CLC(SG)840

October 2000

REPORT ON CIVIL AIRCRAFT AND INCORPORATED EQUIPMENT COVERING THE TECHNICAL SPECIFICATIONS AND RELATED CONFORMITY ASSESSMENT PROCEDURES, REGIONAL OR INTERNATIONAL, IN RELATION TO ELECTROMAGNETIC COMPATIBILITY

Executive Summary

INTRODUCTION

At its 79th meeting in June 1999, the Committee on "Standards and Technical Regulations" (Committee 98/34, former 83/189) approved a mandate to CEN, CENELEC and ETSI for the preparation of harmonized standards under the EMC Directive 89/339/EEC covering the essential EMC requirements for aircraft and aeronautical equipment, including the preparation of an intermediate report, which should refer to existing national and international specifications and practices applied in the current technical situation, which may already satisfy the EMC Directive.

In September 1999, the CENELEC Technical Board accepted the proposed mandate M/282 and invited its Central Secretariat to pave the way for the intermediate report through exploratory contacts with CEN, ETSI, the Commission, AECMA, EUROCAE, JAA and the relevant international organizations (FAA, RTCA).

An ad hoc EMC Aircraft and Aeronautical Interest Group (EMC/AAIG) was set up and held three exploratory meetings under the convenorship of CENELEC CS, during which the different aspects of aircraft and aeronautical equipment in relation to the EMC Directive were examined and an agreement was reached on the draft outline of this report. Two drafting groups, one under the auspices of JAA and one set up by EUROCAE, have turned the draft outline into a preliminary version of the report.

On the occasion of its July 2000 meeting, the CENELEC Technical Board welcomed the progress made by the EMC/AAIG and invited them to finalize their work on the "intermediate" report in time for presentation at the October 2000 meeting of the Technical Board.

Two further EMC/AAIG meetings were held during the summer months to agree on the final version of the report, worked out by a small editing group, convened by AECMA.

REPORT

The purpose of the report is to show how the aircraft safety is addressed and how the aircraft interacts with the EMC environment. In order to achieve this goal, the report is divided into eight chapters, i.e.:

General

Aircraft certification requirements

Aircraft certification process

Aircraft operation and EMC requirements

Aircraft emissions

Aircraft immunity

Portable electronic devices

Conclusions

The conclusions and recommendations made in chapter 8 of the Report were endorsed by the CENELEC Technical Board at the 105th BT meeting (Luzern, 3-5 October 2000, decision D105/156)

In chapter 1 "General",

the purpose is to describe Aviation Safety Principles and to present the International context. The basic principle is that an aircraft is only allowed to fly if it has been designed, manufactured, operated and maintained in accordance with the relevant regulations and if its crew is also qualified in accordance with the relevant regulations.

The international context is provided by the International Civil Aviation Organisation (ICAO). ICAO has developed 18 annexes to the Chicago Convention (1944) which are the basis for Member States Regulations. Annex 8 (Airworthiness) is particularly relevant in the EMC context.

In chapter 2 "Aircraft certification requirements",

the purpose is to describe certification requirements (procedural and technical) using as examples JAR-21 and JAR-25 (JAR: Joint Aviation Requirement), after an introduction to the Joint Aviation Authorities (JAA).

JAR-21 (Certification Procedures for Aircraft and Related Products and Parts) applies to all aspects of design and manufacture. It prescribes procedural requirements for the issue of Type Certificates (TCs) and changes to TCs, for the issue of standard Certificate of Airworthiness (C of A) and the issue of Export Airworthiness Approvals. It describes procedural requirements for the approval of certain parts and appliances. It describes rules governing the holders of certificates or approvals mentioned above. The procedural requirements and rules are applicable to products and parts designed in JAA countries and in non-JAA countries.

Finally it defines procedural requirements for approval of organisations (Design and Production Organisations). However, these are applicable only to organisations under the jurisdiction of JAA Countries, which include all European Union member states.

Technical Airworthiness Codes such as JAR-25 (Large Aeroplanes) contain requirements in relation to performance; handling qualities; structural strength; design and construction; powerplant installation; systems and equipment; manuals and limitations.

It should be kept in mind that aircraft certification is only the starting point for safety. Operations and maintenance of aircraft are also regulated. Flight crew must possess valid licences.

In chapter 3 "Aircraft certification process",

the purpose is to define the two elements of Type Certification (technical findings; legal findings) and to outline the four phases of the technical findings (definition of applicable requirements; definition of means of compliance; demonstration of compliance by the applicant and acceptance by the Authority; final report). This chapter gives also a broad overview of the two JAA certification processes: Joint Multi-national Team process; Joint Local Team process. It concludes with a comparison between the Aviation Certification Process and the EU Global approach to conformity assessment.

In chapter 4 "Aircraft operations and EMC requirements",

justification is provided to consider aircraft as a very specific environment with regard to EMC requirements. Safety is a major objective in aircraft design and certification, hence the essential requirements regarding EMC within the aircraft itself are directly embedded in the safety requirements. Several airworthiness codes exist covering all the types of fixed wings and rotorcraft, each of these codes have general and specific EMC requirements.

Aircraft operations are also controlled through the international regulations. Three major phases of flight have been considered in this report: the aircraft parked or taxiing, the aircraft taking off or landing and the aircraft in its navigation phase. During these various phases the aircraft is always significantly separated from its outside environment according to safety regulations, except in the phase where the aircraft is on the ground at the airport. This last situation leads to separation distances between the aircraft and the airport environment that could be of the same magnitude as the typical separation distance used in the EN 50081-2 (30 meters). Therefore the aircraft at airport represents the worst case to be analyzed in particular in relation to aircraft emission. In this specific case two situations have been considered:

Aircraft handling where the separation distance could be in some cases smaller that the EN selected distance;

Other airport activities where the separation distance is always larger than the EN selected distance.

In the case of aircraft handling, it must be noted that the compatibility between the relevant activities and the aircraft itself is achieved through special and local practices. Therefore the airport must also be considered as a specific environment.

In chapter 5 "Aircraft emissions",

an analysis supported by test data is done to assess both radiated and conducted aircraft emissions.

As regards the radiated emission, two methods are used:

The first considers the radiated emission limit required for each piece of the electrical equipment of an aircraft as specified by the civil aeronautic technical specification EUROCAE ED14, and applies correction factors to take into account all parameters necessary for the comparison to the EN 50081-2 such as: quasipeak versus peak measurement, measurement bandwidth, measurement distances, effect of multiple equipment working together, aircraft attenuation.

The second assesses the maximum field radiated by an aircraft based on the field limits which would cause disturbance to the aircraft receivers used for navigation and communication.

The radiated emission values obtained from the two methods are compared to the EN 50081-2 limit and are found to be lower.

To complement the analysis above, measurements on a large civil aircraft are presented that confirm the results of the analysis.

As regards the aircraft conducted emission there is no direct electrical link between the aircraft and the public power supply network. But even if the aircraft power system is analyzed, the conducted emission limit specified by EUROCAE ED14 is lower than the EN 50081-2 limit.

It is then concluded that any aircraft satisfies the EMC EN 50081-2 emission limit with the existing civil standards and procedures.

In Chapter 6 "Aircraft immunity",

the purpose is to describe the Certification Process to demonstrate an aircraft's immunity to the electromagnetic environment. This chapter discusses how this process has evolved, and the definition of the HIRF (High Intensity Radiated Fields) environment and the resulting immunity test procedures.

It concludes by showing that the essential requirements of the EMC Directive for immunity are covered by current aircraft immunity certification requirements.

In chapter 7 "Portable electronic devices",

the existing Joint Aviation Requirement JAR OPS 1.110 which restricts use of portable electronic devices on aircraft, and the similar US aviation regulation FAR 91.21 (Federal Aviation Regulation), are discussed. The key issues are protecting the sensitive aircraft radio receivers and protecting critical aircraft electronic control systems. Studies have been performed in Europe and the US to assess and quantify the electromagnetic effects from portable electronic devices. These studies showed that the risk of radio interference from portable electronic devices exists, but is relatively low. This chapter focuses on the very high assurance required for aviation safety, which results in operational restrictions on the use of portable electronic devices which are not intentional transmitters on board aircraft. This also results in the requirement prohibiting the use of intentional transmitters during aircraft operation. This approach provides high safety assurance, by taking advantage of existing aircraft system protection, existing limits from portable electronic device electromagnetic emissions, and operational restrictions on using portable electronic devices on aircraft, which all contribute to limit potential interference effects from portable electronic devices. The assessment in this chapter shows that the existing aviation regulations adequately address potential interference from portable electronic devices.

Chapter 8 "Conclusions"

addresses the following:

The comparative analysis developed in this report shows that the requirements of the EMC Directive 89/336/EEC are satisfied by the certification requirements and processes for civil aircraft and incorporated equipment.

These certification requirements and processes will be ultimately harmonized by the Council Regulation 3922/91 and its successor. This harmonization process must be encouraged and as far as possible accelerated.

Based on the two above statements, it is recommended to exclude civil aircraft and incorporated equipment from the scope of the EMC Directive, taking the opportunity of the current process of revision of this Directive, to avoid duplicating certification procedures.

Moreover there is no need to establish a standardization programme as proposed by mandate M/282.

All of the procedures, practices and technical specifications associated with aircraft certification and EMC mentioned in this report are under continual review in order to evolve with changes affecting civil aircraft and incorporated equipment.

*** * ***