Standardization for Defence Procurement - European Handbook, recommendations Electromagnetic Environmental Effects

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Abstract

The European Commission (EC) would like to improve the competitiveness of the European Defence Industry. The large number of (national) standards, more than 10.000, is recognised by EC as a major constraint and cost driver [1].
Electromagnetic Compatibility (EMC) and more generally Electromagnetic Environmental Effects (EEE) have been considered by the EC as a major topic, with 7 other topics such as NBC detectors, energetic materials, fuels and lubricants, batteries, packaging, electrical and mechanical interfaces, and environmental testing.
An EEE expert group (called Expert group 7 or EG7) with representatives from industry and national Ministries of Defence rationalised in 2004 a list of 329 EEE standards, implicitly abandoning national, including American, standards, and develop guidelines for the procurement process.
A limited number of widely accepted and cost effective standards, suitable for use by MoD's (acquisition) and industry (product development), has been defined after making comparisons. It was decided that the best references is the NATO STANAG 4370 series [2]. Comparisons were carried out on some standards against this STANAG 4370 AECTP 500.
The EEE Expert Group (EG7) concluded;

- that no one standard is better or worse than another in achieving the end goal
- there are sufficient similarities to AECTP 500 to adopt this as the fundamental replacement standard.
- there is sufficient agreement on NATO-, IEC- and EN-produced standards to make worthwhile agreement to use a number of standards as replacement for some (or some parts) of existing National Standards.

This paper, presents the work conducted by EG7 focusing on its recommendations on the use of EEE standards, and on the constraints with respect to the standardisation process of National MoD's, NATO, Industry and EN/IEC.

INTRODUCTION

The European Commission requested the European Committee for Standardisation (CEN) to establish Workshop 10 to improve the efficiency and enhance competitiveness of the European defence industry by rationalising the application of (military) standards. Eight Expert Groups (EG) have been established in 2004 and EG 7 addresses the Electromagnetic Environmental Effects (EEE). EG 7 has 29 members from 9 countries, with a majority of the members from industry.
EG 7 has selected the EEE standards used within the member states of the European Union, approximately 430, and made a list of preferred standards. This database with standards has been published in 2004. In 2005 recommendations on the use of EEE standards have been given.
This paper presents and summarises the results of the work conducted by EG7 and the main recommendations of this group for the use of EEE standards. The scope and limitations of those standards are given in Section 2. The standards for electromagnetic environmental effects are described in Section 3. The reduction process and the rationale for the comparison of standards are given in Section 4. The recommendations for best practice are given in Section 5. The results could be used in the acquisition process (by MoD) and development process (by industry) such that systems will be built faster, better and cheaper. Recommendations on the EEE standardisation process has been discussed in Section 6. Conclusions are given in Section 7.

SCOPE AND LIMITATIONS OF EG7

The task of WS10-EG7 was to develop the European handbook of preferred EEE standards for defence applications, although the responsibility for further development of the chosen 'preferred standards' resides with the respective authority.
The military environment is sometimes more severe than the civilian, hence civilian EEE standards are not always appropriate for defence procurement. The

handbook contains a mixture of military and civilian standards to be called upon as applicable.
EEE specifications are a compromise, a balance between cost and performance. In a highly complex system, it may prove impossible to achieve and proof total compatibility. In this case, the customer must decide which other compromises must be made.
Military organisations have prepared their specifications over many years, typically with limited, or no, consultation with industry. While all Nations could use the same specification if starting again with a zero base line, military equipment in service, and that already in design, will not necessarily be compatible with equipment designed to meet the "Handbook".
The time to design and develop military equipment and the in-service life give a combined total of up to 35 years. From this, it can be seen that the change from National Standard to European Handbook could have implications that extend for considerable number of years. That is, if the handbook is accepted today, the last piece of equipment manufactured under some other specification would finally be replaced in 35 years time.
For this reason, the military users need to manage the changeover so that any problems are minimised. However both military and the defence industry would like a quick transition to a common EEE requirement and a near future move to common test formats, preferably based on IEC basic standards to further reduce costs.
The electromagnetic effects covered by EG7 are listed in the following section.

STANDARDS FOR EEE

A survey on the economic impact of standards used has been carried out. The results showed that the most common EEE standards in use are:

1. US MIL-STD
2. National military standards in Europe: Def-Stan (UK), VG (GE) and GAM (FR)
3. European Standards: EN, ETSI
4. STANAG and AP
5. International Electrotechnical Standards: IEC

Based on this survey the listing of most important phenomena and standards is given below:

a) Standards for equipment and subsystems
- Electromagnetic interference requirements and tests at equipment and sub-system level:
- conducted phenomena;
- radiated phenomena (emission, susceptibility, transients (ESD), DC magnetic field)
- Radiation hazards (HERF, HERO, HERP)
- HIRF
- Lightning and nuclear EMP
- Spectrum (emission) control (spurious, harmonics)
- Power quality

b) Standards which are not yet mature
- System level
- Engineering and guidance documents
- Management, including system life cycle.

c) No standards available on
- High Power Microwaves (HPM)
- Ultra Wide Band (UWB)

d) No standards on
- Tempest, due to confidentiality of these standards.

REDUCTION PROCESS

Each Nation represented in EG7 agreed that, after National Standards, much of the defence industry uses United States MIL standards. This would be an obvious point of convergence for most, if not all, for industry. However the MIL standards are produced and maintained by the US and not by the European community. However, NATO Standards (STANAG) are a close representation of the MIL Standards and were agreeable to many EG7 experts.
Existing IEC based standards would allow more free trade at lower costs. However, such standards are changed and upgraded continuously via a ‘democratic’ voting structure and as such are not (yet) appropriate for professional equipment for military applications.
The scope of these IEC (EN) standards could be improved to cover the whole frequency spectrum. If a coherent framework of these standards, including emission standards, is effective, then military standards could be based on the same basic standards.
Until the structure and coverage of IEC (EN) standards has been improved, dedicated military standards must be in place and therefore STANAGs have been taken as the basis for comparison against other standards.
All EMC Standards are a matter of compromise between emissions and immunity requirements, size, weight, technical performance etc. The levels of performance required have been developed empirically, based on experience and so use a different basis for compromise. For this reason standards cannot withstand an in depth comparison against each other. Therefore the comparison is based on a first, high level, assessment. To make the selection two columns of the EEE Standards handbook have been selected in order to give recommendations with the following keywords:

- AECTP 500: *when published then it may be used instead of the indicated standard*.
- Use: *recommended standard*
- Guide: *document which may be used for guidance*
- No: *not recommended standard, obsolete*
- Future: standards *that EG7 have confidence that are being produced, but are not published yet.*

The reduction of EEE standards is depicted below in Figure 1,

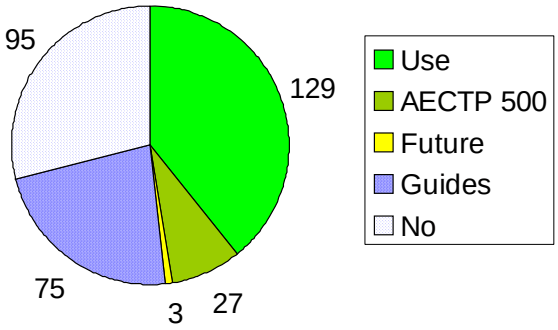


Figure 1. Number of standards, 'Use', 'AECTP500', etc.

The number of 'Use' standard, and AECTP500, are shown in Figure 2.

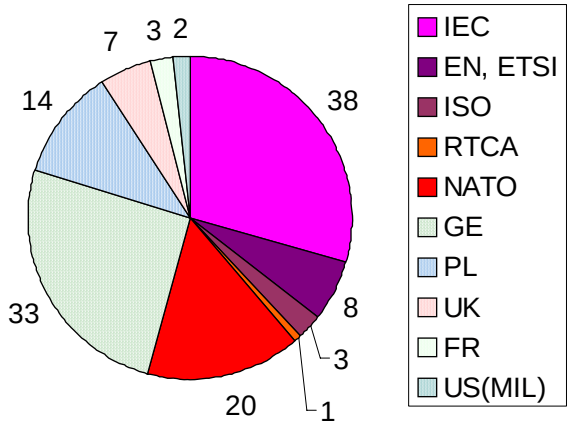


Figure 2: Which standards have been designated as 'Use'

RECOMMENDATIONS FOR BEST PRACTICE

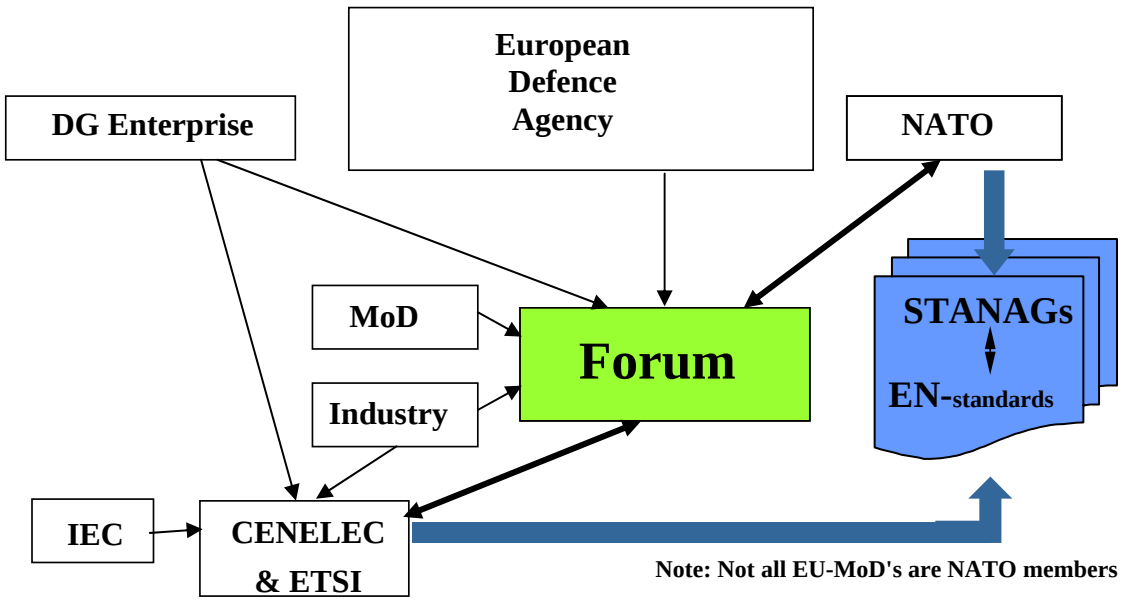
EG7 recommends the use of the preferred standards Electromagnetic Environmental Effects as listed in the European Handbook (EG7 April 2005 version file). This EXCEL file is available and may be accessed through the website (**http://comelec.afnor.fr/cen/ws_def_proc**) after compliance with authorisation access (login and password needed and have to be required to AFNOR). This handbook contains 63 pages.

The use of international standards, STANAG included, shall be encouraged, while the use of national standards shall be discouraged.

RECOMMENDATIONS FOR STANDARDISATION PROCESS

EG7 recommends the following:

- early publication of STANAG 4370 AECTP 500 ed. 2
- development of STANAGs, to replace national standards.
- extension of STANAG 4370 AECTP 500 with the identified shortfalls
- extension of STANAG 4370 AECTP 500 with system level requirements
- cooperation with European industry and non - NATO nations.
- WS10 should encourage the formation of the necessary forum to improve the cooperation with national MoDs and industry for greater harmonization. A possible structure has been shown below.
- All standards must be freely available - preferably by the Internet- to end user.
- National Authorities take a pro-active approach to manage interference issues in co-operation with Spectrum Management activities (ITU and others) and a good working relationship with industry to provide economic solutions.



CONCLUSIONS

To achieve common European military EMC standards, instead of the plethora of national standards, is a significant undertaking and will take some years to finalise. EG7 has accomplished significant steps towards this but continued improvements are dependant on other forums and authorities.
329 standards with relevance for the work of EG7 were found in the initial handbook and added references:

- a number of standards can be replaced by the recommended STANAG 4370 AECTP 500.
- a significant number of standards could be eliminated from the 'Use' category if the recommendations of this report were followed.
- many standards are not recommended for use.
- many standards are mostly for guidance.

EG7 conclude that :

- the scope and quality of IEC (based) standards is insufficient for military purposes except in environments similar to domestic or industrial;
- STANAGs must be used as the basis of harmonization of military standards. The low acceptance level of STANAGs is a threat to this process. Guidance and support from WS10 therefore needed and appreciated.
- agreements could be made regarding some vital areas of standardisation.

References

[1] Study Univ. of Sussex, standardization systems in the defence industries of the EU and the US. 1999

[2] N050_EG7_EMC Hdbk final, **http://comelec.afnor.fr/cen/ws_def_proc**

[3] CEN/ WS 10/EG7/N051 June 2005 Report from the WS10 Expert Group 7 , **http://comelec.afnor.fr/cen/ws_def_proc**