

A Review of the Current Status of IEMI Standards for the HIPOW Project

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Abstract— As an essential contribution to the HIPOW project, QinetiQ have recently completed a study to review the latest standards for the protection of Critical National Infrastructure (CNI) against Intentional Electromagnetic Interference (IEMI). This paper specifically discusses the elements of each standard which relate to High Altitude Electromagnetic Pulse (HEMP) or IEMI environments and includes a review of testing and measuring techniques, as well as the simulation of High Power Electromagnetic environments.

Keywords— IEMI; Electromagnetic; Compatibility; Standards

I. INTRODUCTION

As the threat from Intentional Electromagnetic Interference (IEMI) increases, standards have been developed to aid in the endeavour to protect electronic and electrical systems, equipment and installations. For the most part, civilian systems are designed and tested against commercial/civilian standards which provides for a range of Electromagnetic Environments (EMEs) that are less severe but more commonly occurring than those of IEMI. The majority of systems which make up the Critical National Infrastructure (CNI) in Europe are tested and certified against relatively low levels of Radio Frequency (RF) disturbances, potentially leaving a gap through which a successful IEMI attack could be executed.

The main objective of HIPOW is to improve the current European situation regarding awareness of IEMI threats and the adequacy of protection of critical infrastructure against the threat. It attempts to achieve this by: demonstrating to policy makers the seriousness of the deficiencies regarding the current situation; defining and preparing procedures and tools for a risk management regime; preparing a database and a handbook for policy makers and critical infrastructure owners; and promoting an organisational and institutional framework for the future regulation regime. To this end, a review of international civilian and unclassified military standards relevant to this objective has been undertaken.

II. STANDARDS

A. International Electrotechnical Committee (IEC)

The IEC has been publishing IEMI-related standards and reports since 1989. This has been led by Sub-Committee (SC) 77C which has 20 current publications to its credit. As is evident, significant efforts have been made to provide guidance on the protection of equipment and systems from the effects of High Altitude Electromagnetic Pulse (HEMP) and IEMI. In our review we conclude that this is the most useful body of guidance for the HIPOW project given the generic or horizontal nature of the advice being pertinent to a very wide range of CNI types and functions.

B. North Atlantic Treaty Organization (NATO)

NATO has recently developed Allied Environmental Conditions and Test Publication (AECTP) 250 – a series of nine Leaflets presenting various EME which may influence the design and operation of military systems. The Leaflets considered in this paper are 256 – ‘Nuclear Electromagnetic Pulse (NEMP/EMP)’ – and 257 – ‘High Power Microwave (HPM)’.

C. United States Department of Defense (US DoD)

Military Standard 464C – ‘Electromagnetic Environmental Effects, Requirements for Systems’ – is a US DoD publication focused on a wide range of EMEs relevant to military systems. It describes the EME characteristics which are likely to be experienced by systems and provides guidance on minimum performance and test requirements for exposure to such conditions. Importantly, this document defines an HPM ‘threat’ environment.

D. International Telecommunications Union Telecommunications Standardization Sector (ITU-T)

Study Group (SG) 5 – ‘Environment and Climate Change’ – of the ITU-T provides guidance for the protection of Fixed Telecommunications systems against the effects of HEMP and IEMI. As a baseline, SG5 uses the basic publications of IEC SC77C to aid in the preparation of its recommendations. Recommendations ITU-T K.78 (HEMP) and ITU-T K.81 (IEMI) are of particular importance and relevance to the Telecommunications functions of CNI.

E. Institute of Electrical and Electronics Engineers (IEEE)

With the support of Technical Committee 5, The IEEE Electromagnetic Compatibility Society is in the process of developing Project 1642 – ‘Recommended Practice for Protecting Public Accessible Computer Systems from Intentional EMI’. The purpose of this work is to provide guidance for protecting against IEMI to builders of computer systems which are to be used by or are accessible to the public.

F. Conseil International des Grands Réseaux Electriques/ Council on Large Electric Systems (CIGRÉ)

CIGRÉ Working Group C4.206 – ‘Protection of the High Voltage Power Network Control Electronics Against Intentional Electromagnetic Interference’ – has recently produced a brochure which evaluates the threat of IEMI to High Voltage (HV) substations and recommends mitigation methods. This brochure is considered to be an important reference for the Electrical Power network function of CNI which is considered by many to be the most important as it underpins many others.