ETSI TR 104 657 V1.1.1 (2026-09)



TECHNICAL REPORT

Satellite Earth Stations and Systems (SES); Deployment scenarios and hENs merger analysis

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Executive summary

The present document reviews the contents of several Harmonised Standards under the purview of ETSI TC SES to ensure their requirements remain current amid the rapid expansion of satellite-based services. The study contained in the present document is focused on an initial list provided by the contractual requirements of ETSI plus additional ENs proposed by experts, in summary, assessing the hEN under review for continued compliance with the RED while identifying specific topics requiring further consideration due to technology evolution since the ENs were initially produced. The study contained in the present document focuses on identifying the scenarios and use cases where the targeted hENs are used and finally the present document provides a prioritized list of hEN to be reviewed in detail.

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1 Scope

The present document, as part of the Experts Group, aims to deliver a report covering deployment scenarios, Mapping hENs and use cases resulting from the recommendations and analysis reported in the ETSI TR 104 305 [i.1]

The present document analyses new functionalities and enhancements required for each service (FSS with LEO, FSS with MEO, FSS with GEO, MSS with LEO, MSS with GEO, etc.), based on the use cases and requirements identified in ETSI TR 104 305 [i.1]. It proposes various solutions that can support these enhancements. The solutions discussed include deployment scenarios for each use case. The present document also prioritizes the group of hENs which will require urgent technology updates.

In the analysis of the study contained in the present document, due examination has been taken also on potential for merger some existing ENs into single a (i.e. several hENs addressing earth stations in motion). However, the merger of several hENs, where these hENs are already included in a variety of regulatory frameworks (at international and national levels) raises significant challenges because while the technical merger of some hENs will represent a major improvement and efficiency of the hENs from the technical point of view, such merger would have the potential to raise additional work in the legal and regulatory frames, where those hENs are already mentioned or adopted. The inclusion of new hENs in the standardization system of each country follows specific national procedures the timing of which may raise issues beyond the technical advantages of a potential merger of some hENs.

A prioritization of hENs is also carried out.

2 References

2.1 Normative references

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Normative references are not applicable in the present document.

2.2 Informative references

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References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents may be useful in implementing an ETSI deliverable or add to the reader's understanding, but are not required for conformance to the present document.

[i.1] ETSI TR 104 305 (V1.1.1): "Satellite Earth Stations and Systems (SES); Study of potential updates to certain harmonised ENs due to technology evolution, methods of measurements and regulatory updates".

[i.2] ETSI EN 303 699: "Satellite Earth Stations and Systems (SES); Fixed earth stations communicating with non-geostationary satellite systems in the 20 GHz and 30 GHz FSS bands; Harmonised Standard for access to radio spectrum".

[i.3] ETSI EN 303 978: "Satellite Earth Stations and Systems (SES); Earth Stations on Mobile Platforms (ESOMP) communicating with satellites in geostationary orbit, operating in the 27,5 GHz to 30,0 GHz and 17,3 GHz to 20,2 GHz frequency bands; Harmonised Standard for access to radio spectrum".

[i.4] ETSI EN 303 979: "Satellite Earth Stations and Systems (SES); Harmonised Standard for Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in non-geostationary orbit, operating in the 27,5 GHz to 29,1 GHz and 29,5 GHz to 30,0 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

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[i.5] ETSI EN 303 980: "Satellite Earth Stations and Systems (SES); Fixed and in-motion Earth Stations communicating with non-geostationary satellite systems (NEST) in the 11 GHz to 14 GHz frequency bands; Harmonised Standard for access to radio spectrum".

[i.6] ETSI EN 301 427: "Satellite Earth Stations and Systems (SES); Harmonised Standard for low data rate Mobile satellite Earth Stations (MES) except aeronautical mobile satellite earth stations, operating in the 11/12/14 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.7] ETSI EN 301 442: "Satellite Earth Stations and Systems (SES); Harmonised Standard for NGSO Mobile Earth Stations (MES) including handheld earth stations, for Satellite Personal Communications Networks (S-PCN) operating in the 1 980 MHz to 2 010 MHz (earth-to-space) and 2 170 MHz to 2 200 MHz (space-to-earth) frequency bands under the Mobile Satellite Service (MSS)".

[i.8] ETSI EN 301 443: "Satellite Earth Stations and Systems (SES); Harmonised Standard for Very Small Aperture Terminal (VSAT); Transmit-only, transmit-and-receive, receive-only satellite earth stations operating in the 4 GHz and 6 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.9] ETSI EN 301 447: "Satellite Earth Stations and Systems (SES); Satellite Earth Stations on board Vessels (ESVs) operating in the 4/6 GHz frequency bands allocated to the Fixed Satellite Service (FSS); Harmonised Standard for access to radio spectrum".

[i.10] ETSI EN 301 459: "Satellite Earth Stations and Systems (SES); Harmonised Standard for Satellite Interactive Terminals (SIT) and Satellite User Terminals (SUT) transmitting towards satellites in geostationary orbit, operating in the 29,5 GHz to 30,0 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.11] ETSI EN 301 721: "Satellite Earth Stations and Systems (SES); Harmonised Standard for Mobile Earth Stations (MES) providing Low Bit Rate Data Communications (LBRDC) using Low Earth Orbiting (LEO) satellites operating below 1 GHz frequency band".

[i.12] ETSI EN 302 340: "Satellite Earth Stations and Systems (SES); Harmonised Standard for satellite Earth Stations on board Vessels (ESVs) operating in the 11/12/14 GHz frequency bands allocated to the Fixed Satellite Service (FSS) covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.13] ETSI EN 302 448: "Satellite Earth Stations and Systems (SES); Harmonised Standard for tracking Earth Stations on Trains (ESTs) operating in the 14/12 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.14] ETSI EN 302 574 (all parts): "Satellite Earth Stations and Systems (SES); Harmonised Standard for Mobile Earth Stations (MES) operating in the 1 980 MHz to 2 010 MHz (earth-to-space) and 2 170 MHz to 2 200 MHz (space-to-earth) frequency bands; Part 3: User Equipment (UE) for narrowband systems".

[i.15] ETSI EN 303 984: "Satellite Earth Stations and Systems (SES); Earth Stations on board Aircraft (ESOA) communicating with non-geostationary satellite systems in the 10,7 GHz to 12,75 GHz and 12,75 GHz to 13,25 GHz frequency bands; Harmonised Standard for access to radio spectrum".

[i.16] ETSI EN 302 977: "Satellite Earth Stations and Systems (SES); Harmonised Standard for Vehicle-Mounted Earth Stations (VMES) operating in the 14/12 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.17] ETSI EN 303 981: "Satellite Earth Stations and Systems (SES); Fixed and in-motion Wide Band Earth Stations communicating with non-geostationary satellite systems (WBES) in the 11 GHz to 14 GHz frequency bands; Harmonised Standard for access to radio spectrum".

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3 Definition of terms, symbols and abbreviations

3.1 Terms

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3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AES	Aeronautical Earth Station
CMF	Control and Monitoring Functions
EIRP	Equivalent Isotropically Radiated Power
EN	European Standard
ESIM	Earth Station In Motion
ESOA	Earth Station On board Aircraft
ESOMP	Earth Station On Mobile Platform
EST	Earth Station on Train
ESV	Earth Station on Vessel
ETSI	European Telecommunications Standards Institute
EU	European Union
FSS	Fixed Satellite Service
GEO	Geostationary Earth Orbit
GSO	Geostationary Satellite Orbit
hEN	Harmonised Standard
IoT	Internet of Things
LBRDC	Low Bit Rate Data Communications
LEO	Low Earth Orbit
MEO	Medium Earth Orbit
MES	Mobile Earth Station
MSS	Mobile Satellite Service
NEST	Fixed and in-motion Earth Stations communicating with Non-Geostationary satellite system
NGSO	Non-Geostationary Satellite Orbit
OATS	Open Area Test Site
OTA	Over-the-Air
RED	Radio Equipment Directive
SIT	Satellite Interactive Terminal
S-PCN	Satellite Personal Communications Network
SUT	Satellite User Terminal
TC	Technical Committee
TR	Technical Report
UE	User Equipment
VMES	Vehicle Mounted Earth Station
VSAT	Very Small Aperture Terminal
WBES	Fixed and in-motion Wide Band Earth Stations communicating with non-geostationary satellite systems

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4 Objectives and Scope of this study

The study contained in the present document represents the next technical phase following ETSI TR 104 305 [i.1], building directly on the technology evolution and use-case assessment carried out. While ETSI TR 104 305 [i.1] established how satellite earth station technologies and deployment scenarios are changing, this further study examines the implications of these developments for the structure and coherence of the existing hENs. Its role is to identify where updates, harmonisation, or potential consolidation may be required to ensure that the standards remain aligned with modern operational conditions. The outcomes of the study contained in the present document provide the technical basis for the drafting activities of the selected hENs and guide the subsequent evolution of the hEN framework under TC SES.

The study contained in the present document acts as the bridge between the technology and use-case evolution identified in ETSI TR 104 305 [i.1] and the concrete revision work to be undertaken in subsequent phases of the study. Its role is to assess how emerging deployment scenarios, modern antenna platforms, and multi-orbit operation affect the structure and coherence of existing hENs, identifying where requirements remain adequate, where transversal updates are needed, and where consolidation of standards may improve clarity and long-term maintainability. By analysing overlaps in architecture, measurement methods, emission behaviour, and operational environments, the study contained in the present document determines coherent groups of hENs for harmonisation or merging and prioritizes those requiring urgent updates. The present document provides the technical foundation for further detailed review of the selected hENs, guiding the scope, structure, and sequencing of the drafting work and enabling the development of revised hENs that are robust, future-proof, and aligned with RED essential requirements.

The present document builds directly upon the analytical foundation established in ETSI TR 104 305 [i.1] and serves as the bridge between the identification of technology-driven update needs and the structured revision of Harmonised Standards (hENs) to be carried out subsequently. While ETSI TR 104 305 [i.1] focuses on expert input collection, technology evolution analysis, and the identification of required updates across the hENs under review, the present document transforms these findings into deployment-driven scenarios, cross-standard mappings, and strategic decisions regarding the potential merging or consolidation of hENs. The present document therefore plays a pivotal role in ensuring that the revision process is coherent and aligned with the operational realities of modern satellite earth station technologies.

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The use cases and technology evolution identified in ETSI TR 104 305 [i.1] translates into deployment scenarios across GEO, MEO, and LEO satellite networks, and across maritime, aeronautical, land mobile, fixed, tracking, and narrowband earth station categories. By mapping these deployment scenarios to the hENs under review, the present document identifies where standards overlap, where they diverge, and where consolidation would improve clarity, reduce redundancy, and simplify compliance for manufacturers, notified bodies, and laboratories. This mapping also enables to determine which hENs require update, which require structural reorganization, and which may be merged into unified standards addressing multiple operational environments or frequency bands.

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The present document considers the consistency of requirements and measurement methods across the hENs, using the semantic clustering and cross-EN consolidation matrix produced in ETSI TR 104 305 [i.1] as a basis. This evaluation identifies transversal issues-such as antenna-related provisions, off-axis EIRP masks, spurious emission limits, receiver performance requirements, CMF references, and test site definitions-that should be harmonised across standards.

The present document defines the strategic roadmap for hEN revision, based on the prioritization of expert comments and the urgency assessments provided by ETSI TR 104 305 [i.1], establishing a clear sequence for updating the hENs, identifying which standards should be revised first, which require deeper structural changes, and which can be addressed through harmonisation or consolidation. This roadmap guides Experts Group in the drafting of revised hENs and ensures that the revision process is both technically justified and operationally feasible.

The present document transforms the analytical results of ETSI TR 104 305 [i.1] into a coherent strategy for updating, harmonising, and future potentially merging the hENs under the responsibility of ETSI TC SES. It ensures that the revision process reflects real deployment conditions, aligns with modern satellite technologies, and supports long-term regulatory clarity under the Radio Equipment Directive. The analysis of the present document is therefore essential for bridging the gap between expert-driven analysis and the practical drafting of optimized Harmonised Standards (hENs).

The present document therefore encompasses the following main activities: the expansion of ETSI TR 104 305 [i.1] use cases into deployment scenarios; the mapping of these scenarios to the hENs under review; the identification and justification of hEN consolidation opportunities; and the formulation of a structured revision roadmap for subsequent updates of the selected hENs. The present document does not revise the hENs itself, but it provides the analytical and strategic framework that enables further experts standardization activities to produce technically robust, harmonised, and future-proof standards.

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