

Irish Standard I.S. EN 16603-20-07:2014

Space engineering - Electromagnetic compatibility

© CEN 2014 No copying without NSAI permission except as permitted by copyright law.

I.S. EN 16603-20-07:2014

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on: EN 16603-20-07:2014

Published: 2014-07-09

ICS number:

NOTE: If blank see CEN/CENELEC cover page

This document was published under the authority of the NSAI and comes into effect on:

2014-07-26

T - 252 1 007 2000

NSAI	T +353 1 807 3800	Sales:
1 Swift Square,	F +353 1 807 3838	T +353 1 857 6730
Northwood, Santry	E standards@nsai.ie	F +353 1 857 6729
Dublin 9	W NSAI.ie	W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

EUROPEAN STANDARD

EN 16603-20-07

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2014

ICS 49.140

English version

Space engineering - Electromagnetic compatibility

Ingéniérie spatiale - Compatibilité électromagnétique

Raumfahrttechnik - Elektromagnetische Kompabilität

This European Standard was approved by CEN on 10 February 2014.

CEN and 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 CEN and CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN and CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Table of contents

Forewo	ord		6
Introdu	iction		7
1 Scop	e		8
2 Norm	native re	ferences	9
3 Term	s, defin	itions and abbreviated terms	10
3.1	Terms fi	rom other standards	10
3.2	Terms s	pecific to the present standard	11
3.3	Abbrevia	ated terms	13
4 Requ	irement	ts	15
4.1	General	system requirements	15
4.2	Detailed	l system requirements	15
	4.2.1	Overview	15
	4.2.2	EMC with the launch system	15
	4.2.3	Lightning environment	16
	4.2.4	Spacecraft charging and effects	16
	4.2.5	Spacecraft DC magnetic emission	17
	4.2.6	Radiofrequency compatibility	18
	4.2.7	Hazards of electromagnetic radiation	18
	4.2.8	Intrasystem EMC	18
	4.2.9	EMC with ground equipment	19
	4.2.10	Grounding	19
	4.2.11	Electrical bonding requirements	20
	4.2.12	Shielding (excepted wires and cables)	21
	4.2.13	Wiring (including wires and cables shielding)	21
5 Verif	ication.		23
5.1	Overviev	w	23
	5.1.1	Introduction	23
	5.1.2	Electromagnetic effects verification plan	23
	5.1.3	Electromagnetic effects verification report	23

5.2	Test co	nditions	23
	5.2.1	Measurement tolerances	23
	5.2.2	Test site	24
	5.2.3	Ground plane	26
	5.2.4	Power source impedance	26
	5.2.5	General test precautions	28
	5.2.6	EUT test configurations	28
	5.2.7	Operation of EUT	31
	5.2.8	Use of measurement equipment	32
	5.2.9	Emission testing	33
	5.2.10	Susceptibility testing	35
	5.2.11	Calibration of measuring equipment	36
5.3	System	level	37
	5.3.1	General	37
	5.3.2	Safety margin demonstration for critical or EED circuits	37
	5.3.3	EMC with the launch system	37
	5.3.4	Lightning	38
	5.3.5	Spacecraft and static charging	38
	5.3.6	Spacecraft DC magnetic field emission	38
	5.3.7	Intra-system electromagnetic compatibility	38
	5.3.8	Radiofrequency compatibility	38
	5.3.9	Grounding	39
	5.3.10	Electrical bonding	39
	5.3.11	Wiring and shielding	39
5.4	Equipm	ent and subsystem level test procedures	39
	5.4.1	Overview	39
	5.4.2	CE, power leads, differential mode, 30 Hz to 100 kHz	40
	5.4.3	CE, power and signal leads, 100 kHz to 100 MHz	42
	5.4.4	CE, power leads, inrush current	45
	5.4.5	DC Magnetic field emission, magnetic moment	47
	5.4.6	RE, electric field, 30 MHz to 18 GHz	50
	5.4.7	CS, power leads, 30 Hz to 100 kHz	54
	5.4.8	CS, bulk cable injection, 50 kHz to 100 MHz	56
	5.4.9	CS, power leads, transients	59
	5.4.10	RS, magnetic field, 30 Hz to 100 kHz	62
	5.4.11	RS, electric field, 30 MHz to 18 GHz	66
	5.4.12	Susceptibility to electrostatic discharges	71

This is a free page sample. Access the full version online. $I.S.\ EN\ 16603\text{-}20\text{-}07\text{:}2014$

EN 16603-20-07:2014 (E)

A (informative) Subsystem and equipment limits	77
Overview	77
CE on power leads, differential mode, 30 Hz to 100 MHz	77
CE on power leads, in-rush currents	79
CE on power and signal leads, common mode, 100 kHz to 100 MHz	79
CE on antenna ports	80
DC magnetic field emission	80
A.6.1 General	80
A.6.2 Characterization	81
A.6.3 Limit	82
RE, low-frequency magnetic field	82
RE, low-frequency electric field	82
RE, electric field, 30 MHz to 18 GHz	83
CS, power leads, differential mode, 30 Hz to 100 kHz	84
CS, power and signal leads, common mode, 50 kHz to 100 MHz	85
CS, power leads, short spike transients	85
RS, magnetic field, 30 Hz to 100 kHz	86
RS, electric field, 30 MHz to 18 GHz	87
Susceptibility to electrostatic discharge	88
	A (informative) Subsystem and equipment limits Overview CE on power leads, differential mode, 30 Hz to 100 MHz CE on power and signal leads, common mode, 100 kHz to 100 MHz CE on antenna ports DC magnetic field emission A.6.1 General A.6.2 Characterization A.6.3 Limit RE, low-frequency magnetic field RE, low-frequency electric field RE, low-frequency electric field RE, electric field, 30 MHz to 18 GHz CS, power leads, differential mode, 30 Hz to 100 kHz to 100 MHz CS, power leads, short spike transients RS, magnetic field, 30 MHz to 18 GHz Susceptibility to electrostatic discharge

Figures

Figure 4-1: Bonding requirements	20
Figure 5-1: RF absorber loading diagram	25
Figure 5-2: Line impedance stabilization network schematic	27
Figure 5-3: General test setup	29
Figure 5-4: Typical calibration fixture	33
Figure 5-5: Conducted emission, 30 Hz to 100 kHz, measurement system check	42
Figure 5-6: Conducted emission, 30 Hz to 100 kHz, measurement setup	42
Figure 5-7: Conducted emission, measurement system check	43
Figure 5-8: Conducted emission, measurement setup in differential mode	43
Figure 5-9: Conducted emission, measurement setup in common mode	44
Figure 5-10: Inrush current: measurement system check setup	46
Figure 5-11: Inrush current: measurement setup	46
Figure 5-12: Smooth deperm procedure	50
Figure 5-13: Electric field radiated emission. Basic test setup	52
Figure 5-14: Electric field radiated emission. Antenna positioning	52
Figure 5-15: Electric field radiated emission. Multiple antenna positions	53

Figure 5-16: CS, power leads, measurement system check set-up	55
Figure 5-17: CS, power leads, signal injection	55
Figure 5-18: Bulk cable injection, measurement system check set-up	58
Figure 5-19: Signal test waveform	59
Figure 5-20: CS of power and signal leads, bulk cable injection	59
Figure 5-21: CS of power leads, transients, calibration set-up	61
Figure 5-22: CS of power leads, spike series injection test setup	61
Figure 5-23: CS of power leads, spike parallel injection test setup	61
Figure 5-24: Measurement system check configuration of the radiating system	64
Figure 5-25: Basic test set-up	64
Figure 5-26: Test equipment configuration	68
Figure 5-27: RS Electric field. Multiple test antenna positions	68
Figure 5-28: Receive antenna procedure	69
Figure 5-29: Spacecraft charging ESD susceptibility test	74
Figure 5-30: Susceptibility to ESD: calibration configuration	74
Figure 5-31: Susceptibility to ESD: test equipment configuration	75
Figure A-1 : Power leads, differential mode conducted emission limit	78
Figure A-2 : Common mode conducted emission limit	80
Figure A-3 : Radiated electric field limit	83
Figure A-4 : Conducted susceptibility limit, frequency domain	84
Figure A-5 : CS, voltage spike in percentage of test bus voltage	86
Figure A-6 : Radiated susceptibility limit	87

Tables

Table 5-1: Absorption at normal incidence	25
Table 5-2: Bandwidth and measurement time	34
Table 5-3: Correspondence between test procedures and limits	40
Table A-1 : Equipment: susceptibility to conducted interference, test signal	85

Foreword

This document (EN 16603-20-07:2014) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16603-20-07:2014) originates from ECSS-E-ST-20-07C Rev. 1.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2015, and conflicting national standards shall be withdrawn at the latest by January 2015.

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

This document has been developed to cover specifically space systems and has therefore precedence over any EN covering the same scope but with a wider domain of applicability (e.g. : aerospace).

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom."

Introduction

Electromagnetic compatibility (EMC) of a space system or equipment is the ability to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

The space system is designed to be compatible with its external natural, induced, or man-made electromagnetic environment. Natural components are lightning for launchers, the terrestrial magnetic field for space vehicles. Spacecraft charging is defined as voltage building-up of a space vehicle or spacecraft units when immerged in plasma. Electrostatic discharges result from spacecraft charging with possible detrimental effects. External man-made interference, intentional or not, are caused by radar or telecommunication beams during ground operations and the launching sequence. Intersystem EMC also applies between the launcher and its payload or between space vehicles.

Intrasystem EMC is defined between all electrical, electronic, electromagnetic, and electromechanical equipment within the space vehicle and by the presence of its self-induced electromagnetic environment. It comprises the intentional radiated electromagnetic fields and parasitic emission from on-board equipment. Both conducted and radiated emissions are concerned. An electromagnetic interference safety margin is defined at system critical points by comparison of noise level and susceptibility at these points.

1 Scope

EMC policy and general system requirements are specified in ECSS-E-ST-20.

This ECSS-E-ST-20-07 Standard addresses detailed system requirements (Clause 4), general test conditions, verification requirements at system level, and test methods at subsystem and equipment level (Clause 5) as well as informative limits (Annex A).

Associated to this standard is ECSS-E-ST-20-06 "Spacecraft charging", which addresses charging control and risks arising from environmental and vehicle-induced spacecraft charging when ECSS-E-ST-20-07 addresses electromagnetic effects of electrostatic discharges.

Annexes A to C of ECSS-E-ST-20 document EMC activities related to ECSS-E-ST-20-07: the EMC Control Plan (Annex A) defines the approach, methods, procedures, resources, and organization, the Electromagnetic Effects Verification Plan (Annex B) defines and specifies the verification processes, analyses and tests, and the Electromagnetic Effects Verification Report (Annex C) document verification results. The EMEVP and the EMEVR are the vehicles for tailoring this standard.

This standard may be tailored for the specific characteristic and constrains of a space project in conformance with ECSS-S-ST-00.



This is a free preview. Purchase the entire publication at the link below:

Product Page

S Looking for additional Standards? Visit Intertek Inform Infostore

> Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation