INTERNATIONAL RECOMMENDATION

OIML R 91-2

Edition 202x (E)

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Traffic speed meters

Part 2: Test procedures

Cinémomètres pour la mesure de la vitesse des véhicules

Partie 2: les procédures d'essai

OIML R 91-2 Edition 202x (E)

ORGANISATION INTERNATIONALE DE METROLOGIE LEGALE

INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

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Foreword

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This publication – reference OIML R 91-2, Edition 20xx – was developed by Project Group 3 of Technical Subcommittee TC 7/SC 4 – *Speed meters*. It was approved for final publication by the International Committee of Legal Metrology at its xxth meeting in October 202x. It supersedes the previous edition of R 91 dated 1990.

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1 Introduction

This OIML Recommendation R 91-2 covers the preparation of the test program, selection of test procedures and setting of test levels for speed meters.

This recommendation is used for the type evaluation of speed meters.

2 Test program

The test program shall be prepared to prove that the speed meter or its parts fulfil general, performance and durability requirements from OIML R 91-1 for type evaluation.

The test program shall first determine which test procedures are necessary and which test levels shall apply.

It shall cover:

a. Requirements from OIML R 91-1:202x.
b. Influence factors and disturbance tests according to OIML D 11 [1], and
c. Software tests according to OIML D 31 [2].

3 Requirements from OIML R 91-1

Metrological requirements are stated in clause 5 of OIML R 91-1 and technical requirements are stated in clause 6 of OIML R 91-1.

4 Metrological field test

4.1 General conditions

This test is for stationary speed meters and for moving speed meters in stationary mode. The metrological field test for moving speed meters in moving mode is described in clause 7.7.1.

All conditions shall be within rated operating conditions of the EUT and of the reference speed meter.

Installation of the EUT shall be done according to the user manual.

Tests shall contain conditions to test minimal, typical and maximal distances from the EUT to the measured vehicles. If intervals of alignment parameters (azimuth, elevation, side distance and height) are specified by the manufacturer at least three different installation conditions shall be tested.

If the speed meter can be used to measure approaching and departing vehicles, both driving directions shall be tested.

The EUT and the reference speed meters shall be installed, configured and triggered such that their corresponding measurement sections are overlapping as much as possible and are aligned centrally. If a perfect matching of the measurement sections is not possible the test laboratory shall ensure by other means that the speed comparison is valid even in worst-case scenarios (drivers braking and/or accelerating). Such means might include an estimation of the influence of a worst-case scenario or the detection and exclusion of worst-case scenarios by the use of secondary reference speed meters which cover other measurement sections than the reference speed meter.

4.2 Choice of test sites

It is recommended that the metrological field tests should be completed in real traffic conditions. It might be necessary to perform measurements at several test sites to include all of the following aspects:

a. The speed of the vehicles shall cover the interval from the minimum specified speed to the maximum legal speed on motorways.

b. The occurrence of all types of vehicles: cars, motorcycles, small trucks, vehicles with trailers, and long vehicles such as busses or trucks.

c. A motorway with at least two lanes in the same driving direction, where overtaking occurs regularly during measurements.

d. A road with at least two lanes with traffic in opposite directions (departing and approaching traffic).

On all test sites, the traffic on the road shall generally go smoothly, and shall not be prone to congestion or very small distances between vehicles. The vehicles shall generally not brake abruptly or accelerate close to the site of measurement.

The roads at all test sites, shall be straight or have a curve radius larger than the specified minimum curve radius of the EUT. Additional field or simulation tests are required for across-the-road speed meters that have a specified minimum curve radius lower than the road used for the metrological field test.

4.3 Traffic condition during measurement

The traffic should not be congested during the measurement, which shall be the case when the average speed of the vehicles is above 80 % of the normal (uncongested) average speed and when the average temporal distance between vehicles driving on the same lane is above 1.8 s.

4.4 Number of measurements

In case of automatic measurements a total number of at least 500 valid measurements shall be performed. In case of manual measurements a total number of at least 50 valid measurements shall be performed. Lower numbers of measurements are possible if measurements take long (as might be the case when testing average speed meters) and if this is justified by a statistical analysis of errors.

Larger numbers of measurements might be necessary when several installation conditions or specific scenarios are tested.

The number of valid measurements has to be indicated in the report.

4.5 Reference speed meter

The reference speed meter shall preferably perform automatic measurements. Justified exceptions are possible, for example, when the reference speed meter is moving (as might be the case when testing average speed meters).

The expanded measurement uncertainty ($k = 2$) of the reference speed meter for single measurements shall not exceed 0.6 km/h at speeds up to and including 100 km/h and 0.6 % of the speed value at speeds above 100 km/h.

For the mean of a sequence of measurements, the expanded measurement uncertainty ($k = 2$) of the reference speed meter shall not exceed 0.25 km/h at speeds up to and including 100 km/h and 0.25 % of the speed value at speeds above 100 km/h.

If these uncertainties cannot be met, larger measurement uncertainties can be used, if the added uncertainty is compensated for in the maximum permissible error and in the possible statistical analysis of errors (see clause 4.7).

4.6 Maximum permissible error

The MPE defined in clause 6.4 of R 91-1 shall be respected in all measurements. In the following two cases the EUT shall be considered in accordance with the relevant MPE, even if some measurements have a negative error below the lower MPE value:

a. The EUT is an along-the-road speed meter and the error would be within the relevant MPE if the cosine error would be corrected.

b. The EUT uses the mathematical operation "rounding toward zero (truncating)" to obtain integer speed values and the error would be within the relevant MPE if "rounding to the nearest integer" would have been implemented.

The simple acceptance decision rule (also known as shared risk decision rule) shall be used to decide on conformity. Measurements on vehicles for which either the EUT or the reference speed meter gives no valid speed value shall be ignored.

4.7 Statistical analysis of errors (optional)

A statistical analysis of errors for a sequence of measurements is recommended. For this purpose the errors are subdivided into bins according to the reference speed values. The recommended series of intervals, which serve as bins are: [0 km/h, 50 km/h], [50 km/h, 100 km/h], [100 km/h, 150 km/h], [150 km/h, 200 km/h], etc. Intervals of smaller or larger sizes may be used, depending on the circumstances. The mean value m and the standard deviation σ are than calculated within each bin. A factor z is chosen which is a measure of confidence (the recommended value is $z = 5$). The EUT shall be considered in accordance with the relevant MPE if the interval $[m - z\,\sigma, m + z\,\sigma]$ is fully within the MPE defined in clause 6.4 of R 91-1.

4.8 Assignment to image evidence

The timing and markings of the image evidence must be correct for all measurements. There must be no doubt about the correct assignment of the measured values to the vehicle visible on the image evidence, in particular in the case of overtaking procedures or when the distance from the EUT to the measured vehicles is near the minimal or maximal specified value.

If the measurements at speed values inside the legal interval give rise to any suspicion that the correct assignment might not be guaranteed at speeds above the legal limit, additional field measurements in a protected environment are necessary.

4.9 Speed ~~values~~ measurements outside the legal interval

The metrological performance of the EUT outside the legal speed interval shall be tested either:

a. By performing additional field measurements in a protected environment (for example, on a race circuit).

b. By performing metrological laboratory tests using a validated complete traffic simulator.

5 Metrological laboratory tests by traffic simulation

5.1 General conditions

These simulation tests are for stationary speed meters and for moving speed meters in stationary mode. The ego speed meter of moving speed meters shall be tested using a separate simulation test (see also clause 7.7).

All conditions shall be within rated operating conditions. The ambient temperature shall be within the interval 23 °C ± 5 °C and the relative humidity shall be within the interval 50 % RH ± 30 % RH.

5.2 Characteristics of the traffic simulator

The traffic simulator used for the metrological laboratory test shall be a ~~device, that~~device that is independent ~~from~~ of the speed meter.

The traffic simulator shall generate a signal such as an electrical pulse sequence, light pulses or an electromagnetic radiation pattern, ~~which~~ that corresponds to a vehicle driving at a known speed.

If possible, the use of a complete traffic simulator is recommended (see Figure 1). A partial traffic simulator as illustrated in Figure 2 may be used, if the parts of the measurement chain of speed meter, ~~which~~ that are not covered by the partial traffic simulator, are tested by an appropriate additional test. The partial traffic simulator shall introduce an analogue or digital signal as early as possible into the measurement chain.

The expanded measurement uncertainty ($k = 2$) of the simulated reference speed shall not exceed 0.25 km/h at speeds up to and including 100 km/h and 0.25% of the speed value at speeds above 100 km/h.

The traffic simulator shall be validated by comparing the results of a measurement series on the road with the results of a simulation of a measurement series using the same EUT and simulating the same conditions as where present on the road.

Figure 1 – Complete traffic simulator for the example of a Doppler-radar based speed meter. The simulator introduces the same type of signal in the speed meter as a vehicle (microwave radiation in this case).

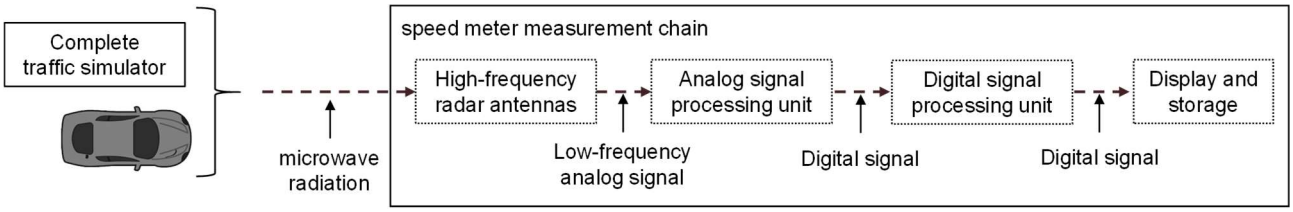
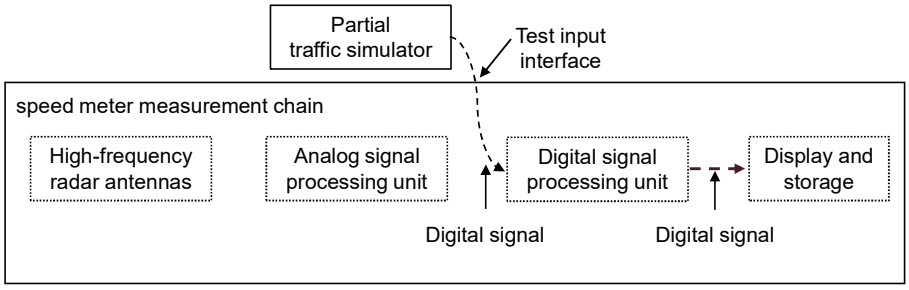


Figure 2 – Example of a partial traffic simulator for a Doppler-radar based speed meter, which introduces a digital signal. Parts of measurement chain, which are not tested by the partial traffic simulator, shall be tested by other appropriate additional tests or means.



5.3 Dynamic performance test

The purpose of the dynamic performance test is to simulate the conditions of the metrological field test as closely as possible, including a possible distribution and variation of the measurement angle and possible vehicle-shape related effects. The simulator used for the dynamic performance test shall be validated by comparing the results of the simulation to the results of the metrological field test using the same device in the same measuring interval.

The simulator shall be configured such that one of the installation conditions tested in the metrological field tests is simulated. If the speed meter can be used to measure approaching and departing vehicles, both driving directions shall be tested.

The simulated speed values shall be randomly chosen from a uniform distribution covering the full specified measuring interval and the acceleration values shall be randomly chosen from a uniform distribution covering the interval between −1.5 m/s^2 and 1.5 m/s^2. The relevant simulated reference speed is the speed on the identical measurement section as used by the EUT.

~~The expanded measurement uncertainty (k = 2) of the simulated reference speed shall not exceed 0.25 km/h at speeds up to and including 100 km/h and 0.25% of the speed value at speeds above 100 km/h.~~

A total number of at least 500 valid simulation measurements shall be performed. To decide on conformity the same MPE and statistical methods as in the metrological field test shall be used.

5.4 Speed linearity test (optional)

The purpose of the speed linearity test is to reveal the characteristics of the speed meter under ideal conditions (i.e. with minimized influence factors). The simulator shall be used without variation of measurement angle and without simulating vehicle-shape related effects. The type of vehicle shall be constantly a car with lengths 5 m and the acceleration shall be constantly 0 m/s^2. The simulated trajectory of the vehicles shall be straight and the measurement angle shall be constantly 0°, if applicable.

Before the actual test, the mathematical operation used by the speed meter to obtain the indicated integer speed values from the higher resolution values given at the test interface is checked. For the evaluation of the error in the speed linearity test, the high-resolution speed values from the test interface of the EUT shall be used or the rounding shall be compensated.

The speed linearity test shall be carried out at least at 10 speed values within the specified measuring interval. The EUT shall give valid speed values for each simulated vehicle. The speed meter shall respect the linearity error limit specified in clause 6.5 of R 91-1.

5.5 Distance linearity test (optional)

The purpose of the optional distance linearity test is to reveal the accuracy of the distance measurements of the EUT under ideal conditions. The simulated vehicle shall be in standstill (speed 0 km/h) and the measurement angle shall be 0°.

The distance linearity test shall be carried out at least at 10 distances of the specified distance interval. The EUT shall give valid distance values for each simulated vehicle. The speed meter shall respect the error limits specified by the manufacturer.

5.6 Angle linearity test (optional)

The purpose of the optional angle linearity test is to reveal the accuracy of the angle measurements of the EUT under ideal conditions. The simulated vehicle shall be in standstill (speed 0 km/h) and the distance shall be a typical value within the specified distance interval.

The angle linearity test shall be carried out at least at 10 angles of the specified angle interval. The EUT shall give valid angle values for each simulated vehicle. The speed meter shall respect the error limits specified by the manufacturer.

6 Influence factor and disturbance tests

Test procedures for influence factors and disturbances are defined in OIML D 11 [1], clauses 9 – 14, including the referenced IEC and ISO publications. Details about the tests which go beyond those defined in OIML D 11 [1], clauses 9 – 14 shall be done according the test levels specified by the manufacturer.

Nevertheless, the test laboratory should take into consideration and re-evaluate the manufacturer's specification based on:

- simulation technique to be used;
- point of use and principle of installation of the EUT (see clause 5 of R91-1);
- installation instructions and further detailed specifications by the manufacturer

before the final test plan is prepared.

6.1 Evaluation method

Following table represents evaluation method environmental conditions:

Table 1 – Influence factors and disturbances

#	Influence quantity exposure	Table(s) from OIML D 11 [1]	Evaluation	
1	Dry heat (operating)	6	I	MPE
2	Dry heat (storage)	6	D	NSFa
3	Cold (operating)	7	I	MPE
4	Cold (storage)	7	D	NSFa
5	Damp heat, steady-state (non-condensing)	8	I	MPE
6	Damp heat, cyclic (condensing)	9	D	NSFa
7	Water	10	D	NSFa
8	Atmospheric pressure (optional)	11,12	I	MPE
9	Sand and dust (optional)	13	D	NSFa
10	Salt mist (optional)	14	D	NSFa
11	Vibration	15,16	I	MPE
12	Mechanical shock	17	D	NSFa
13	DC mains voltage variation	18	I	MPE
14	Ripple on DC mains power	19	D	NSFd
15	AC mains voltage variation	20	I	MPE
16	AC mains frequency variation	21	I	MPE
17	DC mains voltage dips, short interruptions and reductions	22	D	NSFd
18	AC mains voltage dips, short interruptions and voltage reduction	23	D	NSFd
19	AC mains harmonics	24	D	NSFd
20	VLF and LF disturbances on AC and DC mains	25	D	NSFd
21	Bursts (transients) on AC and DC mains	26	D	NSFd
22	Surges on AC and DC mains power	27	D	NSFa
23	Bursts (transients) on signal, data and control lines	28	D	NSFd
24	Surges on signal, data and control lines	29	D	NSFd
25	Mains power frequency magnetic field	30	D	NSFd
26	Conducted (common mode) currents generated by RF EM fields	31	D	NSFd
27	RF electromagnetic fields	32,33,34	D	NSFd
28	Electrostatic discharge	35	D	NSFd
29	Low voltage of internal battery	36	I	MPE
30	Voltage variations of a road vehicle battery	37	I	MPE
31	Electrical transient conduction along supply lines of external 12 V and 24 V batteries (pulses 2a, 3a, 3b)	38	D	NSFd
32	Electrical transient conduction along supply lines of external 12 V and 24 V batteries (pulse 2b)	38	D	NSFa

#	Influence quantity exposure	Table(s) from OIML D 11 [1]	Evaluation	
33	Electrical transient conduction via lines other than supply lines for external 12 V and 24 V batteries	39	D	NSFd
34	Battery voltage variations during cranking	40	D	NSFd
35	"Load dump" test	41	D	NSFa

Note:

I Influence factor

D Disturbance

MPE Maximum permissible error defined in clause OIML R91-1, 6.4 ~~are~~ is respected during the presence of the influence factor (in relation to OIML D 11:2013 [1] MPE)

NSFa No significant fault occurred after the disturbance

NSFd No significant fault occurred during the disturbance

6.2 Reference conditions

Reference conditions are the following:

a. Ambient temperature : 23 °C ± 5 °C, and
b. Relative humidity : 50 % RH ± 30 % RH.

During each test at reference conditions, the temperature and the relative humidity shall not vary by more than 5 °C and 30 % RH, respectively, within the reference intervals. AC mains voltage and frequency (if appropriate) shall be maintained at their nominal values.

6.3 Traffic simulation before and after the presence of disturbances

The speed meter shall pass the dynamic performance test as specified in clause 5.3 before and after the presence of the disturbance. The fault values shall be~~is~~ determined from simulation with all influence factors minimized ~~from the mean error of at least 25 measurements~~.

6.4 Traffic simulation during the presence of influence factors and disturbances

During the presence of influence factors and disturbances it is recommended to repeatedly cycle over a preselected list of reference speed values, which shall cover the full specified measuring interval and shall consist of at least 5 distinct values and including 100 km/h. Alternatively, it is possible to repeatedly carry out the dynamic performance test as specified in clause 5.3.

The use of a complete traffic simulator is recommended.

As few parts of the traffic simulator as possible shall be exposed to the influence factor/disturbance, the other parts being held at reference conditions.

If there is the possibility that parts of the traffic simulator are damaged or influenced by the influence factor/disturbance, the use of a partial traffic simulator is possible. Parts of measurement chain, which are not tested by the partial traffic simulator, shall be tested by other appropriate additional tests or means.

6.5 Checking facilities

The test procedures for dry heat (operating), cold (operating) and DC/AC voltage variations ~~might~~ shall also include the testing of the corresponding checking facilities. The test report shall state if and how the checking facilities were tested.

6.6 Acceleration test

Accelerations in the interval between −1.5 m/s^2 and 1.5 m/s^2 are considered as influence factors. No additional influence factor test is required, as the vehicles simulated in the speed dynamic test have accelerations in this interval.

Accelerations in the intervals [−5 m/s^2, −1.5 m/s^2] and [1.5 m/s^2, 5 m/s^2] are considered as disturbances. A corresponding disturbance test using the evaluation criteria NSFd shall be conducted. The use of a partial traffic simulator is sufficient for this test.

For this test it is particularly important to evaluate the simulated reference speed on the same measurement section as the EUT does.

~~For this test it is particularly important to evaluate the simulated reference speed on the same measurement section as the EUT does. In the acceleration test, the occurrence of a fault is acceptable if the cause is deviating times of measurement of the EUT and the reference.~~

6.7 Further disturbance tests

Further possible disturbances are speed-meter-specific and include rain (or snow), small curve radii of the road, existence of pulsed light sources, dense traffic, or exotic target vehicles (with respect to length, height, shape, surface reflectivity, etc.).

Corresponding field or simulation tests shall be performed if there is any suspicion that the EUT might be so sensitive to such disturbances that a significant fault might occur during the disturbance.

6.8 Installation and alignment of sensor and camera

The installation and alignment of sensor and camera ~~should~~ shall be observed, at all allowed positions to install, to prove that means of identification of the measured vehicle are assigned to the correct vehicle.

7 Tests specific to certain categories of speed meters

7.1 Doppler-radar based speed meters

Specific test procedures shall be performed to determine:

a. carrier frequency or interval of modulated frequencies,
b. antenna pattern test to determine beam width and angles of the measurement beam,
c. equivalent isotropic radiated power [EIRP],
d. minimum and maximum of distance measurement, if applicable,
e. accuracy of angle measurement, if applicable, and
f. accuracy of the aiming device, if applicable.

7.2 Range-finding based speed meters

Specific test procedures ~~should~~ shall be performed to determine:

a. that vehicle shape ~~doesn't~~ does not significantly affect the speed measurement,
b. pulse repetition rate or another characteristic of the time intervals between the pulses,
c. beam width,
d. exit angle of measurement beam, if applicable,
e. ~~or~~ scanning range, if applicable and
~~d.~~ f. modulation.~~.~~

7.3 Average speed meters

Specific test procedures ~~should~~ shall be performed to determine:

a. robustness of time synchronisation mechanism,
b. minimum and maximum area of trigger point/determination, and
c. minimum distance between entry and exit point.

7.4 Fixed-distance speed meters

Specific test procedures ~~should~~ shall be performed to determine:

a. accuracy of trigger point, and
b. minimum and maximum distance between trigger points.

7.5 Image based speed meters

a. accuracy of trigger point, and
b. minimum and maximum distance between trigger points.

7.6 Across-the-road speed meters

a. accuracy of aiming device, if applicable.

7.7 Moving speed meters

7.7.1 Moving metrological field test

Moving speed meters shall be tested on the road under real traffic conditions. Installation of the EUT shall be done on a test vehicle according to the user manual. As a reference an ego speed meter installed on a second vehicle shall be used (called reference vehicle hereafter). The expanded measurement uncertainty (k = 2) of the reference speed meter shall not exceed 1 km/h at speeds up to and including 100 km/h and 1 % of the speed value at speeds above 100 km/h.

The EUT shall perform at least 200 valid measurements of the reference vehicle under various traffic conditions. There shall also be measurements in curved streets as the EUT shall give no valid speed value when the measurement is done outside specified limits. The reference vehicle shall generally not break abruptly or accelerate strongly during the measurements. Appropriate means shall be taken to ensure that the measurements of the EUT are compared to the synchronous reference speed value.

The MPE defined in clause 6.15.1 of R 91-1 shall be respected for each driving direction (if applicable). ~~The simple acceptance decision rule (also known as shared risk decision rule) shall be used to decide on conformity. Measurements for which the EUT gives no valid speed value shall be ignored.~~

7.7.2 Metrological field test of the ego speed meter

The metrological performance of the ego speed meter of the EUT shall be tested on the road. Installation of the EUT shall be done on a test vehicle according to the user manual. A suitable reference for the speed of the test vehicle shall be used. The expanded measurement uncertainty (k = 2) of the reference shall not exceed 0.2 km/h at speeds up to and including 100 km/h and 0.2 % of the speed value at speeds above 100 km/h.

The MPE defined in clause 6.15.3 of R 91-1 shall be respected for all tested speed values.

7.7.3 Traffic simulation for moving speed meters

Separate traffic simulators shall be used to test the metrological performance of the moving speed meter in stationary mode and of the ego speed meter. Moving speed meters shall also be tested simulating both ego speed and moving speed at the same time.–Influence factor and disturbance tests should be performed separately on the moving speed meter in stationary mode and on the ego speed meter using these simulators.

8 Software tests

Software test are performed according to documentation review and functional observation of ~~sample~~the EUT.

Note: National regulations may require higher levels for the validation and examination steps.

8.1 Software evaluation methods

Evaluation methods for software requirements are defined in OIML D 31 [2], clause 7 *Type Evaluation*.

8.2 Software examination level

The speed meter software requirements shall be tested according to the Examination level A according to OIML D 31 [2] – normal examination level.

8.3 Evaluation requirements and method

Requirements from 1 to 7 are mandatory.

8.3.1 General requirements [mandatory]

#	Requirement	OIML D 31 [2]	Evaluation methods
1	Software identification	6.1.1	AD + VFTSw
2	Correctness of algorithms and functions	6.1.2	AD + VFTM

8.3.2 Software protection [mandatory]

#	Requirement	OIML D 31 [2]	Evaluation methods
3	Prevention of misuse	6.1.3.1	AD + VFTSw
4	Evidence of intervention	6.1.3.2	AD + VFTSw

8.3.3 Support of hardware features [mandatory]

#	Requirement	OIML D 31 [2]	Evaluation methods
5	Detection of significant defects	6.1.4.1	AD + VFTSw
6	Durability protection	6.1.4.2	AD + VFTSw
7	Time stamps	6.1.5	AD + VFTSw

8.3.4 Specification and separation of legally relevant parts and specification of interfaces [optional]

#	Requirement	OIML D 31 [2]	Evaluation methods
8	Separation of components	6.2.2.1	AD
9	Specification and separation of software parts	6.2.2.2	AD
10	Shared indication	6.2.3	AD + VFTM/ VFTSw
11	Storage of data	6.2.4	AD + VFTSw
12	The measurement data stored shall be accompanied by all relevant information necessary for future legally relevant use	6.2.4.2	AD + VFTSw
13	The stored measurement data shall be protected by software means to guarantee the authenticity, integrity and~~, if necessary,~~ correctness of the information concerning the ~~time of~~ speed measurement	6.2.4.3	AD + VFTSw
14	Automatic storing	6.2.4.4	AD + VFTSw
15	Transmission via communication lines	6.2.5	AD + VFTSw
16	The measurement data transmitted shall be accompanied by all relevant information necessary for future legally relevant use.	6.2.5.1	AD + VFTSw
17	The transmitted data shall be protected by software means to guarantee the authenticity, integrity and, if necessary correctness of the information concerning the ~~time~~ speed of measurement.	6.2.5.2	AD + VFTSw
18	Transmission delay or interruption	6.2.5.3	AD + VFTSw
19	Compatibility of operating systems and hardware	6.2.6	AD + VFTSw
20	Hardware interfaces not equipped with a protective software interface shall not be able to inadmissibly influence the legally relevant software part.	6.2.6.2	AD + VFTSw
21	If a secure boot process is needed to ensure protection of the legally relevant software part, the following requirements apply.	6.2.6.3	AD + VFTSw
22	The combination of the legally relevant software part and the operating system shall ensure that there are enough resources for the operation of the legally relevant application.	6.2.6.4	AD + VFTSw
23	Protection during use	6.2.6.5	AD + VFTSw

#	Requirement	OIML D 31 [2]	Evaluation methods
24	Communication with the legally relevant software part shall be made via protective interfaces.	6.2.6.6	AD + VFTSw
25	Identification and traceability	6.2.6.7	AD + VFTSw
26	The manufacturer shall identify the hardware and software environment that is suitable. Minimum resources and a suitable configuration necessary for correct functioning shall be declared by the manufacturer.	6.2.6.8	AD + VFTSw
27	Technical means shall be provided in the legally relevant software to prevent operation, if the minimum resources or a suitable configuration are not met.	6.2.6.9	AD + VFTSw

8.3.5 Maintenance and re-configuration [optional]

#	Requirement	OIML D 31 [2]	Evaluation methods
28	Verified update	6.2.8.3	AD
29	Traced update	6.2.8.3	AD + VFTSw

Note 1: AD stands for Analysis of the documentation and evaluation of the design according to OIML D 31 [2], 7.3.2.1.

Note 2: VFTM stands for Verification by functional testing of metrological functions according to OIML D 31 [2], 7.3.2.2.

Note 3: VFTSw stands for Verification by functional testing of software functions according to OIML D 31 [2], 7.3.2.3.

9 Bibliography

[1] OIML D 11:2013 *General requirements for measuring instruments - Environmental conditions*

[2] OIML D 31:2019 *General requirements for software-controlled measuring instruments - Consolidated edition with Amendment 1 (2020)*