DIN EN 16605:2025-06 (E)

Space - Galileo Timing Receiver - Functional and Performance Requirements and associated Tests

Contents

Page

European foreword 5

Introduction 6

1 Scope 7

2 Normative references 8

3 Terms, definitions and abbreviated terms 8
3.1 Terms and definitions 8
3.2 Abbreviated terms 14

4 Galileo Timing Service 17
4.1 Introduction to timing receivers and timing references 17
4.2 Galileo Timing Service - Accuracy and Availability 19
4.3 Galileo Timing Service -Integrity capability 19
4.3.1 General 19
4.3.2 Definition of a Fault-Free Timing solution 19
4.3.3 Definition of a faulty timing solution 20
4.3.4 High-Level Architecture of Galileo Timing Service 20
4.3.5 Timing Flags processing 21
4.3.6 Galileo timing receiver Decision Logic 22
4.3.7 Time To Alert and Time To Notify 26
4.3.8 T-RAIM Processing 26

5 Requirements for Galileo timing receivers 26
5.1 Definitions 26
5.2 Minimum Equipment Characteristics 26
5.3 Functional Requirements 29
5.3.1 Constellations Processed 29
5.3.2 Frequencies Processed 29
5.3.3 Back-up Modes 29
5.3.4 Dynamics of the User 29
5.3.5 Time Scales 30
5.3.6 Processing of Timing Flags and Integrity Requirements 30
5.3.7 T-RAIM Functional Requirements and Consistency Checks 35
5.3.8 Anti-Jamming Capabilities 35
5.3.9 Galileo OS-NMA Processing 37
5.3.10 Holdover Capabilities 37
5.3.11 Multipath mitigation 38
5.3.12 Special Configuration and Output Requirements 38
5.4 Performance Requirements 38
5.4.1 General 38
5.4.2 Accuracy Requirements 39
5.4.3 Availability Requirements 39
5.4.4 Integrity Requirements 40
5.4.5 T-RAIM Performances and thresholds 42
5.4.6 Holdover Timeout 42

6 Verification of Galileo timing receivers 43
6.1 General 43

6.2 Galileo timing receiver Test Policy ... 43
6.3 Strategy for Galileo timing receivers Verification ... 44
6.3.1 Verification Methods ... 44
6.3.2 Galileo timing receivers Verification Strategy ... 44
6.3.3 Galileo timing receiver Test Suite ... 45
6.4 Test Environment ... 50
6.4.1 General ... 50
6.4.2 Record and Replay Test Environment ... 50
6.5 Antenna conditions definition ... 54
6.5.1 Open sky ... 54
6.5.2 Obstructed open sky ... 54
6.5.3 Light indoor ... 56
6.6 Error Budgets for the Tests ... 56
6.7 Traceability Matrix: Requirements vs Verification Method ... 57
6.7.1 Traceability ... 57
6.7.2 Receiver functionalities Verified by Review Method ... 59
6.8 Galileo timing receiver tests ... 59
6.8.1 Record and Replay test configuration ... 59
6.8.2 Calibration of time delays ... 65
6.8.3 For the Verification of Galileo timing receiver Functions (TC-01) ... 65
6.8.4 GST Service Level 1 (TC-02) ... 67
6.8.5 GST Service Level 2 (TC-03) ... 68
6.8.6 GST Service Level 3 (TC-04) ... 69
6.8.7 UTC Service Level 1 (TC-05) ... 69
6.8.8 UTC Service Level 2 (TC-06) ... 70
6.8.9 UTC Service Level 3 (TC-07) ... 71
6.8.10 Performances in obstructed environment (TC-08) ... 72
6.8.11 Performances in light indoor environment (TC-09) ... 73
6.8.12 Test on Robustness to Interferences: Nominal Conditions (TC-10) ... 73
6.8.13 Test on Robustness to Interferences: Degraded Conditions (TC-11) ... 74
6.8.14 Test on T-RAIM Performances (TC-12) ... 76
6.8.15 Test on Receiver Noise (TC-13) ... 80

Annex A (informative) GNSS Timing Equations ... 82

Annex B (informative) Guidelines for Installation and Maintenance ... 85

B.1 Antenna, Cabling and Receiver Installation ... 85
B.1.1 General ... 85
B.1.2 Selecting a GNSS Antenna ... 85
B.1.3 Locating and Installing the GNSS Antenna ... 86
B.1.4 Connecting to the Antenna: Cabling ... 87
B.1.5 Antenna Installation Verification ... 87
B.1.6 Using Ancillary Products ... 87
B.1.7 Evaluating Signal Attenuation to validate cable length ... 87
B.1.8 Multipath Mitigation ... 89
B.1.9 Other Recommendations ... 89
B.2 Precise computation of the antenna position ... 90
B.2.1 General ... 90
B.2.2 Needed inputs for conducting a PPP to precisely compute the antenna position of the Galileo timing receiver ... 90
B.2.3 Available online PPP Services ... 90
B.3 Initial Calibration of the 1PPS receiver chain time delays ... 91
B.4 Periodic re-calibration ... 94

Annex C (informative) Record and Replay additional information ... 95

C.1 Clock reference sources ... 95

Annex D (informative) Timing Flags Definition ... 98

Annex E (normative) Provision of Record and Replay files ... 101

E.1 Requirements for collecting data for the R&R 101
E.1.1 Technical documentation 101
E.1.2 Human resources 102
E.1.3 GNSS signals digitalization 102
E.1.4 GNSS constellations simulator 103
E.2 Requirements for validating R&R data 104
E.2.1 Validation of the field test 104
E.2.2 Validation of the digitized GNSS signals 104

Annex F (informative) Justification of Nominal RFI Environment 106

Annex G (informative) Validation of Test on Receiver Noise (TC-13) 107

Bibliography 108