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GALILEO PRN SPREADING CODE ASSIGNMENT PROCESS

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1 INTRODUCTION

Many radionavigation systems seek a high level of interoperability with Galileo, including the use of Pseudo Random Noise (PRN) codes from the spreading code families developed for Galileo. Signals that employ PRN codes from the Galileo spreading code families achieve an established level of correlation performance to help achieve compatibility and interoperability with Galileo¹. Additionally, the use of PRN codes from the Galileo spreading code families fosters the development of receivers capable of seamlessly using signals from multiple radionavigation systems.

1.1 Scope

The scope of this document is to describe the process applicable to systems other than Galileo planning to transmit Galileo-like signals using PRN codes for one or more of the following signal components:

- E1-B and E1-C
- E6-B and E6-C
- E5a-I, E5a-Q, E5b-I and E5b-Q

The application process shall be followed by all applicants.

1.2 Terms of Use and Disclaimer

1.2.1 Authorised use and scope of use

The Galileo PRN Spreading Code Assignment Process and the information contained herein is made available to the public by the European Union (hereinafter referred to as Publishing Authority) for the benefit and the promotion of the European Global Navigation Satellite Systems programmes (European GNSS Programmes) and according to terms and conditions specified thereafter.

1.2.2 General Disclaimer of Liability

With respect to the Galileo PRN Spreading Code Assignment Process and any information contained herein, including PRN codes themselves, neither the Publishing Authority nor Galileo PRN Code Assignment Authority (GPCAA), European Commission (EC) or European Agency for the Space Programme (EUSPA) make any warranty, express or implied, including the warranty of fitness for a particular purpose, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information hereby disclosed or for any product developed based on this information, or represents that the use of this information would not cause damages or would not infringe any intellectual property rights. No liability is hereby assumed for any direct, indirect, incidental, special or consequential damages, including but not limited to, damages for interruption of business, loss of profits, goodwill or other intangible losses, resulting from the use of Galileo PRN Spreading Code Assignment Process or of the information contained herein, including the PRN codes themselves. Liability is excluded as well for consequences of the use and / or abuse

¹ Radio frequency compatibility with Galileo will be a separate required step necessary for PRN authorisation, see section 4.4.2. This requires a bilateral coordination in accordance with the Radio Regulations of the International Telecommunication Union (ITU)

of this Galileo PRN Spreading Code Assignment Process or the information contained herein, including the PRN codes themselves.

The issuance of a PRN code does not indicate the GPCAA, EUSPA or the EC endorses or approves of the applicant's operations. A PRN code assignment is non-transferable and non-licensable. The applicant shall not assign, transfer or license any of the codes issued under this process. A PRN code assignment does not convey the authority to radiate in the Galileo E1, E6 and E5 frequency bands. GPCAA, EUSPA or the EC assume no responsibility for ensuring subject systems comply with domestic or international radio frequency regulations or ensuring subject systems do not cause radio frequency interference. The applicant and appropriate national and/or international regulatory bodies are responsible for the operation of the system in accordance with all applicable rules and regulations.

1.2.3 Industrial Property Rights

Any use of technology covered by the patents mentioned in the List of IPRs in point 12 of Annex H of [AD.1] must be done in compliance with the terms of the Authorisation stated in Annex H of [AD.1].

1.2.4 Copyright

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1.2.5 Miscellaneous

No failure or delay in exercising any right in relation to the Galileo PRN Spreading Code Assignment Process or the information contained therein shall operate as a waiver thereof, nor shall any single or partial exercise preclude any other or further exercise of such rights. The disclaimers contained in this document apply to the extent permitted by applicable law.

1.2.6 Updates

The Galileo PRN Spreading Code Assignment Process could be subject to modification, update and variations. The publication of updates will be subject to the same terms as stated herein unless otherwise evidenced. Although the Publishing Authority will deploy its efforts to give notice to the public for further updates of Galileo PRN Spreading Code Assignment Process, it does not assume any obligation to advise on further developments and updates of the Galileo PRN Spreading Code Assignment Process, nor to take into account any inputs, comments proposed by interested persons or entities, involved in the updating process.

1.3 Definition of Terms

In this document, the term *subject system* will refer to the system transmitting Galileo PRN codes. Common examples of a subject system would be a regional satellite navigation system, or a satellite payload leased by an SBAS service provider.

The term *applicant* will refer to the requesting agency or sponsoring government administration that is either operating the subject system or acting as the SBAS service provider.

The Galileo Pseudorandom Noise spreading codes are defined in [AD.1] for E1-BC and E5ab signal components, and [AD.2] for the E6-BC signal components. Baseline sets of PRN codes are reserved exclusively for use by Galileo satellites. Additional sets of unassigned PRN codes are defined for eventual use by cooperating radionavigation systems. Each PRN will be assigned individually on each signal component.

In the frame of this document, PRN code assignment is the responsibility of the Galileo PRN-Code Assignment Authority (GPCAA).

1.4 Galileo PRN Assignment Authority

The European Commission Directorate-General for Defence Industry and Space (DG DEFIS) is the Galileo PRN-Code Assignment Authority.

2 PROCESS OVERVIEW

A formal request for a PRN code is initiated when an applicant submits the “Application for PRN Code Assignment” to GPCAA through the GSC HelpDesk (www.gsc-europa.eu). If the review criteria in section 4 are satisfied and PRN codes are available, GPCAA will, at its discretion, and taking into account the other considerations in section 4, issue a PRN code set assignment to the applicant.

The GPCAA has complete discretion in setting the review criteria and other considerations it will use to guide its assessment (section 4), as well as in applying them when assessing applications. PRN codes will be assigned only to the specific signal component for which the applicant is applying for.

The assignment duration will be based on the needs of the subject system and the criteria described in section 4. The applicant may request the renewal of the assigned PRN code set by resubmitting an application with any relevant changes before the assignment expiration date.

2.1 Website

All pertinent documentation, to include the PRN code application and the current lists of assignments, is located at www.gsc-europa.eu.

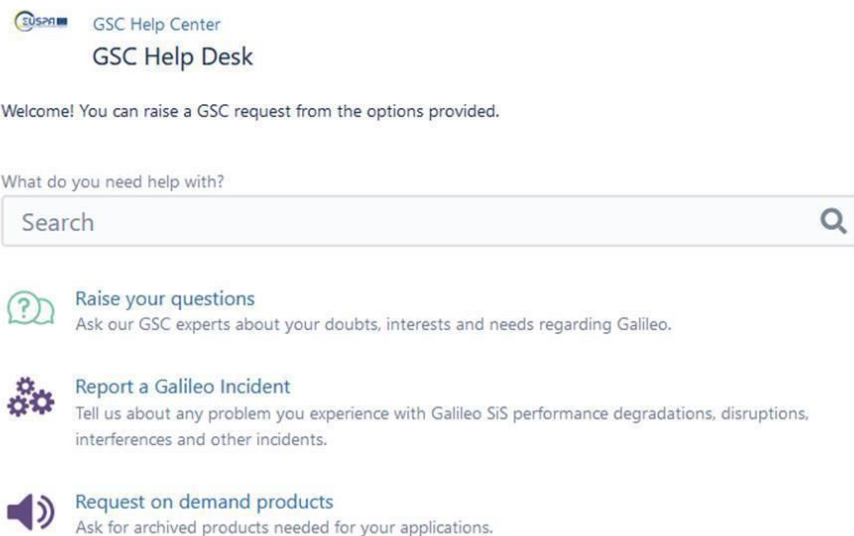
3 REQUEST FOR A PRN CODE ASSIGNMENT

3.1 Application submittal

To request the initial assignment or renewal of one or more PRN codes, an applicant must fill out the “Application for PRN Code Assignment.” This form is found at www.gsc-europa.eu and an example is included in Appendix A of this document.

Once the application is complete, it shall be submitted to GPCAA through the GSC HelpDesk as detailed next. Thorough completion of the application and compliance with the instructions will aid GPCAA assessment.

To submit the application, the applicant shall access GSC Help Desk at www.gsc-europa.eu (registration is needed) and select “Raise your questions”.



In the question form, the applicant shall type “Application for PRN Code Assignment” as subject, select “Open Service (OS)” as target service, and attach the completed application form and any accompanying information.

GSC Help Center / GSC Help Desk
Raise your questions

Subject
Application for PRN Code Assignment

Galileo service to which your message or question is related
Open Service (OS)

User Domain (optional)
None

Write your message or question

Attachment (optional)
Drag and drop files, paste screenshots, or
browse

Create Cancel

3.2 Application content

The purpose of the application is for GPCAA to obtain sufficient technical and programmatic information in order to determine the appropriate PRN codes and assignment duration. This assessment is influenced by the applicant's request and GPCAA's evaluation of the application according to the criteria described in section 4.

3.3 Timeline for Submittal

Informal coordination (e.g. email or in-person communication) on the status of the applicant's program, intentions for PRN code assignment renewal, or intentions to apply for a new PRN code set can be conducted at any time. However, formal application submittal should be accomplished no earlier than 1 year and no later than 4 months before the date when the applicant would like to be assigned the PRN codes.

4 ASSESSMENT OF A PRN CODE ASSIGNMENT APPLICATION

4.1 Receipt and Clarifying Questions

GPCAA should normally reply within 4 weeks of application submittal to confirm receipt of the Application for PRN Code Assignment. Once received, GPCAA will contact the applicant if any additional information is necessary.

4.2 Timeline for Assessment

GPCAA will assess applications as quickly as possible, in the order they are received. If the application is complete, clear, and accurate, an assessment can typically be expected within 2 months after confirmation of receipt. Applicants should specify the PRN code notification need date on the application.

4.3 Types of PRN Code Assignments

For what concerns the duration, there are two types of PRN code assignments: Short and Long. The maximum duration of a Long PRN code assignment is 15 years, while the maximum duration of a Short assignment is 3 years. At the moment, there is no limit on the number of times a Short or Long assignment can be renewed.

4.4 Requirements for PRN Code Assignments

This section contains the requirements for obtaining a PRN code assignment. Section 4.4.4 contains a summary table of requirements for Short and Long assignments.

4.4.1 Completed Application

All relevant sections of the PRN code application must be complete in order to obtain a PRN code assignment.

Applicants requesting multiple PRNs, shall justify the number of PRN codes requested.

Furthermore, for subject systems broadcasting E5 (E5a and/or E5b) PRN codes, applicants must provide evidence of participation and inclusion of their E5 signal parameters (including for the specific signal component for which the PRN is requested) in the annual ITU Resolution 609 (Rev. WRC-07) Consultation Meeting calculations and the associated preparatory process².

² <https://www.itu.int/en/ITU-R/space/Pages/res609.aspx>

4.4.2 Demonstrated Compliance with Governing Spectrum Authorities

The applicant is responsible for ensuring the subject system complies with the relevant governing spectrum regulatory agencies, including evidence of an applicable satellite frequency filing, or filings, submitted to the ITU.

In the case of the subject system transmitting from leased payloads, the service provider may not necessarily be the organization that submits the radio frequency filings, but the responsibility is on the service provider to ensure the appropriate filings are complete, accurate, and approved before broadcasting a PRN code.

GPCAA will use the ITU filing reference info in the Application for PRN Code Assignment to verify compliance. If the ITU is not the governing spectrum authority for the subject system, the applicant must attach evidence of compliance to the applicable spectrum authority (i.e. radiofrequency filing or certification). For Long PRN code assignments, the subject system must have a notification published by ITU, signifying the system successfully completed coordination and is currently in use.

Demonstration of a successful radio frequency coordination with Galileo shall be a fundamental prerequisite for the release of any PRN code.

4.4.3 Program Schedule and Updates

Applicants must submit a program status and schedule that includes the high-level development, implementation, and operation timeline, including when the PRN codes will be required.

It should also include any planned updates or changes that would affect PRN code usage (e.g. system decommission, fielding a new system, etc.).

4.4.4 Summary of Requirements

Completed applications shall address all the items listed in the table below which correspond to the desired PRN type. The required items should be included in the application itself or attached as supporting documents.

Table 1 - Summary of the PRN Assignment Requirements

Short Assignment (max 3 years)	Long Assignment (max 15 years)
Technical justification for the number of PRNs / satellites	Technical justification for the number of PRNs / satellites
If broadcasting E5, provide evidence of successful inclusion in ITU Resolution 609 Consultation meeting calculations as described in section 4.4.1	If broadcasting E5, provide evidence of successful inclusion in ITU Resolution 609 Consultation meeting calculations as described in section 4.4.1
ITU filing (provide reference info in application) OR other appropriate radiofrequency filing (attach evidence to application)	ITU Notification (provide reference info in application) OR other appropriate radiofrequency certification (attach evidence to application)
Program updates (purpose of service, users, schedule for test and operational service). Attach a PDF.	Program updates (purpose of service, users, schedule for test and operational service). Attach a PDF
Successful Galileo-to-operator RF compatibility coordination	Successful Galileo-to-operator RF compatibility coordination

4.5 Evaluation of PRN Code Requests

GPCAA will evaluate whether the applicant meets all requirements in section 4.4. GPCAA will also consider the following factors when determining whether to issue a PRN code, and which PRN code number can be issued.

4.5.1 Compatibility, Interference and Interoperability

GPCAA will conduct initial compatibility and interference screening to include, but not limited to, verifying the transmitter characteristics follow ITU Radio Regulations and assessing compliance with any existing Galileo operator-to-operator agreements (which remains a key prerequisite). In addition also interoperability aspects will be analysed in order to confirm the benefits at user level when Galileo signals are combined with the applicant's signals at user side. In particular, aspects related to the ranging and timing accuracy of the applicant's system will be evaluated.

4.5.2 Existing PRN Code Assignment

If a specific PRN code is requested by multiple applicants, and all other assessment criteria are satisfied, priority will be given to the incumbent (e.g. if Applicant A already possesses a Short assignment for PRN 137, preference will be given to Applicant A for renewal of PRN 137).

4.5.3 Quantity of PRN Codes

As an increasing number of systems request use of this finite resource, the number of PRNs assigned to an applicant must be managed to ensure the assignment process is equitable. The applicant shall justify the number of requested PRN codes.

4.5.4 Users – Assessment of the operational users and geographic area serviced by the subject system

In the event of limited operational PRNs, the number of operational users and geographic area may be considered to determine whether a particular PRN code is assigned.

4.6 Duration of a PRN Code Assignment

4.6.1 Maximum Duration

The maximum duration of the PRN code depends on the type of PRN code assigned. If it is Short, the maximum duration is 3 years. If it is Long, the maximum duration is 15 years. An applicant desiring to extend a PRN code assignment beyond the maximum duration must request the renewal of their assignment by submitting another application and incorporating any pertinent changes.

4.6.2 Assigned Duration

Applicants must specify the requested PRN assignment duration on the Application for PRN Code Assignment. GPCAA will attempt to accommodate the requested duration as long as it is aligned with the submitted program schedule (section 4.4.3).

4.6.3 Issuance of PRN Code Assignment

If the GPCAA considers the application favourably, the GPCAA will issue a PRN code assignment letter to the applicant.

4.6.4 Issuance of PRN Codes

When GPCAA assigns a PRN code, an explicit set of codes is issued, identifying the frequency (E1, E6 and/or E5) on which each code is transmitted.

4.6.5 Recipient of the Assignment

The applicant will be the recipient of the PRN code assignment. The desired addressee for the assignment letter should be included in the Application for PRN Code Assignment

4.6.6 Published Update

GPCAA will publish updates to Code Assignment on all frequencies on the EUSPA website at www.gsc-europa.eu.

4.6.7 Expiration

The PRN code assignment will expire the last day of the last month of the effective assignment. For example, if the PRN code assignment is effective till the month of April 2023, it will expire on 30 April 2023.

5 RETENTION OF A PRN CODE ASSIGNMENT

In order to retain the issued PRN code assignment, the applicant must adhere to the following requirements:

5.1 Notification of Changes

Applicants must notify the GPCAA when the dates of test or operational service have changed significantly with respect to the original application package. Significant changes include permanent cease of transmission or greater than 6-month delay of broadcasts.

5.2 Maintaining Operations

If a subject system ceases broadcasts for 2 consecutive years during the assigned duration, GPCAA reserves the right to rescind the PRN Code Assignment unless there is sufficient justification (proof of current or planned broadcasts).

5.3 Issue or Anomaly Reporting

In the event that an issue or anomaly related to the assigned PRN code is identified with a subject system, the GPCAA shall be notified.

6 MODIFICATION OF A PRN CODE ASSIGNMENT

6.1 PRN Transfer Initiated by GPCAA

GPCAA may request to transfer PRN codes, i.e. to assign a different PRN code than the original, while an assignment is still active. All applicants with affected PRN code assignments must approve of the transfer before it is accomplished.

6.2 Revocation or Suspension

GPCAA reserves the right to revoke or suspend any active PRN code assignment if (1) the system is found to not be in compliance with international or national regulations, standards, or guidance or (2) the system does not meet the criteria in Section 4 and Section 5 (e.g. not using the PRN code assignment for 2+ years). GPCAA will attempt to discuss any issues with the applicant before revoking or suspending the PRN code assignment.

6.3 PRN Transfer Initiated by Applicant.

Applicants that desire to transfer PRN code assignments between two satellites within their systems must contact GPCAA for approval.

6.4 Contact Information

All communications related to the Galileo PRN assignment, including the application and associated questions, should be submitted to the GSC HelpDesk (www.gsc-europa.eu).

7 ACRONYMS

ANSP	Air Navigation Service Provider
CSP	Constellation Service Provider
DFMC	Dual frequency Multi-constellation Receiver
EC	European Commission
EGNOS	European Geostationary Navigation Overlay System
EU	European Union
EUSPA	Agency for the EU Space Programme
GAL	GALileo
GBAS	Ground Based Augmentation System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICAO	International Civil Aviation Authority
IFMEA	Integrity Failure Modes and Effects Analysis
ITU	International Telecommunication Union
MOPS	Minimum Operational Performance Standards
MRD	Mission Requirements Document
OS	Open Service
PRN	PseudoRandom Noise
PS	Performance Standard
RAMS	Reliability Availability Maintainability and Safety
SARPS	Standards And Recommended Practices
SBAS	Satellite Based Augmentation System
SDD	Service Description Document
SoL	Safety of Life
SPS	Standard Positioning Service
TBC	To Be Confirmed
WAAS	Wide Area Augmentation System

8 REFERENCES

The following table lists the documents referred along this document:

AD Reference	Title / Version / Date
AD.1	Galileo Open Service Signal In Space Interface Control Document, Issue 2.1, November 2023 https://www.gsc-europa.eu/
AD.2	Galileo E6-B/C Code Technical Note, January 2019, https://www.gsc-europa.eu/

9 Appendix A: Galileo PRN Spreading Code Application Form

Applicant Information		
1	Application Date	
2	Name	
3	Title	
4	Organization	
5	e-mail	
6	Telephone	
7	Fax	
8	Address	
System Information		
9	System Name	
10	Organization	
11	Sponsoring Government	
12	ITU filing information	

13	PRN Code Request Information				
Requested PRN code	Frequencies	Satellite Name	Notification Need Date	Test Broadcast Dates (begin/end)	Operational Broadcast dates (begin/end)

System Information	
14	Justification for request. Please explain why the requested quantity and type of PRN codes are required:

Please complete the following form for each transmitter:

Satellite Orbit Parameters		
15	PRN Code Requested	
16	Position [LAT, LON, H, WGS-84] (terrestrial transmitters only)	
17	GLAN [°] (GEO only)	
18	RAAN [°]	
19	Argument of Perigee [°]	
20	Mean Anomaly [°]	
21	Semi Major Axis [m]	
22	Inclination [°]	
23	Eccentricity [-]	
24	UTC Time of Epoch [YY-MM-DD, HH:MM:SS]	
Maximum Received Power-Level on Earth's Surface* [dBW]		
25	Maximum Received Power-Level on E1 [dBW]	
26	Maximum Received Power-Level on E6 [dBW]	
27	Maximum Received Power-Level on E5a [dBW]	
28	Maximum Received Power-Level on E5b [dBW]	
29	Axial Ratio of the Transmitting Antenna on E1 [dB]	
30	Axial Ratio of the Transmitting Antenna on E6 [dB]	
31	Axial Ratio of the Transmitting Antenna on E5a [dB]	
32	Axial Ratio of the Transmitting Antenna on E5b [dB]	

*: Link budget assumptions to be applied for the calculation of the maximum user received power-level on earth's surface:

- Loss-less atmosphere
- 0 dBic user antenna gain

Please provide the Maximum Received Power-Level on Earth's Surface as a function of elevation in dBW:

33	Power level [dBW] on Earth's Surface as a function of elevation* [°]																			
Elevation [°]	-5	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
E1																				
E6																				
E5a																				
E5b																				

*: Link budget assumptions to be applied for the calculation of the user received power-level on earth's surface:

- Loss-less atmosphere
- 0 dBic user antenna gain

Performance Characteristics	
34	Describe the system's ranging and timing (wrt. UTC) accuracy – expected accuracy as well as planned committed accuracy. Please provide necessary assumptions applied for the derivation of accuracy (e.g. user location, age of data, percentile, etc).

Interference Analysis	
35	Describe measures taken to avoid interference. If broadcasting E5, provide evidence of participation in ITU Resolution 609 Meetings.

Additional Information for Terrestrial Transmitters (e.g. Pseudolites)	
36	Transmit Antenna Gain Pattern
37	Pulsed Mode
38	Pulse Duty Cycle
39	Pulse Repetition Rate

Required Attachments:

- Program Overview / Schedule




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