3GPP TS 22.119 V16.2.0 (2020-09)

Technical Specification

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Maritime Communication Services over 3GPP system;
Stage 1
(Release 16)

Keywords
Maritime, Requirements

3GPP

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Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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x the first digit:

1 presented to TSG for information;

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document describes service requirements to enable maritime communication services to be supported over a 3GPP system. Requirements for MC services applicable to general maritime usage are specified in 3GPP Technical Specifications dedicated to MC services [2], [3], [4], [5].

Requirements in the present document are specific to maritime usage.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.280: "Mission Critical Services Common Requirements (MCCoRe); Stage 1".

[3] 3GPP TS 22.179: "Mission Critical Push to Talk (MCPTT); Stage 1".

[4] 3GPP TS 22.281: "Mission Critical (MC) video".

[5] 3GPP TS 22.282: "Mission Critical (MC) data".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

(none)

3.2 Symbols

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

(none)

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

ICT	Information and Communication Technologies
IMO	International Maritime Organization
MC	Mission Critical

MCS	Mission Critical Services
NM	nautical mile
SOLAS	International Convention for the Safety of Life at Sea

4 Overview

The maritime domain, one of the 5G vertical domains in 3GPP is moving forward with the digitalisation and mobilisation of commercial as well as safety fields. Legacy 3GPP-based technologies and solutions can be beneficial to the digitalisation and mobilisation of the maritime domain though some of the legacy 3GPP enabling technologies and solutions may not be able to fully support the performances required by the maritime domain. The maritime radio environment was not originally considered by 3GPP when the technical specifications and solutions were standardised for LTE and 5G.

However, most of the legacy mobile services and IoT services based on capabilities of EPS and 5GS specified in 3GPP specifications are applicable to maritime usage for the support of mobile broadband services, and for the support of IoT services or machine-type communication services in a vessel at sea.

In addition, there are service scenarios and requirements specified in 3GPP specifications based on requirements of other related vertical domains (e.g. public safety domain, automotive domain, factory automation domain, and satellite industrial domain). Some requirements derived from service scenarios pertaining to these related vertical domains are applicable to the maritime domain. Thus, it is beneficial to use 3GPP enabling technologies developed to satisfy those requirements for the maritime domain in terms of economy of scale.

For example, satellite access is one of the 3GPP radio access networks supported over the 5G system, so it is possible to provide seamless maritime mobile services by integrating multiple access technologies including satellite access depending on the service scenarios. In addition, 5G LAN-type access that can replace Ethernet-based access is applicable to indoor maritime mobile services inside a vessel.

MC Services specified in 3GPP specifications are applicable to commercial and maritime safety fields. Some similarities exist between the public safety domain and the maritime domain in terms of service scenarios that are essentially the same. For example, in some situations, mobile communication services are supported on or amongst UEs while disconnected from their networks, i.e. off-network mode, or under isolated conditions.

However, the maritime domain also has specific situations that do not pertain in other vertical domains or in the legacy ICT industrial domain. New 3GPP enabling technologies dedicated to the maritime domain can be used to address such specific situations based on requirements derived from maritime use cases. Other vertical domains may benefit from such new 3GPP enabling technologies that consider maritime domain scenarios and may need more robust technologies or solutions than those that currently exist for those vertical domains.

The present document provides the stage 1 requirements specific to maritime usage over a 3GPP system for commercial as well as safety purposes. The stage 1 requirements derived from specific maritime usage but also related to MC services are specified in 3GPP technical specifications dedicated to MC services.

5 Requirements of basic capabilities

5.1 Network connection and service continuity

5.1.1 Description

General 3GPP procedures of network connection and service continuity are applicable to maritime usage within 3GPP communication range. For example, a UE mapped to a vessel needs to perform network reselection when a vessel arrives at a port where 3GPP networks are available different from the 3GPP network that a vessel was previously connected to but disconnected from when the vessel started a voyage and moved out of coverage of that network. Additional capabilities for the establishment of a 3GPP network connection and for service continuity could improve user experiences on maritime communication services over a 3GPP system despite some constraints from the maritime communication environment including the communication environment inside a vessel that is usually made of steel.

5.1.2 Void

5.2 Identification

5.2.1 Description

A UE identity specified in 3GPP specifications is applicable to maritime usage. There are vessel identities for the identification of a vessel as a unique identity in maritime communication services. Mapping a UE identity with a vessel identity is needed to support identification procedures based on vessel identities in maritime domain when a vessel itself plays the role of a UE in a 3GPP system.

5.2.2 Requirements

The 3GPP system shall provide a mechanism to associate a UE identity with a vessel identity.

6 Requirements of multi-access and seamless mobility

6.1 Seamless mobility

6.1.1 Description

Network deployment scenarios are to be taken into account for maritime communication and these may differ from terrestrial communication in order to provide seamless mobile services within a vessel at sea or on inland waterways. The usage of moving networks, isolated networks or satellite access networks may be more commonly applicable for maritime safety services compared with general commercial services over 3GPP networks because fixed mobile network deployments are used for most terrestrial mobile services.

The communication range may depend on a number of factors such as the power level transmitted, the height of the antenna, the type of vessel, the particular service scenario and propagation conditions. Thus, it may not be easy to provide a single value for the communication range between two vessels, and for a vessel that is applicable for all maritime service scenarios.

6.1.2 Requirements

The minimum communication range between vessels shall be equal to the maximum line-of-sight range between antennas mounted on two vessels at sea or on inland waterways.

NOTE: The communication range between vessels is measured in nautical miles (NMs) and 1 NM equals 1852 metres.

EXAMPLE: In the case of non-SOLAS vessels with antenna heights 4 metres above sea level, the minimum communication range is 10 NMs when applying the formula defined in IMO Resolution A.801(19).

7 Requirements of warning notification and emergency request

7.1 Notification for maritime safety

7.1.1 Description

Notifications for maritime safety are transmitted by authorities to maritime mobile users at sea. Notifications can be used to inform vessels of the location of a vessel in danger. A vessel that receives notifications relating to maritime safety needs to be able to relay such notifications to neighbouring vessels that are not in coverage of the 3GPP system.

7.1.2 Requirements

The 3GPP system shall provide a mechanism of including the position, heading and speed of other UEs in a maritime notification transmitted only to a dedicated UE requesting maritime safety information.

7.2 Emergency request for maritime safety

7.2.1 Description

Maritime accidents such as "man overboard" need to be handled quickly and effectively by the 3GPP system. 3GPP specifications provides several mechanisms for reporting emergencies to and requesting assistance from the appropriate authorities. In addition to legacy emergency request mechanisms, additional capabilities could make a 3GPP system more powerful for maritime safety.

7.2.2 Requirements

The 3GPP system shall provide a mechanism of distributing a maritime emergency request received from a UE to all UEs on that vessel.

A UE dedicated to a vessel shall support the capability of sending maritime emergency requests including the vessel-dedicated UE’s actual position (e.g. current position, heading and speed of the vessel and scheduled navigational routes).

Annex A (informative): Status of legacy communication methods used for the navigation

Void

Annex B (informative): Status of legacy communication methods used by equipment inside a vessel

Void

Annex C (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2018-08	SA1#83	S1-182608				TS Skeleton	0.0.0
2018-08	SA1#83	S1-182609				Scope	0.1.0
2018-08	SA1#83	S1-182610				Overview	0.1.0
2018-08	SA1#83	S1-182611				Requirements of basic capabilities	0.1.0
2018-08	SA1#83	S1-182726				Requirements of maritime notification and emergency request	0.1.0
2018-09	SA#81	SP-180762				Raised by MCC to v.1.0.0 for presentation to SA for information	1.0.0
2018-11	SA1#84	S1-183615				Requirement on the communication range between vessels	1.1.0
2018-12	SA#82	SP-181004				Raised by MCC to v.2.0.0 for presentation to SA for approval	2.0.0
2018-12	SA#82	SP-181004				Raised by MCC to v.16.0.0 following SA#82 approval	16.0.0
2019-09	SA#85	SP-190802	0002	2	F	Clarification and editorial updates	16.1.0
2020-09	SA#89e	SP-200785	0003	1	F	R16 CR to TS22.119 for Requirement alignment for Relay	16.2.0
2020-09	SA#89e	SP-200786	0004	1	F	Clarification and disambiguation of text, provision of missing abbreviations and references	16.2.0