SLOVENSKI STANDARD

SIST-TP CLC/TR 50538:2011

01-december-2011

Nadomešča:

SIST R210-008:2003

Vodilo za skladnost opreme za vojaške namene z direktivo EMC

Guide to EMC Directive conformity of equipment designed for military purposes

Leitfaden zur Konformität von Geräten, die für militärische Zwecke entwickelt wurden, mit der EMV-Richtlinie

Guide de conformité à la Directive CEM pour les équipements conçus à usages militaires

Ta slovenski standard je istoveten z: CLC/TR 50538:2010

ICS:

33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general
95.020	Vojaška tehnika. Vojaške zadeve. Orožje	Military engineering. Military affairs. Weapons

SIST-TP CLC/TR 50538:2011 en

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CLC/TR 50538

October 2010

ICS 33.100.01

Supersedes R210-008:2002

English version

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Leitfaden zur Konformität von Geräten, die für militärische Zwecke entwickelt wurden, mit der EMV-Richtlinie

This Technical Report was approved by CENELEC on 2010-09-17.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Ref. No. CLC/TR 50538:2010 E

Foreword

This Technical Report was prepared by WG 9, EMC of Military Equipment, of Technical Committee CENELEC TC 210, Electromagnetic Compatibility (EMC).

It was circulated for voting in accordance with the Internal Regulations, Part 2, Subclause 11.4.3.3 (simple majority) and was approved by CENELEC as CLC/TR 50538 on 2010-09-17.

This document supersedes R210-008:2002.

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

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Introduction

CENELEC R210-008:2002 has been updated and revised with regard to the EMC Directive 2004/108/EC to create this new Technical Report, CLC/TR 50538 "*Guide to EMC Directive conformity of equipment designed for military purposes*".

The EMC Directive, 2004/108/EC [1], does not contain any reference to military equipment.

The manufacturer is fully responsible for complying with the EMC Directive, 2004/108/EC [1] and cannot devolve this responsibility to a third party. Comprehensive guidance is provided in the "*Guide for the EMC Directive 2004/108/EC*" [16].

There are a number of recent and emerging documents that have been considered including

- Defence Procurement Directive 2009/81/EC [2],
- Public Procurement Directive 2004/18/EC [15],
- the EU Interpretative Communication COM (2006) 779 final [4] on the application of Article 296 TEC to the procurement of military equipment. (Note that Article 296 of the Treaty of Amsterdam has now become Article 346 of the Treaty of Lisbon.)

This Technical Report has been prepared by reviewing all currently available relevant documentation as listed in the Bibliography.

The purpose of this Technical Report is to provide guidance to manufacturers, suppliers, importers, procurement authorities and those taking equipment into service within Member States on the application of the EMC Directive to military equipment.

Background

A Technical Report was produced by CLC/TC 210 (EMC) in 1998 in order to provide guidance to manufacturers of military equipment to comply with the EMC Directive 89/336/EEC [5] Under this Directive 89/336/EEC there were interpretations at Member State level which resulted in a non-harmonised application of the directive by military equipment manufacturers across the EU.

An interpretative communication concerning the Public Procurement Directive was issued in late 2006. It states; “According to existing EU law, defence contracts fall under Internal Market rules”. This has been interpreted as meaning that all military equipment is subject to the rules of the EU regarding the procurement of equipment, However Member States can exempt defence contracts under Article 296(1)(b) that it considers to fulfil the concept of ‘essential security interests’.

The conclusion from the Commission lawyers (validated in a court case between the Commission and a Member State), in COM (2006) 799 is very specific and concludes that the exemptions are very few and will have to be assessed on a case-by-case basis by the contracting authority.

More recently the Defence Procurement Directive 2009/81/EC of 13 July 2009 [2] has been published. This concerns the gradual establishment of a European defence equipment market and as a prerequisite an appropriate legislative framework. This Directive has profound implications on Members States procurement of Defence equipment and services. A précis of the Directive is provided in Annex A.

CEN WS 10 EG7 E3 [1)] has reviewed military Electromagnetic standards for inclusion in the “*European Handbook for Defence Procurement*” (CWA 15517 [10]). The information contained in their report has been used and incorporated where applicable.

1) CEN: European Committee for Standardisation, Workshop 10: Standardization for Defence Procurement, EG7: Expert Group 7: Electromagnetic Environment

1 Scope

This Technical Report is applicable to any non-exempt military equipment.

This Technical Report does not affect the requirements to meet military standards.

This Technical Report only covers aspects related to EMC as covered by the EMC Directive 2004/108/EC and other directives that address EMC. In this respect there is no distinction between civilian and defence equipment.

For the purpose of this Technical Report the term “military” is equivalent to the term “defence”.

Annex B describes Article 346 and Annex C provides the associated EC Council List of items under Article 346 [12].

The definitions in EMC Directive 2004/108/EC of “apparatus” and “fixed installations” as applied to military equipment are considered and guidance is given on applicability with the use of flow diagrams.

For apparatus, the use of military standards to demonstrate compliance with the EMC Directive by using various assessment methods that do not use harmonised standards and a “gap” analysis tool for comparison of military standard results with harmonised standards is presented.

This Technical Report also covers fixed installations using military equipment, and their impact on neighbouring environments.

The conformity assessment procedures of EMC Directive 2004/108/EC have been reviewed and guidance given on the applicability and contents of detailed technical EMC assessment.

Annex J includes some case studies to help clarify the extent and use of this Technical Report.

2 Directives for EMC conformity

2.1 EMC Directive

The EMC Directive (2004/108/EC) defines the following protection requirements as essential requirements:

a) the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;

b) it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

The conformity procedures are detailed in 3.2.3 and 3.2.4.

The EMC Directive makes specific exemptions for radio equipment and telecommunications terminal equipment covered by Directive 1999/5/EC [3], civilian aircraft or equipment fitted to civilian aircraft referred to in Regulation (EC) No. 1592/2002 [14], radio amateur equipment and inherently benign equipment.

This section contains a summary of other pertinent EU Directives.

2.2 Radio & Telecommunication Terminal Equipment Directive

As noted above, all equipment in the scope of the R&TTE Directive 1999/5/EC [3] is excluded from the EMC Directive. The EMC aspects of equipment within the scope of the R&TTE Directive are covered by that Directive. It follows that equipment that falls outside the scope of the R&TTE Directive is therefore within the scope of the EMC Directive.

In particular, the R&TTE Directive does not apply to apparatus exclusively used for activities concerning public security, defence, state security and activities of the state in the area of criminal law. Accordingly, military radios used solely by state armed forces may be subject to the EMC Directive. It is important to note that such use must be exclusive. If these radios are also sold to private security operations for use other than defined in the “security” exclusion, they are regulated under the R&TTE Directive. For example, TETRA systems that are widely used by public authorities are subject to the R&TTE Directive because they are not exclusively used for the activities excluded from its scope. However a Tetra-based system designed only for security use as defined in Article 1.5 is excluded from the scope of the R&TTE Directive, whether the equipment is used by a Department of a Member State or by a private or public company undertaking duties on behalf of the Member State.

2.3 Automotive Directive

In the case of vehicles intended for use on public roads, the Automotive EMC Directive 2004/104/EC [6] applies to cars, trailers and their electronic sub-assemblies. It should be noted that Directive 2007/46/EC (Framework Directive) [7] may also apply to other road going vehicles. Compliance with Directive 2004/104/EC is demonstrated by affixing ‘e-marking’ to the equipment or vehicle.

2.4 Marine Equipment Directive

In the case of marine equipment, the Directive 96/98/EC [13] amended by Directives 98/85/EC, 2001/53/EC and 2002/75/EC applies International Maritime Organisation (IMO) standards to assess the compliance of equipment related to safety at sea (navigation and radio communications) and pollution prevention. This is a type approval process and compliance with the directive is demonstrated by affixing “wheelmark” to such equipment. All non-safety equipment are assessed following the EMC Directive 2004/108/EC.

3 Application of the EMC Directive to military equipment

3.1 Introduction to apparatus and installations

In order for military equipment to comply with the EMC Directive it is first important to understand the different types covered. In essence the EMC Directive covers equipment which is either apparatus or fixed installations and defines a different regime for these two categories.

The following definitions are extracted from the EMC Directive 2004/108/EC, Article 2, for clarification on the two types of equipment/system covered by the directive:

a) ‘apparatus’ means any finished appliance or combination thereof made commercially available as a single functional unit, intended for the end user and liable to generate electromagnetic disturbance, or the performance of which is liable to be affected by such disturbance. Apparatus is subject to the full provisions of the directive including a Declaration of Conformity (DoC) and CE marking;

b) ‘fixed installation’ means a particular combination of several types of apparatus and, where applicable, other devices, which are assembled, installed and intended to be used permanently at a predefined location;

Fixed installations do not require a DoC or CE marking but must meet the protection requirements.

In the special case of apparatus intended for incorporation into a specific fixed installation which is otherwise not commercially available the provision of Article 13(1) of the EMC Directive may be applied. This apparatus does not need to be CE marked but must be supplied with installation instructions that ensure the essential protection requirements. This provision is only for an individual apparatus intended for a specific fixed installation.

The protection requirements of the directive are the same for both apparatus and fixed installations such that

c) the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended,

d) it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

Mobile installations are defined as a combination of apparatus intended to be moved and operated in a range of locations. All provisions of the EMC Directive, as defined for apparatus, apply to mobile installations.

3.2 Apparatus

3.2.1 Conformity assessment procedure

This subclause describes the conformity assessment procedure for military apparatus falling within the scope of the EMC Directive.

The conformity assessment procedure for apparatus is described in Article 7 of the EMC Directive 2004/108/EC. Comprehensive guidance is provided in the "*Guide for the EMC Directive 2004/108/EC*" [16].

This conformity assessment procedure applied to military apparatus is given in Annex E.

The EMC assessment described in Annex II of the EMC Directive 2004/108/EC requires all normal intended operating conditions and configurations to be taken into account.

3.2.2 Intended operating conditions, interfaces and environment

As highlighted above due consideration must be given to the operating conditions, interfaces and environment.

The operating conditions relate to the modes of operation. They could include where equipment is provided with a peacetime mode where certain functions may be disabled. All relevant operating conditions (peacetime role) need to be considered where these distinct modes will have an impact on the electromagnetic performance.

The operating environment and interfaces need careful consideration since this will define what and how close other equipment is located. Equipment located in a controlled EM environment (for example, below decks ship equipment) is very different to man portable radio equipment. Refer to Clause D.3.

3.2.3 EMC conformity assessment

3.2.3.1 Introduction

The EMC Directive requires an EMC assessment of the apparatus to determine if the protection requirements are met. The EMC assessment is described in the conformity assessment procedure for apparatus given in Article 7 and Annexes I, II and III of the EMC Directive 2004/108/EC.

According to the "*Guide for the EMC Directive 2004/108/EC*" [16], three methods are possible for the EMC assessment and their application in the context of military equipment is discussed below:

- use of harmonised standards;
- mixed EMC assessment;
- detailed technical EMC assessment.

3.2.3.2 Use of harmonised standards

Harmonised standards are published in the Official Journal of the EU. Apparatus that complies with relevant harmonised standards has a presumption of conformity with the protection requirements of the EMC Directive. Harmonised standards fall into three categories, basic, product specific and generic. Basic standards are those that are referred to by Product specific or Generic standards to simplify the writing of the standards. Product specific standards are those written particularly for a product type. Generic standards are written to provide harmonised standards where there are no product specific standards.

If the manufacturer prefers to use harmonised standards and since there are no harmonised standards dedicated for military equipment, then a suitable civil harmonised standard should be identified.

A description of harmonised standards is given in Clause D.2 with guidance on when they may be applicable to military equipment.

3.2.3.3 Mixed EMC assessment

A mixed EMC assessment is where parts of a harmonised standard have been applied together with a technical assessment to demonstrate that all the protection requirements are met. A more detailed description of the technical EMC assessment is given in 3.2.3.4. The technical assessment may include a wide range of technical analysis methods to identify or mitigate any disparity between the military compliance and EMC Directive protection requirements. Analysis methods are described in 3.2.4.

3.2.3.4 Detailed technical EMC assessment

A detailed technical EMC assessment is where no harmonised standard has been applied but a detailed assessment performed instead.

Annex IV(1) of the EMC Directive 2004/108/EC, states that this includes

- steps taken to meet the requirements,
- description of the electromagnetic assessment,
- results of design calculations (it is suggested by this guide that this could include modelling and simulation),
- examinations carried out,
- test reports.

The "*Guide for the EMC Directive 2004/108/EC*" [16] adds that the assessment required will depend on several factors, such as

- nature of apparatus,
- intended use,
- location of use,
- EMC environment,
- types of disturbance created by or affecting the apparatus,
- environmental conditions,
- performance criteria for immunity.

The technical assessment for military apparatus may include methods such as those shown in Figure E.1.

3.2.4 Examples of detailed technical assessment methods

3.2.4.1 Introduction

The aim of an assessment is to provide evidence that the equipment will meet the protection requirements of the EMC Directive.

The methods include using existing EMC test evidence or in some circumstances additional evidence such as modelling, engineering tests or experiments, or specific in-situ (special) tests, or by gap analysis. Other methods of determining compliance may take the form of a review of existing design evidence, or of particular circumstances that provide mitigation and or control of the products electromagnetic characteristics. One form might be to use the similarity of the current product to an earlier version.

These methods can be applied individually or in combination and are further described below.

3.2.4.2 Using existing EMC test evidence (e.g. military standards)

In many circumstances, test results against a military specification can be examined by experienced personnel who will be able to determine compliance with the protection requirements by inspection.

3.2.4.3 Engineering tests, or experiments, or in-situ (special) tests

There are circumstances where the manufacturer might want to make tests and/or assessments on part of the equipment, or prototypes, or to implement special in-situ tests and practices.

The manufacturer has to evaluate this risk when he declares conformity to the protection requirements allowing himself such deviations, and he takes full responsibility of the choice. The technical documentation should give detailed information on such deviations described hereafter:

a) the nature of the engineering tests or experiments performed, and the rationale for having chosen these tests;

b) the standards, if any, adopted as reference for performing the tests, and all the precautions implemented during the tests execution, or the simplified methods (sometimes called pre-compliance methods) utilized;

c) the test set-up and the deviations from the prescriptions of the standard adopted, and all the other details useful to understand the performed activities;

d) the results of the tests and of any pre-scan measurement made to quickly obtain information on the performances (emission and immunity) of the apparatus, in order to decide whether a full complete measurement is considered necessary;

When applying special tests it is essential to identify

- the coupling mechanism with the external environment,
- the ports/interfaces where conducted and/or radiated (high or low frequency) disturbances may be applied from or towards the fixed installation (power supply port, control and telecommunication ports etc.);

3.2.4.4 Modeling and simulation

In recent years Computational Electromagnetic Modelling (CEM) codes and bespoke simulation tools such as those based on topological processes have become more readily available. These modelling and simulation tools can be used for carrying out detailed modelling and analyses of complex electromagnetic problems such as; induced currents and voltages in wires, conduits, LRU cases, and various structural components. The development of three-dimensional computer codes that can be run on machines of increasing speed and efficiency now has made such analyses viable.

Whilst CEM and simulation tools are unable to directly compute the magnitude of emissions or the immunity of a modelled or simulated apparatus or installation, these tools capable of providing support to the overall analysis. Some examples where modelling and simulations support has been shown to be useful are: