

BS EN 50293:2012



BSI Standards Publication

# Road traffic signal systems — Electromagnetic compatibility

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**National foreword**

This British Standard is the UK implementation of EN 50293:2012. It supersedes BS EN 50293:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/526, Road traffic control signals.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

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English version

## **Road traffic signal systems - Electromagnetic compatibility**

Systèmes de signaux de circulation  
routière -  
Compatibilité électromagnétique

Straßenverkehrs-Signalanlagen -  
Elektromagnetische Verträglichkeit

This European Standard was approved by CENELEC on 2012-05-11. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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Comité Européen de Normalisation Electrotechnique  
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## Foreword

This document (EN 50293:2012) has been prepared by CLC/BTTF 69-3 (TC 214 WG1) "Road traffic signal systems".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-05-11
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2015-05-11

This document supersedes EN 50293:2000.

EN 50293:2012 includes the following significant technical changes with respect to EN 50293:2000:

- adaption to the actual EMC-Standard;
- update of the normative-references;
- editorial revision.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

## 1 Scope

This product standard for EMC requirements applies to road traffic signal systems. The range of products included within the scope of this European Standard are road traffic signal systems and devices including for example signal heads, signalling devices and traffic signs, controller and housing, supports, interconnections, traffic detectors, monitoring equipment, electrical supply. Road traffic signal systems operating in conjunction with other systems e.g. public lighting, railway systems should also comply with the respective standard and should not reduce the safety of all the equipment. Central Office equipment is excluded from this standard. Items with a radio-communication function should also refer to the European ETSI standards.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12368, *Traffic control equipment – Signal heads*

EN 12675, *Traffic signal controllers – Functional safety requirements*

EN 50556:2011, *Road traffic signal systems*

EN 55014-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission (CISPR 14-1)*

EN 55022, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (CISPR 22)*

EN 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits - Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase) (IEC 61000-3-2)*

EN 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current  $\leq 16$  A per phase and not subject to conditional connection (IEC 61000-3-3)*

EN 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test (IEC 61000-4-2)*

EN 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio frequency electromagnetic field immunity test (IEC 61000-4-3)*

EN 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test (IEC 61000-4-4)*

EN 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test (IEC 61000-4-5)*

EN 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-6)*

EN 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test (IEC 61000-4-8)*

EN 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests (IEC 61000-4-11)*

IEC 60050-161:1990, *International electrotechnical vocabulary – Chapter 161: Electromagnetic compatibility*

IEC Guide 107:2009, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions related to EMC and to relevant phenomena given in the EEC Directive, in IEC 60050-161:1990, in IEC Guide 107:2009 and CISPR Publications apply. The following particular terms and definitions apply.

#### 3.1

##### port

particular interface of the specified apparatus with the external electromagnetic environment, including communication interface (see Figure 1)

#### 3.2

##### enclosure port

physical boundary of the apparatus through which electromagnetic fields may radiate or impinge

#### 3.3

##### signal/control port

points at which a conductor or a cable is connected to the apparatus. This includes cables to signal heads, signalling devices and traffic signs, traffic sensors, detectors and monitoring equipment.

[SOURCE: EN 50556]

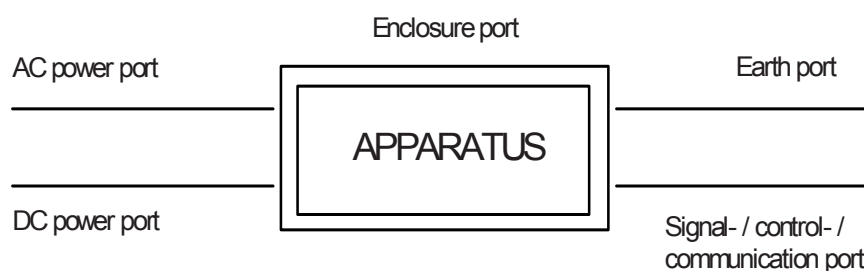


Figure 1 – Example of ports

### 4 Common test conditions

In general the EMC testing of equipment requires it to be operated under conditions similar to those which would be found in practice. Equipment may be tested individually or in a representative system as described below.

The modes of operation that are likely to cause highest levels of emission and in addition those likely to give rise to the most susceptible condition shall be selected. The equipment under test will be tested in such a manner so as to maximise emission and susceptibility levels at the highest operational frequencies.

Equipment having dimmed and undimmed conditions of operation shall be tested in that condition which produces the higher emission level.

For traffic controllers, tests shall be carried out in a system configuration as described in 5.6 with standard loads and standard cycles as defined in 5.4 and 5.5. The standard loads do not need to be installed in the test chamber.

Details of the test configuration and the length of the interconnecting cables used shall be included in the test report.

### 5 Test configuration

#### 5.1 Equipment

The equipment shall be a standard production version.

## **5.2 Supplier**

The supplier shall specify the functions of the equipment.

## **5.3 Technical documentation**

The equipment shall be accompanied by the necessary technical documentation.

This documentation shall at least define modes of operation, the configuration details for the test, the technical specification and installation details sufficient to repeat the test.

## **5.4 Standard load**

For controller or system tests the controller shall be set for two signal group operations.

One signal group shall be connected to the maximum load and the other to the minimum load. These loads shall be either the standard signal heads together with their associated control gear or an electrical equivalent load.

## **5.5 Cycle rate**

The cycle rate for vehicle controller shall be adjusted such that a minimum of **three** switching operations are carried out in one minute. A switching operation is defined as one intentional opening or closing of a switch or contact, i.e. when a lamp is switched 'ON' and then 'OFF' this constitutes two switching operations.

## **5.6 Test set up**

**5.6.1** All interconnecting cables shall be at least 7 m in length.

**5.6.2** All interconnecting cables shall be separated from the floor level by 100 mm. This shall be achieved by an insulated support and stand-offs.

**5.6.3** If a controller is required to be used with loop detectors in its enclosure, at least one detector loop in the manufacturers configuration shall be installed in the calibration zone of the test chamber. This may be achieved by locating the manufacturers detector loop configuration and equipment side by side. Only the controller is required to be rotated during testing.

NOTE The inclusion of a single loop detector does not infer certification of that loop detector product nor limit the controller to that specific detector type.

**5.6.4** For tests on individual items of equipment, the actual loads/drivers shall be consistent with the requirements of 5.6.1, 5.6.2 and 5.6.3 and shall be agreed with the test house.

**5.6.5** For vehicle detectors, the manufacturers loop configuration shall be separated from the floor level by 100 mm. This shall be achieved by an insulated support and stand-offs.



## 6 Performance criteria

The manufacturer and the test house shall define precise criteria for the evaluation of the immunity test results.

Apparatus shall not become dangerous or unsafe as defined in EN 50556, EN 12368 and EN 12675 as a result of the application of the tests defined in this European Standard.

A functional description and a definition of the following performance criteria, during or as a consequence of the EMC testing, shall be noted in the test report.

**Performance Criteria A:** No change shall be observable in the operation. The traffic system shall conform to the standards EN 50556, EN 12368 and EN 12675.

**Performance Criteria B:** There shall be no degradation of safety requirements. There shall be no alteration in the operating mode or of the stored data (Timings, fault logs etc.). It is acceptable for the signals to switch on or off for a period less than the maximum failure detection time. It is acceptable for an additional vehicle to be detected or for the presence of a vehicle not to be detected during the period of the disturbance.

## 7 Emission

### 7.1 Objective

The objective of this section is to define limits and test methods for apparatus defined in the scope, in relation to electromagnetic emissions which may cause interference in other apparatus e.g. radio receivers.

Test requirements are specified for each port considered.

NOTE 1 The limits in this standard may not, however, provide full protection against interference to radio and television reception when the apparatus is used closer than 10 m to the receiving antenna.

NOTE 2 In special cases, for instance when highly susceptible apparatus is being used in proximity, additional mitigation measures may have to be employed to reduce the electromagnetic emission further below the specified levels.

### 7.2 Conditions during testing

The measurements shall be made in the operating mode producing the largest emission in the frequency band being investigated consistent with normal applications.

An attempt shall be made to maximise the emission by varying the configuration of the test sample.

If the apparatus is part of a system, or can be connected to auxiliary apparatus, then the apparatus shall be tested while connected to the normal configuration of auxiliary apparatus necessary to exercise the ports.

The configuration and mode of operation during testing shall be as stated in this European Standard and shall be noted in the test report.

If the apparatus has a large number of terminals, then a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered.

The tests shall be carried out at ambient temperature and humidity or within the specified operating environment range for the apparatus and at its rated supply voltage.

### 7.3 Applicability

Measurements are made on the relevant ports of the apparatus according to Tables 1 to 3. Measurements shall only be carried out where the relevant ports exist.

It may be determined from consideration of the electrical characteristics and usage of a particular apparatus that some of the measurements are inappropriate and therefore unnecessary. In such a case, it is required that the decision not to measure be recorded in the test report.

#### **7.4 Emission limits**

The emission limits for apparatus covered by this standard are given on a port by port basis.

Measurements shall be performed in well-defined and reproducible conditions for each type of disturbance.

The description of the test, the test methods, and the test set-up are given in the reference standards which are referred to in Tables 1 to 3.

The contents of these reference standards are not repeated here, however, modifications or additional information needed for the practical application of the tests are given in this European Standard.

Equipment with a telecommunication port shall comply with the relevant requirements of EN 55022 for that particular port.

For low frequency emission the requirements of Tables 2 and 3 shall apply to the equipment in the scope of this European Standard.

**Table 1 – Emissions – Enclosure port**

	<b>Environmental phenomenon</b>	<b>Units</b>	<b>Test specification</b>		<b>Reference standard</b>	<b>Remarks</b>
1.1	Radio frequency electromagnetic field		Quasi-peak		EN 55022	Class B measured at 10 m
		MHz dB (µV/m)	30 – 230 30			
		MHz dB (µV/m)	230 – 1 000 37			
			Average	Peak	EN 55022	Class B measured at 3 m  see Note
		GHz dB (µV/m)	1 – 3 50	1 – 3 70		
		GHz dB (µV/m)	3 – 6 54	3 – 6 74		
NOTE The limit of frequency to be tested depends on the highest base frequency on EUT. For details of appliance see EN 55022.						

**Table 2 – Emissions – Input AC mains ports (1 of 2)**

	<b>Environmental phenomenon</b>	<b>Units</b>	<b>Test specification</b>	<b>Reference standard</b>	<b>Remarks</b>
2.1	Radio frequency conducted emissions	MHz dB (µV)	0,15 - 0,5 66 to 56 (quasi peak) 56 to 46 (average)		
		MHz dB (µV)	0,5 - 5 56 (quasi peak) 46 (average)	EN 55022	Class B
		MHz dB (µV)	5 - 30 60 (quasi peak) 50 (average)		
2.2	Discontinuous interference			EN 55014-1	Requirements (limits) of the reference standards apply
2.3	Voltage changes, voltage fluctuations and flicker			EN 61000-3-3	Requirements (limits) of the reference standard apply

Table 2 – Emissions– Input AC mains ports (2 of 2)

2.4	Harmonic current	Order of harmonic n	Maximum level of harmonic current A	Reference standard	Remarks
		<b>Odd harmonics</b>			
		3	2.30	EN 61000-3-2	Class A
		5	1.14		
		7	0.77		
		8	0.40		
		11	0.33		
		13	0.21		
		$15 \leq n \leq 39$	$0,15 \times 15/n$		
<b>Even harmonics</b>					
		2	1.08	EN 61000-3-2	Class A
		4	0.43		
		6	0.30		
		$8 \leq n \leq 40$	$0,23 \times 8/n$		
NOTE Requirements (Limits) of the reference standards apply.					

Table 3 – Emissions – Telecommunication terminals

		Frequency range MHz	Limit of voltage dB ( $\mu$ V)		Limit of current dB ( $\mu$ A)		Reference standard	Remarks
			Quasi peak	Average	Quasi peak	Average		
3.1	Asymmetric conducted disturbances	0,15 to 0,5	84 to 74	74 to 64	40 to 30	30 to 20	EN 55022	Class B
		0,5 to 30	74	64	30	20		
		NOTE Requirements (Limits) of the reference standards apply.						

## **8 Immunity**

### **8.1 Objective**

The objective of this section is to define the immunity test requirements for apparatus defined in the scope in relation to continuous and transient, conducted and radiated disturbances including electrostatic discharges.

Test requirements are specified for each port considered.

NOTE 1 This European Standard does not specify basic safety requirements for apparatus such as protection against electric shock, unsafe operation, insulation co-ordination and related dielectric tests.

NOTE 2 In special cases situations will arise where the level of disturbances may exceed the levels specified in this European Standard e.g. where a hand-held transmitter is used in proximity to an apparatus. In these instances special mitigation measures may have to be employed.

### **8.2 Conditions during testing**

The tests shall be made in the most susceptible operating mode in the frequency band being investigated consistent with normal applications. The configuration of the test sample shall be varied to achieve maximum susceptibility.

If the apparatus is part of a system, or can be connected to auxiliary apparatus, then the apparatus shall be tested while connected to the normal configuration of auxiliary apparatus necessary to exercise the ports.

The configuration and mode of operation during the tests shall be precisely noted in the test report.

If the apparatus has a large number of terminals, then a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered.

The tests shall be carried out at ambient temperature and humidity or within the specified operating environment range for the apparatus and at its rated supply voltage.

If a controller is defined to be used for vehicle actuated operation (VA) then for immunity tests this mode of operation shall be used.

### **8.3 Applicability**

Tests are applied to the relevant ports of the apparatus according to Tables 4 to 7. Tests shall only be carried out where the relevant ports exist.

It may be determined from consideration of the electrical characteristics and usage of a particular apparatus that some of the tests are inappropriate and therefore unnecessary. In such a case it is required that the decision not to test shall be recorded in the test report.

### **8.4 Immunity test requirements**

The immunity test requirements for apparatus covered by this European Standard are given on a port by port basis.

Tests shall be conducted in a well-defined and reproducible manner.

The tests shall be carried out as single tests in sequence. The sequence of testing is optional.

The description of the test, the test generator, the test methods, and the test set-up are given in reference standards which are referred to in Tables 4 to 7.

The contents of these reference standards are not repeated here, however, modifications or additional information needed for the practical application of the tests are given in this standard.

Table 4 – Immunity – Enclosure port

	Environmental phenomenon	Units	Test specification	Reference standard	Test set-up	Remarks	Performance criteria
4.1	Radio frequency electromagnetic field	MHz V/m (unmodulated for calibration)	80 - 1 000 10 1 kHz 80 % AM	EN 61000-4-3	EN 61000-4-3		A
4.2	Electrostatic discharge	kV	4 (Contact) 8 (Air)	EN 61000-4-2	EN 61000-4-2		B
4.3	Radio frequency electromagnetic field pulse modulated	MHz $V_{eff}/m$ Duty cycle % Rep. Freq. Hz	$900 \pm 5$ 10 50 200	EN 61000-4-3	EN 61000-4-3		A
		MHz $V_{eff}/m$ Duty cycle % Rep. Freq. Hz	$1\,890 \pm 1$ 10 50 200	EN 61000-4-3	EN 61000-4-3		A
4.4	Induced power frequency	Hz A/m	50 60	EN 61000-4-8	EN 61000-4-8	Applies only if the equipment is susceptible to magnetic fields, e.g. detector loops	B see Note
NOTE CRT display interference is allowed above 3 A/m.							

Table 5 – Immunity – Ports for signal and control lines

	Environmental phenomenon	Units	Test specification	Reference standard	Test set-up	Remarks	Performance criteria
5.1	Radio frequency (common mode)	MHz V (rms) (unmodulated for calibration)	0,15 - 80 10 1 kHz 80 % AM	EN 61000-4-6		See Notes 1 and 2 and footnote to table <sup>a</sup>	A
5.2	Fast transients	kV (peak) $T_r/T_h$ ns Rep. Freq. kHz	1 5/50 5	EN 61000-4-4		See Note 2	B
5.3	Surges Line to Ground Line to Line	$T_r/T_h$ $\mu$ s kV (charge voltage) kV (charge voltage)	1,2/50 (8/20) $\pm 1$ $\pm 0,5$	EN 61000-4-5		Applicable only to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 10 m	B
<sup>a</sup> In the ITU broadcast frequency band 47 MHz to 68 MHz the level shall be 3 V.							
NOTE 1 The test level can be defined as the equivalent current into a 150 $\Omega$ load.							
NOTE 2 Applicable only to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 3 m.							

**Table 6 – Immunity – Ports for DC power ports**

	<b>Environmental phenomenon</b>	<b>Units</b>	<b>Test specification</b>	<b>Reference standard</b>	<b>Test set-up</b>	<b>Remarks</b>	<b>Performance criteria</b>
6.1	Radio frequency (common mode)	MHz V (rms) (unmodulated for calibration)	0,15 - 80 10 1 kHz 80 % AM	EN 61000-4-6		See Notes 1 and 2 and footnote to table <sup>a</sup>	A
6.2	Fast transients	kV (peak) $T_r/T_h$ ns Rep. Freq. kHz	1 5/50 5	EN 61000-4-4		See Note 2	B
6.3	Surges Line to Ground Line to Line	$T_r/T_h$ $\mu$ s kV (charge voltage) kV (charge voltage)	1,2/50 (8/20) $\pm 1$ $\pm 0,5$	EN 61000-4-5		Applicable only to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 10 m	B
<sup>a</sup> In the ITU broadcast frequency band 47 MHz to 68 MHz the level shall be 3 V.							
NOTE 1 The test level can be defined as the equivalent current into a 150 $\Omega$ load.							
NOTE 2 Applicable only to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 3 m.							

**Table 7 – Immunity – Input and output AC power ports**

	<b>Environmental phenomenon</b>	<b>Units</b>	<b>Test specification</b>	<b>Reference standard</b>	<b>Test set-up</b>	<b>Remarks</b>	<b>Performance criteria</b>
7.1	Radio frequency (common mode)	MHz V (rms) (unmodulated for calibration)	0,15 - 80 10 1 kHz 80 % AM	EN 61000-4-6	EN 61000-4-6	See Note and footnote to table <sup>a</sup>	A
7.2	Fast transients (common mode)	kV (peak) $T_r/T_h$ ns Rep. Freq. kHz	1 5/50 5	EN 61000-4-4			B
7.3	Voltage dips		Test according to EN 50556:2011, 4.5	EN 61000-4-11			
7.4	Voltage interrupts		Test according to EN 50556:2011, 4.5	EN 61000-4-11			
7.5	Surges Line to Ground Line to Line	$T_r/T_h$ $\mu$ s kV (peak) kV (peak)	1,2/50 (8/20) $\pm 2$ $\pm 1$	EN 61000-4-5			B
<sup>a</sup> In the ITU broadcast frequency band 47 MHz to 68 MHz the level shall be 3 V.							
NOTE The test level can be defined as the equivalent current into a 150 $\Omega$ load.							

## **Annex ZZ** (informative)

### **Coverage of Essential Requirements of EU Directives**

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in Annex I, Article 1 of the EU Directive 2004/108/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING - Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

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