DIN EN 16603-20-01:2020-11 (E)

Space engineering - Multipactor, design and test; English version EN 16603-20-01:2020

Table of contents

European Foreword 6

Introduction 7

1 Scope 8

2 Normative references 9

3 Terms, definitions and abbreviated terms 10

3.1 Terms and definitions from other standards 10

3.2 Terms and definitions specific to the present standard 11

3.3 Abbreviated terms 13

3.4 Nomenclature 15

4 Verification 16

4.1 Verification process 16

4.2 Multipactor verification plan 18

4.2.1 Generation and updating 18

4.2.2 Description 18

4.3 Power requirements 19

4.3.1 General power requirements 19

4.4 Classification of equipment or component type 20

4.4.1 General classification of equipment or component type 20

4.5 Verification routes 22

4.6 Single carrier 23

4.6.1 General 23

4.6.2 Verification by analysis 23

4.6.3 Verification by test 26

4.7 Multicarrier 27

4.7.1 General 27

4.7.2 Verification by analysis 27

4.7.3 Verification by test 30

5 Design analysis 31

5.1 Overview 31

5.2 Field analysis 31
5.3 Multipactor design analysis 32
5.3.1 Frequency selection 32
5.3.2 Design analysis levels 32
5.3.3 Available data for Multipactor analysis 37

6 Multipactor - Test conditions 45
6.1 Cleanliness 45
6.2 Pressure 45
6.3 Temperature 46
6.4 Signal characteristics 47
6.4.1 Applicable bandwidth 47
6.4.2 Single-frequency test case 47
6.4.3 Multi-frequency test case 47
6.4.4 Pulsed testing 49
6.5 Electron seeding 50
6.5.1 General 50
6.5.2 Multipactor test in CW operation 50
6.5.3 Multipactor test in pulsed operation 50
6.5.4 Multipactor test in multi-carrier operation 50
6.5.5 Seeding sources 50
6.5.6 Seeding verification 51

7 Multipactor - Methods of detection 52
7.1 General 52
7.2 Detection methods 52
7.3 Detection method parameters 53
7.3.1 Verification 53
7.3.2 Sensitivity 53
7.3.3 Rise time 54

8 Multipactor - Test procedure 55
8.1 General 55
8.2 Test bed configuration 55
8.3 Test bed validation 56
8.4 Test sequence 57
8.5 Acceptance criteria 61
8.5.1 Definitions 61
8.5.2 Multipactor Free Equipment or component 61

8.5.3 Steps in case of Discharges or Events during test....61
8.5.4 Investigation of Test Anomalies....66
8.6 Test procedure....66
8.7 Test reporting....67
9 Secondary electron emission yield requirements....68
9.1 General....68
9.2 SEY measurements justification....68
9.3 Worst case SEY measurement....68
9.4 SEY measurements conditions....69
9.4.1 Environmental conditions....69
9.4.2 SEY test bed conditions....69
9.4.3 SEY sample characteristics....70
9.5 SEY measurements procedure....70
9.5.1 SEY Measurements procedure documents....70
9.5.2 SEY measurement calibration....71
9.6 ECSS SEY data selection....71
Annex A (informative) Multipactor document delivery per review....72
Bibliography....74

Figures

Figure 3-1: Minimum inflexion point for Silver multipactor chart.....12
Figure 4-1: Verification routes per component/equipment type and qualification status for multipactor conformance....22
Figure 5-1: Multipactor chart for standard Aluminium obtained with parameters from Table 9-1....42
Figure 5-2: Multipactor chart for standard Copper obtained with parameters from Table 9-1....42
Figure 5-3: Multipactor chart for standard Silver obtained with parameters from Table 9-1....43
Figure 5-4: Multipactor chart for standard Gold obtained with parameters from Table 9-1....43
Figure 5-5: Comparison of Multipactor charts for all standard materials obtained with parameters from Table 9-1....44
Figure 8-1: Illustration of test sequence....60
Figure 8-2: Illustration of test sequence following first Event....63
Figure 8-3: Illustration of test sequence following first potential discharge....65

Tables

Table 4-1: Classification of equipment or component type according to the qualification status and heritage from a multipactor point of view (adapted from Table 5-1 of ECSS-E-ST-10-02)....17

Table 4-2: Classification of equipment or component type according to the material and the geometry....21

Table 4-3: Analysis margins w.r.t. nominal power applicable to P1 and P2 equipment or components with Bm or Cm category verified by analysis....24

Table 4-4: Analysis margins w.r.t. nominal power applicable to P1 and P2 equipment or components with Dm category verified by analysis....25

Table 4-5: Test margins w.r.t. nominal power applicable to P1, P2 and P3 equipment or components verified by test....26

Table 4-6: Analysis margins applicable to P1 and P2 equipment or components with Bm or Cm category verified by analysis....28

Table 4-7: Analysis margins applicable to P1 and P2 equipment or components with Dm category verified by analysis....29

Table 4-8: Test margins w.r.t. nominal power applicable to P1, P2 and P3 equipment or components verified by test....30

Table 5-1: Tabulated values of the lowest breakdown voltage threshold boundary of the multipactor charts, computed with the SEY data of Table 9-1....38

Table 9-1: SEY parameters for Al, Cu, Au and Ag materials....71

Table A-1 : Multipactor deliverable document per review....73