vehicle on the PP' line as shown in Figures **2a and 2b** of the Appendix to this annex. The vehicle shall maintain a constant test speed,  $v_{\text{test}}$  for at least 5 seconds.

..."

*Justification*

*Annex 3, paragraph 3.3.3.1.* (Editorial) – The corrections concerning “For a vehicle ...”, and the addition of the “and the front plane” and “s 2a and” are like the corrections of 3.3.2.1 and 3.3.2.2 above.

3.3.3.2 Reversing test simulated by an external signal to the AVAS with the vehicle in standstill condition

Method (B) or (D): ~~For a~~ A vehicle tested in an indoor or outdoor facility, shall be located with the rear plane **and the front plane** of the vehicle on the PP' line as shown in Figures **s 2a and 2b** of the Appendix to this annex. The vehicle shall maintain a constant simulated test speed,  $v_{\text{test}}$  for at least 5 seconds.

For constant test condition of 6 km/h, the simulated test speed  $v_{\text{test}}$  shall be 6 km/h ± 0,5 km/h.

*Justification*

*Annex 3, paragraph 3.3.3.1.* (Editorial) – The corrections concerning “For a vehicle ...”, and the addition of the “and the front plane” and “s 2a and” are like the corrections of 3.3.2.1, 3.3.2.2. and 3.3.3.1. above.

3.3.3.3. Reversing test in standstill condition

A vehicle tested in an indoor or outdoor facility, shall be located with the rear **and the front** plane of the vehicle on the PP' line as shown in Figures 2a and 2b of the Appendix to this annex.

The vehicle's gear selection control shall be in the reverse position ~~and the brake released for the test.~~ "

*Justification*

*Annex 3, paragraph 3.3.3.1.* (Editorial) – The corrections concerning “For a vehicle ...”, and the addition of the “and the front plane” and “s 2a and” are like the corrections of 3.3.2.1, 3.3.2.2., 3.3.3.1 and 3.3.3.2. above.

In the 01 series “the brake released” was described because standstill measurements were allowed as alternative to reverse in motion. Since the emitting sound when reversing in standstill is mandatory in the 02 series, remove this sentence.

*Annex 3, paragraphs 3.4. to 3.4.2.,* amend to read:

"3.4. Measurement readings and reported values

At least four measurements for each test condition shall be made on both sides of the vehicle.

The first four valid consecutive measurement results for each test condition,  $L_{\text{MicRight\_OA}, j}$  and  $L_{\text{MicLeft\_OA}, j}$ , within 2,0 dB(A) per ~~side~~ **same microphone position**, allowing for the deletion of non-valid results, shall be used for the calculation of the intermediate or final result.

If a sound peak obviously out of character with the general sound pressure level is observed, that measurement shall be discarded.

For measurement of a vehicle in motion (forward and reversing) outdoor, the maximum A-weighted sound pressure level indicated during each passage of **the reference points** of the vehicle between AA' and PP' ( $L_{\text{test},j}$ ) shall be noted for each microphone position, to the first significant digit after the decimal place (for example XX,X).

The reference point for forward conditions is the front plane of the vehicle. The reference point for reverse conditions is the rear plane of the vehicle.

~~For minimum specifications as given in paragraph 6.2.8, results are reported over the distance covered by the reference point from AA' to PP'.~~

~~For maximum specifications as given in 6.2.8, results are reported over the distance covered by the reference point from AA' to PP' plus the vehicle length.~~

For measurement of a vehicle in motion indoor and in standstill (forward and reversing), the maximum A-weighted sound pressure level indicated during each period of 5 seconds for each microphone position,  $L_{\text{test},j}$ , shall be noted, to the first significant digit after the decimal place (for example XX,X). **The measured sound pressure level of both reference points shall be noted.**

For one-third-octave measurements, the frequency range shall be reported from 160 Hz to 5000 Hz. "

*Justification:*

The anticipated and targeted variability of the recorded sound level at each side of the vehicle separably shall be less than 2,0 dB(A). When a microphone array is used (introduced as an

option in this series of amendments) this requirement may be per microphone rather than per side, however this can be seen as a stricter condition.

For the purpose of demonstrating compliance with the sound level requirements as given by paragraph 6.2.8. Table 2a and Table 2b, the sound emission levels shall be measured at both reference points – the leading plane for both requirements, and the trailing edge only for the maximum sound emission requirement. Therefore, the microphones shall be located as shown in Figures 2a and 2b of the Appendix to Annex 3 when measuring according to Method (B), (C) and (D). When measuring according to Method (A) each measurement shall be taken during each passage of the vehicle from the line AA' until PP' plus the vehicle length. Compare with the added text in paragraph 3.3.

These subparagraphs apply only to Method (A) and therefore it is proposed to move them paragraph 3.4.2.

#### 3.4.1. Vehicle stationary (Indoors or outdoors)

For each individual test run  $j$  and microphone position  $i$ , the vehicle A-weighted sound pressure level for each microphone ~~MicLeft<sub>*i*</sub>~~**MicLeft<sub>*i*</sub>** and ~~MicRight<sub>*i*</sub>~~**MicRight<sub>*i*</sub>** shall be measured for a duration of at least 5 s and the maximum value reported as  $L_{\text{MicLeft}_i \text{OA}, j}$  and  $L_{\text{MicRight}_i \text{OA}, j}$ . **For minimum sound requirements, the results at the microphone positions of the reference point are reported. For maximum sound requirements, results at the microphone positions on both planes of the vehicle are reported.**

For each individual test run  $j$  and microphone position  $i$  **at the reference point for forward driving**, the one-third-octave frequency spectrum for each microphone ~~MicLeft<sub>*i*</sub>~~**MicLeft<sub>*i*</sub>** and ~~MicRight<sub>*i*</sub>~~**MicRight<sub>*i*</sub>** shall be measured for a duration of at least 5 s and the maximum hold in each individual one-third-octave-band A-weighted sound pressure level shall be reported as  $L_{\text{MicLeft}_i \text{BAND}, j}$  and  $L_{\text{MicRight}_i \text{BAND}, j}$ .

#### *Justification:*

First the symbol for the microphones have been corrected. Secondly, the same specifications as for the subparagraphs that apply to test of vehicle in motion – Method (A) – has been added. The reference points for both directions shall be measured – the leading plane for both requirements, and the trailing plane only for the maximum sound emission requirement. Therefore, the microphones shall be located as shown in Figures 2a and 2b of the Appendix to Annex 3, as prescribed in paragraph 3.3.

Clarified that the band levels at the front plane for forward driving shall be reported (the band levels at rear plane for both forward and reverse need not be reported). The same correction as previous sub-paragraph has also been made (underscore added between MicLeft/MicRight and  $i$ ).

#### 3.4.2. Vehicle in motion measured with Method (A)

For each individual test run  $j$  and microphone position  $i$ , the vehicle A-weighted sound pressure level for each microphone ~~MicLeft<sub>*i*</sub>~~**MicLeft<sub>*i*</sub>** and ~~MicRight<sub>*i*</sub>~~**MicRight<sub>*i*</sub>** shall be measured between the AA' and PP' line **plus vehicle length** and the maximum value reported as  $L_{\text{MicLeft}_i \text{OA}, j}$  and  $L_{\text{MicRight}_i \text{OA}, j}$ . **For minimum specifications, the maximum sound pressure levels over the distance covered by the reference point from AA' to PP' are reported. For maximum specifications, the maximum sound pressure levels over the distance covered by the reference point from AA' to PP' plus the vehicle length are reported.**

For each individual test run  $j$  and microphone position  $i$ , the one-third-octave frequency spectrum for each microphone ~~MicLeft<sub>*i*</sub>~~**MicLeft<sub>*i*</sub>** and ~~MicRight<sub>*i*</sub>~~**MicRight<sub>*i*</sub>** shall be measured between the AA' and PP' line. The maximum



hold in each individual one-third-octave-band A-weighted sound pressure level shall be reported as  $L_{\text{MicLeft}_i\text{BAND},j}$  and  $L_{\text{MicRight}_i\text{BAND},j}$ ."

*Justification:*

*Brackets have been added on both sides of the "A" in the headline.*

*First the symbol for the microphones have been corrected. Clarified that for minimum specifications as given in paragraph 6.2.8, results are reported over the distance covered by the reference point from AA' to PP' and for maximum specifications as given in 6.2.8, results are reported over the distance covered by the reference point from AA' to PP' plus the vehicle length. These sentences are based on the deleted sentenced from paragraph 3.4.*

*First the symbol for the microphones have been corrected.*

*Annex 3, paragraphs 3.5. to 3.5.3., amend to read:*

"3.5. Data compilation and reported results

For each test condition described in paragraph 3.3., the overall ~~Sound Pressure Level~~ **sound pressure level** and the ~~corresponding~~ one third octave spectra of both sides of the vehicle individually shall be arithmetically averaged and rounded to the first decimal place.

For the measurements of the opposite **side plane** of driving direction at ~~method "B", "C" and "D"~~ **Method (B), (C) and (D)** additional microphones are necessary (see figure 2a , 2b).

The final A-weighted overall sound pressure level results  ~~$L_{\text{crs},10}$ ,  $L_{\text{crs},20}$  and  $L_{\text{reverse}}$~~   **$L_{\text{crs},10}$ ,  $L_{\text{crs},20}$  and  $L_{\text{reverse}}$**  to be reported are the lower values of the two averages of both sides, rounded to the nearest integer. The one third octave band frequency-spectrum, shall be reported for both sides of the vehicle,  $L_{\text{MicLeftBAND}}$  and  $L_{\text{MicRightBAND}}$  .

*Justification:*

*Editorial correction, while sound pressure level is commonly written in low letters.*

*The word "corresponding" has been removed, because the maximum hold for each individual 1/3-octave band that was introduced in 02 series are not necessarily achieved at the same time or position as the maximum OA level.*

*The word "side" in the meaning of leading or trailing edge of the vehicle in motion has been replaced by "plane". The symbols for the test methods have been corrected.*

*The symbols for test results shall be written in italic and have been corrected, and the space between "crs and "10" or "20" has been replaced by a ",".*

3.5.1. Intermediate processing when 5 microphone array is used

For each vehicle operating condition, stationary or moving, the five left and right microphone results shall be processed to provide a single left and right result for each measurement run  $j$ .

The intermediate processing for each measurement run  $j$  and for the five microphone positions  $i$  will produce a single result for the overall sound pressure level for the left and right side of the vehicle and a single one-third octave spectra for the left and right side of the vehicle. All further processing is done using these results.

Figures 6 and 7 in the ~~appendix to Annex A~~ **Appendix to this annex** gives measurement criteria for overall sound pressure level and one-third octave

band sound pressure levels in flowchart form as an aid to measurement and reporting results.

*Justification:*

Editorial correction of the word “appendix” that commonly is spelled with capital “A”, and replacement of “Annex A” for “this annex”. Annex A does not exist.

3.5.2 Maximum A-weighted sound pressure level data compilation

For a given test condition and mode, the four  $j$  test runs are averaged to determine the intermediate result on each side.

For a given test condition and mode, the runs shall be averaged separately for each side.

Calculate  $L_{\text{MicLeftOA}}$

Calculate  $L_{\text{MicRightOA}}$

$$L_{\text{MicLeftOA}} = \left( \sum_{i=1}^4 L_{\text{MicLeft\_OA},j}^{\text{MicLeftOA},j} \right) / 4$$

$$L_{\text{MicRightOA}} = \left( \sum_{i=1}^4 L_{\text{MicRight\_OA},j}^{\text{MicRightOA},j} \right) / 4$$

Calculate the final reported overall sound pressure level for each condition and mode as the lowest of the left and right side.

$$L_{(\text{condition})} = \min(L_{\text{MicLeftOA}}, L_{\text{MicRightOA}})$$

where  $L_{(\text{condition})} = L_{\text{crs},10}$ ,  $L_{\text{crs},20}$  or  $L_{\text{reverse}}$

For each test condition described in paragraph 3.3., the overall ~~Sound Pressure Level~~ **sound pressure level** both sides of the vehicle individually shall be arithmetically averaged and rounded to the first decimal place.

For the measurements at the **front plane** ~~frontline~~ of the vehicle according to annex 3 Paragraph 3.3.2. with Method ~~B, C and D~~ **(B), (C) and (D)** additional microphones are necessary and to be rounded to the first decimal place.

*Justification:*

*Annex 3, paragraph 3.5.2:* Editorial correction of the missing underscore between “LMicLeft/LMicRight” and “OA, $j$ ”), and the typeface of the subscript of the first formula.

The variable “condition” has been defined in the fourth paragraph (the third formula –  $L_{(\text{condition})}$  etc.).

Editorial correction, while sound pressure level is commonly written in low letters.

“frontline” has been replaced with “front plane” in alignment with the agreed language above.

3.5.3 One-third-octave sound pressure level data compilation

For a given test condition and mode, the four  $j$  test runs are averaged to determine the result on each side.

$$L_{\text{MicLeftBAND}} = \left( \sum_{i=1}^4 L_{\text{MicLeft\_BAND},j}^{\text{MicLeftBAND},j} \right) / 4$$

$$L_{\text{MicRightBAND}} = \left( \sum_{i=1}^4 L_{\text{MicRight\_BAND},j}^{\text{MicRightBAND},j} \right) / 4$$

Any further processing of the one-third-octave-band values shall use these results.

Both the  $L_{\text{MicLeftBAND}}$  and the  $L_{\text{MicRightBAND}}$  shall be reported.

Report one-third octave bands as specified in paragraph 6.2.8., Table 3. "

*Justification:*

Editorial correction of the missing underscore between "LMicLeft/LMicRight" and "BAND,j"), and the typeface of the subscript of the first formula.

*Annex 3, paragraph 4.1., amend to read:*

"4.1. General

The provisions on frequency shift outlined in 6.2.3 of the main body shall be checked using one of the test methods ~~A, B, C and D~~ **(A), (B), (C) and (D)** to be selected by the manufacturer.

..."

*Justification:*

Editorial correction by adding parenthesis. Method (A) has been added as this test method also has the capacity to properly detecting the frequency shift. The competent test engineer should choose the test method appropriate with regards to the circumstances.

*Annex 3, paragraphs 4.3. to 4.3.3., amend to read:*

"4.3. Test methods

~~— The vehicle sound emission tests, which are basis for the type approval test shall be~~ **The type approval has to be** "

*Justification:*

Editorial correction: The text under the headline was erroneously added during the process of drafting GRBP/2024/2 and did not exist in the 01 series of amendment of UN R138.

4.3.1. Method (A)

The vehicle shall be operated in the same outdoor test facility and according to the same general operating condition as for the vehicle constant speed testing (paragraph 3.3.2 and paragraph 3.3.3.).

**The vehicle sound emission shall be measured at target speeds of 10 km/h to 20 km/h in steps of 5 km/h with a tolerance of  $\pm 2$  km/h for the speed of 10 km/h and of  $\pm 1$  km/h for any other speeds.**

*Justification*

*Annex 3, paragraph 4.3.1., 4.3.2., 4.3.3.:* The definition of the test speeds for frequency shifts was deleted in the 02 series. To reliably validate a frequency shifting with speed at least 3 checking speeds should be assessed, as defined in 01series. It shall be noted that in series 01 the vehicle shall, if possible, be tested in 5 km/h or at the lowest possible speed above 5 km/h. That means that cars that cannot drive in a normal way in 5 km/h can be tested at a higher speed. To avoid any misunderstandings the requirement for testing in 5 km/h in Method (A) has not been introduced again.

4.3.2. Method (B) and Method (D)

The vehicle shall be operated in a test facility where the vehicle can accept an external vehicle speed signal to the AVAS simulating vehicle operation. The microphone locations shall be as for the complete vehicle test conditions as

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specified in Figure 2a of the Appendix to this annex. The front plane of the vehicle shall be placed on line PP’.

**The vehicle sound emission shall be measured at simulated speeds of 5 km/h to 20 km/h in steps of 5 km/h with a tolerance of  $\pm 0.5$  km/h for each test speed.**

*Justification:*

The definition of the test speeds for frequency shifts was deleted in 02 series. To reliably validate a frequency shifting with speed at least 3 checking speeds should be assessed, as defined in 01 series. So, restore the test speed conditions from the 01 series

4.3.3. Method (C) – ~~Indoor facility and vehicle in motion~~

The vehicle shall be installed in an indoor test facility where the vehicle can operate on a chassis dynamometer in the same manner as outdoors. All microphone locations shall be as for the vehicle test conditions as specified in Figure 2a of the Appendix to this annex. The front plane of the vehicle shall be placed on line PP’.

**The vehicle sound emission shall be measured at target speeds of 5 km/h to 20 km/h in steps of 5 km/h with a tolerance of  $\pm 2$  km/h for the speed of 10 km/h or less and of  $\pm 1$  km/h for any other speeds. The speed of 5 km/h is the lowest target speed. If the vehicle cannot be operated at this speed within the given precision, the lowest possible speed below 10 km/h shall be used instead. "**

*Justification:*

The headline of 4.3.3. has been shortened by only keeping “Method (C)”, in alignment with previous paragraphs.

The definition of the test speeds for frequency shifts was deleted in 02 series. To reliably validate a frequency shifting with speed at least 3 checking speeds should be assessed, as defined in 01 series. So, restore the test speed conditions from the 01 series.

*Annex 3, paragraph 4.4.2., amend to read:*

"4.4.2. Test Methods (B), (C) and (D)

The emitted sound shall be measured at every speed specified in correlated paragraphs above for at least 5 seconds.<sup>19</sup>

<sup>19</sup> **Note: As an aid for measurement of frequency shift see flowchart in Figure 7a-8a, 7b-8b or 7e 8c of the Appendix to this annex.**

---

\* **Note by the secretariat: as an aid for measurement of frequency shift see flowchart in Figure 7a, 7b or 7e of the Appendix to this annex. "**

*Justification:*

The note by the secretary should be updated with the correct numbering of the Figures in Appedix.

Annex 3, paragraphs 4.5. and 4.5.1., amend to read:

"4.5. Signal Processing

...

Table 4  
**Analysis of the shifted frequency per target condition per side**

| Target speed | Test run per target condition | Reported speed (average per sample segment) | Determined frequency of interest ( $f_{j, speed}$ ) | Reported Speed per target condition (average of the reported speeds) | Reported frequency of interest per target condition ( $f_{speed}$ ) |
|--------------|-------------------------------|---|---|--|---|
| km/h         | No                            | km/h  | Hz  | km/h   | Hz  |
| 5*           | 1                             |   |   |  |   |
|              | 2                             |   |   |  |   |
|              | 3                             |   |   |  |   |
|              | 4                             |   |   |  |   |
| 10           | 1                             |   |   |  |   |
|              | 2                             |   |   |  |   |
|              | 3                             |   |   |  |   |
|              | 4                             |   |   |  |   |
| 15           | 1                             |   |   |  |   |
|              | 2                             |   |   |  |   |
|              | 3                             |   |   |  |   |
|              | 4                             |   |   |  |   |
| 20           | 1                             |   |   |  |   |
|              | 2                             |   |   |  |   |
|              | 3                             |   |   |  |   |
|              | 4                             |   |   |  |   |

**\*) 5 km/h is not mandatory for Method (A).**~~not for Method A~~

For all other test methods the derived frequency spectrum shall directly be used for the further calculation.

*Justification:*

With the added text about the conditions for verification of frequency shift in paragraph 4.3.1. there is no need for general exclusion of 5 km/h for Method (A). Instead, the speed of 5 km/h may be increased to the minimum speed that works for the test.

4.5.1. Data compilation and reported results

...

Table 5  
**Report table, to be completed for each frequency analysed**

|  |                                      |
|--|--------------------------------------|
|  | <i>Test Results at Target Speeds</i> |
|--|--------------------------------------|

|  |      | 5 km/h*<br>(Reference) | 10 km/h<br>(Reference*) | 15km/h | 20<br>km/h |
|--|------|------------------------|-------------------------|--------|------------|
| Reported Speed                         | km/h |                        |                         |        |            |
| Frequency, $f_{speed}$ , Left Side     | Hz   |                        |                         |        |            |
| Frequency, $f_{speed}$ , Right Side    | Hz   |                        |                         |        |            |
| Frequency Shift, $del\_f$ , Left Side  | %    | n.a.                   | n.a.*                   |        |            |
| Frequency Shift, $del\_f$ , Right Side | %    | n.a.                   | n.a.*                   |        |            |

\*) **5 km/h is not mandatory for Method (A)** ~~not for Method A "~~

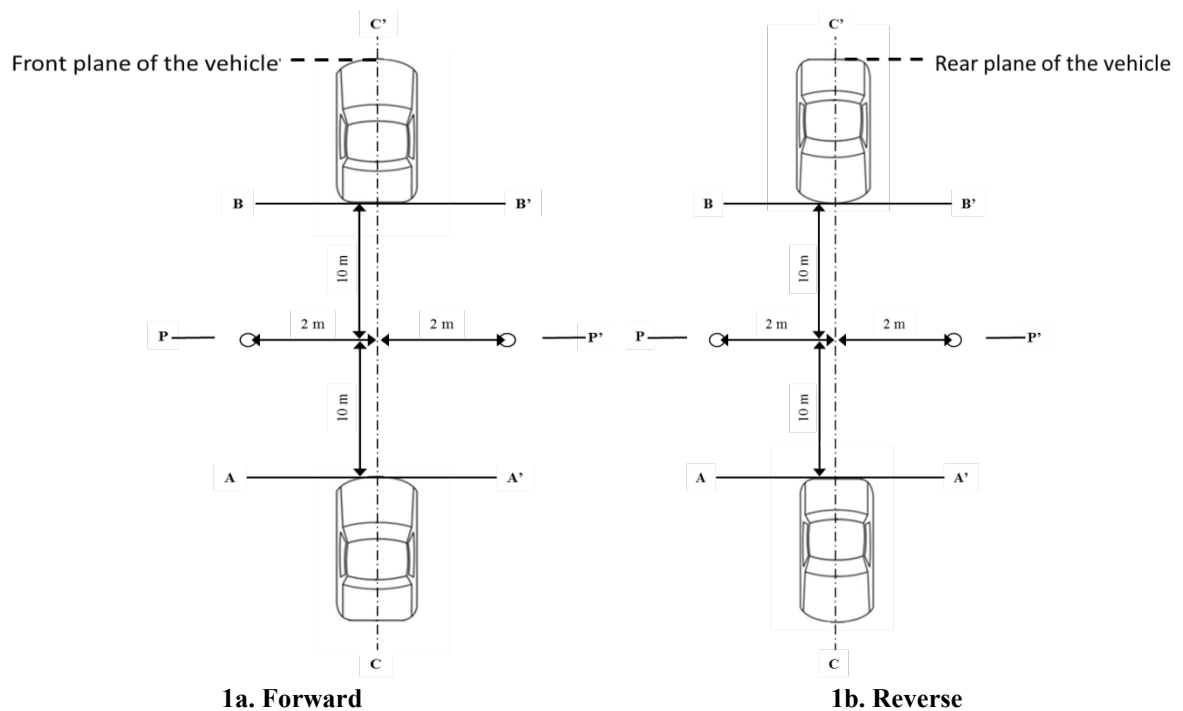
*Justification:*

With the added text about the conditions for verification of frequency shift in paragraph 4.3.1. there is no need for general exclusion of 5 km/h for Method (A). Instead the speed of 5 km/h may be increased to the minimum speed that works for the test.

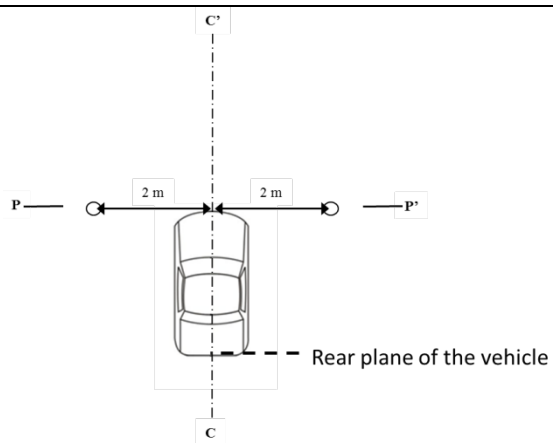
Annex 3, Appendix, amend to read:

**"Figures and flowcharts**

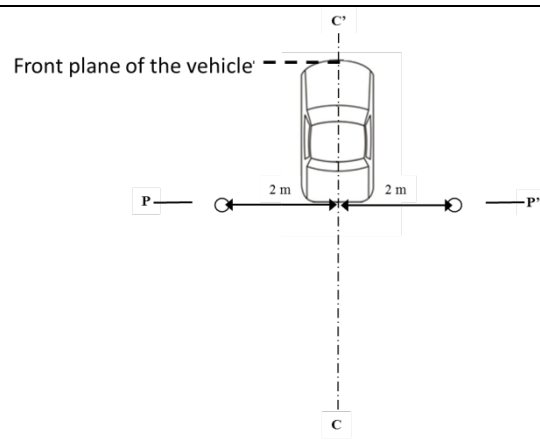
Figures 1a and 1b  
**Measuring positions for vehicles in motion outdoor**



Figures 2a and 2b  
**Measuring positions for vehicles in motion indoor and in standstill**  
~~additional 2 microphones needed at the front and in the back in 2 m distance~~



**2a. Forward** Measuring position at the front plane of the vehicle

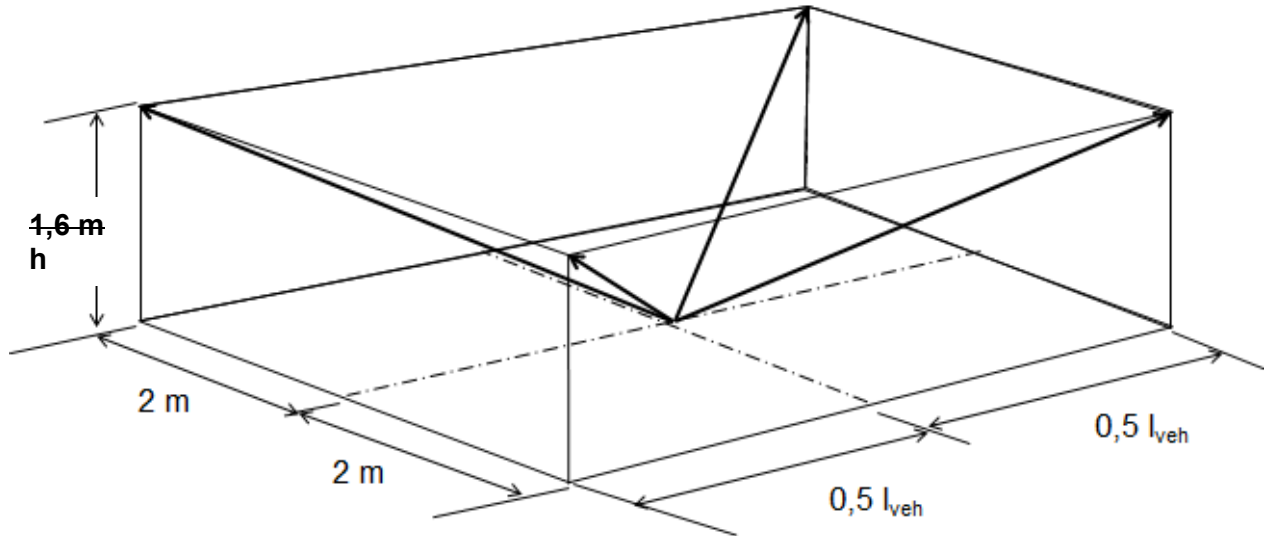


**2b. Reverse** Measuring position at the rear plane of the vehicle

The microphone set-up of figures 2a and 2b are required for both forward and reverse testing.

The microphone set-up of figure 2a is required for the measurement of frequency shift.

Figure 3  
Minimum space to be qualified as Semi-Anechoic chamber



The height  $h$  shall be at least  $1,2\text{ m}$  if the test in this annex is done with 1 microphone at each side. The height  $h$  shall be at least  $1,6\text{ m}$  if 5 microphone array at each side is used.

*Justifications linked to Figure 1 and 2:*

Correction of the figure texts to clarify that the illustrated measurement set-ups are showing the microphone positions relative the front plane and the rear plane respectively.

Added text to clarify that the microphone set-up in Figure 2a and/or 2b shall be used.

*Justification linked to Figure 3:*

The figure description and the figure has been modified to cover both the one-microphone set-up as well as the five-microphone set-up defined in Annex 3, paragraph 3.1.



Figure 4  
**Background Noise Measurement**

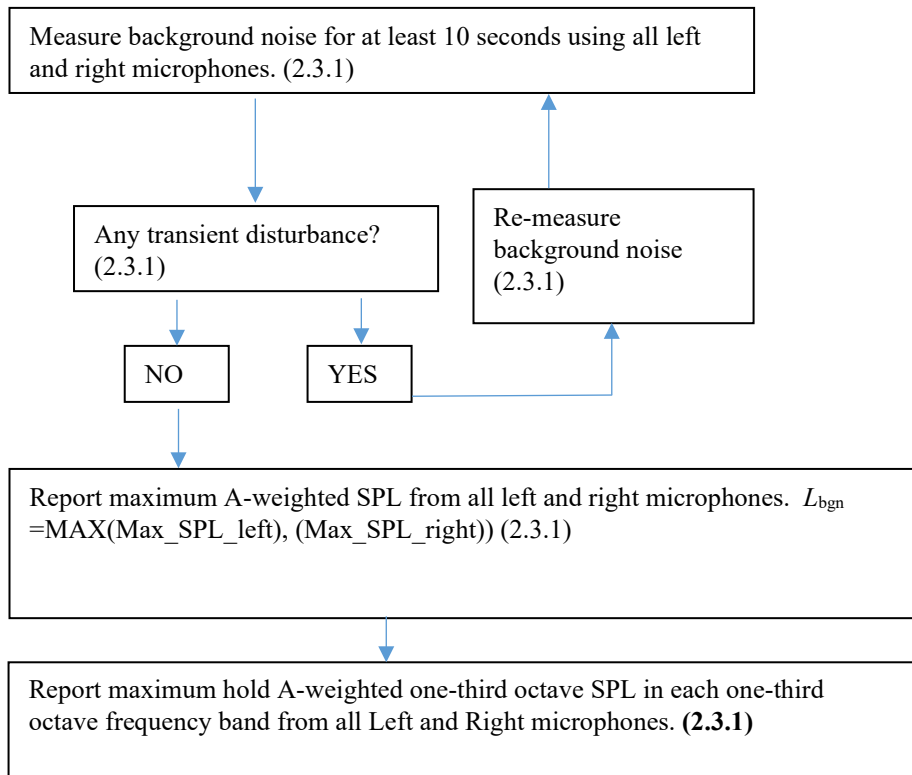


Figure 5  
Background noise requirements

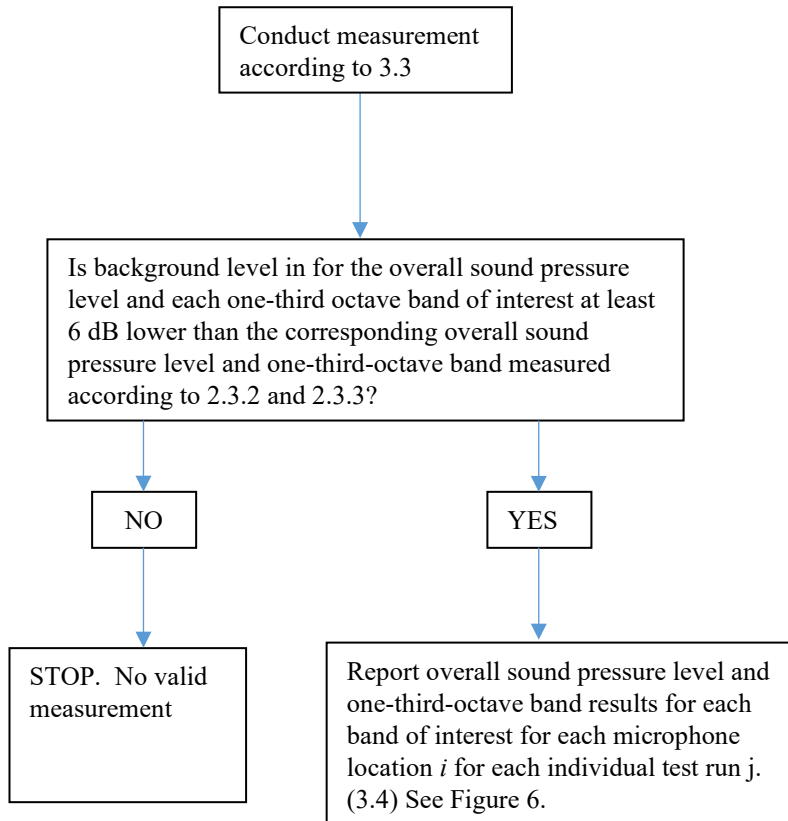
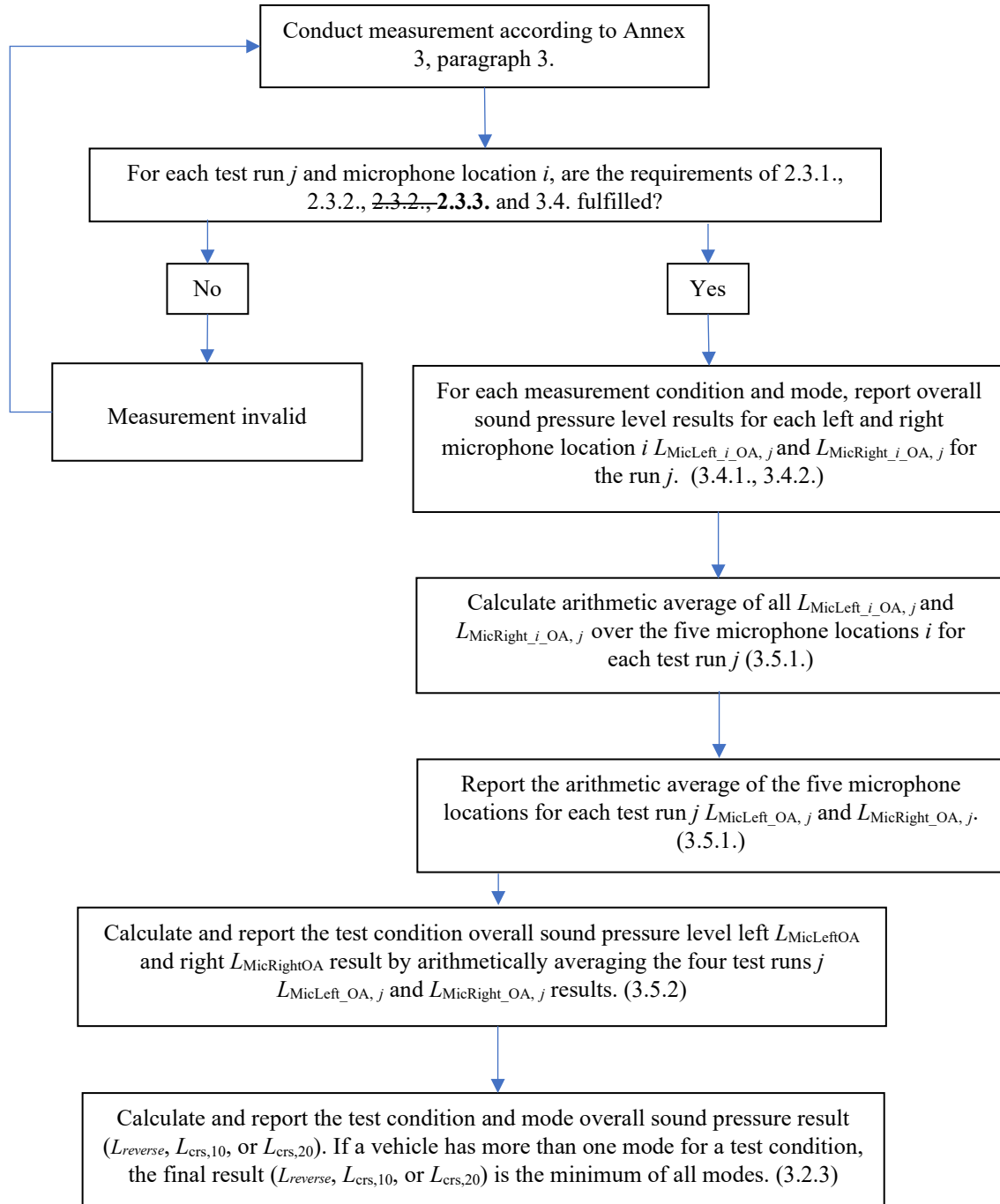


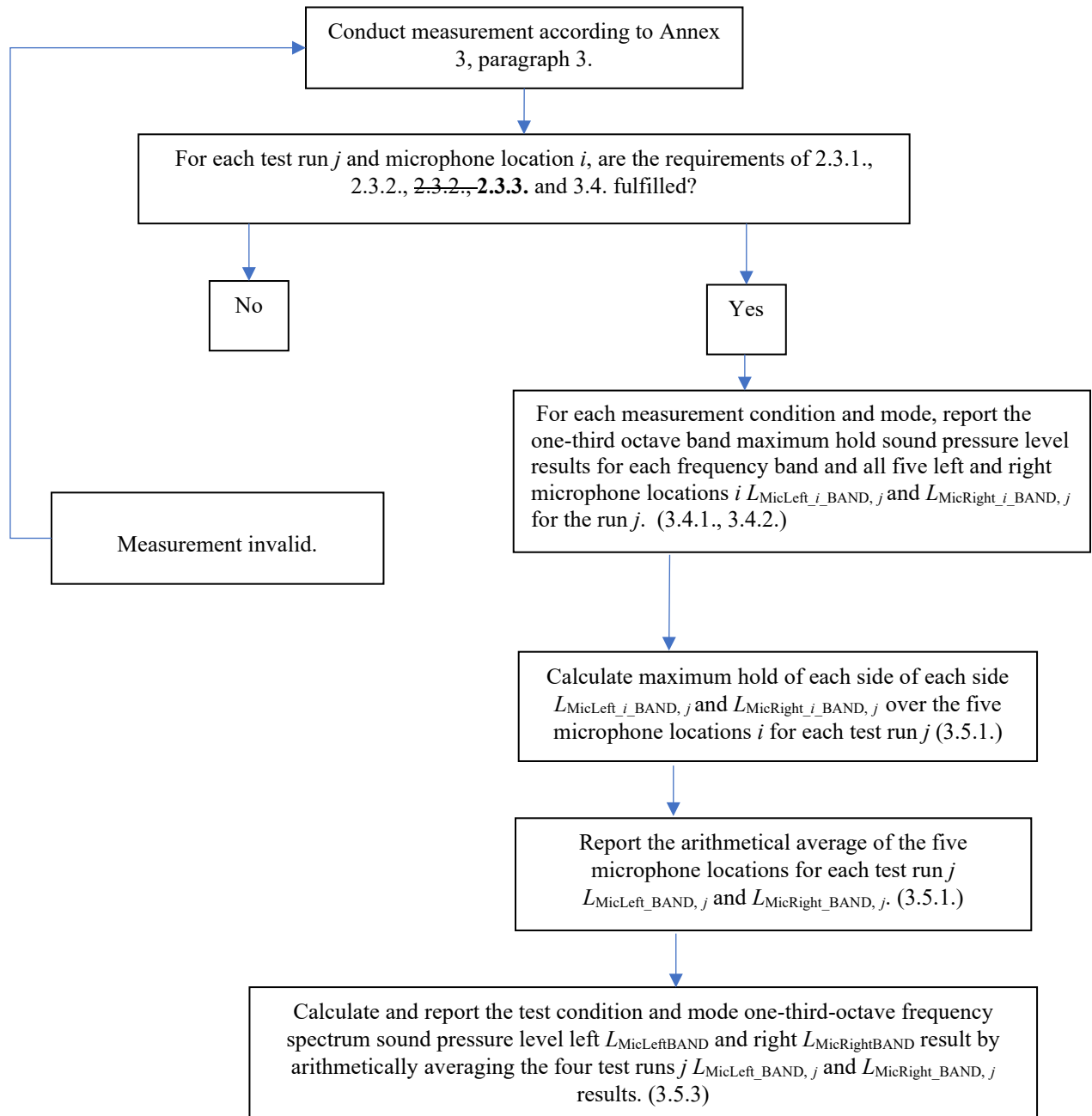
Figure 6.  
**Flowchart for the procedure to measure and report overall A-weighted sound pressure levels**



The purpose of Figure 6 is to show how to go from the five microphone results for each measurement run to a final answer. It conceptually has two major steps:

1. First reduce the five microphones to a single result for each measurement run  $j$ . In this case, the maximum overall sound pressure level in each microphone  $i$  is arithmetically averaged to produce the final result.
2. Average the four  $j$  measurement runs to provide the final answer for the test condition and mode.

Figure 7.  
**Flowchart for the procedure to measure and report A-weighted one third octave sound pressure levels**



The purpose of Figure 7 is to show how to go from the five microphone results for each measurement run to a final answer. It conceptually has two major steps:

1. First reduce the five microphones to a single result for each measurement run  $j$ . In this case, the maximum one-third-octave sound pressure level in each frequency in each microphone  $i$  is measured. Then these five spectra are again reduced to a single spectrum by taking the maximum one-third-octave sound pressure level in each frequency. The result is then the reported frequency spectrum for a given test run  $j$ .
2. Average the four  $j$  measurement runs to provide the final answer for the test condition and mode.

Figure 78a  
Test procedures for measurement of frequency shift

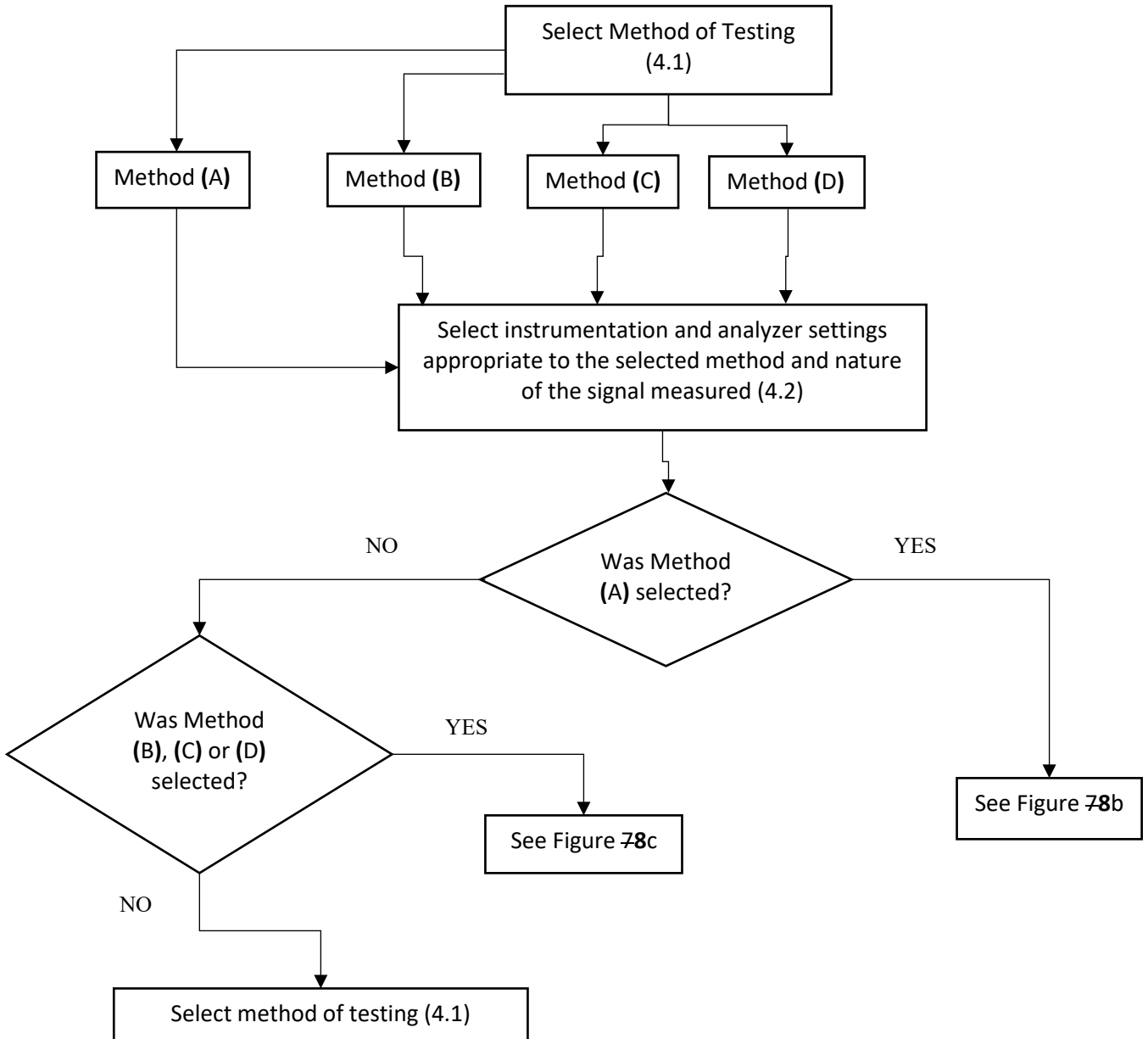
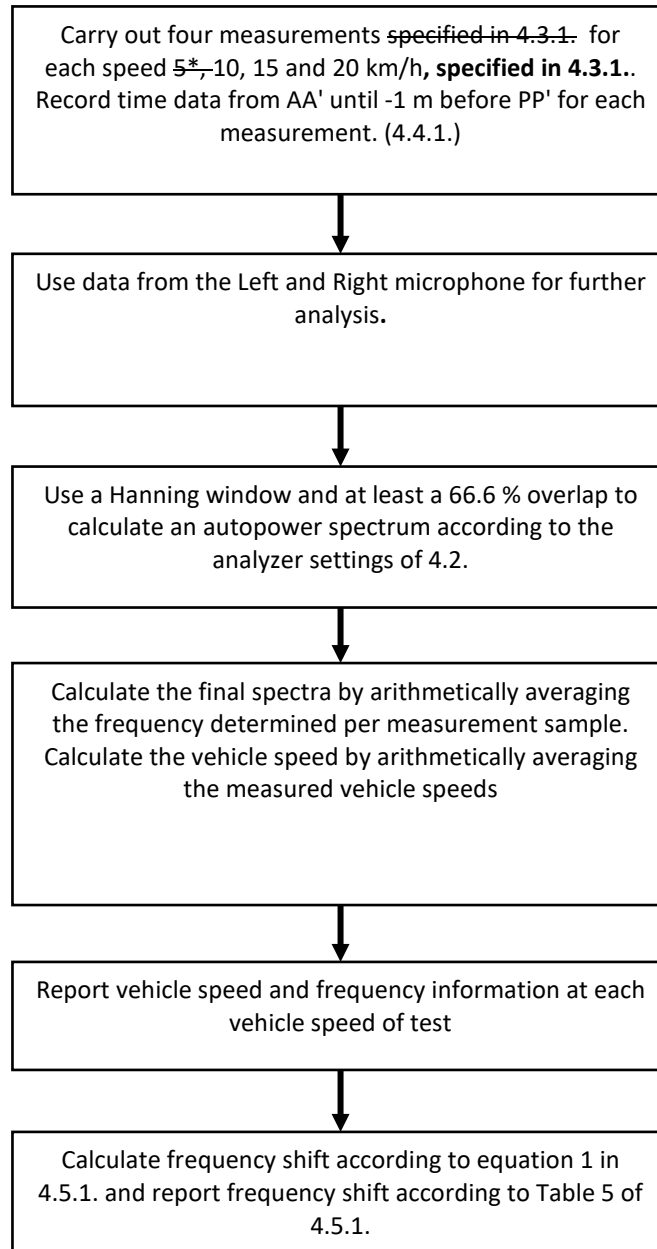
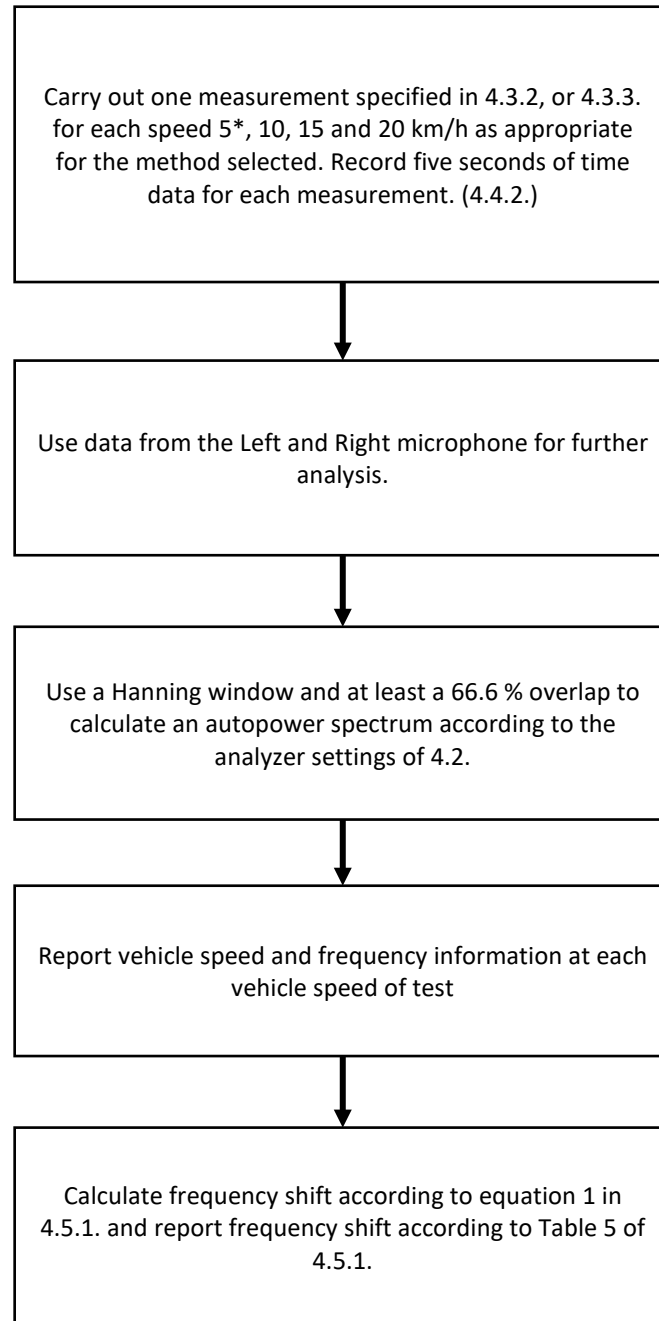


Figure 78b  
**Test procedures for measurement of frequency shift, Method (A)**



\*) 5 km/h is not mandatory for Method (A) ~~not for Method A~~

Figure 78c  
**Test procedures for measurement of frequency shift, Methods (B), (C) and (D)**



\*) not for Method A “

*Justification:*

Correction of the number of the Figures and the symbols for the test methods with brackets around the letter – Methods (B) etc.

The exemption for vehicles that are unable to run properly at 5 km/h in Method (A) has been adjusted in Figure 8b and has been deleted in Figure 8c, since this Figure is about (B), (C) and (D).

## **II. Justification**

1. All justifications have been placed inside the text flow above for clarity.
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