

SLOVENSKI STANDARD
kSIST FprEN 16603-20-01:2014
01-oktober-2014

Vesoljska tehnika - Multipaction - Zasnova in preskušanje

Space engineering - Multipaction, design and test

Raumfahrttechnik - Multipaction-Konzeption und -Test

Systèmes sol et opérations - Conception et test prenant en compte l'effet Multipactor

Ta slovenski standard je istoveten z: FprEN 16603-20-01

ICS:

49.140 Vesoljski sistemi in operacije Space systems and operations

kSIST FprEN 16603-20-01:2014 **en,fr,de**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

FINAL DRAFT
FprEN 16603-20-01

May 2014

ICS 49.140

Will supersede EN 14777:2004

English version

Space engineering - Multipaction, design and test

Systèmes sol et opérations - Conception et test prenant en compte l'effet Multipactor

Raumfahrttechnik - Multipaction-Konzeption und -Test

This draft European Standard is submitted to CEN members for unique acceptance procedure. It has been drawn up by the Technical Committee CEN/CLC/TC 5.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN and CENELEC 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.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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

Table of contents

Foreword	7
Introduction.....	8
1 Scope.....	9
2 Normative references.....	10
3 Terms, definitions and abbreviated terms.....	11
3.1 Terms and definitions from other standards	11
3.2 Terms and definitions specific to the present standard	11
3.3 Abbreviated terms.....	14
4 Verification	15
4.1 Verification process	15
4.2 Verification levels.....	15
4.3 Verification plan	15
4.3.1 Introduction	15
4.3.2 Generation and updating.....	16
4.3.3 Description.....	16
4.4 Verification routes	17
4.5 Classification of component type	17
4.6 Single carrier	18
4.6.1 General	18
4.6.2 Margins	18
4.6.3 Route to demonstrate compliance.....	18
4.7 Multi-carrier.....	21
4.7.1 General	21
4.7.2 Threshold above peak envelope power.....	21
4.7.3 Threshold below peak envelope power	22
4.7.4 Route to demonstrate conformance	22
5 Design analysis	25
5.1 Overview	25
5.2 General requirements	25

5.2.1	Field analysis	25
5.2.2	Secondary emission yield data.....	25
5.3	Critical region identification	26
5.4	Multipaction sensitivity analysis	27
5.5	Venting	27
6	Test conditions	28
6.1	Cleanliness	28
6.2	Pressure	28
6.3	Temperature	29
6.4	Frequencies.....	29
6.5	Pulse duration.....	29
6.5.1	General.....	29
6.5.2	CW units	30
6.5.3	Pulse duration	30
6.6	Electron seeding	30
6.6.1	Multipactor test in CW operation	30
6.6.2	Multipactor test in pulsed operation.....	30
6.6.3	Multipactor test in multi-carrier operation	31
6.6.4	Seeding sources	31
7	Methods of detection.....	33
7.1	General.....	33
7.2	Detection methods.....	33
7.3	Detection method parameters.....	33
7.3.1	Sensitivity.....	33
7.3.2	Rise time	34
8	Test procedures.....	35
8.1	Test configuration	35
8.2	Test facility validation.....	35
8.3	Test execution	36
8.3.1	General	36
8.3.2	Test procedure	36
8.4	Acceptance criteria	37
8.4.1	General	37
8.4.2	Multi-carrier test	38
Annex A	(informative) Multipaction background.....	39
A.1	Physics of multipaction	39

FprEN 16603-20-01:2014 (E)

A.2	Other physical processes.....	40
A.3	RF operating environment	40
A.3.1	General.....	40
A.3.2	CW approach	41
A.3.3	Pulsed approach	41
A.3.4	Multi-carrier approach	41
A.3.5	Multi-carrier multipaction thresholds.....	42
A.4	Parallel plate multipaction.....	48
A.4.1	Introduction	48
A.4.2	Woode and Petit results	50
A.5	Coaxial line multipaction	52
A.5.1	Introduction	52
A.5.2	Problem definition	53
A.5.3	Simulations	53
A.5.4	Results.....	53
Annex B (normative) Cleaning, handling, storage and contamination	56	
B.1	Generic process	56
B.1.1	Introduction	56
B.1.2	Cleaning and handling of critical components	56
B.2	Cleaning, handling and storage	56
B.2.1	Introduction	56
B.2.2	Cleaning and handling of critical components	57
B.2.3	Storage of components	58
B.3	Contaminants	59
B.3.1	The effect of contaminants on the multipaction threshold	59
B.3.2	Contamination measurement (wipe test)	59
B.3.3	Summary of test made and the results	59
B.3.4	Summary conclusions to the test.....	61
B.3.5	Surface verification.....	61
Annex C (informative) Electron seeding	62	
C.1	Introduction.....	62
C.2	CW test.....	62
C.3	Pulsed test.....	62
C.4	Multi-carrier test.....	62
C.4.1	General.....	62
C.4.2	Generic multi-carrier test.....	62
C.4.3	Multi-carrier test with transient detection	63

C.5 Types of seeding sources	64
C.5.1 Overview	64
C.5.2 Radioactive source	64
C.5.3 UV lamp	66
C.5.4 Regulated electron gun	67
C.6 Guidelines for the use of seeding sources	68
Annex D (informative) Test methods	70
D.1 Introduction	70
D.2 General test methods	70
D.2.1 Close to carrier noise	70
D.2.2 Return loss	72
D.2.3 Harmonic noise	75
D.3 Transient tests methods	75
D.3.1 Introduction	75
D.3.2 Signal generation	77
D.4 Test facility validation	82
Annex E (informative) Secondary electron emission	83
E.1 SEY Definition and properties	83
E.2 SEY and multipactor	84
E.3 Factors affecting SEY	86
E.4 SEY testing	87
Bibliography	91

Figures

Figure 4-1: Routes to conformance for single carrier	20
Figure 4-2: Routes to conformance for multi-carrier test	24
Figure 5-1: The susceptibility zone boundaries for examples of aluminium, copper, silver, gold and alodine 1200 used in Annex A	26
Figure A-1 : Total secondary electron emission as a function of the incident electron	48
Figure A-2 : Multipaction susceptibility zones for parallel plates of an example of aluminium	49
Figure A-3 : Multipaction threshold for all materials studied, plotted in a single graph as labelled	54
Figure D-1 : Generic close to carrier noise multipaction test site	71
Figure D-2 : Principal multipaction test set-up for nulling detection method	73
Figure D-3 : Test configuration (mode 1)	76
Figure D-4 : Test configuration (mode 2)	76

FprEN 16603-20-01:2014 (E)

Figure D-5 : Detected envelope of a five carrier waveform	79
Figure D-6 : Charge probe.....	81
Figure E-1 : Typical dependence of SEY coefficients on primary electron energy	84
Figure E-2 : Energy distribution of emitted electron from Au target surface submitted to 112 eV electron irradiation [23].....	84
Figure E-3 : Experimental arrangement for SEY test with emission collector.....	88
Figure E-4 : SEY experimental setup (without collector around the sample).....	89

Tables

Table 4-1: Classification of component type	18
Table 4-2: Margins applicable to Type 1, 2 and 3 components	18
Table 4-3: Multi-carrier margins applicable to Type 1 components when the single carrier multipaction threshold is above the peak envelope power	22
Table 4-4: Multi-carrier margins applicable to Type 1 components when the single carrier multipaction threshold is below the peak envelope power	22
Table A-1 : Worst case mode order for susceptible gaps for an example of gold.....	43
Table A-2 : Worst case mode order for susceptible gaps for an example of silver	44
Table A-3 : Worst case mode order for susceptible gaps for an example of aluminium	45
Table A-4 : Worst case mode order for susceptible gaps for an example of alodine	46
Table A-5 : Worst case mode order for susceptible gaps for an example of copper.....	47
Table A-6 : Constants for the tested materials.....	52
Table A-7 : Critical voltages for multipaction in 50 Ohms coaxial lines using an example of materials	54
Table C-1 : Rate and energy of injected electrons going through a particular aluminium wall.....	65