

ETSI TS 124 514 V18.2.0 (2024-10)



**5G;
Ranging based services and sidelink positioning in 5G
system(5GS);
Stage 3
(3GPP TS 24.514 version 18.2.0 Release 18)**



Reference

RTS/TSGC-0124514v120

Keywords

5G

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from the
ETSI [Search & Browse Standards application](#).

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on [ETSI deliver](#).

Users should be aware that the present document may be revised or have its status changed,
this information is available in the [Milestones listing](#).

If you find errors in the present document, please send your comments to
the relevant service listed under [Committee Support Staff](#).

If you find a security vulnerability in the present document, please report it through our
[Coordinated Vulnerability Disclosure \(CVD\)](#) program.

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2024.
All rights reserved.

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

Legal Notice

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

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under <https://webapp.etsi.org/key/queryform.asp>.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights	2
Legal Notice	2
Modal verbs terminology.....	2
Foreword.....	8
1 Scope	10
2 References	10
3 Definitions of terms, symbols and abbreviations	11
3.1 Terms.....	11
3.2 Abbreviations	11
4 General description.....	12
5 Provisioning of configuration information for ranging and sidelink positioning service	12
5.1 Overview	12
5.2 Configuration and precedence of ranging and sidelink positioning configuration parameters.....	13
5.2.1 General.....	13
5.2.2 Precedence of ranging and sidelink positioning configuration information	13
5.2.3 Configuration parameters for ranging and sidelink positioning.....	13
5.3 Procedures	14
5.3.1 General.....	14
5.3.2 UE-requested RSLPP provisioning procedure.....	14
5.3.2.1 General	14
5.3.2.2 UE-requested RSLPP provisioning procedure initiation.....	14
5.3.2.3 UE-requested RSLPP provisioning procedure accepted by the network	15
5.3.2.4 UE-requested RSLPP provisioning procedure not accepted by the network	15
5.3.2.5 Abnormal cases on the network side.....	15
5.3.2.6 Abnormal cases on the UE.....	15
6 Ranging and sidelink positioning UE discovery and selection	15
6.1 Overview	15
6.2 Ranging and sidelink positioning UE discovery with 5G ProSe capable UE.....	16
6.2.1 General.....	16
6.2.2 Procedures.....	16
6.2.2.1 5G ProSe direct discovery for ranging and sidelink positioning procedure over PC5 interface with model A.....	16
6.2.2.1.1 General	16
6.2.2.1.2 Announcing UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning initiation.....	16
6.2.2.1.3 Announcing UE procedure 5G ProSe direct discovery for ranging and sidelink positioning completion	18
6.2.2.1.4 Monitoring UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning initiation.....	18
6.2.2.1.5 Monitoring UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning completion	20
6.2.2.2 5G ProSe direct discovery procedure for ranging and sidelink positioning over PC5 interface with model B.....	20
6.2.2.2.1 General	20
6.2.2.2.2 Discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning initiation.....	20
6.2.2.2.3 Discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning completion	22
6.2.2.2.4 Discoveree UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning initiation.....	22
6.2.2.2.5 Discoveree UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning completion	24

6.2.2.3	Group member procedure for ranging and sidelink positioning over PC5 interface with model A	24
6.2.2.3.1	General	24
6.2.2.3.2	Announcing UE procedure for group member discovery for ranging and sidelink positioning initiation.....	25
6.2.2.3.3	Announcing UE procedure for group member discovery for ranging and sidelink positioning completion.....	26
6.2.2.3.4	Monitoring UE procedure for group member discovery for ranging and sidelink positioning initiation.....	27
6.2.2.3.5	Monitoring UE procedure for group member discovery for ranging and sidelink positioning completion.....	28
6.2.2.4	Group member discovery for ranging and sidelink positioning over PC5 interface with model B.....	29
6.2.2.4.1	General	29
6.2.2.4.2	Discoverer UE procedure for group member discovery for ranging and sidelink positioning initiation.....	29
6.2.2.4.3	Discoverer UE procedure for group member discovery for ranging and sidelink positioning completion.....	31
6.2.2.4.4	Discoveree UE procedure for group member discovery for ranging and sidelink positioning initiation.....	32
6.2.2.4.5	Discoveree UE procedure for group member discovery for ranging and sidelink positioning completion.....	34
6.3	Ranging and sidelink positioning UE discovery with V2X capable UEs.....	34
6.4	Located UE selection.....	34
6.4.1	General.....	34
6.4.2	Procedures.....	35
6.4.2.1	Target UE selecting located UE.....	35
6.4.2.1.1	General	35
6.4.2.1.2	Target UE selecting located UE for UE-only operation	35
6.4.2.1.3	target UE selecting located UE for network-based operation or network-assisted operation.....	35
6.4.2.2	LMF selecting located UE	36
6.5	SL positioning server UE selection	36
6.5.1	General.....	36
6.5.2	Target UE selecting SL positioning server UE.....	37
6.6	SL reference UE selection.....	37
6.6.1	General.....	37
6.6.2	Procedures.....	38
6.6.2.1	Target UE selecting SL reference UE	38
7	Ranging and sidelink positioning communication	38
7.1	Overview	38
7.2	Ranging and sidelink positioning direct communication over PC5.....	38
7.2.1	General.....	38
7.2.2	Unicast mode ranging and sidelink positioning direct communication over PC5	39
7.2.2.1	Unicast mode communication over PC5 with 5G ProSe capable UEs.....	39
7.2.2.2	Unicast mode communication over PC5 with V2X capable UEs	39
7.3	Ranging and sidelink positioning communication on LCS aspect	40
7.4	Supplementary RSPP signaling over PC5-U	41
7.4.1	General.....	41
7.4.2	Sidelink positioning service request procedure.....	41
7.4.2.1	General	41
7.4.2.2	Sidelink positioning service request procedure initiation.....	41
7.4.2.3	Sidelink positioning service request procedure completion	42
7.4.2.4	Sidelink positioning service request procedure not accepted by target UE.....	42
7.4.3.1	General	42
7.4.3.2	Sidelink positioning SLPP transport initiation	42
7.4.4	Sidelink positioning privacy check procedure	43
7.4.4.1	General	43
7.4.4.2	Sidelink positioning privacy check procedure initiation	43
7.4.4.3	Sidelink positioning privacy check procedure accepted by the target UE	44
7.4.4.4	Sidelink positioning privacy check procedure not accepted by the target UE	44
8	Security for ranging and sidelink positioning	44
8.1	Overview	44

8.1.1	Overview for procedures over PC8* interface.....	44
8.2	Security for ranging and sidelink positioning UE discovery.....	45
8.2.1	Security for ranging and sidelink positioning UE discovery with 5G ProSe capable UE.....	45
8.2.1.1	General.....	45
8.2.1.2	Ranging and sidelink positioning discovery key request procedure.....	45
8.2.1.2.1	General.....	45
8.2.1.2.2	Ranging and sidelink positioning discovery key request procedure initiation.....	45
8.2.1.2.3	Ranging and sidelink positioning discovery key request procedure accepted by the SLPKMF.....	46
8.2.1.2.4	Ranging and sidelink positioning discovery key request procedure completion by the UE.....	47
8.2.1.2.5	Ranging and sidelink positioning discovery key request procedure not accepted by the SLPKMF.....	47
8.2.1.2.6	Abnormal cases in the UE.....	47
8.2.1.2.7	Abnormal cases in the SLPKMF.....	48
8.2.2	Security for ranging and sidelink positioning UE discovery with V2X capable UE.....	48
8.3	Security for ranging and sidelink positioning communication.....	48
8.3.1	Security for ranging and sidelink positioning communication with 5G ProSe capable UE.....	48
8.3.1.1	Security for unicast direct communication over RSPP.....	48
8.3.1.1.1	General.....	48
8.3.1.1.2	5G ProSe UE SLP key request procedure.....	48
8.3.1.1.2.1	General.....	48
8.3.1.1.2.2	UE SLP key request procedure initiation.....	48
8.3.1.1.2.3	UE SLP key request procedure accepted by the SLPKMF.....	49
8.3.1.1.2.4	UE SLP key request procedure completion by the UE.....	49
8.3.1.1.2.5	5G ProSe UE SLP key request procedure not accepted by the SLPKMF.....	49
8.3.1.1.2.6	Abnormal cases in the UE.....	50
8.3.1.1.2.7	Abnormal cases in the SLPKMF.....	50
8.3.1.1.3	SLP key request procedure.....	50
8.3.1.1.3.1	General.....	50
8.3.1.1.3.2	SLP key request procedure initiation.....	50
8.3.1.1.3.3	SLP key request procedure accepted by the SLPKMF.....	51
8.3.1.1.3.4	SLP key request procedure completion by the UE.....	51
8.3.1.1.3.5	SLP key request procedure not accepted by the SLPKMF.....	52
8.3.1.1.3.6	Abnormal cases in the UE.....	52
8.3.1.1.3.7	Abnormal cases in the SLPKMF.....	52
8.3.2	Security for ranging and sidelink positioning communication with V2X capable UE.....	52
9.	Handling of unknown, unforeseen, and erroneous signalling protocol data.....	52
9.1	General.....	52
9.2	Handling of unknown, unforeseen and erroneous protocol data in messages sent over the PC8* interface.....	53
9.2.1	Unforeseen message type.....	53
9.3	Handling of unknown, unforeseen and erroneous protocol data in messages sent over the PC5 interface.....	53
10.	Message functional definition and contents.....	53
10.1	Overview.....	53
10.2	5G ProSe direct discovery for ranging and sidelink positioning procedure messages.....	53
10.2.1	Message definition.....	53
10.2.2	Serving PLMN ID.....	55
10.2.3	RSPP metadata.....	56
10.2.4	Discoveree user info.....	56
10.2.5	Discoverer user info.....	56
10.2.6	Target user info.....	56
10.3	Coding of Security for ranging and sidelink positioning messages.....	56
10.3.1	General.....	56
10.3.2	application/vnd.3gpp-rangingsl-pc8*+xml.....	56
10.3.3	XML schema.....	57
10.3.4	Semantics.....	60
10.3.4.1	General.....	60
10.3.4.2	Semantics of <PROSE_UE_SLPK_REQUEST> element.....	60
10.3.4.3	Semantics of <PROSE_UE_SLPK_RESPONSE> element.....	60
10.3.4.4	Semantics of <PROSE_SLPK_REQUEST> element.....	61
10.3.4.5	Semantics of <PROSE_SLPK_RESPONSE> element.....	61
10.3.4.6	Semantics of <PROSE_SECURITY_PARAM_REQUEST> element.....	62

10.3.4.7	Semantics of <PROSE_SECURITY_PARAM_RESPONSE> element	63
10.4	Supplementary RSPP signalling over PC5-U messages	64
10.4.1	Sidelink positioning service request	64
10.4.1.1	Message definition	64
10.4.1.2	Target UE	65
10.4.1.3	SL reference UE list	65
10.4.1.4	Requested sidelink results	65
10.4.1.5	Related UE list	65
10.4.1.6	Location QoS	65
10.4.2	Sidelink positioning service response	66
10.4.2.1	Message definition	66
10.4.2A	Sidelink positioning service reject	66
10.4.2A.1	Message definition	66
10.4.3	Sidelink positioning SLPP transport message	66
10.4.3.1	Message definition	66
10.4.4	Sidelink positioning privacy check request	67
10.4.4.1	Message definition	67
10.4.4.2	SL positioning client UE user info	67
10.4.5	Sidelink positioning privacy check accept	67
10.4.5.1	Message definition	67
10.4.6	Sidelink positioning privacy check reject	68
10.4.6.1	Message definition	68
11.	Information elements coding	68
11.1	Overview	68
11.2	PC5 direct discovery message formats	68
11.2.1	ProSe direct discovery PC5 message type	68
11.2.2	RSPP metadata	68
11.2.3	Application layer ID	69
11.2.4	PLMN ID	69
11.2.5	Application layer group ID	69
11.3	Security for ranging and sidelink positioning message formats	69
11.3.1	Transition ID	69
11.3.2	SLPK	69
11.3.3	SLPK-ID	69
11.3.4	PC8* control protocol cause value	69
11.3.5	K_{SLP}	70
11.3.6	K_{SLP} freshness parameter 1	70
11.3.7	K_{SLP} freshness parameter 2	70
11.3.8	rangingsl-application-ID	70
11.3.9	UE role	70
11.3.10	Expiration timer	70
11.3.11	Current time	70
11.4	Supplementary RSPP signalling message formats	70
11.4.1	PC5-U message type	70
11.4.2	Procedure transaction ID	71
11.4.3	Related user info	71
11.4.4	List of related user info	72
11.4.5	Requested sidelink results	73
11.4.6	Location QoS	73
11.4.7	List of sidelink positioning results	77
11.4.8	List of SLPP PDUs	82
11.4.9	Sidelink positioning protocol cause	83
12	Encoding of UE policies for ranging and sidelink positioning	84
12.1	General	84
12.2	Information elements coding	84
13	List of system parameters	106
13.1	Overview	106
13.2	Timers of provisioning of parameters for ranging and sidelink positioning configuration procedures	106
13.3	Timers for PC8* interface	107

Annex A (informative): **Change history**108
History111

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:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- 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.

In the present document, modal verbs have the following meanings:

- shall** indicates a mandatory requirement to do something
- shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

- should** indicates a recommendation to do something
- should not** indicates a recommendation not to do something
- may** indicates permission to do something
- need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

- can** indicates that something is possible
- cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

- will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document
- will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document
- might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the protocols for ranging based service and sidelink positioning in 5G system as specified in 3GPP TS 23.586 [2] for the following aspects:

- a) provisioning of configuration information for ranging and sidelink positioning service;
- b) ranging and sidelink positioning UE discovery; and
- c) ranging and sidelink positioning communication, including the communication among UEs and the communication between UE and LMF. The support of ranging and sidelink positioning protocol (RSPP) transport is defined as part of the ranging and sidelink positioning communication.

The present document defines the associated procedures for the aspects listed above, and also defines the message format, message contents, error handling and system parameters applied by the protocols for ranging based service and sidelink positioning in 5GS.

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 TR 23.586: "Ranging based services and Sidelink Positioning".
- [3] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".
- [4] 3GPP TS 24.587: "Vehicle-to-Everything (V2X) services in 5G System (5GS); Protocol aspects; Stage 3".
- [5] 3GPP TS 33.533: "Security aspects of ranging based services and sidelink positioning".
- [6] 3GPP TS 24.554: "Proximity-services (ProSe) in 5G System (5GS) protocol aspects".
- [7] ITU-T Recommendation E.212: "The international identification plan for public networks and subscriptions", 2016-09-23.
- [8] IETF RFC 4122: "A Universally Unique IDentifier (UUID) URN Namespace".
- [9] ISO TS 17419 ITS-AID AssignedNumbers :
http://standards.iso.org/iso/ts/17419/TS17419%20Assigned%20Numbers/TS17419_ITS-AID_AssignedNumbers.pdf.
- [10] ISO/IEC 10118-3:2018: "IT Security techniques – Hash-functions – Part 3: Dedicated hash-functions".
- [11] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".
- [12] 3GPP TS 38.355: "NR; Sidelink Positioning Protocol (SLPP); Protocol Specification".
- [13] IETF RFC 9110: "HTTP Semantics".
- [14] IETF RFC 9112: "HTTP/1.1".

- [15] 3GPP TS 24.526: "UE policies for 5G System (5GS); Stage 3".
- [16] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".
- [17] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode".
- [18] 3GPP TS 23.003: "Numbering, addressing and identification".
- [19] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol Specification".
- [20] 3GPP TS 38.304: "User Equipment (UE) procedures in Idle mode and RRC Inactive state".
- [21] 3GPP TS 29.572: "5G System; Location Management Services; Stage 3".
- [22] 3GPP TS 24.571: "5G System (5GS) Control plane Location Services (LCS) procedures; Stage 3".
- [23] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms 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].

example: text used to clarify abstract rules by applying them literally.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.586 [2] apply:

Located UE
Network-assisted operation
Network-based operation
Positioning
Ranging
Relative position
Relative velocity
SL reference UE
Sidelink positioning
SL positioning client UE
SL positioning server UE
Target UE
UE-only operation
User info ID
Application layer ID

3.2 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].

5G ProSe	5G Proximity-based Services
DUCK	Discovery User Confidentiality Key
DUIK	Discovery User Integrity Key
DUSK	Discovery User Scrambling Key
FQDN	Fully Qualified Domain Name
LSB	Least Significant 8 Bits
ME	Mobile Equipment
MO-LR	Mobile Originated Location Request
MT-LR	Mobile Terminated Location Request

PQI	PC5 5QI
RSLPP	Ranging and sidelink positioning policy
RSPP	Ranging and sidelink positioning protocol
SLPP	Sidelink positioning protocol
SLPK	SideLink Positioning Key
SLPKMF	SideLink Positioning Key Management Function
SL-MO-LR	Sidelink Mobile Originating Location Request
SL-MT-LR	Sidelink Mobile Terminating Location Request
UICC	Universal Integrated Circuit Card
URSP	UE Route Selection Policy
V2X	Vehicle-to-Everything

4 General description

Any UE supporting ranging and sidelink positioning, e.g. target UE, reference UE, sidelink positioning server UE, supports a ranging and sidelink positioning (RSP) layer. The RSP layer handles service requests received from application layer to control the ranging and sidelink positioning operation.

The RSP layer supports the following functionalities:

- a) Provisioning of configuration information and authorization for ranging and sidelink positioning;
- b) UE discovery and selection; and
- c) Ranging and sidelink positioning communication between UEs or between the UE and the LMF.

Transport of ranging and sidelink positioning protocol (RSPP) payload over PC5-U is supported by the ranging and sidelink positioning communication between UEs over PC5.

The above functions are applicable for both public safety UE and commercial UEs.

The security aspects for 5G ranging and sidelink positioning features are specified in 3GPP TS 33.533 [5].

The extended PC5 signalling protocol for ranging and sidelink positioning, includes extensions for PC5 signalling protocol for V2X and extensions for PC5 signalling protocol for ProSe, is defined to support UE discovery and selection as defined in clause 6 and Ranging and sidelink positioning communication between UEs as defined in clause 7.2.

The extended PC5 signalling protocol for ranging and sidelink positioning and the supplementary RSPP signalling protocol over PC5-U for ranging and sidelink positioning defined by this specification follow the protocol architecture model for layer 3 as described in 3GPP TS 24.007 [23].

5 Provisioning of configuration information for ranging and sidelink positioning service

5.1 Overview

Ranging and sidelink positioning configuration information are configured by the related procedures which allow configuration of necessary ranging and sidelink positioning configuration information to UE.

The ranging and sidelink positioning configuration information is described in clause 5.2.

The procedures to allow the UE to obtain the ranging and sidelink positioning policy (RSLPP) is described in clause 5.3.

5.2 Configuration and precedence of ranging and sidelink positioning configuration parameters

5.2.1 General

UE's usage of ranging and sidelink positioning service is controlled by ranging and sidelink positioning configuration information.

5.2.2 Precedence of ranging and sidelink positioning configuration information

The configuration information for ranging and sidelink positioning can be:

- a) pre-configured in the ME;
- b) configured in the UICC;
- c) provided as a RSLPP by PCF;
- d) provided by a ranging and sidelink positioning application server via SR1 reference point; or
- e) a combination of case a), b), c) or d) above.

The UE shall use the ranging and sidelink positioning configuration information in the following order of decreasing precedence:

- a) the configuration information for ranging and sidelink positioning provided as a RSLPP by PCF;
- b) the configuration information for ranging and sidelink positioning by a ranging and sidelink positioning application server via SR1 reference point;
- c) the configuration information for ranging and sidelink positioning configured in the UICC; and
- d) the configuration information for ranging and sidelink positioning pre-configured in the ME.

5.2.3 Configuration parameters for ranging and sidelink positioning

The configuration parameters for ranging and sidelink positioning consist of:

- a) a validity timer for the validity of the configuration parameter for ranging and sidelink positioning;
- b) a list of PLMNs in which the UE is authorised to perform ranging and sidelink positioning when the UE is "served by NG-RAN" and in each PLMN the role which the UE is authorized to act as one or more of the following:
 - 1) located UE;
 - 2) SL positioning client UE; and
 - 3) SL positioning server UE;

NOTE 1: A UE authorised to perform ranging and sidelink positioning in a given PLMN is also authorised to act as a target UE and as an SL reference UE in this PLMN.

- c) an indication of whether the UE is authorized to perform ranging and sidelink positioning when "not served by NG-RAN" and the role which the UE is authorized to act as one or more of the following:
 - 1) located UE; or
 - 2) SL positioning server UE;

NOTE 2: A UE authorised to perform ranging and sidelink positioning when "not served by NG-RAN" is also authorised to act as a target UE and as an SL reference UE when "not served by NG-RAN".

- d) one or more of the below:
- 1) 5G ProSe related mapping rules including:
 - i) a list of ProSe identifier for ranging and sidelink positioning to ranging and sidelink positioning QoS parameters mapping rules. The ranging and sidelink positioning QoS parameters are defined in clause 5.7.2 of 3GPP TS 23.586 [2]; and
 - ii) a list of ProSe identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules. The PQI for RSPP transport QoS is defined in clause 5.7.3 of 3GPP TS 23.586 [2]; or
 - 2) V2X service related mapping rules including:
 - i) a list of V2X service identifier for ranging and sidelink positioning to ranging and sidelink positioning QoS parameters mapping rules. The ranging and sidelink positioning QoS parameters are defined in clause 5.7.2 of 3GPP TS 23.586 [2]; and
 - ii) a list of V2X service identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules. The PQI for RSPP transport QoS is defined in clause 5.7.3 of 3GPP TS 23.586 [2];
- e) an indication of whether the UE is allowed to use UE-only operation to perform ranging and sidelink positioning when the UE is served by the NG-RAN and the network-based operation is not supported by the network;
- f) optionally, the SLPKMF address information; and
- g) optionally, user info ID for ranging and sidelink positioning UE discovery.

NOTE 3: If the application layer ID is not available then the user Info ID can be used as provided by the PCF, configured in the UICC, or configured in the ME.

5.3 Procedures

5.3.1 General

The procedure for provisioning of parameters for ranging and sidelink positioning allows the UE to obtain the ranging and sidelink positioning policy (RSLPP).

5.3.2 UE-requested RSLPP provisioning procedure

5.3.2.1 General

The UE-requested RSLPP provisioning procedure enables the UE to request RSLPP from the PCF in the following cases:

- a) if the T5aaa for UE policies for ranging and sidelink positioning expires; and
- b) if there are no valid configuration parameters, e.g., for the current area, or due to abnormal situation.

The UE shall follow the principles of PTI handling for UE policy delivery service procedures defined in 3GPP TS 24.501 [3] clause D.1.2.

5.3.2.2 UE-requested RSLPP provisioning procedure initiation

In order to initiate the UE-requested RSLPP provisioning procedure, the UE shall create a UE POLICY PROVISIONING REQUEST message (see example in figure 5.3.2.2.1). The UE:

- a) shall allocate a PTI value currently not used and set the PTI IE to the allocated PTI value;
- b) shall include the Requested UE policies IE indicating whether the UE policies for ranging and sidelink positioning are requested;

- c) shall transport the UE POLICY PROVISIONING REQUEST message using the NAS transport procedure as specified in 3GPP TS 24.501 [3] clause 5.4.5; and
- d) shall start timer T5040.

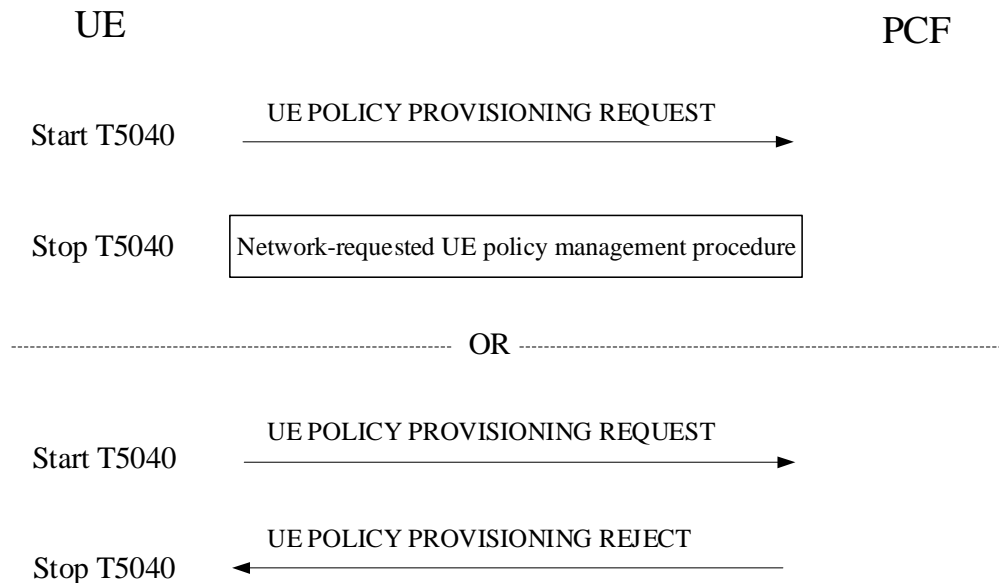


Figure 5.3.2.2.1: UE-requested RSLPP provisioning procedure

5.3.2.3 UE-requested RSLPP provisioning procedure accepted by the network

Handling in 3GPP TS 24.587 [4] clause 5.3.2.3 shall apply.

If new UE policies for ranging and sidelink positioning are included in the MANAGE UE POLICY COMMAND message, the UE shall stop timer T5151 if it is running and start timer T5151 with the value included in the UE policies for ranging and sidelink positioning and start using the new UE policies for ranging and sidelink positioning included in the MANAGE UE POLICY COMMAND message.

5.3.2.4 UE-requested RSLPP provisioning procedure not accepted by the network

Handling in 3GPP TS 24.587 [4] clause 5.3.2.4 shall apply.

5.3.2.5 Abnormal cases on the network side

Handling in 3GPP TS 24.587 [4] clause 5.3.2.5 shall apply.

5.3.2.6 Abnormal cases on the UE

Handling in 3GPP TS 24.587 [4] clause 5.3.2.6 shall apply.

6 Ranging and sidelink positioning UE discovery and selection

6.1 Overview

Ranging and sidelink positioning UE discovery and selection includes:

- a) ranging and sidelink positioning UE discovery with 5G ProSe capable UE (see clause 6.2);

- b) ranging and sidelink positioning UE discovery with V2X capable UE (see clause 6.3);
- c) located UE selection (see clause 6.4);
- d) sidelink positioning server UE selection (see clause 6.5); and
- e) sidelink positioning reference UE selection (see clause 6.6).

6.2 Ranging and sidelink positioning UE discovery with 5G ProSe capable UE

6.2.1 General

This clause describes the procedures of 5G ProSe direct discovery for ranging and sidelink positioning over PC5 interface. The purpose of 5G ProSe direct discovery for ranging and sidelink positioning procedure over PC5 interface is to enable a ProSe-enabled UE to detect and identify another ProSe-enabled UE for ranging and sidelink positioning over PC5 interface.

NOTE 1: The procedures of 5G ProSe direct discovery for ranging and sidelink positioning are triggered by the RSP layer and performed in the 5G ProSe layer.

To perform 5G ProSe direct discovery for ranging and sidelink positioning procedure with 5G ProSe capable UE over PC5 interface, the UE is configured with the related information as described in clause 5.2.3. If a UE cannot derive any of the necessary configurations (e.g. default destination layer-2 ID for initial discovery signalling) according to the mapping rules for the ProSe identifier of a "Ranging and Sidelink Positioning" service, then the UE is not allowed to perform any operation specified in clause 6.2.2 for the "Ranging and Sidelink Positioning" service.

The following procedures 5G ProSe direct discovery for ranging and sidelink positioning UE discovery procedure over PC5 interface are supported:

- a) model A uses a single discovery protocol message (Announcement);
- b) model B uses two discovery protocol messages (Solicitation and Response);
- c) group member discovery in model A; and
- d) group member discovery in model B.

NOTE 2: If the UE is authorized to perform both 5G ProSe direct discovery model A and 5G ProSe direct discovery model B, it is up to UE implementation to select which model to perform or perform both models simultaneously.

6.2.2 Procedures

6.2.2.1 5G ProSe direct discovery for ranging and sidelink positioning procedure over PC5 interface with model A

6.2.2.1.1 General

In this procedure, the UE sending the PROSE PC5 DISCOVERY message is called the "announcing UE" and the "monitoring UE" is the UE that triggers the lower layer to start monitoring for PROSE PC5 DISCOVERY message.

6.2.2.1.2 Announcing UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning initiation

The UE is authorised to perform the announcing UE procedure for ranging and sidelink positioning UE discovery if:

- a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using announcing procedure when the UE is not served by NG-RAN and is configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;

- b) the UE is served by NG-RAN and is authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using announcing in the PLMN indicated by the serving cell; or
- c) the UE is:
 - 1) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [17] and the reason for the UE being in limited service state is one of the following:
 - i) the UE is unable to find a suitable cell in the selected PLMN as specified in 3GPP TS 38.304 [20];
 - ii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #11 "PLMN not allowed" as specified in 3GPP TS 24.501 [3]; or
 - iii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #7 "5GS services not allowed " as specified in 3GPP TS 24.501 [3]; and
 - 2) authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using announcing when the UE is not served by NG-RAN; and:
 - i) configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN; or
 - ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure.

NOTE 1: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.

otherwise, the UE is not authorised to perform the announcing UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning.

Figure 6.2.2.1.2.1 illustrates the interaction of the UEs in the announcing UE procedure for 5G ProSe direct discovery.

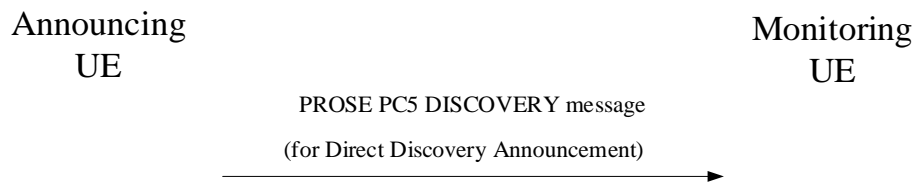


Figure 6.2.2.1.2.1: Announcing UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning

When the UE is triggered by an upper layer application to perform announcing UE procedure for 5G ProSe direct discovery announcing procedure, if the UE is authorised to perform the announcing UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning, then the UE:

- a) if the UE is served by NG-RAN and the UE in 5GMM-IDLE mode needs to request resources for sending PROSE PC5 DISCOVERY messages as specified in 3GPP TS 38.331 [19], shall perform a service request procedure as specified in 3GPP TS 24.501 [3];
- b) shall generate a PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery announcement according to clause 10.2.1. In the PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery announcement, the UE:
 - 1) shall set the ProSe direct discovery PC5 message type parameter for 5G ProSe direct discovery announcement for ranging and sidelink positioning UE discovery according to clause 11.2.1 3GPP TS 24.554 [6];
 - 2) shall include the RSPP metadata IE to provide the RSPP metadata information e.g., the role(s) of the announcing UE;
 - 3) shall set the announcer info parameter to the user info ID of announcing UE;

- 4) shall include the PLMN ID IE to provide the serving PLMN ID of the announcing UE if the announcing UE is acting as a located UE and the announcing UE performs the ranging and sidelink positioning operation utilizing the location services signalling messages as defined in 3GPP TS 23.273 [11];
- 5) shall include the MIC field computed as described in 3GPP TS 33.533 [5], by using the UTC-based counter and the DUK contained in the <RangingSI-discovery-security-parameters-accept> element of the PROSE_SECURITY_PARAM_RESPONSE message; and
- 6) shall set the UTC-based counter LSB parameter to the 4 least significant bits of the UTC-based counter;
- c) shall apply the DUK, DUSK, or DUCK with the associated Encrypted Bitmask, along with the UTC-based counter to the PROSE PC5 DISCOVERY message for whichever security mechanism(s) configured to be applied, e.g., integrity protection, message scrambling or confidentiality protection of one or more above parameters, as specified in 3GPP TS 33.533 [5];
- d) shall set the destination layer-2 ID to the default destination layer-2 ID as specified in clause 5.2.3 and self-assign a source layer-2 ID for sending the direct discovery announcement; and
- e) shall pass the resulting PROSE PC5 DISCOVERY message along with the source layer-2 ID and destination layer-2 ID for direct discovery announcement and an indication that the message is for 5G ProSe direct discovery to the lower layers for transmission over the PC5 interface.

The announcing UE shall ensure that it keeps on passing the same PROSE PC5 DISCOVERY message to the lower layers for transmission until the request from upper layers to perform announcing UE procedure for 5G ProSe direct discovery is still in place. How this is achieved is left up to UE implementation.

NOTE 2: The announcing UE can stop announcing UE procedure for 5G ProSe direct discovery for power saving by implementation specific means e.g. an implementation-specific maximum number of 5G ProSe direct links configured in the UE, or an implementation-specific timer expires.

6.2.2.1.3 Announcing UE procedure 5G ProSe direct discovery for ranging and sidelink positioning completion

When the request from upper layers to perform announcing UE procedure for 5G ProSe direct discovery is not in place, the UE may instruct the lower layers to stop announcing.

NOTE: The announcing UE can stop announcing UE procedure for 5G ProSe direct discovery for power saving by implementation specific means e.g. an implementation-specific maximum number of 5G ProSe direct links configured in the UE, or an implementation-specific timer expires.

When the UE stops announcing, if the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [19].

6.2.2.1.4 Monitoring UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning initiation

The UE is authorised to perform the monitoring UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning if:

- a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery using monitoring when the UE is not served by NG-RAN and is configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;
- b) the UE is served by NG-RAN and is authorised to perform 5G ProSe direct discovery monitoring in at least one PLMN; or
- c) the UE is:
 - 1) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [17] and the reason for the UE being in limited service state is one of the following:
 - i) the UE is unable to find a suitable cell in the selected PLMN as specified in 3GPP TS 38.304 [20];

- ii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #11 "PLMN not allowed" as specified in 3GPP TS 24.501 [3]; or
 - iii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #7 "5GS services not allowed" as specified in 3GPP TS 24.501 [3]; and
- 2) authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using monitoring when the UE is not served by NG-RAN; and:
- i) configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN; or
 - ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure.

NOTE 1: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.

otherwise, the UE is not authorised to perform the monitoring UE procedure for 5G ProSe direct discovery procedure.

Figure 6.2.2.1.4.1 illustrates the interaction of the UEs in the monitoring UE procedure for 5G ProSe direct discovery procedure for ranging and sidelink positioning.

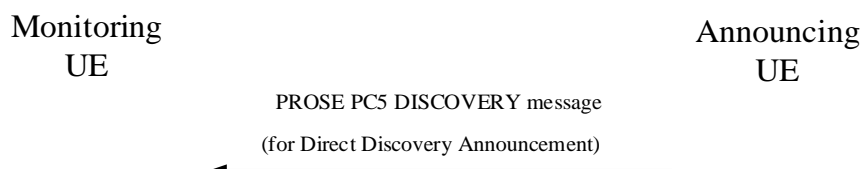


Figure 6.2.2.1.4.1: Monitoring UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning

When the UE is triggered by an upper layer application to perform monitoring UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning for a ProSe application identifier for ranging and sidelink positioning; and:

- a) if the UE is authorised to perform the monitoring UE procedure for 5G ProSe direct discovery;

then the UE shall instruct the lower layers to start monitoring for PROSE PC5 DISCOVERY message.

NOTE 2: The UE can determine the received PROSE PC5 DISCOVERY message for 5G ProSe direct discovery announcement is for 5G ProSe direct discovery based on an indication from the lower layer.

Upon reception of a PROSE PC5 DISCOVERY message for direct discovery announcement for ranging and sidelink positioning, the UE shall use the associated DUSK, if received from the SLPKMF and the UTC-based counter obtained during the reception operation to unscramble the PROSE PC5 DISCOVERY message as described in 3GPP TS 33.533 [5]. Then, if a DUCK is received from the SLPKMF, the UE shall use the DUCK and the UTC-based counter to decrypt the configured message-specific confidentiality-protected portion, as described in 3GPP TS 33.533 [5]. Finally, if a DUIK is received from the SLPKMF, the UE shall use the DUIK and the UTC-based counter to verify the MIC field in the unscrambled PROSE PC5 DISCOVERY message direct discovery announcement for ranging and sidelink positioning.

The UE shall consider that the UE it seeks to monitor has been discovered if there is a match event as follows:

- a) the role(s) of the announcing UE included in the RSPP metadata information of the PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery announcement, should be the same as the configured role(s) for the UE as specified in clause 5.2.3.

6.2.2.1.5 Monitoring UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning completion

During the monitoring UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning, if the request from upper layers to perform the monitoring UE procedure for 5G ProSe direct discovery is not in place, the UE may instruct the lower layers to stop monitoring.

When the UE stops monitoring, if the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [19].

6.2.2.2 5G ProSe direct discovery procedure for ranging and sidelink positioning over PC5 interface with model B

6.2.2.2.1 General

In this procedure, the UE sending the PROSE PC5 DISCOVERY message is called the "discoverer UE" and the other UE is called the "discoveree UE".

6.2.2.2.2 Discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning initiation

The UE is authorised to perform the discoverer UE procedure for ranging and sidelink positioning UE discovery if:

- a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery discoverer operation for ranging and sidelink positioning when the UE is not served by NG-RAN and is configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;
- b) the UE is served by NG-RAN and is authorised to perform 5G ProSe direct discovery discoverer operation for ranging and sidelink positioning in the PLMN indicated by the serving cell; or
- c) the UE is:
 - 1) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [17] and the reason for the UE being in limited service state is one of the following:
 - i) the UE is unable to find a suitable cell in the selected PLMN as specified in 3GPP TS 38.304 [20];
 - ii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #11 "PLMN not allowed" as specified in 3GPP TS 24.501 [3]; or
 - iii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #7 "5GS services not allowed" as specified in 3GPP TS 24.501 [3]; and
 - 2) authorised to perform 5G ProSe direct discovery discoverer operation for ranging and sidelink positioning when the UE is not served by NG-RAN; and:
 - i) configured with the radio parameters to be used for 5G ProSe direct discovery use when not served by NG-RAN; or
 - ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure.

NOTE 1: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.

otherwise, the UE is not authorised to perform the discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning.

Figure 6.2.2.2.2.1 illustrates the interaction of the UEs in the discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning.

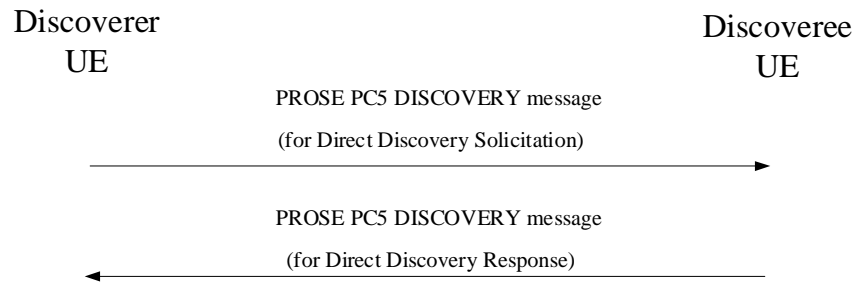


Figure 6.2.2.2.1: Discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning

When the UE is triggered by an upper layer application to perform the discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning; and if the UE is authorised to perform the discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning in the registered PLMN or the local PLMN operating the radio resources that the UE intends to use; then the UE:

- a) if the UE is served by NG-RAN and the UE in 5GMM-IDLE mode needs to request resources for sending PROSE PC5 DISCOVERY messages as specified in 3GPP TS 38.331 [19], shall perform a service request procedure as specified in 3GPP TS 24.501 [3];
- b) shall generate a PROSE PC5 DISCOVERY message for 5G ProSe direct discovery solicitation for ranging and sidelink positioning. In the PROSE PC5 DISCOVERY message for 5G ProSe direct discovery solicitation for ranging and sidelink positioning, the UE:
 - 1) shall set the ProSe direct discovery PC5 message type parameter for PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery solicitation according to clause 11.2.1 of 3GPP TS 24.554 [6];
 - 2) shall include the discoveree user info set to the application layer ID of the discoveree UE if it is provided by the upper layers to identify a specific discoveree UE;
 - 3) shall include the discoverer user info set to the application layer ID of the discoverer UE as provided by the upper layers;
 - 4) may include the RSPP metadata IE to provide the RSPP metadata information e.g., the specific role(s) to be discovered;
 - 5) shall include the MIC field computed as described in 3GPP TS 33.533 [5], by using the UTC-based counter and the DUIK contained in the <RangingSI-discovery-security-parameters-accept> element of the PROSE_SECURITY_PARAM_RESPONSE message; and
 - 6) shall set the UTC-based counter LSB parameter to the 4 least significant bits of the UTC-based counter.
- c) shall apply the DUIK, DUSK, or DUCK with the associated Encrypted Bitmask, along with the UTC-based counter to the PROSE PC5 DISCOVERY message for whichever security mechanism(s) configured to be applied, e.g., integrity protection, message scrambling or confidentiality protection of one or more above parameters, as specified in 3GPP TS 33.533 [5];
- d) shall set the destination layer-2 ID to the default destination layer-2 ID as specified in clause 5.2.3 of 3GPP TS 24.554 [6] and self-assign a source layer-2 ID for sending the direct discovery solicitation; and

NOTE 2: The UE implementation ensures that the value of the self-assigned source layer-2 ID is different from any other self-assigned source layer-2 ID(s) in use for 5G ProSe direct communication, is different from any other provisioned destination layer-2 ID(s), and is different from any other self-assigned source layer-2 ID in use for a simultaneous 5G ProSe direct discovery procedure over PC5 with a different discovery model as specified in 3GPP TS 24.554 [6].

- e) shall pass the resulting PROSE PC5 DISCOVERY message along with the source layer-2 ID and destination layer-2 ID for 5G ProSe direct discovery solicitation and the PLMN ID of the intended announcing PLMN if available in the discovery entry and an indication that the message is for 5G ProSe direct discovery to the lower layers for transmission over the PC5 interface and shall instruct the lower layer to start monitoring.

The UE shall ensure that it keeps on passing the same PROSE PC5 DISCOVERY message to the lower layers for transmission until the request from upper layers to perform the discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning is not in place. How this is achieved is left up to UE implementation.

NOTE 3: The discoverer UE can stop discoverer UE procedure for 5G ProSe direct discovery for power saving by implementation specific means e.g. an implementation-specific maximum number of 5G ProSe direct links configured in the UE, or an implementation-specific timer expires.

Upon reception of a PROSE PC5 DISCOVERY message for direct discovery response for ranging and sidelink positioning, for the target destination layer-2 ID of the direct discovery to be discovered, the UE shall use the associated DUSK, if received from the SLPKMF and the UTC-based counter obtained during the reception operation to unscramble the PROSE PC5 DISCOVERY message as described in 3GPP TS 33.533 [5]. Then, if a DUCK is received from the SLPKMF, the UE shall use the DUCK and the UTC-based counter to decrypt the configured message-specific confidentiality-protected portion, as described in 3GPP TS 33.533 [5]. Finally, if a DUIK is received from the SLPKMF, the UE shall use the DUIK and the UTC-based counter to verify the MIC field in the unscrambled PROSE PC5 DISCOVERY message for direct discovery response for ranging and sidelink positioning. Then the UE decides that the other UE the UE seeks to discover has been discovered if the role(s) to be discovered included in the RSPP metadata of the PROSE PC5 DISCOVERY message UE discovery solicitation for ranging and sidelink positioning, if available, should be the same as the role(s) of the discoveree UE included in the RSPP metadata of the PROSE PC5 DISCOVERY message for UE discovery response for ranging and sidelink positioning.

6.2.2.2.3 Discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning completion

During the discoverer operation, if the request from upper layers to perform the discoverer UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning in restricted discovery Model B, is not in place, then the UE may instruct the lower layers to stop the discoverer operation. When the UE stops discoverer operation, if the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [19].

6.2.2.2.4 Discoveree UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning initiation

The UE is authorised to perform the discoveree UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning if:

- a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery discoveree operation for ranging and sidelink positioning when the UE is not served by NG-RAN and is configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;
- b) the UE is served by NG-RAN and is authorised to perform 5G ProSe direct discovery discoverer operation for ranging and sidelink positioning in the PLMN indicated by the serving cell; or
- c) the UE is:
 - 1) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [17] and the reason for the UE being in limited service state is one of the following:
 - i) the UE is unable to find a suitable cell in the selected PLMN as specified in 3GPP TS 38.304 [20];
 - ii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #11 "PLMN not allowed" as specified in 3GPP TS 24.501 [3]; or
 - iii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #7 "5GS services not allowed" as specified in 3GPP TS 24.501 [3]; and
 - 2) authorised to perform 5G ProSe direct discovery discoverer operation for ranging and sidelink positioning when the UE is not served by NG-RAN; and:
 - i) configured with the radio parameters to be used for 5G ProSe direct discovery use when not served by NG-RAN; or
 - ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure.

NOTE 1: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.

otherwise, the UE is not authorised to perform the discoveree UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning.

Figure 6.2.2.4.1 illustrates the interaction of the UEs in the discoveree UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning.

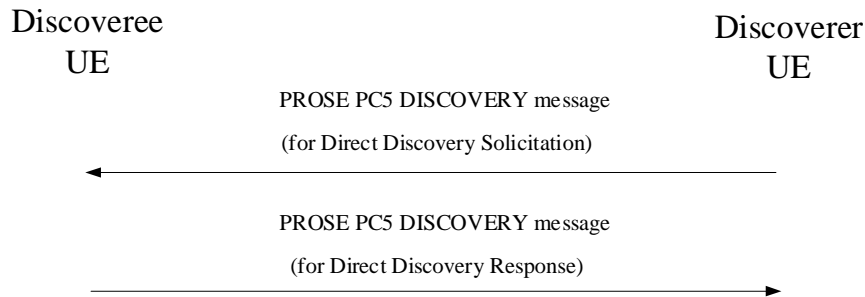


Figure 6.2.2.4.1: Discoveree UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning

When the UE is triggered by an upper layer application to perform discoveree operation for ranging and sidelink positioning; and if:

- a) the UE is authorised to perform the discoveree UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning;

then the UE:

- a) if the UE is served by NG-RAN and the UE in 5GMM-IDLE mode needs to request resources for sending PROSE PC5 DISCOVERY messages as specified in 3GPP TS 38.331 [19], shall perform a service request procedure or registration procedure as specified in 3GPP TS 24.501 [3]; and
- b) shall instruct the lower layers to start monitoring for PROSE PC5 DISCOVERY messages as specified in 3GPP TS 38.331 [19].

Upon reception of a PROSE PC5 DISCOVERY message for direct discovery solicitation for ranging and sidelink positioning for the destination layer-2 ID which the UE is configured to respond for, the match occurs if:

- a) If the discoveree user info is included in the PROSE PC5 DISCOVERY message, the discoveree user info shall match the user info ID of the UE; and
- b) The role(s) to be discovered included in the RSPP metadata of the PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery solicitation, if available, is the same as the configured role(s) for the UE as specified in clause 5.2.3;

Once the match occurs, the UE process this match event and requests the lower layers to announce the corresponding response. If the UE in 5GMM-IDLE mode has to request resources for 5G ProSe direct discovery announcing as specified in 3GPP TS 38.331 [19], the UE shall perform a service request procedure or registration procedure as specified in 3GPP TS 24.501 [3]. The UE shall generate a PROSE PC5 DISCOVERY message for 5G ProSe direct discovery response for ranging and sidelink positioning. In the PROSE PC5 DISCOVERY message for 5G ProSe direct discovery response for ranging and sidelink positioning, the UE:

- 1) shall set the ProSe direct discovery PC5 message type parameter for 5G ProSe direct discovery response for ranging and sidelink positioning according to clause 9.2.1;
- 2) shall include the RSPP metadata IE to provide the RSPP metadata information e.g., the specific role(s) of the discoveree UE;
- 3) shall include the discoveree user info set to the application layer ID of the discoveree UE;

- 4) shall include the PLMN ID IE to provide the serving PLMN ID of the discoveree UE if the discoveree UE is acting as a located UE and the discoveree UE performs the ranging and sidelink positioning operation utilizing the location services signalling messages as defined in 3GPP TS 23.273 [11];
- 5) shall include the MIC field computed as described in 3GPP TS 33.533 [5], by using the UTC-based counter and the DUIK contained in the <RangingSI-discovery-security-parameters-accept> element of the PROSE_SECURITY_PARAM_RESPONSE message; and
- 6) shall set the UTC-based counter LSB parameter to the 4 least significant bits of the UTC-based counter.

After generating the PROSE PC5 DISCOVERY message for 5G ProSe direct discovery response, the UE:

- a) shall apply the DUIK, DUSK, or DUCK with the associated Encrypted Bitmask, along with the UTC-based counter to the PROSE PC5 DISCOVERY message for whichever security mechanism(s) configured to be applied, e.g., integrity protection, message scrambling or confidentiality protection of one or more above parameters, as specified in 3GPP TS 33.533 [5];
- b) shall set the destination layer-2 ID to the source layer-2 ID of the received message and self-assign a source layer-2 ID for sending the direct discovery response message; and

NOTE 5: The UE implementation ensures that the value of the self-assigned source layer-2 ID is different from any other self-assigned source layer-2 ID(s) in use for 5G ProSe direct communication and is different from any other provisioned destination layer-2 ID(s) as specified in 3GPP TS 24.554 [6].

- c) shall pass the resulting PROSE PC5 DISCOVERY message along with the source layer-2 ID and destination layer-2 ID for 5G ProSe direct discovery response, the PLMN ID of the intended announcing PLMN and an indication that the message is for 5G ProSe direct discovery to the lower layers for transmission over the PC5 interface.

NOTE 6: If the UE is processing a PROSE DIRECT LINK ESTABLISHMENT REQUEST message from the same source layer-2 ID of the received PROSE PC5 DISCOVERY message for direct discovery solicitation for ranging and sidelink positioning, it depends on UE implementation to avoid the conflict of destination layer-2 ID (e.g. send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #3 "conflict of layer-2 ID for unicast communication is detected", or ignore the PROSE DIRECT DISCOVERY message for direct discovery solicitation for ranging and sidelink positioning).

For each match event, the UE shall at least pass PROSE PC5 DISCOVERY message once to the lower layers for transmission. The UE shall ensure that it keeps on passing PROSE PC5 DISCOVERY messages to the lower layers for transmission as response(s) to the match event(s).

6.2.2.2.5 Discoveree UE procedure for 5G ProSe direct discovery for ranging and sidelink positioning completion

During the discoveree operation, if the request from upper layers to perform discoveree operation for ranging and sidelink positioning is not in place, then the UE may instruct the lower layers to stop monitoring.

When the UE stops monitoring, if the lower layers indicate that the UE is required to send a discovery indication to the NG-RAN and the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [19].

6.2.2.3 Group member procedure for ranging and sidelink positioning over PC5 interface with model A

6.2.2.3.1 General

In this procedure, the UE sending the PROSE PC5 DISCOVERY message is called the "announcing UE" and the "monitoring UE" is the UE that triggers the lower layer to start monitoring for PROSE PC5 DISCOVERY message.

6.2.2.3.2 Announcing UE procedure for group member discovery for ranging and sidelink positioning initiation

The UE is authorised to perform the announcing UE procedure for ranging and sidelink positioning UE discovery if:

- a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using announcing procedure when the UE is not served by NG-RAN and is configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;
- b) the UE is served by NG-RAN and is authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using announcing in the PLMN indicated by the serving cell; or
- c) the UE is:
 - 1) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [17] and the reason for the UE being in limited service state is one of the following:
 - i) the UE is unable to find a suitable cell in the selected PLMN as specified in 3GPP TS 38.304 [20];
 - ii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #11 "PLMN not allowed" as specified in 3GPP TS 24.501 [3]; or
 - iii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #7 "5GS services not allowed " as specified in 3GPP TS 24.501 [3]; and
 - 2) authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using announcing when the UE is not served by NG-RAN; and:
 - i) configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN; or
 - ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure. and

NOTE 1: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.

- d) the UE is configured with the application layer group ID identifying the application layer group for ranging and sidelink positioning using announcing to be announced and with the User info ID for the group member discovery parameter;

otherwise, the UE is not authorised to perform the announcing UE procedure for group member discovery procedure for ranging and sidelink positioning.

Figure 6.2.2.3.2.1 illustrates the interaction of the UEs in the announcing UE procedure for group member discovery for ranging and sidelink positioning.

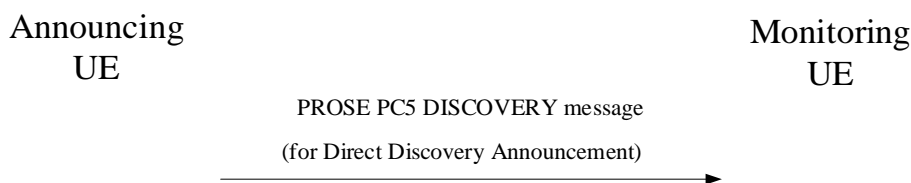


Figure 6.2.2.3.2.1: Announcing UE procedure for group member discovery for ranging and sidelink positioning

When the UE is triggered by an upper layer application to announce availability in a discovery group for ranging and sidelink positioning, if the UE is authorised to perform the announcing UE procedure for group member discovery for ranging and sidelink positioning, then the UE:

- a) if the UE is served by NG-RAN and the UE in 5GMM-IDLE mode needs to request resources for sending PROSE PC5 DISCOVERY messages as specified in 3GPP TS 38.331 [19], shall perform a service request procedure as specified in 3GPP TS 24.501 [3];

- b) shall generate a PROSE PC5 DISCOVERY message for group member discovery announcement for ranging and sidelink positioning. In the PROSE PC5 DISCOVERY message for group member discovery announcement for ranging and sidelink positioning, the UE:
- 1) shall set the announcer info parameter to the user info ID for the group member discovery parameter;
 - 2) shall set the application layer group ID parameter to the application layer group ID identifying the ranging and sidelink positioning group that the UE belongs to be announced;
 - 3) shall set the ProSe direct discovery PC5 message type parameter for 5G ProSe direct discovery announcement for group member discovery for ranging and sidelink positioning according to clause 11.2.1 3GPP TS 24.554 [6];
 - 4) shall include the RSPP metadata IE to provide the RSPP metadata information e.g., the role(s) of the Announcing UE;
 - 5) shall set the PLMN ID IE to provide the serving PLMN ID of the announcing UE if the announcing UE is acting as a located UE and the announcing UE performs the ranging and sidelink positioning operation utilizing the location services signalling messages as defined in 3GPP TS 23.273 [11];
 - 6) shall include the MIC field computed as described in 3GPP TS 33.533 [5], by using the UTC-based counter and the DUIK contained in the <RangingSI-discovery-security-parameters-accept> element of the PROSE_SECURITY_PARAM_RESPONSE message; and
 - 7) shall set the UTC-based counter LSB parameter to the 4 least significant bits of the UTC-based counter.
- c) shall apply the DUIK, DUSK, or DUCK with the associated Encrypted Bitmask, along with the UTC-based counter to the PROSE PC5 DISCOVERY message for whichever security mechanism(s) configured to be applied, e.g., integrity protection, message scrambling or confidentiality protection of one or more above parameters, as specified in 3GPP TS 33.533 [5];
- d) shall apply one of the following to determine the destination layer-2 ID:
- 1) if the application layer group ID has a configured layer-2 group ID as specified in clause 5.2.3, set the destination layer-2 ID to the layer-2 group ID; or
 - 2) otherwise, convert the application layer group ID into a destination layer-2 ID as following:
 - i) to use the group identifier as the input to the SHA-256 hashing algorithm as specified in ISO/IEC 10118-3:2018 [10]; and
 - ii) to use the 24 least significant bits of the 256 bits of the output as destination layer-2 ID;
- e) shall self-assign a source layer-2 ID for sending the direct discovery announcement; and
- f) shall pass the resulting PROSE PC5 DISCOVERY message for group member discovery announcement along with the source layer-2 ID and destination layer-2 ID for direct discovery announcement to the lower layers for transmission over the PC5 interface.

The announcing UE shall ensure that it keeps on passing the same PROSE PC5 DISCOVERY message to the lower layers for transmission until the announcing UE is triggered by an upper layer application to stop announcing availability in a discovery group, or until the UE stops being authorised to perform the announcing UE procedure for group member discovery for ranging and sidelink positioning.

NOTE 4: The announcing UE can stop announcing UE procedure for group member discovery for ranging and sidelink positioning for power saving by implementation specific means e.g. an implementation-specific maximum number of 5G ProSe direct links configured in the UE, or an implementation-specific timer expires.

6.2.2.3.3 Announcing UE procedure for group member discovery for ranging and sidelink positioning completion

When the announcing UE is triggered by an upper layer application to stop announcing availability in a discovery group, or when the announcing UE stops being authorised to perform the announcing UE procedure for group member discovery for ranging and sidelink positioning, the UE shall instruct the lower layers to stop announcing.

NOTE: The announcing UE can stop announcing UE procedure for group member discovery for ranging and sidelink positioning for power saving by implementation specific means e.g. an implementation-specific maximum number of 5G ProSe direct links configured in the UE, or an implementation-specific timer expires.

When the UE stops announcing, if the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [19].

6.2.2.3.4 Monitoring UE procedure for group member discovery for ranging and sidelink positioning initiation

The UE is authorised to perform the monitoring UE procedure for group member discovery for ranging and sidelink positioning if:

- a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery using monitoring when the UE is not served by NG-RAN and is configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;
- b) the UE is served by NG-RAN and is authorised to perform 5G ProSe direct discovery monitoring in at least one PLMN; or
- c) the UE is:
 - 1) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [17] and the reason for the UE being in limited service state is one of the following:
 - i) the UE is unable to find a suitable cell in the selected PLMN as specified in 3GPP TS 38.304 [20];
 - ii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #11 "PLMN not allowed" as specified in 3GPP TS 24.501 [3]; or
 - iii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #7 "5GS services not allowed" as specified in 3GPP TS 24.501 [3]; and
 - 2) authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using monitoring when the UE is not served by NG-RAN; and:
 - i) configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN; or
 - ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure. and

NOTE 1: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.

- b) the UE is configured with the application layer group ID parameter identifying the discovery group for ranging and sidelink positioning to be monitored;

otherwise, the UE is not authorised to perform the monitoring UE procedure for group member discovery for ranging and sidelink positioning.

Figure 6.2.2.3.4.1 illustrates the interaction of the UEs in the monitoring UE procedure for group member discovery for ranging and sidelink positioning.

Monitoring UE

Announcing UE

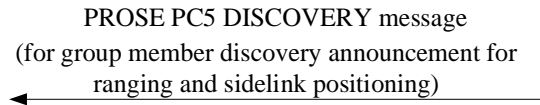


Figure 6.2.2.3.4.1: Monitoring UE procedure for group member discovery for ranging and sidelink positioning

When the UE is triggered by an upper layer application to monitor proximity of other UEs in a discovery group for ranging and sidelink positioning and if the UE is authorised to perform the monitoring UE procedure for group member discovery for ranging and sidelink positioning, then the UE shall instruct the lower layers to start monitoring for PROSE PC5 DISCOVERY message as following:

- a) if the application layer group ID has a configured layer-2 group ID as specified in clause 5.2.3, the UE shall monitor for PROSE PC5 DISCOVERY message with the layer-2 group ID as specified in clause 5.2.3; or
- b) otherwise, the UE shall convert the application layer group ID into a destination layer-2 ID and shall monitor for PROSE PC5 DISCOVERY message with the converted destination layer-2 ID. The UE shall convert the application layer group ID for ranging and sidelink positioning into a destination layer-2 ID as following:
 - 1) to use the group identifier as the input to the SHA-256 hashing algorithm as specified in ISO/IEC 10118-3:2018 [10]; and
 - 2) to use the 24 least significant bits of the 256 bits of the output as destination layer-2 ID.

NOTE 2: SHA-256 hashing algorithm is implemented in the ME.

Upon reception of a PROSE PC5 DISCOVERY message for direct discovery announcement for ranging and sidelink positioning, the UE shall use the associated DUSK, if received from the SLPKMF and the UTC-based counter obtained during the reception operation to unscramble the PROSE PC5 DISCOVERY message as described in 3GPP TS 33.533 [5]. Then, if a DUCK is received from the SLPKMF, the UE shall use the DUCK and the UTC-based counter to decrypt the configured message-specific confidentiality-protected portion, as described in 3GPP TS 33.533 [5]. Finally, if a DUIK is received from the SLPKMF, the UE shall use the DUIK and the UTC-based counter to verify the MIC field in the unscrambled PROSE PC5 DISCOVERY message direct discovery announcement for ranging and sidelink positioning.

The UE shall consider that the UE it seeks to monitor has been discovered if there is a match event as follows:

- a) the application layer group ID parameter of the PROSE PC5 DISCOVERY message for group member discovery announcement for ranging and sidelink positioning is the same as the configured application layer group ID parameter as specified in clause 5.2.3;
- b) if the PLMN ID parameter is included in the PROSE PC5 DISCOVERY message for group member discovery announcement for ranging and sidelink positioning and it is the same with the serving PLMN ID of the monitoring UE; and
- c) the role(s) of the announcing UE included in the RSP metadata information of the PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery announcement, is the same as the configured role(s) for the UE as specified in clause 5.2.3.

6.2.2.3.5 Monitoring UE procedure for group member discovery for ranging and sidelink positioning completion

When the UE is triggered by an upper layer application to stop monitoring proximity of other UEs in a discovery group for ranging and sidelink positioning, or when the UE stops being authorised to perform the monitoring UE procedure for group member discovery for ranging and sidelink positioning, the UE shall instruct the lower layers to stop monitoring.

When the UE stops monitoring, if the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [19].

6.2.2.4 Group member discovery for ranging and sidelink positioning over PC5 interface with model B

6.2.2.4.1 General

In this procedure, the UE sending the PROSE PC5 DISCOVERY message is called the "discoverer UE" and the other UE is called the "discoveree UE".

6.2.2.4.2 Discoverer UE procedure for group member discovery for ranging and sidelink positioning initiation

The UE is authorised to perform the discoverer UE procedure for group member discovery for ranging and sidelink positioning initiation if:

- a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery discoverer operation for ranging and sidelink positioning when the UE is not served by NG-RAN and is configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;
- b) the UE is served by NG-RAN and is authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using announcing in the PLMN indicated by the serving cell; or
- c) the UE is:
 - 1) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [17] and the reason for the UE being in limited service state is one of the following:
 - i) the UE is unable to find a suitable cell in the selected PLMN as specified in 3GPP TS 38.304 [20];
 - ii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #11 "PLMN not allowed" as specified in 3GPP TS 24.501 [3]; or
 - iii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #7 "5GS services not allowed" as specified in 3GPP TS 24.501 [3]; and
 - 2) authorised to perform 5G ProSe direct discovery discoverer operation for ranging and sidelink positioning when the UE is not served by NG-RAN; and:
 - i) configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN; or
 - ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure. and

NOTE 1: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.

- d) the UE is configured with the application layer group ID identifying the application layer group for ranging and sidelink positioning using announcing to be announced and with the User info ID for the group member discovery parameter;

otherwise, the UE is not authorised to perform the discoverer UE procedure for group member discovery for ranging and sidelink positioning.

Figure 6.2.2.4.2.1 illustrates the interaction of the UEs in the discoverer UE procedure for group member discovery for ranging and sidelink positioning.

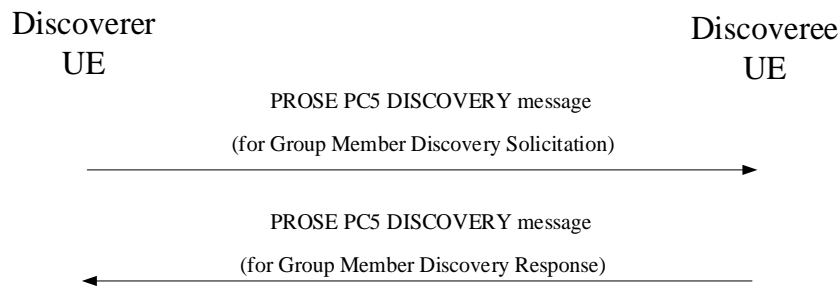


Figure 6.2.2.4.2.1: Discoverer UE procedure for group member discovery for ranging and sidelink positioning

When the UE is triggered by an upper layer application to solicit proximity of other UEs in a discovery group for ranging and sidelink positioning and if the UE is authorised to perform the discoverer UE procedure for group member discovery, then the UE:

- a) if the UE is served by NG-RAN and the UE in 5GMM-IDLE mode needs to request resources for sending PROSE PC5 DISCOVERY messages as specified in 3GPP TS 38.331 [19], shall perform a service request procedure as specified in 3GPP TS 24.501 [3];
- b) shall generate a PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning. In the PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning, the UE:
 - 1) shall set the discoverer info parameter to the user info ID for the group member discovery parameter;
 - 2) shall set the application layer group ID parameter to the application layer group ID parameter identifying the ranging and sidelink positioning group to be solicited;
 - 3) shall set the ProSe direct discovery PC5 message type parameter for PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning according to clause 9.2.1;
 - 4) shall set the target user info parameter to the target info, if the target information is provided by the upper layers to identify a specific group member of the application layer group identified by the configured application layer group ID;
 - 5) may include the RSPP metadata IE to provide the RSPP metadata information e.g., the specific role(s) to be discovered;
 - 6) shall include the MIC field computed as described in 3GPP TS 33.533 [5], by using the UTC-based counter and the DUIK contained in the <RangingSI-discovery-security-parameters-accept> element of the PROSE_SECURITY_PARAM_RESPONSE message; and
 - 7) shall set the UTC-based counter LSB parameter to the 4 least significant bits of the UTC-based counter.
- c) shall apply the DUIK, DUSK, or DUCK with the associated Encrypted Bitmask, along with the UTC-based counter to the PROSE PC5 DISCOVERY message for whichever security mechanism(s) configured to be applied, e.g., integrity protection, message scrambling or confidentiality protection of one or more above parameters, as specified in 3GPP TS 33.533 [5];
- d) shall apply one of the following to determine the destination layer-2 ID:
 - 1) if the application layer group ID has a configured layer-2 group ID as specified in clause 5.2.3, set the destination layer-2 ID to the layer-2 group ID; or
 - 2) otherwise, convert the application layer group ID into a destination layer-2 ID as following:
 - i) to use the group identifier as the input to the SHA-256 hashing algorithm as specified in ISO/IEC 10118-3:2018 [10]; and
 - ii) to use the 24 least significant bits of the 256 bits of the output as destination layer-2 ID;

NOTE 3: SHA-256 hashing algorithm is implemented in the ME.

- e) shall self-assign a source layer-2 ID for sending the group member discovery solicitation message for ranging and sidelink positioning; and

NOTE 4: The UE implementation ensures that the value of the self-assigned source layer-2 ID is different from any other self-assigned source layer-2 ID(s) in use for 5G ProSe direct communication, is different from any other provisioned destination layer-2 ID(s), and is different from any other self-assigned source layer-2 ID in use for a simultaneous 5G ProSe direct discovery procedure over PC5 with a different discovery model as specified in 3GPP TS 24.554 [6].

- f) shall pass the resulting PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning along with the source layer-2 ID and destination layer-2 ID to the lower layers for transmission over the PC5 interface.

The UE shall ensure that it keeps on passing the same PROSE PC5 DISCOVERY message to the lower layers for transmission until the UE is triggered by an upper layer application to stop soliciting proximity of other UEs in a discovery group for ranging and sidelink positioning, or until the UE stops being authorised to perform the discoverer UE procedure for group member discovery for ranging and sidelink positioning. How this is achieved is left up to UE implementation.

NOTE 5: The discoverer UE can stop discoverer UE procedure for group member discovery for ranging and sidelink positioning for power saving by implementation specific means e.g. an implementation-specific maximum number of 5G ProSe direct links configured in the UE, or an implementation-specific timer expires.

Upon reception of a PROSE PC5 DISCOVERY message for group member discovery response for ranging and sidelink positioning, the UE shall use the associated DUSK, if received from the SLPKMF and the UTC-based counter obtained during the reception operation to unscramble the PROSE PC5 DISCOVERY message as described in 3GPP TS 33.533 [5]. Then, if a DUCK is received from the SLPKMF, the UE shall use the DUCK and the UTC-based counter to decrypt the configured message-specific confidentiality-protected portion, as described in 3GPP TS 33.533 [5]. Finally, if a DUIK is received from the SLPKMF, the UE shall use the DUIK and the UTC-based counter to verify the MIC field in the unscrambled PROSE PC5 DISCOVERY message for group member discovery response for ranging and sidelink positioning. Then for the target application layer group ID of the discovery group to be discovered, if:

- a) the application layer group ID parameter of the PROSE PC5 DISCOVERY message for group member discovery response for ranging and sidelink positioning is the same as the application layer group ID parameter of the PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning,
- b) the target information is not provided by the upper layers to identify a specific group member of the application layer group, or the discoveree info in the PROSE PC5 DISCOVERY message for group member discovery response for ranging and sidelink positioning is the same as the target information if the target information is provided by the upper layers, and
- c) the role(s) to be discovered included in the RSPP metadata of the PROSE PC5 DISCOVERY message UE discovery solicitation for ranging and sidelink positioning, if available, is the same as the role(s) of the discoveree UE included in the RSPP metadata of the PROSE PC5 DISCOVERY message for UE discovery response for ranging and sidelink positioning.

the UE shall consider that other UE in the discovery group the UE seeks to discover has been discovered.

6.2.2.4.3 Discoverer UE procedure for group member discovery for ranging and sidelink positioning completion

When the UE is triggered by an upper layer application to stop soliciting proximity of other UEs in a discovery group for ranging and sidelink positioning, or when the UE stops being authorised to perform the discoverer UE procedure for group member discovery for ranging and sidelink positioning, the UE shall instruct the lower layers to stop discoverer operation.

NOTE: The discoverer UE can stop discoverer UE procedure for group member discovery for ranging and sidelink positioning for power saving by implementation specific means e.g. an implementation-specific maximum number of 5G ProSe direct links configured in the UE, or an implementation-specific timer expires.

When the UE stops discoverer operation, if the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [19].

6.2.2.4.4 Discoverer UE procedure for group member discovery for ranging and sidelink positioning initiation

The UE is authorised to perform the Discoverer UE procedure for group member discovery for ranging and sidelink positioning initiation if:

- a) the UE is not served by NG-RAN, is authorised to perform 5G ProSe direct discovery discoverer operation for ranging and sidelink positioning when the UE is not served by NG-RAN and is configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN;
- b) the UE is served by NG-RAN and is authorised to perform 5G ProSe direct discovery for ranging and sidelink positioning using announcing in the PLMN indicated by the serving cell; or
- c) the UE is:
 - 1) in 5GMM-IDLE mode, in limited service state as specified in 3GPP TS 23.122 [17] and the reason for the UE being in limited service state is one of the following:
 - i) the UE is unable to find a suitable cell in the selected PLMN as specified in 3GPP TS 38.304 [20];
 - ii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #11 "PLMN not allowed" as specified in 3GPP TS 24.501 [3]; or
 - iii) the UE received a REGISTRATION REJECT message or a SERVICE REJECT message with the 5GMM cause #7 "5GS services not allowed" as specified in 3GPP TS 24.501 [3]; and
 - 2) authorised to perform 5G ProSe direct discovery discoverer operation for ranging and sidelink positioning when the UE is not served by NG-RAN; and:
 - i) configured with the radio parameters to be used for 5G ProSe direct discovery when not served by NG-RAN; or
 - ii) the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure. and
- NOTE 1: When the lower layers indicate that the UE does not need to request resources for 5G ProSe direct discovery procedure, the serving cell broadcasts a common radio resources pool for ProSe discovery transmission and the UE can use this common radio resources pool while in limited service state.
- d) the UE is configured with the application layer group ID identifying the application layer group for ranging and sidelink positioning using announcing to be announced and with the User info ID for the group member discovery parameter;

otherwise, the UE is not authorised to perform the discoverer UE procedure for group member discovery for ranging and sidelink positioning.

Figure 6.2.2.4.4.1 illustrates the interaction of the UEs in the discoverer UE procedure for group member discovery. for ranging and sidelink positioning.

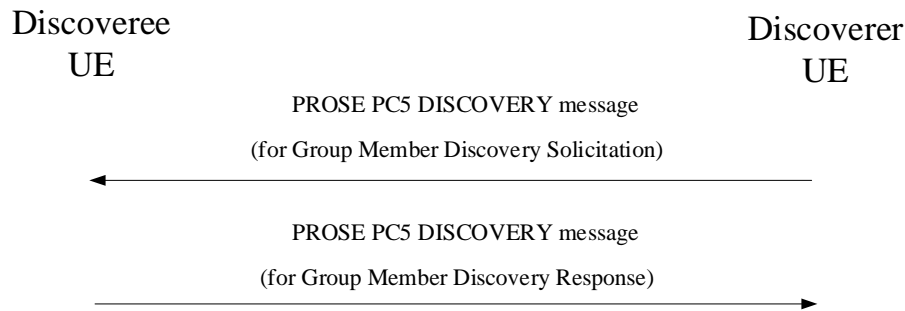


Figure 6.2.2.4.4.1: Discoveree UE procedure for group member discovery for ranging and sidelink positioning

When the UE is triggered by an upper layer application to start responding to solicitation on proximity of a UE in a discovery group for ranging and sidelink positioning and if the UE is authorised to perform the discoveree UE procedure for group member discovery for ranging and sidelink positioning, then the UE:

- a) if the UE is served by NG-RAN and the UE in 5GMM-IDLE mode needs to request resources for sending PROSE PC5 DISCOVERY messages as specified in 3GPP TS 38.331 [19], shall perform a service request procedure as specified in 3GPP TS 24.501 [3]; and
- b) shall instruct the lower layers to start monitoring for PROSE PC5 DISCOVERY messages.

Upon reception of a PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning, if:

- a) the application layer group ID parameter of the received PROSE PC5 DISCOVERY message is the same as the application layer group ID parameter for the discovery group;
- b) the target user info parameter is not included in the received PROSE PC5 DISCOVERY message or the target user info parameter in the received PROSE PC5 DISCOVERY message is the same as the user info ID for the group member discovery provided by the upper layers or same as the configured user info ID for the group member discovery as specified in clause 5.2.3; and
- c) The role(s) to be discovered included in the RSPP metadata of the PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning, if available, is the same as the configured role(s) for the UE as specified in clause 5.2.3;

the UE:

- a) shall generate a PROSE PC5 DISCOVERY message for group member discovery response for ranging and sidelink positioning. In the PROSE PC5 DISCOVERY message for group member discovery response for ranging and sidelink positioning, the UE:
 - 1) shall set the ProSe direct discovery PC5 message type parameter for group member discovery response for ranging and sidelink positioning according to clause 9.2.1;
 - 2) shall include the RSPP metadata IE to provide the RSPP metadata information e.g., the specific role(s) of the discoveree UE;
 - 3) shall include the discoveree user info set to the application layer ID of the discoveree UE;
 - 4) shall include the PLMN ID IE to provide the serving PLMN ID of the discoveree UE if the discoveree UE is acting as a located UE and the discoveree UE performs the ranging and sidelink positioning operation utilizing the location services signalling messages as defined in 3GPP TS 23.273 [11],
 - 5) may include the Metadata IE to provide the application layer metadata information;
 - 6) shall include the MIC field computed as described in 3GPP TS 33.533 [5], by using the UTC-based counter and the DUIK contained in the <RangingSI-discovery-security-parameters-accept> element of the PROSE_SECURITY_PARAM_RESPONSE message; and
 - 7) shall set the UTC-based counter LSB parameter to the 4 least significant bits of the UTC-based counter.

- b) shall apply the DUIK, DUSK, or DUCK with the associated Encrypted Bitmask, along with the UTC-based counter to the PROSE PC5 DISCOVERY message for whichever security mechanism(s) configured to be applied, e.g., integrity protection, message scrambling or confidentiality protection of one or more above parameters, as specified in 3GPP TS 33.533 [5]
- c) shall set the destination layer-2 ID to the source layer-2 ID from the discoverer UE used in the transportation of the PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning and self-assign a source layer-2 ID for sending the group member discovery response message for ranging and sidelink positioning; and

NOTE 2: The UE implementation ensures that the value of the self-assigned source layer-2 ID is different from any other self-assigned source layer-2 ID(s) in use for 5G ProSe direct communication and is different from any other provisioned destination layer-2 ID(s) as specified in 3GPP TS 24.554 [6].

- d) shall pass the resulting PROSE PC5 DISCOVERY message for group member discovery response for ranging and sidelink positioning along with the source layer-2 ID and the destination layer-2 ID to the lower layers for transmission over the PC5 interface.

NOTE 3: If the UE is processing a PROSE DIRECT LINK ESTABLISHMENT REQUEST message from the same source layer-2 ID of the received PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning, it depends on UE implementation to avoid the conflict of destination layer-2 ID (e.g. send a PROSE DIRECT LINK ESTABLISHMENT REJECT message containing PC5 signalling protocol cause value #3 "conflict of layer-2 ID for unicast communication is detected", or ignore the PROSE DIRECT DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning).

6.2.2.4.5 Discoverer UE procedure for group member discovery for ranging and sidelink positioning completion

When the UE is triggered by an upper layer application to stop responding to solicitation on proximity of other UEs in a discovery group for ranging and sidelink positioning, or when the UE stops being authorised to perform the discoverer UE procedure for group member discovery for ranging and sidelink positioning, the UE shall instruct the lower layers to stop monitoring.

When the UE stops monitoring, if the UE is in 5GMM-CONNECTED mode, the UE shall trigger the corresponding procedure in lower layers as specified in 3GPP TS 38.331 [19].

6.3 Ranging and sidelink positioning UE discovery with V2X capable UEs

The ranging and sidelink positioning UE discovery with V2X capable UE uses the PC5 unicast establishment procedure with the V2X service identifier indicating "ranging and sidelink positioning" as specified in clause 6.1.2.2 of 3GPP TS 24.587 [4].

6.4 Located UE selection

6.4.1 General

Located UE selection(s) can be performed by the target UE or by LMF as specified in clause 5.2.2 of 3GPP TS 23.586 [2]. Whether the selection is done by the LMF or by the target UE, is based on each procedure in which the located UE selection is performed as specified in clause 6.20 of 3GPP TS 23.273 [11] and in clause 6.8 of 3GPP TS 23.586 [2].

Procedure of target UE selecting located UE is specified in clause 6.4.2.1.

Procedure of LMF selecting located UE is specified in clause 6.4.2.2.

6.4.2 Procedures

6.4.2.1 Target UE selecting located UE

6.4.2.1.1 General

If the UE is authorised to act as a target UE as specified in clause 5.2.3, the located UE selection is performed by target UE in following cases:

- a) when the LMF is not involved, and UE-only operation for ranging and sidelink positioning is used (see clause 6.4.2.1.2); and
- b) when the LMF is involved, network-based operation or network-assisted operation for ranging and sidelink positioning is used and the LMF determines the located UE selection is performed by the target UE (see clause 6.4.2.1.3).

The target UE can consider capabilities of the candidate located UE(s) if available (i.e., by exchanging SLPP message as specified in 3GPP TS 38.355 [12], or from local configuration). How to use that information for the located UE selection is up to implementation.

6.4.2.1.2 Target UE selecting located UE for UE-only operation

The target UE shall select the located UE(s) from the UE(s) which are discovered using:

- a) the monitoring procedure for UE discovery as specified in clause 6.2.2.1 or clause 6.2.2.3 when located UE acts as announcing UE;
- b) the discoverer procedure for UE discovery as specified in clause 6.2.2.2 or clause 6.2.2.4 when located UE acts as discoveree UE;
- c) the procedure for ranging and sidelink positioning UE discovery with V2X capable UEs as specified in clause 6.3; or
- d) both a) and b).

NOTE 1: How the located UE can be triggered to perform the announcing procedure for UE discovery as specified in clause 6.2.2.1 or clause 6.2.2.3 is up to UE implementation.

The target UE may select the located UE(s) if:

- a) the UE role in the RSPP metadata in the PROSE PC5 DISCOVERY message or, for V2X capable UEs, in the DIRECT LINK ESTABLISHMENT ACCEPT message indicates that the UE supports UE as a located UE (see 3GPP TS 38.355 [12]); and
- b) the serving PLMN ID in the PROSE PC5 DISCOVERY message or, for V2X capable UEs, in the DIRECT LINK ESTABLISHMENT ACCEPT message indicating the same PLMN as the serving PLMN of the target UE.

NOTE 2: The located UE is represented in the RSPP metadata by setting the "sl-anchorUE" bit to 1 with presence of the "knownLocationAvailable" field as defined in 3GPP TS 38.355 [12].

6.4.2.1.3 target UE selecting located UE for network-based operation or network-assisted operation

If the located UE selection is triggered by supplementary service message from the LMF with the indication of target UE selecting located UE to the target UE, the target UE shall select the located UE(s) from

- a) the UE(s) as specified in clause 6.4.2.1.2; and
- b) the candidate located UE list if received from the LMF.

The target UE shall send the selected located UE(s) based a) and b) above to the LMF.

6.4.2.2 LMF selecting located UE

The located UE selection is performed by LMF if the UE is authorised to act as a target UE as specified in clause 5.2.3, the located UE selection is performed by LMF when the LMF is involved, network-based operation or network-assisted operation for ranging and sidelink positioning is used and the LMF determines the located UE selection is performed by the LMF.

If the located UE selection is triggered by supplementary service message from the LMF with the indication of LMF selecting located UE to the target UE, the target UE shall determine the UE(s) as candidate located UE list to be provided to the LMF from the UE(s) which are discovered using:

- a) the monitoring procedure for UE discovery as specified in clause 6.2.2.1 or clause 6.2.2.3 when located UE acts as announcing UE;

NOTE 1: How the located UE can be triggered to perform the announcing procedure for UE discovery as specified in clause 6.2.2.1 or clause 6.2.2.3 is up to UE implementation.

- b) the discoverer procedure for UE discovery as specified in clause 6.2.2.2 or clause 6.2.2.4 when located UE acts as discoveree UE;
- c) the procedure for ranging and sidelink positioning UE discovery with V2X capable UEs as specified in clause 6.3; or
- d) both a) and b).

The UE shall be included as located UE candidate from target UE sent to LMF if:

- a) the UE role in the RSPP metadata in the PROSE PC5 DISCOVERY message or, for V2X capable UEs, in the DIRECT LINK ESTABLISHMENT ACCEPT message indicates that the UE supports UE role as a located UE (see 3GPP TS 38.355 [12]);
- b) the serving PLMN ID in the PROSE PC5 DISCOVERY message or, for V2X capable UEs, in the DIRECT LINK ESTABLISHMENT ACCEPT message indicating the same PLMN as the serving PLMN of the target UE; and
- c) the UE is included candidate located UE list from the LMF, if available.

NOTE 2: The located UE is represented in the RSPP metadata by setting the "sl-anchorUE" bit to 1 with presence of the "knownLocationAvailable" field as defined in 3GPP TS 38.355 [12].

The target UE shall send the candidate located UE list to the LMF in the corresponding response supplementary service message for located UE selection. The LMF may select the UE(s) as located UE(s) from:

- a) the candidate located UE list if received from the target UE; and
- b) the locally configured candidate located UE list.

The LMF can consider capabilities of the candidate located UE(s) or the positioning QoS parameters supported by the candidate located UE(s), if any of that information is available (i.e., by exchanging SLPP message as specified in 3GPP TS 38.355 [12], ranging and sidelink positioning communication procedure(s) as specified in clause 7 of this specification, or from local configuration). How to use that information for the located UE selection is up to implementation.

6.5 SL positioning server UE selection

6.5.1 General

When ranging and sidelink positioning service is applied, SL positioning server UE is required in the following case:

- a) When LMF is not involved, in case of out-of-coverage or for UE-only operation if the serving network does not support ranging and sidelink positioning, SL positioning server UE can be discovered and selected by the target UE; or

- b) When LMF is involved, for network-assisted operation, the LMF can decide an SL positioning server UE from the target UE, SL reference UE or located UE involved in the ongoing ranging and sidelink positioning service.

In any case requiring SL positioning server UE, the SL positioning server UE discovery is performed by the target UE.

For the SL positioning server UE selection, the following are considered:

- a) Selecting the target UE capable of performing SL positioning server UE functionalities as the SL positioning server UE.
- b) Selecting the SL reference UE or located UE capable of performing SL positioning server UE functionalities as the SL positioning server UE.

The target UE can consider capabilities of the candidate SL positioning server UE(s) if available (i.e., by exchanging SLPP message as specified in 3GPP TS 38.355 [12], or from local configuration). How to use that information for the SL positioning server UE selection is up to implementation.

6.5.2 Target UE selecting SL positioning server UE

The target UE shall trigger the target UE selecting SL positioning server UE operation if the following conditions are met:

- a) the UE is authorised to act as a target UE for ranging and sidelink positioning as specified in clause 5.2.3 and the target UE is not capable of performing SL positioning server UE functionalities; and
- b) a list of SL positioning server UE candidate(s) is available based on the following:
 - 1) the monitoring procedure for UE discovery as specified in clause 6.2.2.1 or clause 6.2.2.3 when SL positioning server UE acts as announcing UE;

NOTE: How the SL positioning server UE can be triggered to perform the announcing procedure for UE discovery as specified in clause 6.2.2.1 or clause 6.2.2.3 is up to UE implementation.

- 2) the discoverer procedure for UE discovery as specified in clause 6.2.2.2 or clause 6.2.2.4 when SL positioning server UE acts as discoveree UE; or
- 3) the ranging and sidelink positioning UE discovery with V2X capable UEs as specified in clause 6.3.

If there is only one SL positioning server UE candidate, then that SL positioning server UE is selected. If there are more than one SL positioning server UE candidate, the SL positioning server UE is selected in the following order of decreasing precedence:

- a) any SL reference UE or located UE for the ranging and sidelink positioning service capable of performing SL positioning server UE functionalities; and
- b) a UE other than the SL reference UE or located UE for the ranging and sidelink positioning service capable of performing SL positioning server UE functionalities.

6.6 SL reference UE selection

6.6.1 General

When ranging and sidelink positioning service is applied, SL reference UE discovery and selection may be triggered in an SL-MO-LR, SL-MT-LR, 5GC-MO-LR or 5GC-MT-LR procedure as specified in clause 5.2.4 of 3GPP TS 23.586 [2].

SL reference UE selection is performed by the target UE. The target UE can consider capabilities of SL reference UE if available (i.e., by exchanging SLPP message as specified in 3GPP TS 38.355 [12] or from local configuration). How to use that information for SL reference UE selection is up to implementation.

6.6.2 Procedures

6.6.2.1 Target UE selecting SL reference UE

The target UE shall select SL reference UE(s) from the UE(s) which are discovered using:

- a) the monitoring procedure for UE discovery as specified in clause 6.2.2.1 or clause 6.2.2.3 when SL reference UE acts as announcing UE;
- b) the discoverer procedure for UE discovery as specified in clause 6.2.2.2 or clause 6.2.2.4 when SL reference acts as discoveree UE;
- c) the procedure for ranging and sidelink positioning UE discovery with V2X capable UEs as specified in clause 6.3; or
- d) both a) and b).

NOTE 1: How the SL reference UE can be triggered to perform the announcing procedure for UE discovery as specified in clause 6.2.2.1 or clause 6.2.2.3 is up to UE implementation.

A discovered UE can be selected as an SL reference UE if the UE role in the RSPP metadata in the PROSE PC5 DISCOVERY message or, for V2X capable UEs, in the DIRECT LINK ESTABLISHMENT ACCEPT message indicates that the UE supports the SL reference UE role (see 3GPP TS 38.355 [12]).

NOTE 2: The SL reference UE is represented in the RSPP metadata by setting the "sl-anchorUE" bit to 1 with absence of the "knownLocationAvailable" field as defined in 3GPP TS 38.355 [12].

7 Ranging and sidelink positioning communication

7.1 Overview

Ranging and sidelink positioning communication procedures include the following aspects:

- a) ranging and sidelink positioning direct communication over PC5 (see clause 7.2);
- b) ranging and sidelink positioning communication on LCS aspect (see clause 7.3); and
- c) supplementary RSPP signaling over PC5-U (see clause 7.4).

7.2 Ranging and sidelink positioning direct communication over PC5

7.2.1 General

Depending on type of the UE (e.g. V2X capable or 5G ProSe capable), V2X communication procedures as defined in 3GPP TS 24.587 [4] or 5G ProSe direct communication procedures as defined in 3GPP TS 24.554 [6] are used for ranging and sidelink positioning communication over PC5.

For the RSPP transport between UEs over PC5, the following modification is applied:

- a) For V2X capable UEs, V2XP is used to determine the corresponding transport configurations for the RSPP signalling. The V2X service identifier shall take the value(s) defined for "ranging and sidelink positioning Protocol".
- b) For 5G ProSe capable UEs, ProSeP is used to determine the corresponding transport configuration for the RSPP signalling. The ProSe identifier shall take the value(s) defined for "ranging and sidelink positioning Protocol".

NOTE: For a UE with both V2X capability and 5G ProSe capability, separate RSPP transport links per the capability are used, i.e., the RSPP transport link over V2X communication is independent with the RSPP transport link over 5G ProSe direct communication.

The RSP layer supports broadcast mode, groupcast mode, and unicast mode PC5 communication depending on the policy and parameter configuration in the UE.

"Non-IP" layer-3 protocol data unit type for V2X capable UEs and "Unstructured" layer-3 protocol data unit type for 5G ProSe capable UEs are used for the transport of RSPP payload. For the transport of RSPP payload by "Non-IP" layer-3 protocol data unit type for V2X capable UEs, the non-IP type field of the non-IP PDU format shall indicate "SLPP" as specified in 3GPP TS 24.587 [4] clause 9.2. For the transport of supplementary RSPP signalling message by "Non-IP" layer-3 protocol data unit type for V2X capable UEs, the non-IP type field of the non-IP PDU format shall indicate "Supplementary RSPP signalling" as specified in 3GPP TS 24.587 [4] clause 9.2.

7.2.2 Unicast mode ranging and sidelink positioning direct communication over PC5

7.2.2.1 Unicast mode communication over PC5 with 5G ProSe capable UEs

This clause describes the PC5 signalling protocol procedures between two UEs for unicast mode of 5G ProSe communication for ranging and sidelink positioning. The following PC5 signalling protocol procedures are supported:

- a) PC5 unicast link establishment procedure with 5G ProSe capable UEs as specified in 3GPP TS 24.554 [6] clause 7.2.2;
- b) PC5 unicast link modification procedure with 5G ProSe capable UEs as specified in 3GPP TS 24.554 [6] clause 7.2.3;
- c) PC5 unicast link release with procedure 5G ProSe capable UEs as specified in 3GPP TS 24.554 [6] clause 7.2.6;
- d) PC5 unicast link identifier update procedure with 5G ProSe capable UEs as specified in 3GPP TS 24.554 [6] clause 7.2.4; and
- e) PC5 unicast link keep-alive procedure with 5G ProSe capable UEs as specified in 3GPP TS 24.554 [6] clause 7.2.5.

7.2.2.2 Unicast mode communication over PC5 with V2X capable UEs

This clause describes the PC5 signalling protocol procedures between two UEs for unicast mode of V2X communication for ranging and sidelink positioning. The following PC5 signalling protocol procedures are supported:

- a) PC5 unicast link establishment procedure with V2X capable UEs as specified in 3GPP TS 24.587 [4] clause 6.1.2.2;
- b) PC5 unicast link modification procedure with V2X capable UEs as specified in 3GPP TS 24.587 [4] clause 6.1.2.3;
- c) PC5 unicast link release with procedure V2X capable UEs as specified in 3GPP TS 24.587 [4] clause 6.1.2.4;
- d) PC5 unicast link identifier update procedure with V2X capable UEs as specified in 3GPP TS 24.587 [4] clause 6.1.2.5; and
- e) PC5 unicast link keep-alive procedure with V2X capable UEs as specified in 3GPP TS 24.587 [4] clause 6.1.2.8.

7.3 Ranging and sidelink positioning communication on LCS aspect

The UE or the network initiates the ranging and sidelink positioning communication utilizing the location services signalling messages defined in 3GPP TS 23.273 [11] to obtain the location information including one or more of the following:

- a) absolute location of the UE;
- b) absolute velocity of the UE;
- c) range and direction between a pair of UEs (see clause 5.10 of 3GPP TS 23.032 [16]);
- d) relative location between a pair of UEs; (see clause 5.11 and 5.12 of 3GPP TS 23.032 [16]); and
- e) relative velocity between a pair of UEs (see clause 8.4a of 3GPP TS 23.032 [16]).

In order to obtain the absolute location the absolute velocity, or both of the target UE, the following procedures defined in 3GPP TS 23.273 [11] are applied:

- a) (SL-MO-LR) procedure;
- b) MO-LR using sidelink positioning;
- c) SL-MT-LR procedure;
- d) SL-MT-LR for periodic and triggered Location events procedure; and
- e) MT-LR using sidelink positioning.

NOTE: In order to estimate the location of the UE, the network can decide to utilize the ranging and sidelink positioning during the MO-LR procedure (i.e., MO-LR using sidelink positioning) and the MT-LR procedure (i.e., MT-LR using sidelink positioning).

In order to obtain one or more among the relative location, the range and direction, and the relative velocity between a pair of UEs, the following procedures defined in 3GPP TS 23.273 [11] are applied:

- a) SL-MO-LR procedure;
- b) SL-MT-LR procedure;
- c) SL-MT-LR for periodic and triggered Location events procedure.

The following interactions between UE and LMF for ranging and sidelink positioning are supported:

- Sidelink positioning information transport procedure as defined in clause 5.2.1.6 of 3GPP TS 24.571 [22];
- Network initiated RSPP supplementary information transport procedure as defined in clause 5.2.1.7 of 3GPP TS 24.571 [22];
- Sidelink mobile terminating location request procedure as defined in clause 5.2.1.8 of 3GPP TS 24.571 [22];
- Sidelink mobile originated location request procedure as defined in clause 5.2.2.9 of 3GPP TS 24.571 [22];
- UE initiated sidelink positioning information transport procedure as defined in clause 5.2.2.10 of 3GPP TS 24.571 [22]; and
- UE initiated RSPP supplementary information transport procedure as defined in clause 5.2.2.11 of 3GPP TS 24.571 [22].

7.4 Supplementary RSPP signaling over PC5-U

7.4.1 General

This clause describes procedures to exchange supplementary RSPP signalling messages among UEs over PC5-U as defined in 3GPP TS 23.586 [2], including:

- a) sidelink positioning service request procedure (see clause 7.4.2);
- b) sidelink positioning SLPP transport procedure (see clause 7.4.3); and
- c) sidelink positioning privacy check procedure (see clause 7.4.4).

The supplementary RSPP signalling is transferred over PC5-U as specified in clause 7.2.

7.4.2 Sidelink positioning service request procedure

7.4.2.1 General

This procedure is applied to the following cases:

- a1) between the sidelink SL positioning client UE and the target UE for ranging and sidelink positioning or SL reference UE or located UE for ranging and sidelink positioning service exposure through PC5 as defined in clause 6.7.1.1 of 3GPP TS 23.586 [2];
- a2) between the target UE for ranging and sidelink positioning or SL reference UE and the SL positioning server UE for UE-only operation in the ranging and sidelink positioning control procedure as defined in clause 6.8 of 3GPP TS 23.586 [2]; and
- a3) between the target UE for ranging and sidelink positioning and the located UE to request the absolute location from a located UE during the Sidelink Mobile Originated Location Request (SL-MO-LR) procedure as defined in 3GPP TS 23.273 [11].

For case a1), the sidelink positioning client UE acts as an "initiating UE" and the target UE for ranging and sidelink positioning or SL reference UE or located UE acts as a "target UE"; for case a2), the target UE for ranging and sidelink positioning or SL reference UE acts as an "initiating UE" and the SL positioning server UE acts as a "target UE" and for case a3), the target UE for ranging and sidelink positioning acts as an "initiating UE" and a located UE acts as a "target UE".

The purpose of the sidelink positioning service request procedure is:

- for case a1), to enable an SL positioning client UE to request the ranging and sidelink positioning result from a target UE for ranging and sidelink positioning or SL reference UE or located UE upon a request from upper layers.
- for case a2), to enable a target UE for ranging and sidelink positioning or SL reference UE or located UE to request the ranging and sidelink positioning result from an SL positioning server UE upon a request from upper layers or an request from a SL positioning client UE.
- for case a3), to enable a target UE for ranging and sidelink positioning to request absolute location from a located UE during the Sidelink Mobile Originated Location Request (SL-MO-LR) procedure as defined in 3GPP TS 23.273 [11].

7.4.2.2 Sidelink positioning service request procedure initiation

When a ranging and sidelink positioning service is triggered by the upper layer in initiating UE, or a request is received from an SL positioning client UE to request the ranging and sidelink positioning result, the initiating UE performs the sidelink positioning service request procedure while the following pre-conditions are met:

- a) for case a1) in clause 7.4.2.1, the initiating UE has discovered and selected the target UE from a list of SL reference UE(s) or a list of located UE(s) and target UE for ranging and sidelink positioning to receive SL positioning service request as described in clause 6;

- b) for case a2) in clause 7.4.2.1, the initiating UE has discovered and selected the target UE from a list of candidate SL positioning server UE(s) to receive SL positioning service request as described in clause 6;
- c) for case a3) in clause 7.4.2.1, the initiating UE has discovered and selected the target UE from a list of located UE(s) as described in clause 6; and
- d) the initiating UE has direct PC5 link established with the target UE as described in clause 7.2.

The initiating UE shall initiate the sidelink positioning service request procedure by sending a sidelink positioning service request message, and the initiating UE:

- a) shall include a new transaction ID;
- b) shall include the source user info set to the initiating UE's application layer ID and the initiating UE's UE role received from upper layers;
- c) for case a1) in clause 7.4.2.1, shall include the user info of target UE as specified in clause 10.4.1.2, and SL reference UE list as specified in clause 10.4.1.3;
- d) for case a2) or a3) in clause 7.4.2.1, shall include the requested sidelink results as specified in clause 10.4.1.4;
- e) for case a2), shall include the related UE list as specified in clause 10.4.1.5; and
- a) f) for case a2) or a3), may include the Location QoS including the required QoS for ranging and sidelink positioning as specified in clause 10.4.1.6.

7.4.2.3 Sidelink positioning service request procedure completion

Upon receiving the sidelink positioning service request message, the target UE shall:

- for case a1) in clause 7.4.2.1, request either the LMF or SL positioning server UE performing the ranging and sidelink positioning operation to obtain the ranging and sidelink positioning result;
- for case a2) in clause 7.4.2.1, act as SL positioning server UE performing the ranging and sidelink positioning operation to obtain the ranging and sidelink positioning result;
- for case a3) in clause 7.4.2.1, trigger 5GC-MO-LR procedure to acquire its own absolute location if not available; and
- send sidelink positioning service response message including the sidelink positioning result to the initiating UE.

NOTE: For case a3), it is up to located UE implementation whether and how to perform privacy check when a target UE for ranging and sidelink positioning requests the absolute location from a located UE.

7.4.2.4 Sidelink positioning service request procedure not accepted by target UE

If the sidelink positioning service request message cannot be accepted, then the target UE shall send a sidelink positioning service reject message to the initiating UE. The sidelink positioning service reject message contains a sidelink positioning protocol cause IE.

7.4.3 Sidelink positioning SLPP transport procedure

7.4.3.1 General

The sidelink positioning SLPP transport procedure is used by the SL positioning server UE and the target UE for ranging and sidelink positioning or SL reference UE to send embedded SLPP message(s) and the associated UE's application layer ID(s) of the SLPP message(s) as specified in clause 6.8 of 3GPP TS 23.586 [2].

7.4.3.2 Sidelink positioning SLPP transport initiation

When an initiating UE needs to transport SLPP message(s) for other UE(s) to the target UE for ranging and sidelink positioning or SL reference UE or to the SL positioning server UE as specified in clause 6.8 of 3GPP TS 23.586 [2], the initiating UE shall generate a sidelink positioning SLPP transport message, and the sidelink positioning SLPP transport

message shall include embedded SLPP message(s) for other UE(s) and the associated UE's application layer ID(s) of the SLPP message(s) where the SLPP message is either for sidelink positioning capability, sidelink positioning assistance data, sidelink positioning location measurement request, or sidelink positioning reference signalling measurement data as specified in 3GPP TS 38.355 [12].

7.4.3.3 Sidelink positioning SLPP transport reception

Upon receiving the sidelink positioning SLPP transport message from the initiating UE,

- a) if the target UE is the SL positioning server UE, the target UE proceeds with the ranging and sidelink positioning control procedure for the received SLPP message(s) and its associated application layer ID(s), as specified in clause 6.8 of 3GPP TS 23.586 [2]; or
- b) if the target UE is the target UE for ranging and sidelink positioning or SL reference UE, the target UE proceed with the SLPP message(s) as specified in 3GPP TS 23.586 [2] based on the application layer ID(s) received in sidelink positioning SLPP transport message as specified in clause 11.4.8.

7.4.4 Sidelink positioning privacy check procedure

7.4.4.1 General

The sidelink positioning privacy check procedure is applied for:

- a) authorization procedure for ranging and sidelink positioning service exposure through PC5 for UE-only operation or before triggering SL-MO-LR for network based operation as defined in 3GPP TS 33.533 [3]; and
- b) UE privacy verification for UE-only operation as defined in 3GPP TS 33.533 [3].

The purpose of the sidelink positioning privacy check procedure is:

- for case a), upon receiving a sidelink positioning service request from an SL positioning client UE:
 - to enable a target UE for the ranging and sidelink positioning to request the privacy check of exposure to the SL positioning client UE from an SL reference UE if relative location is requested, or from a located UE if absolute location is requested. The target UE for ranging and sidelink positioning service acts as an "initiating UE" and the SL reference UE or located UE for ranging and sidelink positioning service acts as a "target UE";
 - to enable an SL reference UE to request the privacy check of exposure to the SL positioning client UE from another SL reference UE or a target UE for ranging and sidelink positioning service if relative location is requested. The SL reference UE acts as an "initiating UE" and the other SL reference UE or the target UE for ranging and sidelink positioning service acts as a "target UE"; or
 - to enable a located UE to request the privacy check of exposure to the SL positioning client UE from another located UE or a target UE for ranging and sidelink positioning service if absolute location is requested. The located UE acts as an "initiating UE" and the other located UE or the target UE for ranging and sidelink positioning service acts as a "target UE".
- for case b), upon receiving a sidelink positioning service request from RSPP application layer:
 - to enable a target UE for the ranging and sidelink positioning to request the privacy check of exposure to the target UE for the ranging and sidelink positioning from an SL reference UE if relative location is requested, or from a located UE if absolute location is requested. The target UE for ranging and sidelink positioning service acts as an "initiating UE" and the SL reference UE or located UE for ranging and sidelink positioning service acts as a "target UE".

7.4.4.2 Sidelink positioning privacy check procedure initiation

When a sidelink positioning service request from an SL positioning client UE is received for case a) of clause 7.4.4.1, or a sidelink positioning service request from RSPP application layer is received for case b) of clause 7.4.4.1, the initiating UE performs the sidelink positioning privacy check procedure the while the following pre-conditions are met:

- a) the initiating UE has discovered and selected the target UE as described in clause 6; and

- b) the initiating UE has direct PC5 link established with the target UE as described in clause 7.2.

The UE shall initiate the sidelink positioning privacy check procedure by sending a SIDELINK POSITIONING PRIVACY CHECK REQUEST message. In the SIDELINK POSITIONING PRIVACY CHECK REQUEST message, the UE:

- a) shall include a new procedure transaction ID;
- b) shall include the source user info set to the initiating UE's application layer ID received from upper layers and the UE role; and
- c) shall include the SL positioning client UE user info set to the SL positioning client UE's application layer ID and the SL positioning client UE role, if the procedure is performed for case a) of clause 7.4.4.1.

Upon receiving the SIDELINK POSITIONING PRIVACY CHECK REQUEST message, the target UE shall perform the UE privacy check according to 3GPP TS 33.533 [5].

7.4.4.3 Sidelink positioning privacy check procedure accepted by the target UE

If the UE privacy check in the target UE is successful, the target UE shall send SIDELINK POSITIONING PRIVACY CHECK ACCEPT message. In the SIDELINK POSITIONING PRIVACY CHECK ACCEPT message, the UE shall include the procedure transaction ID received in the SIDELINK POSITIONING PRIVACY CHECK REQUEST message.

7.4.4.4 Sidelink positioning privacy check procedure not accepted by the target UE

If the UE privacy check in the target UE is not successful, the target UE shall send SIDELINK POSITIONING PRIVACY CHECK REJECT message. In the SIDELINK POSITIONING PRIVACY CHECK REJECT message, the UE shall include the procedure transaction ID received in the SIDELINK POSITIONING PRIVACY CHECK REQUEST message.

8 Security for ranging and sidelink positioning

8.1 Overview

Security mechanisms are defined in 3GPP TS 33.533 [5] to provide protection for ranging and sidelink positioning UE discovery and ranging and sidelink positioning communication for both ProSe capable UE and V2X capable UE.

For ProSe capable UEs, the security mechanisms using long-term credentials provided by applications when ranging and sidelink positioning services are provided by application providers as defined in clause 8.2.2 and clause 8.3.2, and the security mechanisms with interaction between UE and the SideLink Positioning Key Management Function (SLPKMF), where the interface is PC8* for generation and provisioning of security materials used for ranging and sidelink positioning services when the ranging and sidelink positioning services are provided by network operators as are defined in clause 8.2.1 and clause 8.3.1.

For V2X capable UE, the security mechanisms used for ranging and sidelink positioning services are defined in clause 8.2.2 and clause 8.3.2.

8.1.1 Overview for procedures over PC8* interface

The UE and SLPKMF shall use HTTP 1.1 as specified in IETF RFC 9110 [13] and IETF RFC 9112 [14] as the transport protocol for PC8* messages over the PC8* interface. The PC8* messages described here shall be included in the body of either an HTTP request message or an HTTP response message.

The following rules apply for UE-initiated procedures over PC8*:

- a) the UE initiates 5G ProSe transactions with an HTTP request message containing the PC8* request(s);
- b) the SLPKMF responds to the requests with an HTTP response message containing the PC8* response(s) for the PC8* request(s); and

- c) HTTP POST methods are used for 5G ProSe procedures over PC8* interface.

The UE may use UE local configuration or URSP, as defined in 3GPP TS 24.526 [15], to establish a PDU session for reaching the HPLMN SLPKMF:

- a) if a PDU session for reaching the HPLMN SLPKMF is not established yet, the UE shall establish the PDU session for reaching the HPLMN SLPKMF and shall send the HTTP request message via the PDU session for reaching the HPLMN SLPKMF; and
- b) if a PDU session for reaching the HPLMN SLPKMF is already established (e.g., either due to other 5G ProSe feature or due to other application), the UE shall send the HTTP request message via the PDU session for reaching the HPLMN SLPKMF.

The SLPKMF address can be pre-configured in the UE or provided in the RSLPP by the PCF. The UE shall use the SLPKMF address in the following order of decreasing precedence:

- a) provided in the RSLPP by the PCF;
- b) pre-configured in the ME.

8.2 Security for ranging and sidelink positioning UE discovery

8.2.1 Security for ranging and sidelink positioning UE discovery with 5G ProSe capable UE

8.2.1.1 General

For ranging and sidelink positioning services provided by network operators, the security procedure for ranging and sidelink positioning UE discovery with 5G ProSe capable UE include the following:

- the ranging and sidelink positioning discovery key request procedure as defined in clause 8.2.1.2.

8.2.1.2 Ranging and sidelink positioning discovery key request procedure

8.2.1.2.1 General

The purpose of the ranging and sidelink positioning discovery key request procedure is for the 5G ProSe capable UE:

- to obtain the ranging and sidelink positioning UE discovery security parameters for 5G ProSe capable UE, applicable when the UE acts as any UE role for ranging and sidelink positioning over user plane as specified in 3GPP TS 33.533 [5].

8.2.1.2.2 Ranging and sidelink positioning discovery key request procedure initiation

The UE shall initiate the ranging and sidelink positioning discovery key request procedure if the UE is authorized to act as any UE role for ranging and sidelink positioning and uses the security procedure over user plane as specified in 3GPP TS 33.533 [5]:

- 1) when the UE has no ranging and sidelink positioning UE discovery security parameters for 5G ProSe capable UE and the UE is in NG-RAN coverage; or
- 2) after expiration of timer T5152, when in NG-RAN coverage or when entering NG-RAN coverage; or

The UE shall initiate the ranging and sidelink positioning discovery key request procedure by sending a PROSE_SECURITY_PARAM_REQUEST message with the <RangingSI-discovery-security-parameters-request> element. In the <RangingSI-discovery-security-parameters-request> element, the UE:

- a) shall include a new transaction ID;
- b) shall indicate the UE role(s) of the UE requesting the ranging and sidelink positioning UE discovery security parameters for 5G ProSe capable UE;

- c) shall include the PC5 UE security capabilities indicating ciphering algorithms supported by the UE;
- d) may indicate the requested model indicating the model of the ranging and sidelink positioning UE discovery over PC5 interface for which security parameters are requested, set to "model A" or "model B"; and
- e) shall include the ranging and sidelink positioning application identifier.

NOTE: If the requested model is not included in the PROSE_SECURITY_PARAM_REQUEST message, security parameters are requested for both model A and model B of the ranging and sidelink positioning UE discovery over PC5 interface.

Figure 8.2.1.2.2.1 illustrates the interaction of the UE and the SLPKMF in the Discovery key request procedure.

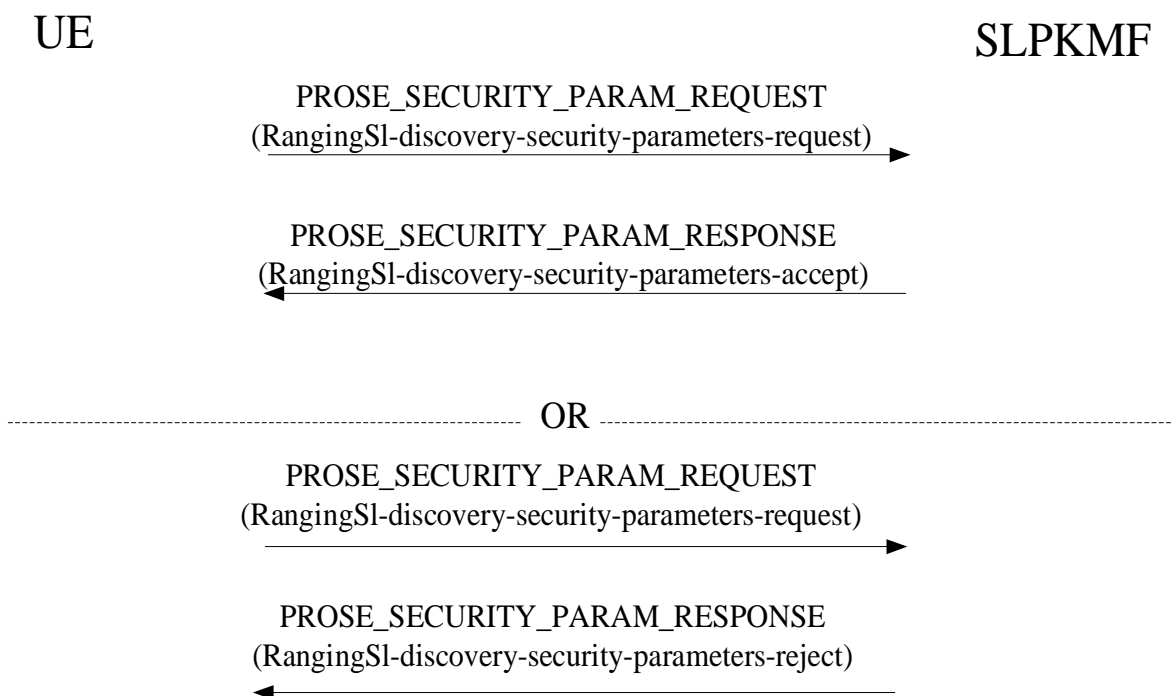


Figure 8.2.1.2.2.1: Discovery key request procedure

8.2.1.2.3 Ranging and sidelink positioning discovery key request procedure accepted by the SLPKMF

Upon receiving a PROSE_SECURITY_PARAM_REQUEST message with the <RangingSI-discovery-security-parameters-request> element, if the PROSE_SECURITY_PARAM_REQUEST message is received over a TLS tunnel established by a UE authorized to act as any UE role for ranging and sidelink positioning the SLPKMF shall send a PROSE_SECURITY_PARAM_RESPONSE message containing a <RangingSI-discovery-security-parameters-accept> element. In the <RangingSI-discovery-security-parameters-accept> element, the SLPKMF:

- a) shall include the transaction ID set to the value of the transaction ID received in the PROSE_SECURITY_PARAM_REQUEST message;
- b) shall include the expiration timer of the ranging and sidelink positioning UE discovery security parameters for 5G ProSe capable UE;
- c) for the received ranging and sidelink positioning application identifier for which the UE is authorized to act as any UE role for the ranging and sidelink positioning:

- 1) if the requested model is not indicated in the PROSE_SECURITY_PARAM_REQUEST message or is set to "model A", may include the code-receiving security parameters for model A containing one or more of DUSK, DUIK and DUCK with associated encrypted bitmask;
- 2) if the requested model is not indicated in the PROSE_SECURITY_PARAM_REQUEST message or is set to "model B", may include the code-receiving security parameters for model B containing one or more of DUSK, DUIK and DUCK with associated encrypted bitmask and the code-sending security parameters for model B containing one or more of DUSK, DUIK and DUCK with associated encrypted bitmask; and
- 3) shall include the selected ciphering algorithm;
- d) shall include the current time set to the current UTC-based time at the SLPKMF and the max offset.

The SLPKMF of the monitoring or discoverer UE discovers the SLPKMF(s) of potential announcing or discoveree UE(s) supporting the ranging and sidelink positioning based on a configured list of PLMNs supporting the corresponding ranging and sidelink positioning.

8.2.1.2.4 Ranging and sidelink positioning discovery key request procedure completion by the UE

Upon receipt of the PROSE_SECURITY_PARAM_RESPONSE message with the <RangingSI-discovery-security-parameters-accept>, if the transaction ID contained in the <RangingSI-discovery-security-parameters-accept> element matches the value sent by the UE in a PROSE_SECURITY_PARAM_REQUEST message with the <RangingSI-discovery-security-parameters-request> element, the UE:

- a) shall store the ranging and sidelink positioning UE discovery security parameters for 5G ProSe capable UE, shall stop timer T5152 if running, and shall start timer T5152 with the value of the expiration timer indicated in the ranging and sidelink positioning UE discovery security parameters for 5G ProSe capable UE; and
- b) shall set a ProSe clock (see 3GPP TS 33.533 [5]) to the value of the received current time parameter and store the received max offset.

8.2.1.2.5 Ranging and sidelink positioning discovery key request procedure not accepted by the SLPKMF

If the PROSE_SECURITY_PARAM_REQUEST message with the <RangingSI-discovery-security-parameters-request> element cannot be accepted by the SLPKMF, the SLPKMF shall send a PROSE_SECURITY_PARAM_RESPONSE message containing a <RangingSI-discovery-security-parameters-reject> element. In the <RangingSI-discovery-security-parameters-reject> element, the SLPKMF shall include the transaction ID set to the value of the transaction ID received in the PROSE_SECURITY_PARAM_REQUEST message and shall include an appropriate PC8 control protocol cause value.

Upon receipt of the PROSE_SECURITY_PARAM_RESPONSE message with the <RangingSI-discovery-security-parameters-reject> element, if the transaction ID contained in the <RangingSI-discovery-security-parameters-reject> element matches the value sent by the UE in a PROSE_SECURITY_PARAM_REQUEST message with the <RangingSI-discovery-security-parameters-request> element, the UE shall consider the Discovery key request procedure as rejected.

8.2.1.2.6 Abnormal cases in the UE

The following abnormal cases can be identified:

- a) Indication from the transport layer of transmission failure of PROSE_SECURITY_PARAM_REQUEST message (e.g. after TCP retransmission timeout).

The UE shall close the existing secure connection to the SLPKMF, establish a new secure connection and then restart the Discovery key request procedure.

- b) No response from the SLPKMF after the PROSE_SECURITY_PARAM_REQUEST message has been successfully delivered (e.g. TCP ACK has been received for the PROSE_SECURITY_PARAM_REQUEST message)

The UE shall retransmit the PROSE_SECURITY_PARAM_REQUEST message.

NOTE: The timer to trigger retransmission and the maximum number of allowed retransmissions are UE implementation specific.

8.2.1.2.7 Abnormal cases in the SLPKMF

The following abnormal cases can be identified:

- a) Indication from the lower layer of transmission failure of PROSE_SECURITY_PARAM_RESPONSE message.

After receiving an indication from lower layer that the PROSE_SECURITY_PARAM_RESPONSE message has not been successfully acknowledged (e.g. TCP ACK is not received), the SLPKMF shall abort the procedure.

8.2.2 Security for ranging and sidelink positioning UE discovery with V2X capable UE

For V2X capable UE, the security mechanisms used for ranging and sidelink positioning services are defined in clause 6.1.2 of 3GPP TS 24.587 [4]

8.3 Security for ranging and sidelink positioning communication

8.3.1 Security for ranging and sidelink positioning communication with 5G ProSe capable UE

8.3.1.1 Security for unicast direct communication over RSPP

8.3.1.1.1 General

For ranging and sidelink positioning services provided by application providers, long-term credentials provided by applications are assumed available on the UE and the security procedures for unicast communication with long-term credentials are specified in clause 8.3.2.

For ranging and sidelink positioning services provided by network operators, there are no long-term credentials provided by applications on the UE. The security procedures for ranging and sidelink positioning services provided by network include the following:

- the 5G ProSe UE SLP key request procedure as defined in clause 8.3.1.1.2.
- the SLP key request procedure as defined in clause 8.3.1.1.3.

8.3.1.1.2 5G ProSe UE SLP key request procedure

8.3.1.1.2.1 General

The purpose of the UE SLP key request procedure is for the UE authorized to act as any UE role for ranging and sidelink positioning to obtain an SLPK and an SLPK ID. The UE roles for ranging and sidelink positioning include target UE, reference UE, located UE, and sidelink positioning server UE.

Before initiating this procedure, the UE needs to be authorized to perform ranging and sidelink positioning service in the registered PLMN or local PLMN based on the configuration parameters as specified in clause 5.2.5.

8.3.1.1.2.2 UE SLP key request procedure initiation

If the UE is authorized to perform ranging and sidelink positioning service in the registered PLMN or local PLMN, it shall initiate this procedure.

The UE shall initiate the UE SLP key request procedure by sending a PROSE_UE_SLPK_REQUEST message with the <UE-SLPK-request> element. In the <UE-SLPK-request> element, the UE:

- a) shall include a new transaction ID not used in any other procedures in PC8* interface; and

b) shall include the SLPK ID set to the SLPK ID associated with the UE stored SLPK, if the UE stores SLPK.

Figure 8.3.1.1.2.2.1 illustrates the interaction of the UE and the SLPKMF in the UE SLP key request procedure.

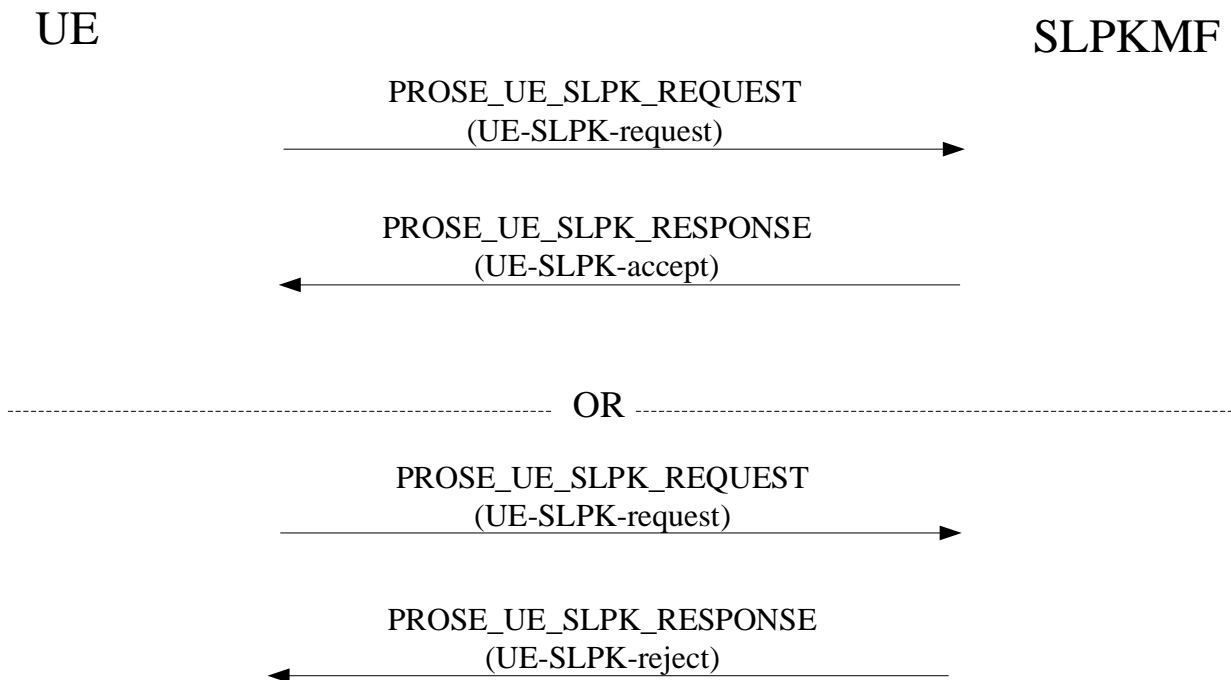


Figure 8.3.1.1.2.2.1: UE SLP key request procedure

8.3.1.1.2.3 UE SLP key request procedure accepted by the SLPKMF

Upon receiving a PROSE_UE_SLPK_REQUEST message, the SLPKMF shall check whether the UE is authorized to act as any UE role for ranging and sidelink positioning. If authorized, the SLPKMF shall then send a PROSE_UE_SLPK_RESPONSE message with the <UE-PRUK-accept> element. In the <UE-PRUK-accept> element, the SLPKMF shall include:

- the transaction ID set to the value of the transaction ID received in the PROSE_UE_SLPK_REQUEST message from the UE;
- the SLPK ID set to the value of the SLPK ID associated with the SLPK; and
- the SLPK set to the value of the allocated SLPK to the UE.

8.3.1.1.2.4 UE SLP key request procedure completion by the UE

Upon receipt of the PROSE_UE_SLPK_RESPONSE message, if the transaction ID matches the value sent by the UE in a PROSE_UE_SLPK_REQUEST message, the UE shall delete any previously stored SLPK and SLPK ID and store the received SLPK and the associated SLPK ID.

8.3.1.1.2.5 5G ProSe UE SLP key request procedure not accepted by the SLPKMF

If the PROSE_UE_SLPK_REQUEST message cannot be accepted by the SLPKMF, the SLPKMF sends a PROSE_UE_SLPK_RESPONSE message containing a <UE-SLPK-reject> element to the UE including an appropriate PC8* control protocol cause value and including the transaction ID set to the value of the transaction ID received in the PROSE_UE_SLPK_REQUEST message.

Upon receipt of the PROSE_UE_SLPK_RESPONSE message containing a <UE-SLPK-reject> element, if the transaction ID matches the value sent by the UE in a PROSE_UE_SLPK_REQUEST message, the UE shall consider the UE SLP key request procedure as rejected.

If the UE is not authorized for acting as any UE role for ranging and sidelink positioning, the SLPKMF shall send the PROSE_UE_SLPK_RESPONSE message containing a <UE-SLPK-reject> element with PC8 control protocol cause value #1 "UE authorization failure".

8.3.1.1.2.6 Abnormal cases in the UE

The following abnormal cases can be identified:

- a) Indication from the transport layer of transmission failure of PROSE_UE_SLPK_REQUEST message (e.g., after TCP retransmission timeout).

The UE shall close the existing secure connection to the SLPKMF, establish a new secure connection and then restart the SLPK request procedure.

- b) No response from the SLPKMF after the PROSE_UE_SLPK_REQUEST message has been successfully delivered (e.g., TCP ACK has been received for the PROSE_UE_SLPK_REQUEST message).

The UE shall retransmit the PROSE_UE_SLPK_REQUEST message.

NOTE: The timer to trigger retransmission and the maximum number of allowed retransmissions are UE implementation specific.

8.3.1.1.2.7 Abnormal cases in the SLPKMF

The following abnormal cases can be identified:

- a) Indication from the lower layer of transmission failure of PROSE_UE_SLPK_RESPONSE message.

After receiving an indication from lower layer that the PROSE_UE_SLPK_RESPONSE message has not been successfully acknowledged (e.g. TCP ACK is not received), the SLPKMF shall abort the procedure.

8.3.1.1.3 SLP key request procedure

8.3.1.1.3.1 General

The purpose of the SLP key request procedure is for the UE authorized to act as any UE role for ranging and sidelink positioning to obtain security parameter needed for establishment of 5G ProSe direct link with the UE to be communicated over PC5 and authorized to act as any UE role for ranging and sidelink. The UE roles for ranging and sidelink positioning include target UE, reference UE, located UE, and sidelink positioning server UE.

Before initiating this procedure, the UE needs to be authorized to perform ranging and sidelink positioning service in the registered PLMN or local PLMN based on the configuration parameters as specified in clause 5.2.

8.3.1.1.3.2 SLP key request procedure initiation

The UE shall initiate this procedure when the UE is authorized to perform ranging and sidelink positioning service in the registered PLMN or local PLMN receives a request to establish a 5G ProSe direct link from a UE authorized to perform ranging and sidelink positioning service.

The UE shall initiate the SLP key request procedure by sending a PROSE_SLPK_REQUEST message with the <SLPK-request> element. In the <SLPK-request> element, the UE:

- a) shall include a new transaction ID not used in any other procedures in PC8* interface;
- b) shall include the service identifier for ranging and sidelink positioning which the 5G ProSe direct link is requested to be established;
- c) shall include the SLPK ID of the UE initiating the 5G ProSe direct link establishment, received from the UE initiating the 5G ProSe direct link establishment;
- d) shall include the K_{SLP} freshness parameter 1, received from the UE initiating the 5G ProSe direct link establishment; and

e) shall include the PLMN identity of the HPLMN of the UE initiating the 5G ProSe direct link establishment, if received from the UE initiating the 5G ProSe direct link establishment.

Figure 8.3.1.1.3.2.1 illustrates the interaction of the UE and the SLPKMF in the SLP key request procedure.

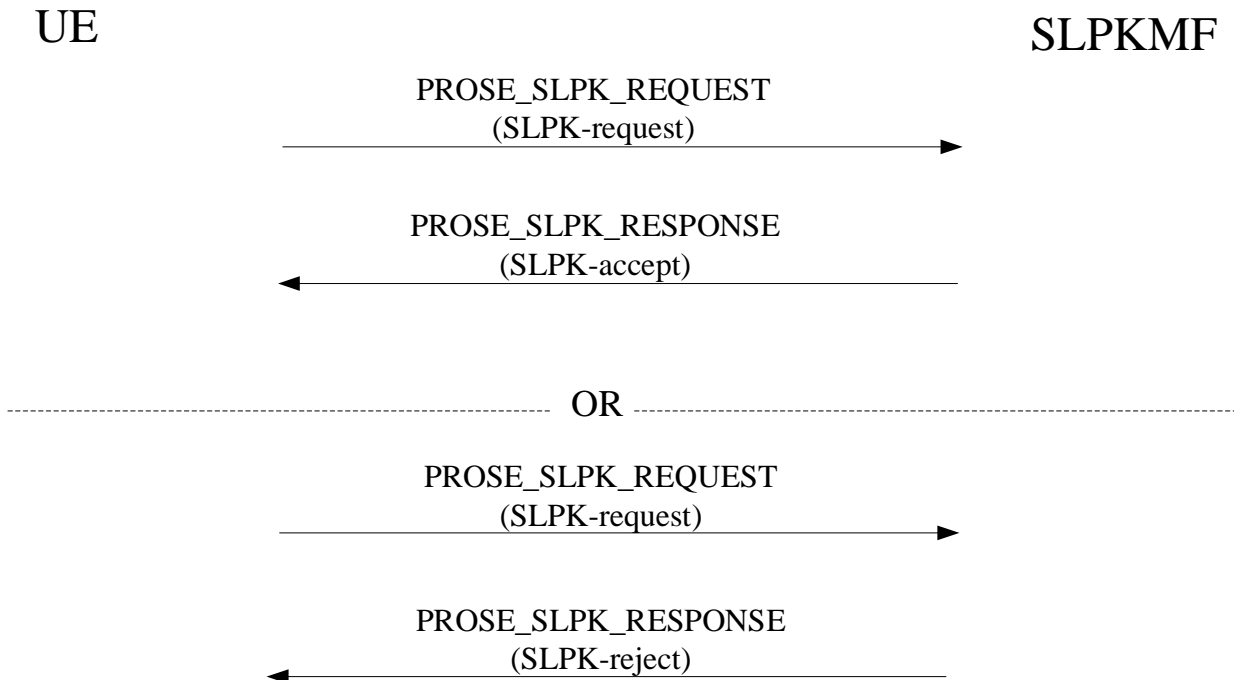


Figure 8.3.1.1.3.2.1: SLP key request procedure

8.3.1.1.3.3 SLP key request procedure accepted by the SLPKMF

Upon receiving a PROSE_SLPK_REQUEST message, the SLPKMF shall check whether the UE is authorized to act as any UE role for the ranging and sidelink positioning service. If authorized, the SLPKMF shall then send a PROSE_SLPK_RESPONSE message with the <SLPK-accept> element. In the <SLPK-accept> element, the SLPKMF shall include:

- the transaction ID set to the value of the transaction ID received in the PROSE_SLPK_REQUEST message from the UE;
- the SLK ID of the UE initiating the 5G ProSe direct link establishment;
- the K_{SLP} ; and
- the K_{SLP} freshness parameter 2.

If the UE initiating the 5G ProSe direct link establishment is served by another SLPKMF, the SLPKMF of the UE initiating the SLP key request procedure requests the SLPKMF of the UE initiating the 5G ProSe direct link establishment to check that the UE initiating the 5G ProSe direct link establishment identified by the SLK ID and the PLMN identity of the HPLMN of the UE initiating the 5G ProSe direct link establishment, if any, indicated in the PROSE_SLPK_REQUEST message, is authorized to act as any UE role for the ranging and sidelink positioning service indicated in the PROSE_SLPK_REQUEST message and to provide the SLP ID of the UE initiating the 5G ProSe direct link establishment, the K_{SLP} and the K_{SLP} freshness parameter 2.

8.3.1.1.3.4 SLP key request procedure completion by the UE

Upon receipt of the PROSE_SLPK_RESPONSE message with the <SLPK-accept> element, if the transaction ID contained in the <SLPK-accept> element matches the value sent by the UE in a PROSE_SLPK_REQUEST message with the <SLPK-request> element, the UE shall use the SLPK ID of the UE initiating the 5G ProSe direct link establishment, the K_{SLP} and the K_{SLP} freshness parameter 2, if received, in the 5G ProSe direct link establishment..

8.3.1.1.3.5 SLP key request procedure not accepted by the SLPKMF

If the PROSE_SLPK_REQUEST message with <SLPK-request> element cannot be accepted by the SLPKMF, the SLPKMF shall send a PROSE_SLPK_RESPONSE message containing an <SLPK-reject> element. In the <SLPK-reject> element, the SLPKMF shall include the transaction ID set to the value of the transaction ID received in the PROSE_SLPK_REQUEST message and shall include an appropriate PC8* control protocol cause value.

NOTE: The SLPKMF decides to reject the PROSE_SLPK_REQUEST message when e.g. the SLPK is not found in the network.

Upon receipt of the PROSE_SLPK_RESPONSE message with the <SLPK-reject> element, if the transaction ID contained in the <SLPK-reject> element matches the value sent by the UE in a PROSE_SLPK_REQUEST message with the <SLPK-request> element, the UE shall consider the SLP key request procedure as rejected.

8.3.1.1.3.6 Abnormal cases in the UE

The following abnormal cases can be identified:

- a) Indication from the transport layer of transmission failure of PROSE_SLPK_REQUEST message (e.g., after TCP retransmission timeout)

The UE shall close the existing secure connection to the SLPKMF, establish a new secure connection and then restart the SLP key request procedure.

- b) No response from the SLPKMF after the PROSE_SLPK_REQUEST message has been successfully delivered (e.g. TCP ACK has been received for the PROSE_SLPK_REQUEST message)

The UE shall retransmit the PROSE_SLPK_REQUEST message.

NOTE: The timer to trigger retransmission and the maximum number of allowed retransmissions are UE implementation specific.

8.3.1.1.3.7 Abnormal cases in the SLPKMF

The following abnormal cases can be identified:

- a) Indication from the lower layer of transmission failure of PROSE_SLPK_RESPONSE message

After receiving an indication from lower layer that the PROSE_SLPK_RESPONSE message has not been successfully acknowledged (e.g., TCP ACK is not received), the SLPKMF shall abort the procedure.

8.3.2 Security for ranging and sidelink positioning communication with V2X capable UE

For V2X capable UE, the security mechanisms used for ranging and sidelink positioning services are defined in clause 6.1.2 of 3GPP TS 24.587 [4]

9. Handling of unknown, unforeseen, and erroneous signalling protocol data

9.1 General

The procedures specified in the present document apply to those PC5 messages which pass the checks described in this clause.

This clause also specifies procedures for the handling of unknown, unforeseen and erroneous protocol data by the receiving entity. These procedures are called "error handling procedures", but in addition to providing recovery mechanisms for error situations they define a compatibility mechanism for future extensions of the protocols.

Detailed error handling procedures in the network are implementation dependent and may vary from PLMN to PLMN. However, when extensions of this protocol are developed, networks will be assumed to have the error handling that is indicated in this clause as mandatory ("shall") and that is indicated as strongly recommended ("should").

Also, the error handling of the network is only considered as mandatory or strongly recommended when certain thresholds for errors are not reached during a dedicated connection.

9.2 Handling of unknown, unforeseen and erroneous protocol data in messages sent over the PC8* interface

9.2.1 Unforeseen message type

If the UE receives a PC8* message with a message type corresponding to a ProSe discovery or a ProSe communication for ranging and sidelink positioning that the UE is not authorised to use by the network, the UE shall discard the message.

If the SLPKMF receives a PC8* message, whose message type indicates that this corresponds to a ProSe discovery or a ProSe communication for ranging and sidelink positioning the sending UE is not authorised to support, the SLPKMF shall discard the message.

9.3 Handling of unknown, unforeseen and erroneous protocol data in messages sent over the PC5 interface

For V2X capable UE, the handling of unknown, unforeseen, and erroneous PC5 signalling protocol data defined in clause 6A of 3GPP TS 24.587 [4] is applied.

For 5G ProSe capable UE, the the handling of unknown, unforeseen, and erroneous PC5 signalling protocol data defined in clause 9.3 of 3GPP TS 24.554 [6] is applied.

10. Message functional definition and contents

10.1 Overview

This clause contains the definition and contents of the messages used in the procedures described in the present document.

10.2 5G ProSe direct discovery for ranging and sidelink positioning procedure messages

10.2.1 Message definition

This message is sent by the UE over the PC5 interface for 5G ProSe direct discovery for ranging and sidelink positioning procedure.

Message type: PROSE PC5 DISCOVERY

Significance: dual

Direction: UE to peer UE

Table 10.2.1.1: PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery announcement content

IEI	Information Element	Type/Reference	Presence	Format	Length
	ProSe direct discovery PC5 message type (NOTE)	ProSe direct discovery PC5 message type 11.2.1	M	V	1
	RSPP metadata	RSPP metadata 11.2.2	M	LV	2-3
	Announcer info	Application layer ID 11.2.3	M	LV	2-256
10	Serving PLMN ID	PLMN ID 11.2.4	O	TLV	5
NOTE: The discovery type is set to "Restricted discovery", the content type is set to "Ranging and sidelink positioning UE discovery announcement" as defined in clause 11.2.1 of 3GPP TS 24.554 [6].					

Table 10.2.1.2: PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery solicitation content

IEI	Information Element	Type/Reference	Presence	Format	Length
	ProSe direct discovery PC5 message type (NOTE)	ProSe direct discovery PC5 message type 11.2.1	M	V	1
11	RSPP metadata	RSPP metadata 11.2.2	O	TLV	3-4
12	Discoveree user info	Application layer ID 11.2.3	O	TLV	3-257
13	Discoverer user info	Application layer ID 11.2.3	O	TLV	3-257
NOTE: The discovery type is set to "Restricted discovery", the content type is set to "Ranging and sidelink positioning UE discovery solicitation" as defined in clause 11.2.1 of 3GPP TS 24.554 [6].					

Table 10.2.1.3: PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery response content

IEI	Information Element	Type/Reference	Presence	Format	Length
	ProSe direct discovery PC5 message type (NOTE)	ProSe direct discovery PC5 message type 11.2.1	M	V	1
	RSPP metadata	RSPP metadata 11.2.2	M	LV	2-3
	Discoveree user info	Application layer ID 11.2.3	M	LV	2-256
10	Serving PLMN ID	PLMN ID 11.2.4	O	TLV	5
NOTE: The discovery type is set to "Restricted discovery", the content type is set to "Ranging and sidelink positioning UE discovery response" as defined in clause 11.2.1 of 3GPP TS 24.554 [6].					

Table 10.2.1.4: PROSE PC5 DISCOVERY message group member discovery announcement for ranging and sidelink positioning content

IEI	Information Element	Type/Reference	Presence	Format	Length
	ProSe direct discovery PC5 message type (NOTE)	ProSe direct discovery PC5 message type 11.2.1	M	V	1
	Application layer group ID	Application layer group ID	M	LV	2-256
	Announcer info	Application layer ID 11.2.3	M	LV	2-256
	RSPP metadata	RSPP metadata 11.2.2	M	LV	2-3
10	Serving PLMN ID	PLMN ID 11.2.4	O	TLV	5
NOTE: The discovery type is set to "Restricted discovery", the content type is set to "Group member discovery announcement for ranging and sidelink positioning" as defined in clause 11.2.1 of 3GPP TS 24.554 [6].					

Table 10.2.1.5: PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning content

IEI	Information Element	Type/Reference	Presence	Format	Length
	ProSe direct discovery PC5 message type (NOTE)	ProSe direct discovery PC5 message type 11.2.1	M	V	1
	Application layer group ID	Application layer group ID	M	LV	2-256
	Discoverer info	Application layer ID 11.2.3	M	LV	2-256
11	RSPP metadata	RSPP metadata 11.2.2	O	TLV	3-4
14	Target user info	Application layer ID 11.2.3	O	TLV	3-257
NOTE: The discovery type is set to "Restricted discovery", the content type is set to "Group member discovery solicitation for ranging and sidelink positioning" as defined in clause 11.2.1 of 3GPP TS 24.554 [6].					

Table 10.2.1.6: PROSE PC5 DISCOVERY message for group member discovery response for ranging and sidelink positioning content

IEI	Information Element	Type/Reference	Presence	Format	Length
	ProSe direct discovery PC5 message type (NOTE)	ProSe direct discovery PC5 message type 11.2.1	M	V	1
	Application layer group ID	Application layer group ID	M	LV	2-256
	Discoveree info	Application layer ID 11.2.3	M	LV	2-256
	RSPP metadata	RSPP metadata 11.2.2	M	LV	2-3
10	Serving PLMN ID	PLMN ID 11.2.4	O	TLV	5
NOTE: The discovery type is set to "Restricted discovery", the content type is set to "Group member discovery response for ranging and sidelink positioning" as defined in clause 11.2.1 of 3GPP TS 24.554 [6].					

10.2.2 Serving PLMN ID

The serving PLMN ID IE shall be included:

- in the PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery announcement as described in Table 10.2.1.1 or PROSE PC5 DISCOVERY message group member discovery announcement for ranging and sidelink positioning as described in Table 10.2.1.4 by the announcing UE if the announcing UE is acting as a located UE and the announcing UE performs the ranging and sidelink positioning operation utilizing the location services signalling messages as defined in 3GPP TS 23.273 [11]; or
- in the PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery response as described in Table 10.2.1.3 or PROSE PC5 DISCOVERY message for group member discovery response for

ranging and sidelink positioning as described in Table 10.2.1.6 by the discoveree UE if the discoveree UE is acting as a located UE and the discoveree UE performs the ranging and sidelink positioning operation utilizing the location services signalling messages as defined in 3GPP TS 23.273 [11].

10.2.3 RSPP metadata

The RSPP metadata IE shall be included in PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery solicitation as described in Table 10.2.1.2 or PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning as described in Table 10.2.1.5 if available in the discoverer UE to provide the RSPP metadata information e.g., the specific role(s) to be discovered.

10.2.4 Discoveree user info

The discoveree user info IE shall be included in PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery solicitation as described in Table 10.2.1.2 if it is provided by the upper layers to identify a specific discoveree UE.

10.2.5 Discoverer user info

The discoverer user info IE shall be included in PROSE PC5 DISCOVERY message for ranging and sidelink positioning UE discovery solicitation as described in Table 10.2.1.2 if it is provided by the upper layers to identify a specific discoveree UE.

10.2.6 Target user info

The target user info IE shall be included in PROSE PC5 DISCOVERY message for group member discovery solicitation for ranging and sidelink positioning as described in Table 10.2.1.5 if the target information is provided by the upper layers to identify a specific group member of the application layer group identified by the configured application layer group ID.

10.3 Coding of Security for ranging and sidelink positioning messages

10.3.1 General

This clause defines the XML schema and MIME type related to 5G ProSe security messages for ranging and sidelink positioning.

10.3.2 application/vnd.3gpp-rangingsl-pc8*+xml

The MIME type is used to carry information related to the 5G ProSe security operation for ranging and sidelink positioning. It shall be coded as an XML document containing one of the following 5G ProSe security messages for ranging and sidelink positioning:

- a) a PROSE_UE_SLPK_REQUEST message;
- b) a PROSE_UE_SLPK_RESPONSE message;
- c) a PROSE_SLPK_REQUEST message; and
- d) a PROSE_SLPK_RESPONSE message;
- e) a PROSE_SECURITY_PARAM_REQUEST message; and
- f) a PROSE_SECURITY_PARAM_RESPONSE message.

Each of those messages is presented in the XML document as an XML element named after the corresponding message.

10.3.3 XML schema

Implementations in compliance with the present document shall implement the XML schema defined below for messages used in 5G ProSe security procedures for ranging and sidelink positioning over PC8* interface.

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns="urn:3GPP:ns:Ranging_SL:Security:2024"
  elementFormDefault="qualified"
  targetNamespace="urn:3GPP:ns:Ranging_SL:Security:2024">
  <xs:annotation>
    <xs:documentation>
      Info for Ranging_SL Security Control Messages Syntax
    </xs:documentation>
  </xs:annotation>

  <xs:complexType name="empty-type"/>

<!-- Complex types defined for transaction-level -->
<xs:complexType name="UE-SLPK-request-type">
  <xs:sequence>
    <xs:element name="transaction-ID" type="xs:integer"/>
    <xs:element name="SLPK-ID" type="xs:string" minOccurs="0"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="UE-SLPK-accept-type">
  <xs:sequence>
    <xs:element name="transaction-ID" type="xs:integer"/>
    <xs:element name="SLPK-ID" type="xs:string"/>
    <xs:element name="SLPK" type="xs:hexBinary"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="reject-type">
  <xs:sequence>
    <xs:element name="transaction-ID" type="xs:integer"/>
    <xs:element name="PC8x-control-protocol-cause-value" type="xs:integer"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<!-- Complex types defined for Message-level -->
<xs:complexType name="PROSE_UE_SLPK_REQUEST-type">
  <xs:sequence>
    <xs:element name="UE-SLPK-request" type="UE-SLPK-request-type" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="PROSE_UE_SLPK_RESPONSE-type">
  <xs:sequence>
    <xs:element name="UE-SLPK-accept" type="UE-SLPK-accept-type" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="UE-SLPK-reject" type="reject-type" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="SLPK-request-type">
  <xs:sequence>
    <xs:element name="transaction-ID" type="xs:integer"/>
    <xs:element name="rangingsl-application-ID" type="xs:hexBinary"/>
    <xs:element name="SLPK-ID" type="xs:string" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>
```

```

    <xs:element name="Kslp-freshness-parameter-1" type="xs:hexBinary"/>
    <xs:element name="HPLMN-ID" type="xs:hexBinary"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="SLPK-accept-type">
  <xs:sequence>
    <xs:element name="transaction-ID" type="xs:integer"/>
    <xs:element name="SLPK-ID" type="xs:string"/>
    <xs:element name="Kslp" type="xs:hexBinary"/>
    <xs:element name="Kslp-freshness-parameter-2" type="xs:hexBinary"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<!-- Complex types defined for Message-level -->
<xs:complexType name="PROSE_SLPK_REQUEST-type">
  <xs:sequence>
    <xs:element name="SLPK-request" type="SLPK-request-type" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="PROSE_SLPK_RESPONSE-type">
  <xs:sequence>
    <xs:element name="SLPK-accept" type="SLPK-accept-type" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="SLPK-reject" type="reject-type" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="model-type">
  <xs:sequence>
    <xs:element name="model-A" type="empty-type" minOccurs="0"/>
    <xs:element name="model-B" type="empty-type" minOccurs="0"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="DUCK-type">
  <xs:sequence>
    <xs:element name="discovery-user-confidentiality-key" type="xs:hexBinary"/>
    <xs:element name="encrypted-bitmask" type="xs:hexBinary"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="code-sending-or-receiving-security-parameters-type">
  <xs:sequence>
    <xs:element name="DUSK" type="xs:hexBinary" minOccurs="0" />
    <xs:element name="DUIK" type="xs:hexBinary" minOccurs="0" />
    <xs:element name="DUCK" type="DUCK-type" minOccurs="0" />
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="security-parameters-type">
  <xs:sequence>
    <xs:element name="expiration-timer" type="xs:integer"/>
    <xs:element name="code-sending-security-parameters-for-model-A" type="code-sending-or-receiving-security-parameters-type" minOccurs="0"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

```

```

    <xs:element name="code-receiving-security-parameters-for-model-B" type="code-sending-or-receiving-security-parameters-type" minOccurs="0"/>
    <xs:element name="code-sending-security-parameters-for-model-B" type="code-sending-or-receiving-security-parameters-type" minOccurs="0"/>
    <xs:element name="selected-PC5-ciphering-algorithm" type="xs:integer"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<!-- Complex types defined for transaction-level -->
<xs:complexType name="RangingSl-discovery-security-parameters-request-type">
  <xs:sequence>
    <xs:element name="transaction-ID" type="xs:integer"/>
    <xs:element name="UE-role" type="xs:integer"/>
    <xs:element name="PC5-UE-security-capabilities" type="xs:integer"/>
    <xs:element name="rangingSl-application-ID" type="xs:hexBinary"/>
    <xs:element name="model" type="model-type" minOccurs="0"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="RangingSl-discovery-security-parameters-accept-type">
  <xs:sequence>
    <xs:element name="transaction-ID" type="xs:integer"/>
    <xs:element name="security-parameters" type="security-parameters-type" minOccurs="0"/>
    <xs:element name="Current-Time" type="xs:dateTime"/>
    <xs:element name="Max-Offset" type="xs:integer"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<!-- Complex types defined for Message-level -->
<xs:complexType name="PROSE_SECURITY_PARAM_REQUEST-type">
  <xs:sequence>
    <xs:element name="RangingSl-discovery-security-parameters-request" type="RangingSl-discovery-security-parameters-request-type" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<xs:complexType name="PROSE_SECURITY_PARAM_RESPONSE-type">
  <xs:sequence>
    <xs:element name="RangingSl-discovery-security-parameters-accept" type="RangingSl-discovery-security-parameters-accept-type" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="RangingSl-discovery-security-parameters-reject" type="reject-type" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="anyExt" type="anyExtType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:anyAttribute namespace="##any" processContents="lax"/>
</xs:complexType>

<!-- XML attribute for any future extensions -->
<xs:complexType name="anyExtType">
  <xs:sequence>
    <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>

<!-- Top level Security Message definition -->
<xs:element name="rangingSl-security-message">
  <xs:complexType>
    <xs:choice>
      <xs:element name="PROSE_UE_SLPK_REQUEST" type="PROSE_UE_SLPK_REQUEST-type"/>
      <xs:element name="PROSE_UE_SLPK_RESPONSE" type="PROSE_UE_SLPK_RESPONSE-type"/>
      <xs:element name="PROSE_SLPK_REQUEST" type="PROSE_SLPK_REQUEST-type"/>
    </xs:choice>
  </xs:complexType>
</xs:element>

```

```

    <xs:element name="PROSE_SLPK_RESPONSE" type="PROSE_SLPK_RESPONSE-type" />
    <xs:element name="PROSE_SECURITY_PARAM_REQUEST" type="PROSE_SECURITY_PARAM_REQUEST-type" />
    <xs:element name="PROSE_SECURITY_PARAM_RESPONSE" type="PROSE_SECURITY_PARAM_RESPONSE-type" />
    <xs:any namespace="##other" processContents="lax" />
  </xs:choice>
</xs:complexType>
</xs:element>

</xs:schema>

```

10.3.4 Semantics

10.3.4.1 General

The <rangingsl-security-message> element is the root element of this XML document and it can be one of the following elements:

- a) <PROSE_UE_SLPK_REQUEST>;
- b) <PROSE_UE_SLPK_RESPONSE>;
- c) <PROSE_SLPK_REQUEST>;
- d) <PROSE_SLPK_RESPONSE>;
- e) a <PROSE_SECURITY_PARAM_REQUEST> element; or
- f) a <PROSE_SECURITY_PARAM_RESPONSE> element.

10.3.4.2 Semantics of <PROSE_UE_SLPK_REQUEST> element

The <PROSE_UE_SLPK_REQUEST> element contains:

- a) zero or more <UE-SLPK-request> elements which contain transactions sent from the UE to the SLPKMF;
- b) zero or one <anyExt> element containing elements defined in future releases;
- c) zero or more elements from other namespaces defined in future releases; and
- d) zero or more attributes defined in future releases.

The <UE-SLPK-request> element contains:

- a) a <transaction-ID> element containing the parameter defined in clause 11.3.1;
- b) zero or one <SLPK-ID> element containing the parameter defined in clause 11.3.3;
- c) zero or one <anyExt> element containing elements defined in future releases;
- d) zero or more elements from other namespaces defined in future releases; and
- e) zero or more attributes defined in future releases;

10.3.4.3 Semantics of <PROSE_UE_SLPK_RESPONSE> element

The <PROSE_UE_SLPK_RESPONSE> element contains:

- a) zero or more <UE-SLPK-accept> elements which contain the accepted transactions;
- b) zero or more <UE-SLPK-reject> elements which contain the rejected transactions;
- c) zero or one <anyExt> element containing elements defined in future releases;
- d) zero or more elements from other namespaces defined in future releases; and
- e) zero or more attributes defined in future releases.

The <UE-SLPK-accept> element contains:

- a) a <transaction-ID> element containing the parameter defined in clause 11.3.1;
- b) a <SLPK-ID> element containing the parameter defined in clause 11.3.3;
- c) a <SLPK> element containing the parameter defined in clause 11.3.2;
- d) zero or one <anyExt> element containing elements defined in future releases;
- e) zero or more elements from other namespaces defined in future releases; and
- f) zero or more attributes defined in future releases.

The <UE-SLPK-reject> element contains:

- a) a <transaction-ID> element containing the parameter defined in clause 11.3.1;
- b) a <PC8x-control-protocol-cause-value> element containing the parameter defined in clause 11.3.4;
- c) zero or one <anyExt> element containing elements defined in future releases;
- d) zero or more elements from other namespaces defined in future releases; and
- e) zero or more attributes defined in future releases.

10.3.4.4 Semantics of <PROSE_SLPK_REQUEST> element

The <PROSE_SLPK_REQUEST> element contains:

- a) zero or more <SLPK-request> elements which contain transactions sent from the UE to the SLPKMF;
- b) zero or one <anyExt> element containing elements defined in future releases;
- c) zero or more elements from other namespaces defined in future releases; and
- d) zero or more attributes defined in future releases.

The <SLPK-request> element contains:

- a) a <transaction-ID> element containing the parameter defined in clause 11.3.1;
- b) a <rangingsl-application-ID> element containing the parameter defined in clause 11.3.8;
- c) a <SLPK-ID> element containing the parameter defined in clause 11.3.3;
- e) a <Kslp-freshness-parameter-1> element containing the parameter defined in clause 11.3.6;
- f) zero or one <HPLMN-ID> element;
- i) zero or one <anyExt> element containing elements defined in future releases;
- j) zero or more elements from other namespaces defined in future releases; and
- k) zero or more attributes defined in future releases.

10.3.4.5 Semantics of <PROSE_SLPK_RESPONSE> element

The <PROSE_SLPK_RESPONSE> element contains:

- a) zero or more <SLPK-accept> elements which contain the accepted transactions;
- b) zero or more <SLPK-reject> elements which contain the rejected transactions;
- c) zero or one <anyExt> element containing elements defined in future releases;
- d) zero or more elements from other namespaces defined in future releases; and

- e) zero or more attributes defined in future releases.

The <SLPK-accept> element contains:

- a) a <transaction-ID> element containing the parameter defined in clause 11.3.1;
- b) a <SLPK-ID> element containing the parameter defined in clause 11.3.3;
- c) a <Kslp> element containing the parameter defined in clause 11.3.5;
- d) a <Kslp-freshness-parameter-2> element containing the parameter defined in clause 11.3.7;
- f) zero or one <anyExt> element containing elements defined in future releases;
- g) zero or more elements from other namespaces defined in future releases; and
- h) zero or more attributes defined in future releases.

The <SLPK-reject> element contains:

- a) a <transaction-ID> element containing the parameter defined in clause 11.3.1;
- b) a <PC8x-control-protocol-cause-value> element containing the parameter defined in clause 11.3.4;
- c) zero or one <anyExt> element containing elements defined in future releases;
- d) zero or more elements from other namespaces defined in future releases; and
- e) zero or more attributes defined in future releases.

10.3.4.6 Semantics of <PROSE_SECURITY_PARAM_REQUEST> element

The <PROSE_SECURITY_PARAM_REQUEST> element contains:

- a) zero or more <RangingSI-discovery-security-parameters-request> elements which contain transactions sent from the UE to the SLPKMF;
- b) zero or one <anyExt> element elements defined in future releases;
- c) zero or more elements from other namespaces defined in future releases; and
- d) zero or more attributes defined in future releases.

The <RangingSI-discovery-security-parameters-request> contains:

- a) a <transaction-ID> element containing the parameter defined in clause 11.3.1;
- b) a <UE-role> element containing the parameter defined in clause 11.3.9;
- c) a <PC5-UE-security-capabilities> element containing the parameter defined in clause 11.6.2.4 of 3GPP TS 24.554 [6];
- d) a <rangingsl-application-ID> element containing the parameter defined in clause 11.3.8;
- e) zero or one <model> element;
- f) zero or one <anyExt> element containing elements defined in future releases;
- g) zero or more elements from other namespaces defined in future releases; and
- h) zero or more attributes defined in future releases.

The <model> element contains:

- a) a <model-A> elements indicating that security parameters are requested for ranging and sidelink positioning UE discovery over PC5 interface model A or an <model-B> elements indicating that security parameters are requested for ranging and sidelink positioning UE discovery over PC5 interface model B;

- b) zero or one <anyExt> element containing elements defined in future releases;
- c) zero or more elements from other namespaces defined in future releases; and
- d) zero or more attributes defined in future releases.

10.3.4.7 Semantics of <PROSE_SECURITY_PARAM_RESPONSE> element

The <PROSE_SECURITY_PARAM_RESPONSE> element sent from the SLPKMF to the UE contains:

- a) zero or more <RangingSI-discovery-security-parameters-accept> elements which contain accepted transactions;
- b) zero or more <RangingSI-discovery-security-parameters-reject> elements which contain rejected transactions;
- c) zero or more elements from other namespaces defined in future releases; and
- d) zero or more attributes defined in future releases.

The <RangingSI-discovery-security-parameters-accept> contains:

- a) a <transaction-ID> element containing the parameter defined in clause 11.3.1;
- b) zero or one <security-parameters> element indicating the discovery security parameters for ranging and sidelink positioning UE discovery over PC5 interface;
- c) a <Current-Time> element containing the parameter defined in clause 11.3.11;
- d) a <Max-Offset> element containing the parameter defined in clause 11.3.2.8 of 3GPP TS 24.554 [6];
- e) zero or one <anyExt> element containing elements defined in future releases;
- f) zero or more elements from other namespaces defined in future releases; and
- g) zero or more attributes defined in future releases.

The <security-parameters> element contains:

- a) an <expiration-timer> element containing the parameter defined in clause 11.3.10;
- b) optionally a <code-receiving-security-parameters-for-model-A> element;
- c) optionally a <code-receiving-security-parameters-for-model-B> element;
- d) optionally a <code-sending-security-parameters-for-model-B> element;
- e) a <selected-PC5-ciphering-algorithm> element containing the parameter defined in clause 11.3.2.11 of 3GPP TS 24.554 [6];
- f) zero or one <anyExt> element containing elements defined in future releases;
- g) zero or more elements from other namespaces defined in future releases; and
- h) zero or more attributes defined in future releases.

The <code-receiving-security-parameters-for-model-A> element, the <code-sending-security-parameters-for-model-A> element, the <code-receiving-security-parameters-for-model-B> element and the <code-sending-security-parameters-for-model-B> element contain:

- a) optionally a <DUSK> element containing the parameter defined in clause 11.3.2.12 of 3GPP TS 24.554 [6];
- b) optionally a <DUIK> element containing the parameter defined in clause 11.3.2.13 of 3GPP TS 24.554 [6];
- c) optionally a <DUCK> element;
- d) zero or one <anyExt> element containing elements defined in future releases;
- e) zero or more elements from other namespaces defined in future releases; and

- f) zero or more attributes defined in future releases.

The <DUCK> element contains:

- a) a <discovery-user-confidentiality-key> element containing the parameter defined in clause 11.3.2.14 of 3GPP TS 24.554 [6];
- b) an <encrypted-bitmask> element containing the parameter defined in clause 11.3.2.15 of 3GPP TS 24.554 [6];
- c) zero or one <anyExt> element containing elements defined in future releases;
- d) zero or more elements from other namespaces defined in future releases; and
- e) zero or more attributes defined in future releases.

The <RangingSI-discovery-security-parameters-reject> element contains:

- a) a <transaction-ID> element containing the parameter defined in clause 11.3.1;
- b) a <PC8x-control-protocol-cause-value> element containing the parameter defined in clause 11.3.4;
- c) zero or one <anyExt> element containing elements defined in future releases;
- d) zero or more elements from other namespaces defined in future releases; and
- e) zero or more attributes defined in future releases.

10.4 Supplementary RSPP signalling over PC5-U messages

10.4.1 Sidelink positioning service request

10.4.1.1 Message definition

This message is sent by the initiating UE to request the ranging and sidelink positioning result from a target UE over the PC5-U interface.

Message type: SIDELINK POSITIONING SERVICE REQUEST

Significance: dual

Direction: UE to peer UE

Table 10.4.1.1: SIDELINK POSITIONING SERVICE REQUEST message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	SIDELINK POSITIONING SERVICE REQUEST message identity	PC5-U message type 11.4.1	M	V	1
	PTI	Procedure transaction ID 11.4.2	M	V	1
	Source user info	Related user info 11.4.3	M	LV	3-256
15	Target UE	Related user info 11.4.3	O	TLV	4-257
70	SL reference UE list	List of related user info 11.4.4	O	TLV-E	6-16131
17	Requested sidelink results	Requested sidelink results 11.4.5	O	TLV	3-10
71	Related UE list	List of related user info 11.4.4	O	TLV-E	6-16131
19	Location QoS	Location QoS 11.4.6	O	TLV	5-33

10.4.1.2 Target UE

The UE shall include this IE to indicate the user info of target UE for ranging and sidelink positioning if the message is exchanged between the sidelink SL positioning client UE and the target UE or SL reference UE or located UE for ranging and sidelink positioning service exposure through PC5.

10.4.1.3 SL reference UE list

The UE shall include this IE to indicate the info of SL reference UE(s) for ranging and sidelink positioning if the message is exchange between the sidelink SL positioning client UE and the target UE or SL reference UE or located UE for ranging and sidelink positioning service exposure through PC5.

10.4.1.4 Requested sidelink results

The UE shall include this IE to indicate the requested ranging location results, including absolute locations, relative locations or ranges and directions related to the UEs for ranging and sidelink positioning for the following:

- if the message is exchanged between the target UE or SL reference UE and the SL positioning server UE for UE-only operation in the ranging and sidelink positioning control procedure as defined in clause 6.8 of 3GPP TS 23.586 [2]; or
- if the message is exchanged between the target UE and the located UE to request the absolute location from a located UE for ranging and sidelink positioning during the Sidelink Mobile Originated Location Request (SL-MO-LR) procedure as defined in 3GPP TS 23.273 [11], and the requested ranging location results is set to absolute locations in the case.

10.4.1.5 Related UE list

The UE shall include this IE including application layer ID(s) and optional the UE role of each UE if the message is exchanged between the target UE or SL reference UE and the SL positioning server UE for UE-only operation in the ranging and sidelink positioning control procedure as defined in clause 6.8 of 3GPP TS 23.586 [2].

10.4.1.6 Location QoS

The UE may include this IE including the required QoS for ranging and sidelink positioning if the requested sidelink results is included.

10.4.2 Sidelink positioning service response

10.4.2.1 Message definition

This message is sent by a UE to another peer UE to response the received SIDELINK POSITIONING SERVICE REQUEST message over the PC5-U interface. See table 10.4.2.1.1.

Message type: SIDELINK POSITIONING SERVICE RESPONSE

Significance: dual

Direction: UE to peer UE

Table 10.4.2.1.1: SIDELINK POSITIONING SERVICE RESPONSE message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	SIDELINK POSITIONING SERVICE RESPONSE message identity	PC5-U message type 11.4.1	M	V	1
	PTI	Procedure transaction ID 11.4.2	M	V	1
	Sidelink positioning result	List of sidelink positioning results 11.4.7	M	LV-E	4-19343

10.4.2A Sidelink positioning service reject

10.4.2A.1 Message definition

This message is sent by a UE to another peer UE to indicate that the sidelink positioning service request is not accepted. See table 10.4.2A.1.1.

Message type: SIDELINK POSITIONING SERVICE REJECT

Significance: dual

Direction: UE to peer UE

Table 10.4.2A.1.1 SIDELINK POSITIONING SERVICE REJECT message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	SIDELINK POSITIONING SERVICE REJECT message identity	PC5-U message type 11.4.1	M	V	1
	PTI	Procedure transaction ID 11.4.2	M	V	1
	Sidelink positioning protocol cause	Sidelink positioning protocol cause 11.4.9	M	V	1

10.4.3 Sidelink positioning SLPP transport message

10.4.3.1 Message definition

This message is sent by a UE to another peer UE to transport the SLPP message(s) and the associated UE's application layer ID(s) of the SLPP message(s) as specified in clause 6.8 of 3GPP TS 23.586 [2]. See table 10.4.3.1.1.

Message type: SIDELINK POSITIONING SLPP TRANSPORT

Significance: dual

Direction: UE to peer UE

Table 10.4.3.1.1:SIDELINK POSITIONING SLPP TRANSPORT message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	SIDELINK POSITIONING SLPP TRANSPORT message identity	PC5-U message type 11.4.1	M	V	1
	SLPP PDU list	List of SLPP PDUs 11.4.8	M	LV-E	8-65537

10.4.4 Sidelink positioning privacy check request

10.4.4.1 Message definition

This message is sent by a UE to another peer UE to request performing UE privacy check as specified in 3GPP TS 33.533 [5]. See table 10.4.4.1.1.

Message type: SIDELINK POSITIONING PRIVACY CHECK REQUEST

Significance: dual

Direction: UE to peer UE

Table 10.4.4.1.1:SIDELINK POSITIONING PRIVACY CHECK REQUEST message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	SIDELINK POSITIONING PRIVACY CHECK REQUEST message identity	PC5-U message type 11.4.1	M	V	1
	PTI	Procedure transaction ID 11.4.2	M	V	1
	Source user info	Related user info 11.4.3	M	LV	2-256
20	SL positioning client UE user info	Related user info 11.4.3	O	TLV	3-257

10.4.4.2 SL positioning client UE user info

The UE shall include this IE to indicate the user info of SL positioning client UE if the message is exchanged for authorization procedure for ranging and sidelink positioning service exposure through PC5.

10.4.5 Sidelink positioning privacy check accept

10.4.5.1 Message definition

This message is sent by a UE to another peer UE to indicate that UE privacy check as specified in 3GPP TS 33.533 [5] was successful. See table 10.4.5.1.1.

Message type: SIDELINK POSITIONING PRIVACY CHECK ACCEPT

Significance: dual

Direction: UE to peer UE

Table 10.4.5.1.1:SIDELINK POSITIONING PRIVACY CHECK ACCEPT message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	SIDELINK POSITIONING PRIVACY CHECK ACCEPT message identity	PC5-U message type 11.4.1	M	V	1
	PTI	Procedure transaction ID 11.4.2	M	V	1

10.4.6 Sidelink positioning privacy check reject

10.4.6.1 Message definition

This message is sent by a UE to another peer UE to indicate that UE privacy check as specified in 3GPP TS 33.533 [5] was not successful. See table 10.4.6.1.1.

Message type: SIDELINK POSITIONING PRIVACY CHECK REJECT

Significance: dual

Direction: UE to peer UE

Table 10.4.6.1.1:SIDELINK POSITIONING PRIVACY CHECK REJECT message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	SIDELINK POSITIONING PRIVACY CHECK REJECT message identity	PC5-U message type 11.4.1	M	V	1
	PTI	Procedure transaction ID 11.4.2	M	V	1

11. Information elements coding

11.1 Overview

This clause contains general message format and information elements coding for the messages used in the procedures described in the present document.

11.2 PC5 direct discovery message formats

11.2.1 ProSe direct discovery PC5 message type

This parameter is used to indicate the type of ProSe direct discovery message over PC5 interface as specified in clause 11.2.1 of 3GPP TS 24.554 [6].

11.2.2 RSPP metadata

This parameter carries the metadata information.

The RSPP metadata information element is coded as shown in Figure 11.2.2.1 and Table 11.2.2.1.

The RSPP metadata is a type 4 information element.

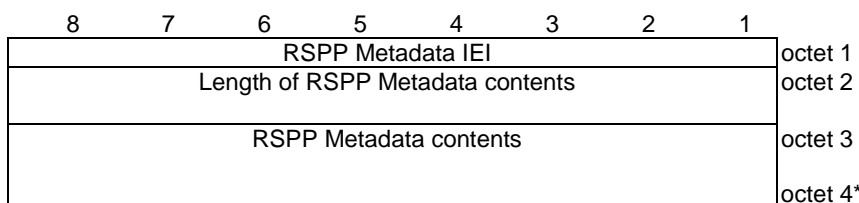


Figure 11.2.2.1: RSPP metadata information element

Table 11.2.2.1: RSRP metadata information element

The length of RSPP metadata contents field contains the binary coded representation of the length of the Metadata contents field.

The RSPP Metadata contents field contains the octets indicating the RSPP metadata parameter. The format of the RSPP metadata parameter is coded as RSPP-Metadata as specified in clause 6.11 of 3GPP TS 38.355 [12].

11.2.3 Application layer ID

The user info ID parameter carries an application layer ID as specified in clause 11.2.15 of 3GPP TS 24.554 [6].

11.2.4 PLMN ID

The PLMN ID information element is coded as the PLMN identity information element specified in clause 9.11.3.85 of 3GPP TS 24.501 [3].

11.2.5 Application layer group ID

This parameter carries an identifier of an application layer group that the UE belongs to as specified in clause 11.2.6 of 3GPP TS 24.554 [6].

11.3 Security for ranging and sidelink positioning message formats

11.3.1 Transition ID

This parameter is used to uniquely identify a PC8* control protocol for Ranging_SL security transaction when it is combined with other PC8* control protocol for Ranging_SL security transactions in the same transport message. The UE shall set this parameter to a new number for each outgoing new key request. The transaction ID is an integer in the 0-255 range.

11.3.2 SLPK

This parameter is used to indicate the SLPK allocated by the SLPKMF. The calculation of the SLPK is defined in 3GPP TS 33.533 [5].

11.3.3 SLPK-ID

This parameter is used to indicate the identifier of the UE stored SLPK.

11.3.4 PC8* control protocol cause value

This parameter is used to indicate the particular reason why a PROSE_UE_SLPK_REQUEST message from the UE has been rejected by the SLPKMF. It is an integer in the 0-255 range encoded in Table 11.3.4.

Table 11.3.4: PC8* control protocol cause value

0	Reserved
3	UE authorization failure
1, 2, 4-255	Unused

11.3.5 K_{SLP}

This parameter is used to provide a 256-bit K_{SLP} as specified in 3GPP TS 33.533 [5].

11.3.6 K_{SLP} freshness parameter 1

This parameter is used to indicate 128-bit long K_{SLP} freshness parameter 1 as specified in 3GPP TS 33.533 [5].

11.3.7 K_{SLP} freshness parameter 2

This parameter is used to indicate 128-bit long K_{SLP} freshness parameter 2 as specified in 3GPP TS 33.533 [5].

11.3.8 rangingsl-application-ID

This parameter is used to identify the particular application that triggers the security operation for ranging and sidelink positioning. This information element is coded as the ProSe identifier specified in clause 11.3.3 of 3GPP TS 24.554 [6].

11.3.9 UE role

This parameter is used to identify the UE role of the UE acts in the ongoing ranging and sidelink positioning service. It is an integer in the 0-255 range encoded in Table 11.4.3.2.

11.3.10 Expiration timer

This parameter is used to indicate the expiration timer of the discovery security parameters for ranging and sidelink positioning UE discovery over PC5 interface.

It is an integer in the 1-525600 (decimal) range representing the timer value in unit of minutes.

11.3.11 Current time

This parameter is used to carry the current UTC-based time at the SLPKMF. The format of this parameter follows the XML data type defined in table 11.4.1.1 of 3GPP TS 24.554 [6] for ProSe parameter type "Time".

11.4 Supplementary RSPP signalling message formats

11.4.1 PC5-U message type

The purpose of the PC5-U message type information element is to indicate the type of messages used over PC5 user plane.

The value part of the PC5-U message type information element is coded as shown in table 11.4.1.1.

The PC5-U message type is a type 3 information element, with the length of 1 octet.

Table 11.4.1.1: PC5-U message type

Bits								
8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	1	SIDELINK POSITIONING SERVICE REQUEST
0	0	0	0	0	0	1	0	SIDELINK POSITIONING SERVICE RESPONSE
0	0	0	0	0	0	1	1	SIDELINK POSITIONING SERVICE REJECT
0	0	0	0	0	1	0	0	SIDELINK POSITIONING SLPP TRANSPORT
0	0	0	0	0	1	0	1	SIDELINK POSITIONING PRIVACY CHECK REQUEST
0	0	0	0	0	1	1	0	SIDELINK POSITIONING PRIVACY CHECK ACCEPT
0	0	0	0	0	1	1	1	SIDELINK POSITIONING PRIVACY CHECK REJECT

The other values are reserved.

11.4.2 Procedure transaction ID

This parameter is used to uniquely identify a PC5-U transaction when it is combined with other PC5-U transactions in the same transport message. The procedure transaction ID is an integer in the 0-127 range.

The Procedure transaction ID is a type 3 information element with length of 1 octet.

The Procedure transaction ID information element is coded as shown in figure 11.4.2.1 and table 11.4.2.1.

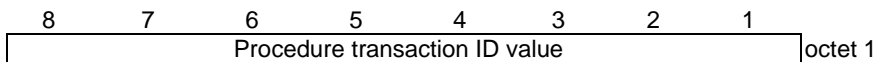


Figure 11.4.2.1: Procedure transaction ID information element

Table 11.4.2.1: Procedure transaction ID information element

Procedure transaction ID value (octet 1)								
Bits								
8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	\
								} Procedure transaction ID value
to								
0	1	1	1	1	1	1	1	/

All other values are reserved.

11.4.3 Related user info

The purpose of the related user info parameter information element carries an application layer ID as specified in clause 11.2.5 and the associated UE role of the UE acts in the ongoing ranging and sidelink positioning service.

The related user info information element is coded as shown in figure 11.4.3.1 and table 11.4.3.1.

The related user info is a type 4 information element.

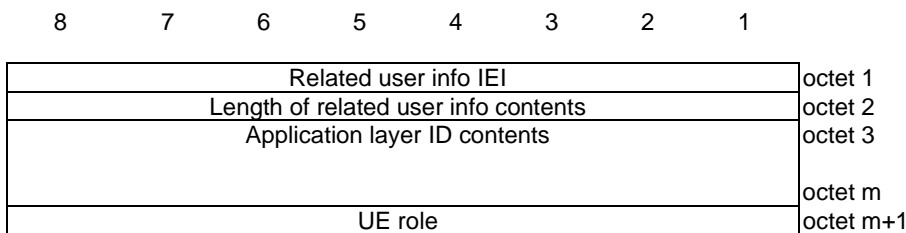


Figure 11.4.3.1: Related user info information element

Table 11.4.3.1: Related user info information element

<p>The length of related user info contents field contains the binary coded representation of the length of the related user info contents field.</p> <p>Application layer ID (octet 2 to m) The Application layer ID field contains the user info ID parameter carrying an application layer ID as specified in clause 11.2.15 of 3GPP TS 24.554 [6].</p> <p>UE role (octet m+1) The UE role field contains the role the UE acts in the ongoing ranging and sidelink positioning service.</p>
--

Table 11.4.3.2: UE role

Bits		
8 7 6 5 4 3 2 1		
0 0 0 0 0 0 0 1	LOCATED_UE	
0 0 0 0 0 0 1 0	SL REFERENCE_UE	
0 0 0 0 0 0 1 1	TARGET_UE	
0 0 0 0 0 1 0 0	SL POSITINING SERVER_UE	
0 0 0 0 0 1 0 1	SL POSITINING CLIENT_UE	
All other values reserved		

11.4.4 List of related user info

The List of related user info information element contains a list of related user info as specified in clause 11.4.3.

The List of related user info information element is a type 6 information element with the minimum length of 6 octets and the maximum length of 16131 octets.

NOTE: The maximum number of UEs supported for ranging and sidelink positioning is 64, and the maximum number of related user info entry in a list of related user info IE is 63. When the maximum number of related user info entry is 63, the maximum length of the List of related user info information element is 16131 octets.

The list of related user info information element is coded as shown in figure 11.4.4.1 and table 11.4.4.1.

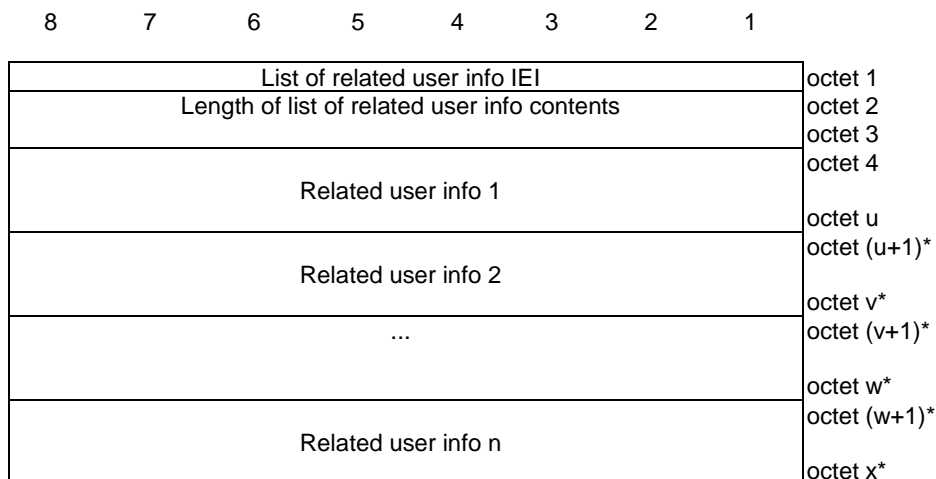


Figure 11.4.4.1: List of related user info information element

Table 11.4.4.1: List of Related user info information element

<p>The length of list of related user info contents field contains the binary coded representation of the length of the list related user info contents field.</p> <p>Related user info (octet 4 u) The related user info field contains an application layer ID and the associated UE role as specified in clause 11.4.3.</p>

11.4.5 Requested sidelink results

The requested sidelink results contains the sidelink result type(s).

The requested sidelink results information element is a type 4 information element with a minimum length of 3 octets and maximum length of 10 octets.

The requested sidelink results information element is coded as shown in figure 11.4.5.1 and table 11.4.5.1.

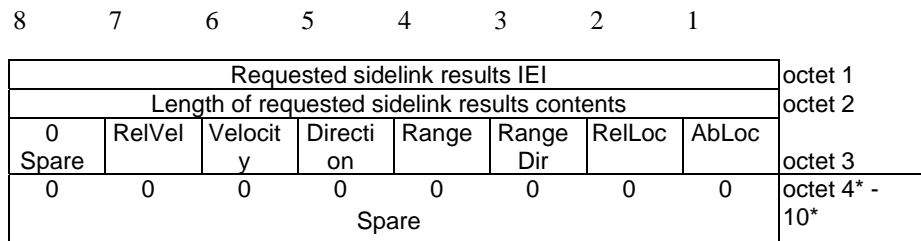


Figure 11.4.5.1: Ranging sidelink result

Table 11.4.5.1: Ranging sidelink result

Requested sidelink results (octet 3)	
Absolute location requested (octet 3, bit 1)	
0	The absolute location of the target UE not requested
1	The absolute location of the target UE requested
Relative location requested (octet 3, bit 2)	
0	The position of the target UE relative to other UEs not requested
1	The position of the target UE relative to other UEs requested
Range and direction requested (octet 3, bit 3)	
0	The distance and the direction between two UEs or more UEs not requested
1	The distance and the direction between two UEs or more UEs requested
Range requested (octet 3, bit 4)	
0	The distance between two UEs or more UEs not requested
1	The distance between two UEs or more UEs requested
Direction requested (octet 3, bit 5)	
0	The direction between two UEs or more UEs not requested
1	The direction between two UEs or more UEs requested
Velocities requested (octet 3, bit 6)	
0	The velocities of the target UE not requested
1	The velocities of the target UE requested
Relative velocities requested (octet 3, bit 7)	
0	The velocities of the target UE relative to other UEs not requested
1	The velocities of the target UE relative to other UEs requested
Bit 8 of octet 3 and bits in octets 4 to 10 are spare and shall be coded as zero.	

11.4.6 Location QoS

The location QoS is used to indicate the required QoS of the result requested for ranging and sidelink positioning.

The location QoS is a type 4 information element with minimum length of 5 octets and a maximum length of 33 octets.

The location QoS information element is coded as shown in figure 11.4.6.1 and table 11.4.6.1.

8	7	6	5	4	3	2	1	
Location QoS IEI								octet 1
Length of location QoS								octet 2
DIRAI	DISAI	RVAI	RHAI	VAI	HAI	RTI	LQCI	octet 3
Spare	Spare	Spare	Spare	Spare	DBI	PLI	RANI	octet 4
LCS QoS class								octet 5*
Response time								octet 6*
Horizontal accuracy								octet 7* octet 10*
Vertical accuracy								octet 11* octet 14*
Relative horizontal accuracy								octet 15* octet 18*
Relative vertical accuracy								octet 19* octet 22*
Distance accuracy								octet 23* octet 26*
Direction accuracy								octet 27* octet 30*
Range								octet 31*
Priority level								octet 32*
Delay Budget								octet 33*

Figure 11.4.6.1: Location QoS information element

Table 11.4.6.1: Location QoS information element

LCS QoS class indication (LQCI) (octet 3, bit 1)
Bit
1
0 LCS QoS class is not required
1 LCS QoS class is required
Response time indication (RTI) (octet 3, bit 2)
Bit
2
0 Response time is not required
1 Response time is required
Horizontal accuracy indication (HAI) (octet 3, bit 3)
Bit
3
0 Horizontal accuracy is not required
1 Horizontal accuracy is required
Vertical accuracy indication (VAI) (octet 3+1, bit 4)
Bit
4
0 Vertical accuracy is not required
1 Vertical accuracy field is required
Relative horizontal accuracy indication (RHAI) (octet 3, bit 5)
Bit
5
0 Relative horizontal accuracy is not required
1 Relative horizontal accuracy is required
Relative vertical accuracy indication (VAI) (octet 3, bit 6)
Bit
6
0 Relative vertical accuracy is not required
1 Relative vertical accuracy is required
Distance accuracy indication (DISAI) (octet 3, bit 7)
Bit
7
0 Distance accuracy is not required
1 Distance accuracy is required
Direction accuracy indication (DIRAI) (octet 3, bit 8)
Bit
8
0 Direction accuracy is not required
1 Direction accuracy is required
Range indication (RANI) (octet 4, bit 1)
Bit
1
0 Range is not required
1 Range is required
Priority level indication (PLI) (octet 4, bit 2)
Bit
2
0 Priority level is not required
1 Priority level is required
Delay budget indication (DBI) (octet 4, bit 3)
Bit
3
0 Delay budget is not required
1 Delay budget is required

<p>LCS QoS class (octet 5):</p> <p>Bits</p> <p>8 7 6 5 4 3 2 1</p> <p>0 0 0 0 0 0 0 0 Reserved</p> <p>0 0 0 0 0 0 0 1 Best effort class</p> <p>0 0 0 0 0 0 1 0 Multiple QoS class</p> <p>0 0 0 0 0 0 1 1 Assured class</p> <p>The other values are spare.</p> <p>Response time (octet 6):</p> <p>Bits</p> <p>8 7 6 5 4 3 2 1</p> <p>0 0 0 0 0 0 0 0 Reserved</p> <p>0 0 0 0 0 0 0 1 No delay</p> <p>0 0 0 0 0 0 1 0 Low delay</p> <p>0 0 0 0 0 0 1 1 Delay tolerant</p> <p>The other values are spare.</p> <p>Horizontal accuracy (octet 7 to octet 10):</p> <p>The horizontal accuracy field indicates a binary encoded value of the required horizontal accuracy as defined in 3GPP TS 29.572 [21].</p> <p>Vertical accuracy (octet 11 to octet 14):</p> <p>The vertical accuracy field indicates a binary encoded value of the required vertical accuracy as defined in 3GPP TS 29.572 [21].</p> <p>Relative horizontal accuracy (octet 15 to octet 18):</p> <p>The relative horizontal accuracy field indicates a binary encoded value of the required relative horizontal accuracy as defined in 3GPP TS 29.572 [21].</p> <p>Relative vertical accuracy (octet 19 to octet 22):</p> <p>The relative vertical accuracy field indicates a binary encoded value of the required relative vertical accuracy as defined in 3GPP TS 29.572 [21].</p> <p>Distance accuracy (octet 23 to octet 26):</p> <p>The distance accuracy field indicates a binary encoded value of the required distance accuracy as defined in 3GPP TS 29.572 [21].</p> <p>Direction accuracy (octet 27 to octet 30):</p> <p>The direction accuracy field indicates a binary encoded value of the required direction accuracy as defined in 3GPP TS 29.572 [21].</p> <p>Range (octet 31):</p> <p>The range field indicates a binary encoded value of the range in meters. The range indicates the applicability of the QoS parameters over PC5.</p> <p>Priority level (octet 32):</p> <p>The priority level field indicates binary encoded value of the priority level. The format of priority level is encoded as sl-PRS-Priority as specified in clause 6.6 of 3GPP TS 38.355 [12].</p> <p>Delay Budget (octet 33):</p> <p>The delay budget field indicates the ranging and sidelink positioning service latency in millisecond. The format of delay budget is encoded as sl-PRS-DelayBudget as specified in clause 6.6 of 3GPP TS 38.355 [12].</p> <p>NOTE: LQCI shall be set to 1 if both HAI and VAI are set to 0.</p>
--

11.4.7 List of sidelink positioning results

The purpose of the list of sidelink positioning results parameter information element carries one absolute location or a list of relative locations.

The list of sidelink positioning results information element is a type 6 information element with the minimum length of 5 octets and the maximum length of 19344 octets.

NOTE: The maximum number of UEs supported for ranging and sidelink positioning is 64, and the maximum number of sidelink positioning result entry in a list of sidelink positioning results IE is 63. When the maximum number of sidelink positioning result entry is 63, the maximum length of the List of related user info information element is 19344 octets.

The list of sidelink positioning results information element is coded as shown in figure 11.4.7.1 and table 11.4.7.1.

8	7	6	5	4	3	2	1	
List of sidelink positioning results IEI								octet 1
Length of list of sidelink positioning results contents								octet 2 octet 3
Sidelink positioning result 1								octet 4
Sidelink positioning result 2								octet u octet (u+1)*
...								octet v* octet (v+1)*
Sidelink positioning result n								octet w* octet (w+1)* octet x*

Figure 11.4.7.1: List of sidelink positioning results information element

8	7	6	5	4	3	2	1	
Length of sidelink positioning result contents								octet 4
0	0	0	0	0	0	RLTI	ABSI	octet 5
Spare	Spare	Spare	Spare	Spare	Spare			octet 6*
Absolute location								octet o1* octet (o1+1)*
Relative location								octet o2*

Figure 11.4.7.2: Sidelink positioning result

8	7	6	5	4	3	2	1	
Length of absolute location contents								octet 6*
0	0	0	0	0	0	VLCTI	LESTI	octet 7*
Spare	Spare	Spare	Spare	Spare	Spare			octet 8*
Location estimate								octet l* octet (l+1)*
Velocity estimate								octet o1*

Figure 11.4.7.3: Absolute location

8	7	6	5	4	3	2	1	
Length of relative location contents								octet o1+1*
0 Spare	0 Spare	0 Spare	RLTVL CI	3DRLTI	2DRLTI	RNGDI	APPIDI	octet o1+2*
Length of application layer ID								octet o1+3*
Application layer ID								octet o1+4*
Length of range direction								octet o3*
Range direction								octet (o3+1)* octet (o3+2)*
2D relative location								octet o4* octet (o4+1)*
3D relative location								octet o5* octet (o5+1)*
Relative velocity								octet o6* octet (o6+1)*
								octet o2*

Figure 11.4.7.4: Relative location

Table 11.4.7.1: List of sidelink positioning results information element

<p>Absolute location indication (octet 5, bit 1) (NOTE 1)</p> <p>Bit</p> <p>1</p> <p>0 Absolute location does not exist</p> <p>1 Absolute location exists</p>
<p>Relative location indication (octet 5, bit 2) (NOTE 1)</p> <p>Bit</p> <p>2</p> <p>0 Relative location does not exist</p> <p>1 Relative location exists</p>
<p>Location estimate (octet 8 to l)</p> <p>The Location estimate field contains the content of absolute location of a UE as specified in 3GPP TS 23.273 [11].</p>
<p>Velocity estimate (octet l+1 to o1)</p> <p>The Velocity estimate field contains the content of absolute velocity of a UE as specified in 3GPP TS 23.273 [11].</p>
<p>Location estimate indication (octet 7, bit 1) (NOTE 2)</p> <p>Bit</p> <p>1</p> <p>0 Location estimate does not exist</p> <p>1 Location estimate exists</p>
<p>Velocity estimate indication (octet 7, bit 2) (NOTE 2)</p> <p>Bit</p> <p>2</p> <p>0 Velocity estimate does not exist</p> <p>1 Velocity estimate exists</p>
<p>Application layer ID indication (octet o1+2, bit 1)</p> <p>Bit</p> <p>1</p> <p>0 Application layer ID does not exist</p> <p>1 Application layer ID exists</p>
<p>Range direction indication (octet o1+2, bit 2) (NOTE 3)</p> <p>Bit</p> <p>2</p> <p>0 Range direction does not exist</p> <p>1 Range direction exists</p>
<p>2D relative location indication (octet o1+2, bit 3) (NOTE 3)</p> <p>Bit</p> <p>3</p> <p>0 2D relative location does not exist</p> <p>1 2D relative location exists</p>
<p>3D relative location indication (octet o1+2, bit 4) (NOTE 3)</p> <p>Bit</p> <p>4</p> <p>0 3D relative location does not exist</p> <p>1 3D relative location exists</p>
<p>Relative velocity indication (octet o1+2, bit 5) (NOTE 3)</p> <p>Bit</p> <p>5</p> <p>0 Relative velocity does not exist</p> <p>1 Relative velocity exists</p>
<p>Application layer ID (octet o1+4 to o3)</p> <p>The Application layer ID field contains the user info ID parameter carries an application layer ID as specified in clause 11.2.15 of 3GPP TS 24.554 [6].</p> <p>The Range direction field contains a range and direction from a point A to a point B, comprising a range, an azimuth direction, and an elevation direction from the target UE to a UE identified with the application layer ID as specified 3GPP TS 23.273 [11].</p>
<p>The 2D relative location field contains a relative 2D location with uncertainty ellipse, characterised by a point described in 2D local co-ordinates with origin corresponding to another known point identified with the application layer ID, distances r1 and r2 and an angle of orientation A as specified 3GPP TS 23.273 [11].</p>

The 3D relative location field contains a relative 3D location with uncertainty ellipsoid, characterised by a point described in 3D local co-ordinates with origin corresponding to another known point identified with the application layer ID, distances r1 (the "semi-major uncertainty"), r2 (the "semi-minor uncertainty") and r3 (the "vertical uncertainty") and an angle of orientation A (the "angle of the major axis"). as specified 3GPP TS 23.273 [11].

The Relative velocity field contains UE velocity relative to the UE identified with the application layer ID as specified 3GPP TS 23.273 [11].

NOTE 1: Absolute location or Relative location exists for one sidelink positioning result.
 NOTE 2: Location estimate or Velocity estimate exists for one absolute location.
 NOTE 3: One of Range direction, 2D relative location, 3D relative location or Relative velocity exists for one relative location.

11.4.8 List of SLPP PDUs

The list of SLPP PDUs parameter is to indicate a list of SLPP messages and the associated UE's application layer ID for each SLPP message.

The list of SLPP PDUs information element is a type 6 information element with the minimum length of 9 octets and the maximum length of 65538 octets.

The list of SLPP PDUs information element is coded as shown in figure 11.4.8.1 and table 11.4.8.1.

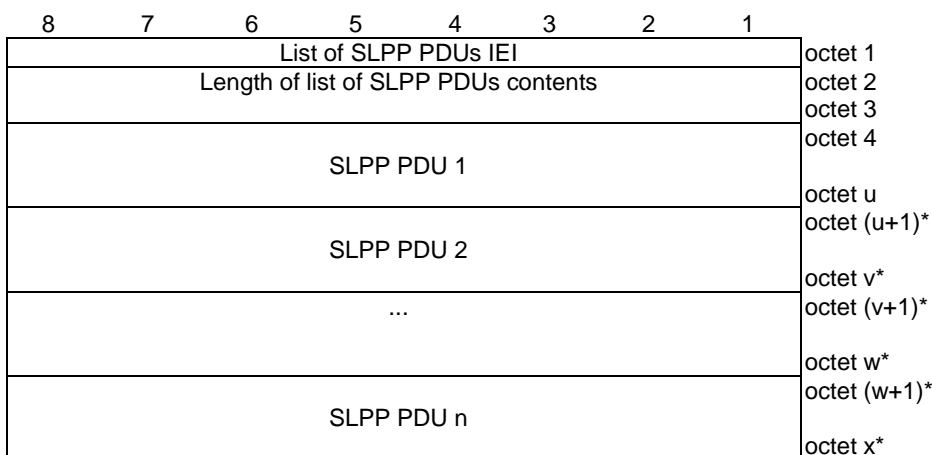


Figure 11.4.8: List of SLPP PDUs information element

Table 11.4.8: List of SLPP PDUs information element

SLPP PDU (octet 4 to u)
 The SLPP PDU field contains the SLPP message and its associated UE's application layer ID and is coded as figure 11.4.8.2 and table 11.4.8.2.

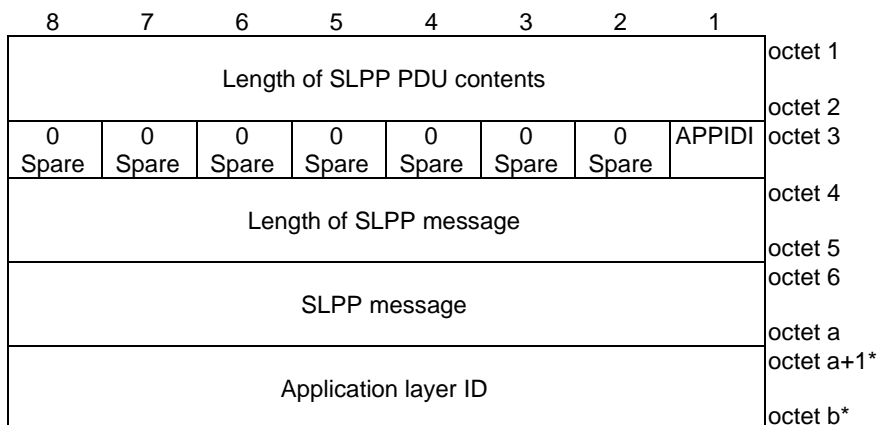


Figure 11.4.8.2: SLPP PDU

Table 11.4.8.2: SLPP PDU

Application layer ID indication (APPIDI) (octet 3 bit 1): Bit 1 0 Application layer ID does not exist 1 Application layer ID exists
SLPP message (octet 3 to a) The SLPP message field contains the content of the SLPP message as specified in 3GPP TS 38.355 [12].
Application layer ID (octet a+1 to b) The Application layer ID field contains the user info ID parameter carries an application layer ID as specified in clause 11.2.15 of 3GPP TS 24.554 [6].

11.4.9 Sidelink positioning protocol cause

The purpose of the sidelink protocol cause information element is to indicate the cause used in the sidelink positioning service request procedures.

The sidelink positioning protocol cause is a type 3 information element with a length of 2 octets.

The sidelink positioning protocol cause information element is coded as shown in figure 11.4.9.1 and table 11.4.9.1.

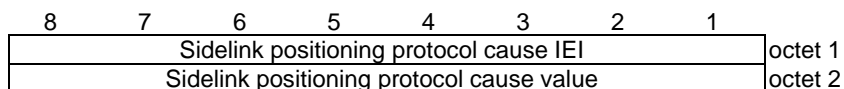


Figure 11.4.9.1: Sidelink positioning protocol cause information element

Table 11.4.9.1: Sidelink positioning protocol cause information element

Sidelink positioning protocol cause value (octet 2)									
Bits									
8	7	6	5	4	3	2	1		
0	0	0	0	0	0	0	1	Authorization failure	
0	1	1	0	1	1	1	1	Protocol error, unspecified	
Any other value received by the UE shall be treated as 0110 1111, "protocol error, unspecified".									

12 Encoding of UE policies for ranging and sidelink positioning

12.1 General

The UE policies for ranging and sidelink positioning are provided to the UE in a UE policy part using the UE policy delivery service as specified in 3GPP TS 24.501 [3] annex D.

The UE policies for ranging and sidelink positioning are coded in clause 12.2.

12.2 Information elements coding

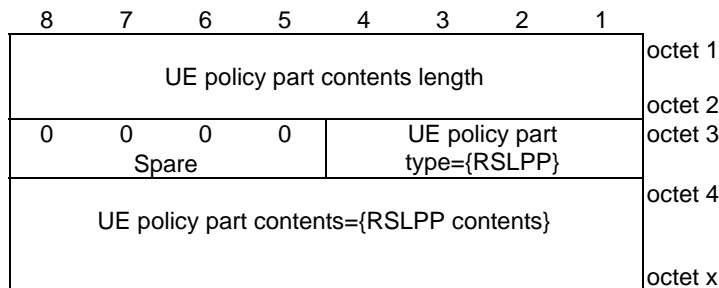


Figure 12.2.1: UE policy part when UE policy part type = {RSLPP}

Table 12.2.1: UE policy part when UE policy part type = {RSLPP}

UE policy part type field is set to '0110' (=RSLPP) as specified in 3GPP TS 24.501 [3] annex D.

RSLPP contents (octets 4 to x):
 The RSLPP contents field is encoded in Figure 12.2.2 and Table 12.2.2.

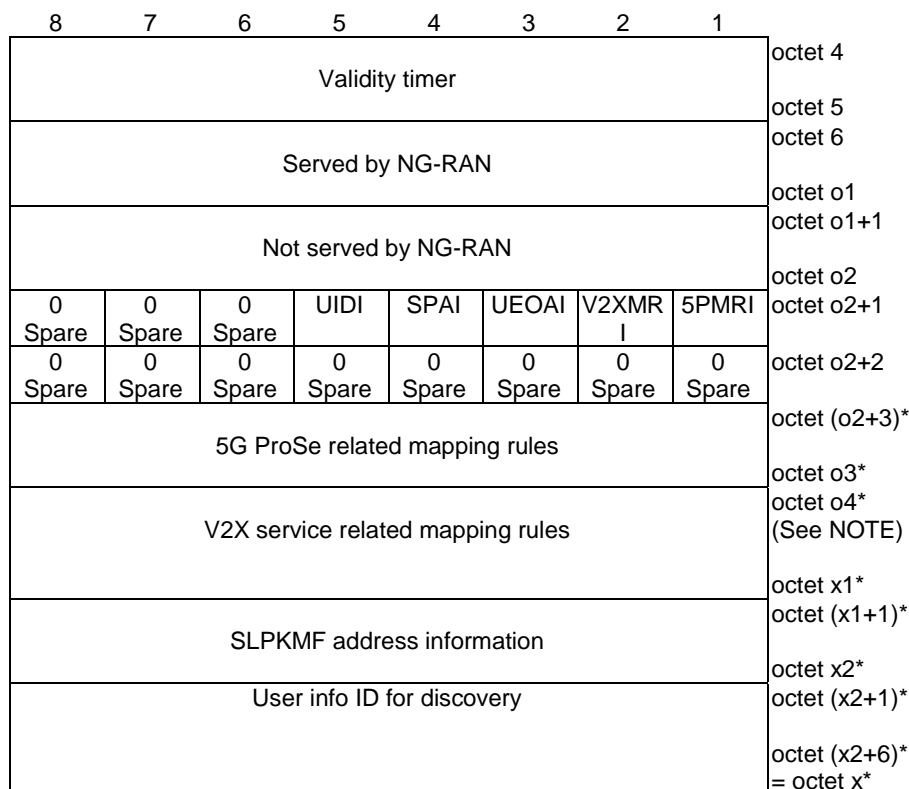


Figure 12.2.2: RSLPP contents

NOTE: The field is placed immediately after the last present preceding field.

Table 12.2.2: RSLPP contents

Validity timer (octet 4 to 5):

The validity timer field provides the expiration time of validity of the UE policies for ranging and sidelink positioning. The validity timer field is a binary coded representation of a UTC time, in seconds since midnight UTC of January 1, 1970 (not counting leap seconds).

Served by NG-RAN (octet 6 to o1):

The served by NG-RAN field is coded according to figure 12.2.3 and table 12.2.3, and contains configuration parameters for ranging and sidelink positioning when the UE is served by NG-RAN.

Not served by NG-RAN (octet o1+1 to o2):

The not served by NG-RAN field is coded according to figure 12.2.7a and table 12.2.7a, and contains configuration parameters for ranging and sidelink positioning when the UE is not served by NG-RAN.

5G ProSe related mapping rules indication (5PMRI) (octet o2+1 bit 1):

Bit

1

- 0 5G ProSe related mapping rules field is absent
- 1 5G ProSe related mapping rules is present

V2X service related mapping rules indication (V2XMRI) (octet o2+1 bit 2):

Bit

2

- 0 V2X service related mapping rules is absent
- 1 V2X service related mapping rules is present

UE-only operation authorization indication (UEOAI) (octet o2+1 bit 3):

Bit

3

- 0 UE-only operation is not authorized when the UE is served by NG-RAN and network-based operation not supported
- 1 UE-only operation is authorized when the UE is served by NG-RAN and network-based operation not supported by the network

SLPKMF address indication (SPAI) (octet o1+1 bit 4)

The SPAI indicates whether the SLPKMF address information is included in the IE or not

Bit

4

- 0 SLPKMF address information is not included
- 1 SLPKMF address information is included

User info ID for discovery indication (PAI) (octet o1+2 bit 5)

Bit

4

- 0 User info ID for discovery is not included
- 1 User info ID for discovery is included

5G ProSe related mapping rules (octet o2+3 to o3):

The 5G ProSe related mapping rules field is coded according to figure 12.2.7 and table 12.2.7 and includes the 5G ProSe related mapping rules.

V2X service related mapping rules (octet o4 to x1):

The V2X service related mapping rules field is coded according to figure 12.2.13 and table 12.2.13 and includes the V2X service related mapping rules.

SLPKMF address information (octet (x1+1) to x2)

SLPKMF address information contains the IPv4 address(es), IPv6 address(es) and/or FQDN of the SLPKMF and is coded according to Figure 12.2.19, Figure 12.2.20, Figure 12.2.21 and Table 12.2.19. At least one of the address parameters (FQDN, IPv4 address list or IPv6 address list) shall be included.

User info ID for discovery (octet (x2+1) to octet(x2+6)):

The value of the User info ID parameter is a 48-bit long bit string. The format of the User info ID parameter is out of scope of this specification.

If the length of RSLPP contents field is bigger than indicated in figure 12.2.2, receiving entity shall ignore any superfluous octets located at the end of the RSLPP contents.

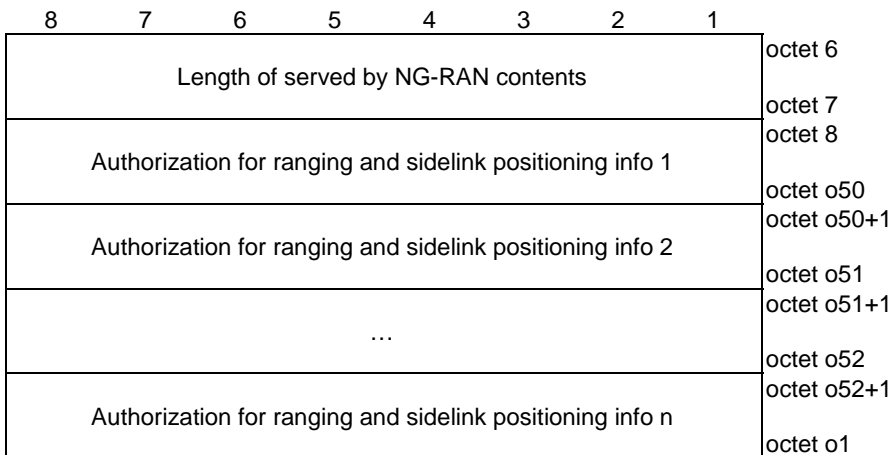


Figure 12.2.3: Served by NG-RAN

Table 12.2.3: Served by NG-RAN

Authorization for ranging and sidelink positioning info:
The authorization for ranging and sidelink positioning info field is coded according to figure 12.2.4 and table 12.2.4.

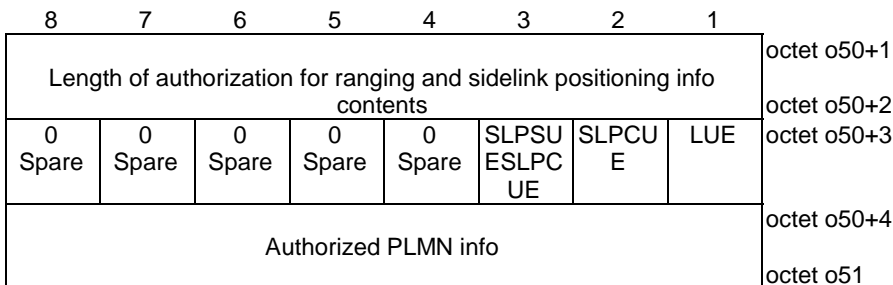


Figure 12.2.4: Authorization for ranging and sidelink positioning info

Table 12.2.4: Authorization for ranging and sidelink positioning info

<p>Authorized PLMN info (octet o50+4 to o51): The authorized PLMN info field is coded according to figure 12.2.5 and table 12.2.5.</p> <p>Located UE (LUE) (octet o51+1 bit 1): Bit 1 0 Located UE is not authorized 1 Located UE is authorized</p> <p>SL positioning client UE (SLPCUE) (octet o50+3 bit 2): Bit 2 0 SL positioning client UE is not authorized 1 SL positioning client UE is authorized</p> <p>SL positioning server UE (SLPSUE) (octet o50+3 bit 3): Bit 3 0 SL positioning server UE is not authorized 1 SL positioning server UE is authorized</p> <p>If the length of authorization for ranging and sidelink positioning info field is bigger than indicated in figure 12.2.4, receiving entity shall ignore any superfluous octets located at the end of the authorization for ranging and sidelink positioning info.</p>
--

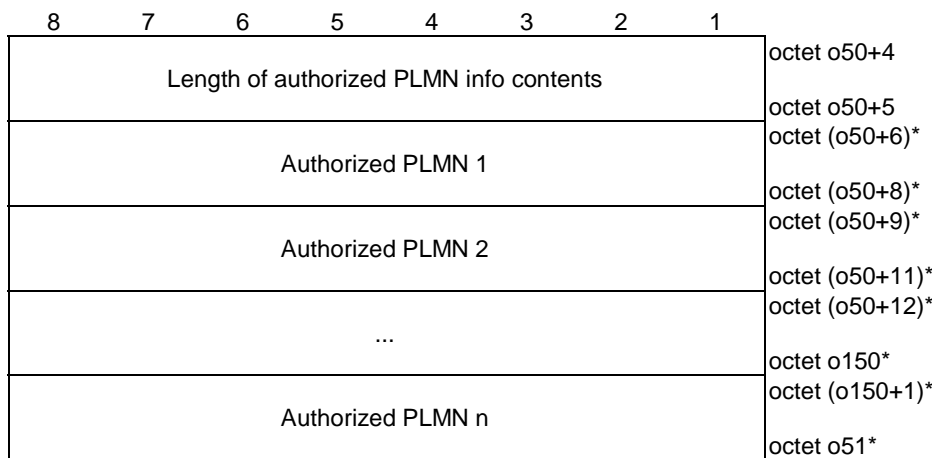


Figure 12.2.5: Authorized PLMN info

Table 12.2.5: Authorized PLMN

<p>Authorized PLMN: The authorized PLMN field is coded according to figure 12.2.6 and table 12.2.6.</p>
--

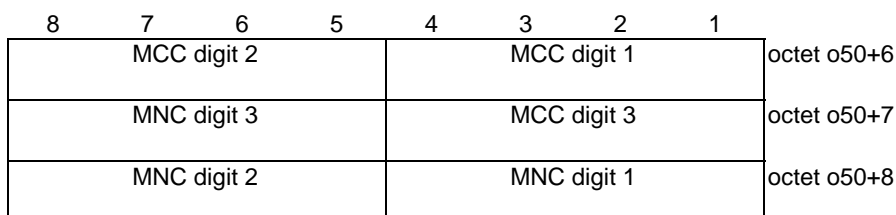


Figure 12.2.6: PLMN ID

Table 12.2.6: PLMN ID

Mobile country code (MCC) (octet o50+5, octet o50+6 bit 1 to 4):
 The MCC field is coded as in ITU-T Recommendation E.212 [7], annex A.

Mobile network code (MNC) (octet o50+6 bit 5 to 8, octet o50+7):
 The coding of MNC field is the responsibility of each administration but BCD coding shall be used. The MNC shall consist of 2 or 3 digits. If a network operator decides to use only two digits in the MNC, MNC digit 3 shall be coded as "1111".

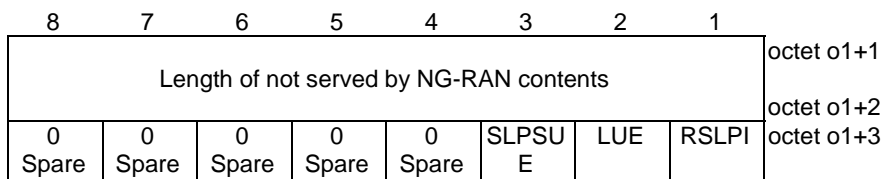


Figure 12.2.7a: Not served by NG-RAN

Table 12.2.7a: Not served by NG-RAN

Ranging and sidelink positioning indicator (RSLPI) (octet o1+3 bit 1):
 Bit
1
 0 Ranging and sidelink positioning is not authorized (NOTE)
 1 Ranging and sidelink positioning is authorized

Located UE (LUE) (octet o1+3 bit 2):
 Bit
2
 0 Located UE is not authorized
 1 Located UE is authorized

SL positioning server UE (SLPSUE) (octet o1+3 bit 3):
 Bit
3
 0 SL positioning server UE is not authorized
 1 SL positioning server UE is authorized

NOTE: If the RSLPI bit is set to 0, the other bits in octet o1+3 shall also be 0.

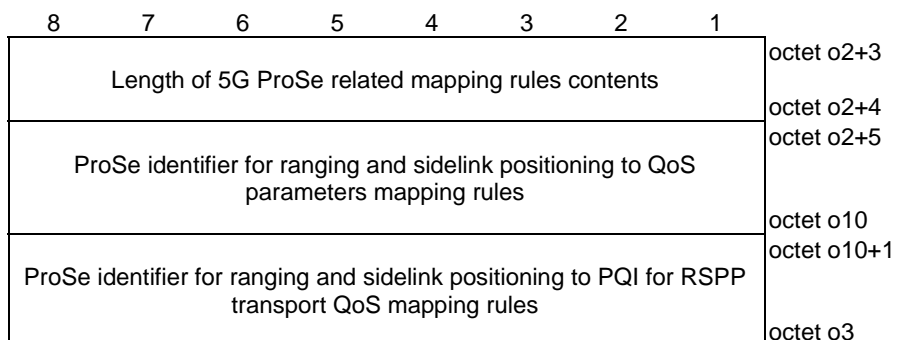


Figure 12.2.7: 5G ProSe related mapping rules

Table 12.2.7: 5G ProSe related mapping rules

ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rules (octet o1+5 to o10):
 The ProSe identifier for ranging and sidelink positioning to ranging and sidelink positioning QoS parameters mapping rules field is coded according to figure 12.2.8 and table 12.2.8 and includes the ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rules.

ProSe identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules (octet o10+1 to o2):
 The ProSe identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules field is coded according to figure 12.2.8 and table 12.2.8 and includes the ProSe identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules.

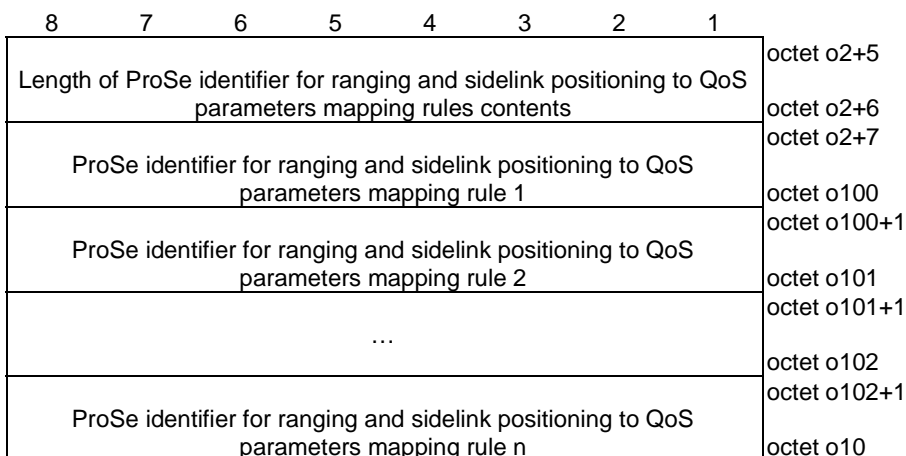


Figure 12.2.8: ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rules

Table 12.2.8: ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rules

ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rule:
 The ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rule field is coded according to figure 12.2.9 and table 12.2.9 and includes the ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rule.

8	7	6	5	4	3	2	1	
Length of ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rule contents								octet o100+1
ProSe identifiers								octet o100+2 octet o100+3
DIRAI	DISAI	RVAI	RHAI	VAI	HAI	RTI	LQCI	octet o103 octet o103+1
Spare	Spare	Spare	Spare	Spare	DBI	PLI	RANI	octet o103+2
LCS QoS class								octet o103+3
Response time								octet (o103+4)*
Horizontal accuracy								octet (o103+5)* octet (o103+8)*
Vertical accuracy								octet (o103+9)* octet (o103+12)*
Relative horizontal accuracy								octet (o103+13)* octet (o103+16)*
Relative vertical accuracy								octet (o103+17)* octet (o103+20)*
Distance accuracy								octet (o103+21)* octet (o103+24)*
Direction accuracy								octet (o103+25)* octet (o103+28)*
Range								octet (o103+29)*
Priority level								octet (o103+30)*
Delay budget								octet (o103+31)* =o101

Figure 12.2.9: ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rule

Table 12.2.9: ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rule

ProSe identifiers (octet o100+3 to o103):
The ProSe identifiers field is coded according to figure 12.2.10 and table 12.2.10 and includes the ProSe identifiers.

LCS QoS class indication (LQCI) (octet o103+1 bit 1) (NOTE)

Bit

1

0 LCS QoS class field is absent

1 LCS QoS class field is present

Response time indication (RTI) (octet o103+1 bit 2)

Bit

2

0 Response time field is absent

1 Response time field is present

Horizontal accuracy indication (HAI) (octet o103+1 bit 3) (NOTE)

Bit

3

0 Horizontal accuracy field is absent

1 Horizontal accuracy field is present

Vertical accuracy indication (VAI) (octet o103+1 bit 4) (NOTE)

Bit

4

0 Vertical accuracy field is absent

1 Vertical accuracy field is present

Relative horizontal accuracy indication (RHAI) (octet o103+1 bit 5)

Bit

5

0 Relative horizontal accuracy field is absent

1 Relative horizontal accuracy field is present

Relative vertical accuracy indication (VAI) (octet o103+1 bit 6)

Bit

6

0 Relative vertical accuracy field is absent

1 Relative vertical accuracy field is present

Distance accuracy indication (DISAI) (octet o103+1 bit 7)

Bit

7

0 Distance accuracy field is absent

1 Distance accuracy field is present

Direction accuracy indication (DIRAI) (octet o103+1 bit 8)

Bit

8

0 Direction accuracy field is absent

1 Direction accuracy field is present

Range indication (RANI) (octet o103+2 bit 1)

Bit

1

0 Range field is absent

1 Range field is present

Priority level indication (PLI) (octet o103+2 bit 2)

Bit

2

0 Priority level field is absent

1 Priority level field is present

Delay budget indication (DBI) (octet o103+2 bit 3)

Bit

3

0	Delay budget field is absent
1	Delay budget field is present
LCS QoS class (octet o103+3):	
Bits	
8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Reserved
0 0 0 0 0 0 0 1	Best effort class
0 0 0 0 0 0 1 0	Multiple QoS class
0 0 0 0 0 0 1 1	Assured class
The other values are spare.	
Response time (octet o103+4):	
Bits	
8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Reserved
0 0 0 0 0 0 0 1	No delay
0 0 0 0 0 0 1 0	Low delay
0 0 0 0 0 0 1 1	Delay tolerant
The other values are spare.	
Horizontal accuracy (octet o103+5 to o103+8):	
The horizontal accuracy field is a binary encoded value of the horizontal accuracy as defined in 3GPP TS 29.572 [21].	
Vertical accuracy (octet o103+9 to o103+12):	
The vertical accuracy field is a binary encoded value of the vertical accuracy as defined in 3GPP TS 29.572 [21].	
Relative horizontal accuracy (octet o103+13 to o103+16):	
The relative horizontal accuracy field is a binary encoded value of the relative horizontal accuracy as defined in 3GPP TS 29.572 [21].	
Relative vertical accuracy (octet o103+17 to o103+20):	
The relative vertical accuracy field is a binary encoded value of the relative vertical accuracy as defined in 3GPP TS 29.572 [21].	
Distance accuracy (octet o103+21 to o103+24):	
The distance accuracy field is a binary encoded value of the distance accuracy as defined in 3GPP TS 29.572 [21].	
Direction accuracy (octet o103+25 to o103+28):	
The direction accuracy field is a binary encoded value of the direction accuracy as defined in 3GPP TS 29.572 [21].	
Range (octet o103+29):	
The range field indicates a binary encoded value of the range in meters. The range indicates the applicability of the QoS parameters over PC5.	
Priority level (octet o103+30):	
The priority level field indicates binary encoded value of the priority level. The format of priority level is encoded as sl-PRS-Priority as defined in clause 6.6 of 3GPP TS 38.355 [12].	
Delay budget (octet o103+31):	
The delay budget field indicates binary encoded value of the ranging and sidelink positioning service latency in millisecond. The format of delay budget is encoded as sl-PRS-DelayBudget as specified in clause 6.6 of 3GPP TS 38.355 [12].	
NOTE: LQCI shall be set to 1 if both HAI and VAI are set to 0.	

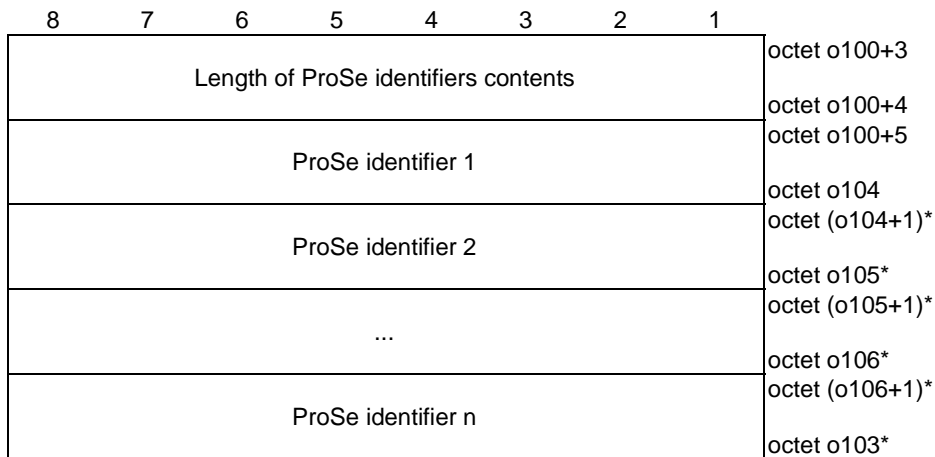


Figure 12.2.10: ProSe identifiers

Table 12.2.10: ProSe identifiers

<p>ProSe identifier: The ProSe identifier field contains a sequence of a sixteen octet OS Id field, a one octet OS App Id length field, and an OS App Id field. The OS Id field shall be transmitted first. The OS Id field contains a Universally Unique Identifier (UUID) as specified in IETF RFC 4122 [8].</p> <p>NOTE: Further definition of the format of OS App ID is beyond the scope of this specification.</p>
--

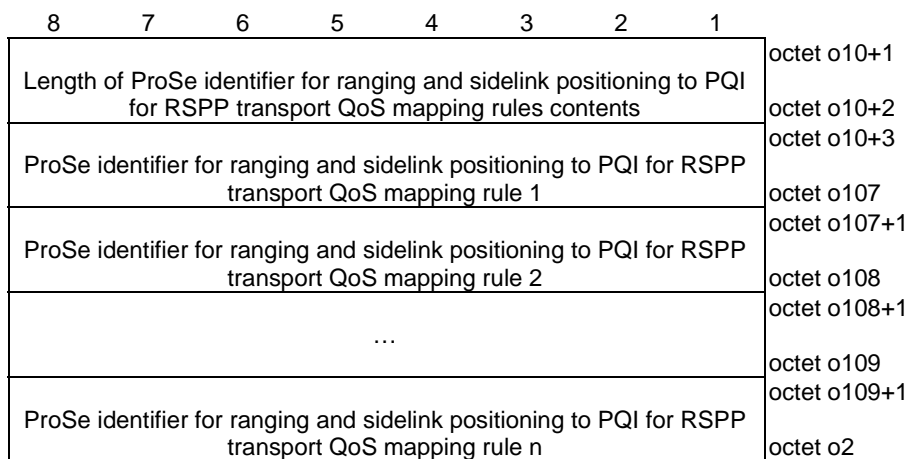


Figure 12.2.11: ProSe identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules

Table 12.2.11: ProSe identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules

<p>ProSe identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rule: The ProSe identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rule field is coded according to figure 12.2.12 and table 12.2.12 and includes the ProSe identifier for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rule.</p>

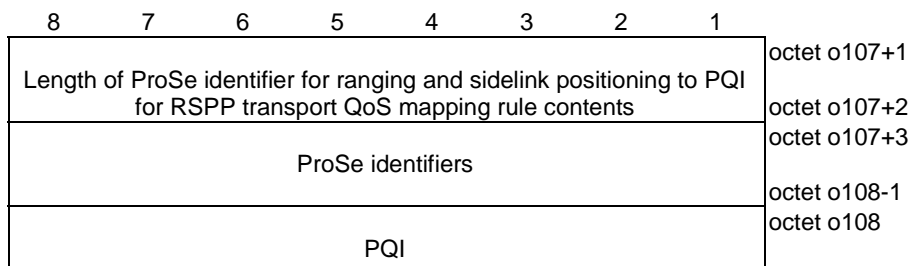


Figure 12.2.12: ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rule

Table 12.2.12: ProSe identifier for ranging and sidelink positioning to QoS parameters mapping rule

ProSe identifiers (octet o107+3 to o108-1):
 The ProSe identifiers field is coded according to figure 12.2.10 and table 12.2.10 and includes the ProSe identifiers.

PQI (octet o108):

Bits

8	7	6	5	4	3	2	1	
00000000								Reserved
00000001								to Spare
00010100								
00010101								PQI 21
00010110								PQI 22
00010111								PQI 23
00011000								PQI 24
00011001								PQI 25
00011010								PQI 26
00011011								to Spare
00110110								
00110111								PQI 55
00111000								PQI 56
00111001								PQI 57
00111010								PQI 58
00111011								PQI 59
00111100								PQI 60
00111101								PQI 61
00111110								to Spare
01011001								
01011010								PQI 90
01011011								PQI 91
01011100								PQI 92
01011101								PQI 93
01011110								to Spare
01111111								
10000000								to Operator-specific PQIs
11111110								
11111111								Reserved

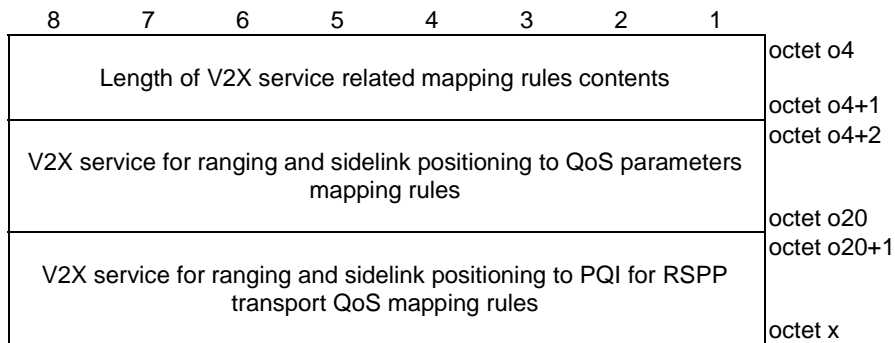


Figure 12.2.13: V2X service related mapping rules

Table 12.2.13: V2X service related mapping rules

V2X service for ranging and sidelink positioning to QoS parameters mapping rules (octet o3+2 to o20):
 The V2X service for ranging and sidelink positioning to ranging and sidelink positioning QoS parameters mapping rules field is coded according to figure 12.2.8 and table 12.2.8 and includes the V2X service for ranging and sidelink positioning to QoS parameters mapping rules.

V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules (octet o20+1 to x):
 The V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules field is coded according to figure 12.2.8 and table 12.2.8 and includes the V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules.

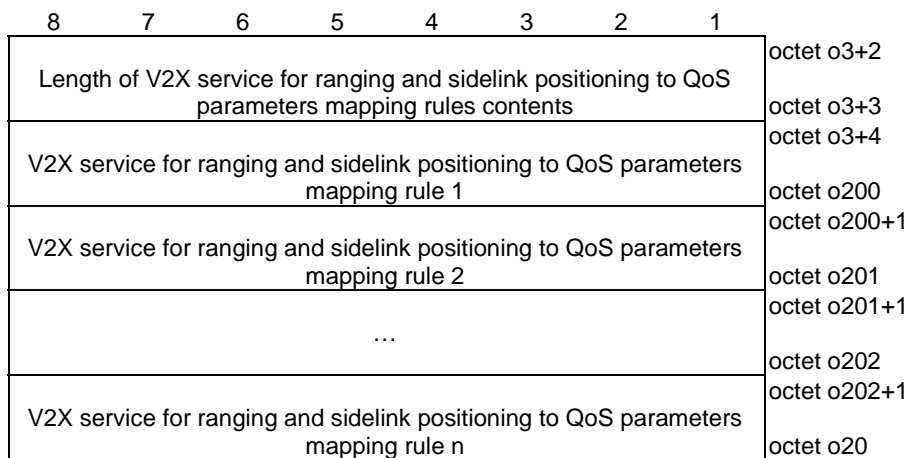


Figure 12.2.14: V2X service for ranging and sidelink positioning to QoS parameters mapping rules

Table 12.2.14: V2X service for ranging and sidelink positioning to QoS parameters mapping rules

V2X service for ranging and sidelink positioning to QoS parameters mapping rule:
 The V2X service for ranging and sidelink positioning to QoS parameters mapping rule field is coded according to figure 12.2.15 and table 12.2.15 and includes the V2X service for ranging and sidelink positioning to QoS parameters mapping rule.

8	7	6	5	4	3	2	1	
Length of V2X service for ranging and sidelink positioning to QoS parameters mapping rule contents								octet o200+1
V2X service identifiers								octet o200+2 octet o200+3
DIRAI	DISAI	RVAI	RHAI	VAI	HAI	RTI	LQCI	octet o203 octet o203+1
Spare	Spare	Spare	Spare	Spare	DBI	PLI	RANI	octet o203+2
LCS QoS class								octet (o203+3)*
Response time								octet (o203+4)*
Horizontal accuracy								octet (o203+5)* octet (o203+8)*
Vertical accuracy								octet (o203+9)* octet (o203+12)*
Relative horizontal accuracy								octet (o203+13)* octet (o203+16)*
Relative vertical accuracy								octet (o203+17)* octet (o203+20)*
Distance accuracy								octet (o203+21)* octet (o203+24)*
Direction accuracy								octet (o203+25)* octet (o203+28)*
Range								octet (o203+29)*
Priority level								octet (o203+30)*
Delay budget								octet (o203+31)* = o201*

Figure 12.2.15: V2X service for ranging and sidelink positioning to QoS parameters mapping rule

Table 12.2.15: V2X service for ranging and sidelink positioning to QoS parameters mapping rule

V2X service identifiers (octet o200+3 to o203):
The V2X service identifiers field is coded according to figure 12.2.16 and table 12.2.16 and includes the V2X service identifiers.

LCS QoS class indication (LQCI) (octet o203+1 bit 1) (NOTE)

Bit

1

0 LCS QoS class field is absent

1 LCS QoS class field is present

Response time indication (RTI) (octet o203+1 bit 2)

Bit

2

0 Response time field is absent

1 Response time field is present

Horizontal accuracy indication (HAI) (octet o203+1 bit 3) (NOTE)

Bit

3

0 Horizontal accuracy field is absent

1 Horizontal accuracy field is present

Vertical accuracy indication (VAI) (octet o203+1 bit 4) (NOTE)

Bit

4

0 Vertical accuracy field is absent

1 Vertical accuracy field is present

Relative horizontal accuracy indication (RHAI) (octet o203+1 bit 5)

Bit

5

0 Relative horizontal accuracy field is absent

1 Relative horizontal accuracy field is present

Relative vertical accuracy indication (VAI) (octet o203+1 bit 6)

Bit

6

0 Relative vertical accuracy field is absent

1 Relative vertical accuracy field is present

Distance accuracy indication (DISAI) (octet o203+1 bit 7)

Bit

7

0 Distance accuracy field is absent

1 Distance accuracy field is present

Direction accuracy indication (DIRAI) (octet o203+1 bit 8)

Bit

8

0 Direction accuracy field is absent

1 Direction accuracy field is present

Range indication (RANI) (octet o203+2 bit 1)

Bit

1

0 Range field is absent

1 Range field is present

Priority level indication (PLI) (octet o203+2 bit 2)

Bit

2

0 Priority level field is absent

1 Priority level field is present

Delay budget indication (DBI) (octet o203+2 bit 3)

Bit

3

0	Delay budget field is absent
1	Delay budget field is present
LCS QoS class (octet o203+3):	
Bits	
8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Reserved
0 0 0 0 0 0 0 1	Best effort class
0 0 0 0 0 0 1 0	Multiple QoS class
0 0 0 0 0 0 1 1	Assured class
The other values are spare.	
Response time (octet o203+4):	
Bits	
8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Reserved
0 0 0 0 0 0 0 1	No delay
0 0 0 0 0 0 1 0	Low delay
0 0 0 0 0 0 1 1	Delay tolerant
The other values are spare.	
Horizontal accuracy (octet o203+5 to o203+8):	
The horizontal accuracy field is a binary encoded value of the horizontal accuracy as defined in 3GPP TS 29.572 [21].	
Vertical accuracy (octet o203+9 to o203+12):	
The vertical accuracy field is a binary encoded value of the vertical accuracy as defined in 3GPP TS 29.572 [21].	
Relative horizontal accuracy (octet o203+13 to o203+16):	
The relative horizontal accuracy field is a binary encoded value of the relative horizontal accuracy as defined in 3GPP TS 29.572 [21].	
Relative vertical accuracy (octet o203+17 to o203+20):	
The relative vertical accuracy field is a binary encoded value of the relative vertical accuracy as defined in 3GPP TS 29.572 [21].	
Distance accuracy (octet o203+21 to o203+24):	
The distance accuracy field is a binary encoded value of the distance accuracy as defined in 3GPP TS 29.572 [21].	
Direction accuracy (octet o203+25 to o203+28):	
The direction accuracy field is a binary encoded value of the directionaccuracy as defined in 3GPP TS 29.572 [21].	
Range (octet o203+29):	
The range field indicates a binary encoded value of the range in meters. The range indicates the applicability of the QoS parameters over PC5.	
Priority level (octet o103+30):	
The priority level field indicates binary encoded value of the priority level which corresponds to the "sl-PRS-Priority" as defined in 3GPP TS 38.355 [12].	
Delay budget (octet o103+31):	
The delay budget field indicates binary encoded value of the ranging and sidelink positioning service latency in millisecond. The format of delay budget is encoded as sl-PRS-DelayBudget as specified in clause 6.6 of 3GPP TS 38.355 [12].	
NOTE: LQCI shall be set to 1 if both HAI and VAI are set to 0.	

8	7	6	5	4	3	2	1	
Length of V2X service identifiers contents								octet o200+3
V2X service identifier 1								octet o200+4 octet o200+5
V2X service identifier 2								octet o204 octet (o204+1)*
...								octet o205* octet (o205+1)*
V2X service identifier n								octet o206* octet (o206+1)* octet o203*

Figure 12.2.16: V2X service identifiers

Table 12.2.16: V2X service identifiers

V2X service identifier:
The V2X service identifier field contains a binary coded V2X service identifier as specified in ISO TS 17419 ITS-AID AssignedNumbers [9].

8	7	6	5	4	3	2	1	
Length of V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules contents								octet o20+1 octet o20+2 octet o20+3
V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rule 1								octet o207 octet o207+1
V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rule 2								octet o208 octet o208+1
...								octet o209 octet o209+1
V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rule n								octet x

Figure 12.2.17: V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules

Table 12.2.17: V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rules

V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rule:
The V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rule field is coded according to figure 12.2.18 and table 12.2.18 and includes the V2X service for ranging and sidelink positioning to PQI for RSPP transport QoS mapping rule.

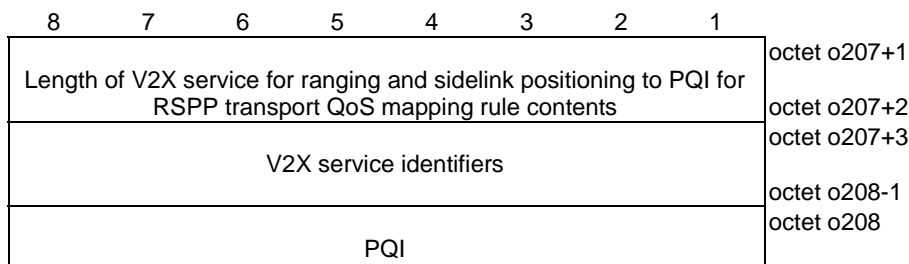


Figure 12.2.18: V2X service for ranging and sidelink positioning to QoS parameters mapping rule

Table 12.2.18: V2X service for ranging and sidelink positioning to QoS parameters mapping rule

V2X service identifiers (octet o207+3 to o208-1):
 The V2X service identifiers field is coded according to figure 12.2.16 and table 12.2.16 and includes the V2X service identifiers.

PQI (octet o208):

Bits

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Reserved
0	0	0	0	0	0	0	1	to Spare
0	0	0	1	0	1	0	0	
0	0	0	1	0	1	0	1	PQI 21
0	0	0	1	0	1	1	0	PQI 22
0	0	0	1	0	1	1	1	PQI 23
0	0	0	1	1	0	0	0	to Spare
0	0	1	1	0	1	1	0	
0	0	1	1	0	1	1	1	PQI 55
0	0	1	1	1	0	0	0	PQI 56
0	0	1	1	1	0	0	1	PQI 57
0	0	1	1	1	0	1	0	PQI 58
0	0	1	1	1	0	1	1	PQI 59
0	0	1	1	1	1	0	0	to Spare
0	1	0	1	1	0	0	1	
0	1	0	1	1	0	1	0	PQI 90
0	1	0	1	1	0	1	1	PQI 91
0	1	0	1	1	1	0	0	to Spare
0	1	1	1	1	1	1	1	
1	0	0	0	0	0	0	0	to Operator-specific PQIs
1	1	1	1	1	1	1	0	
1	1	1	1	1	1	1	1	Reserved

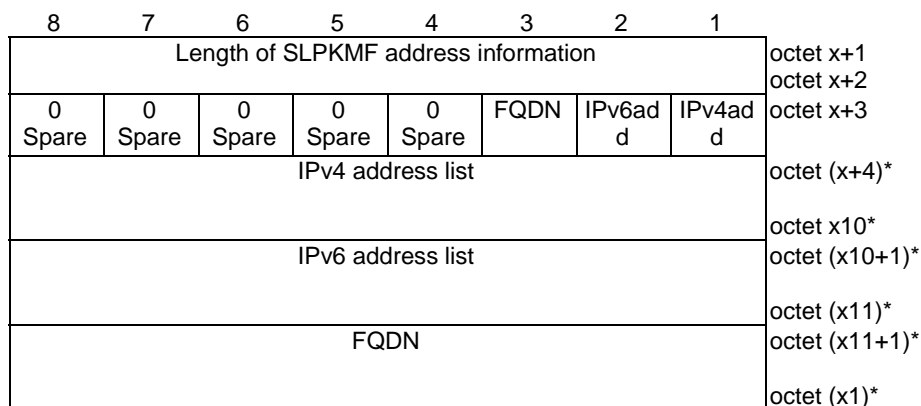


Figure 12.2.19: SLPKMF address information

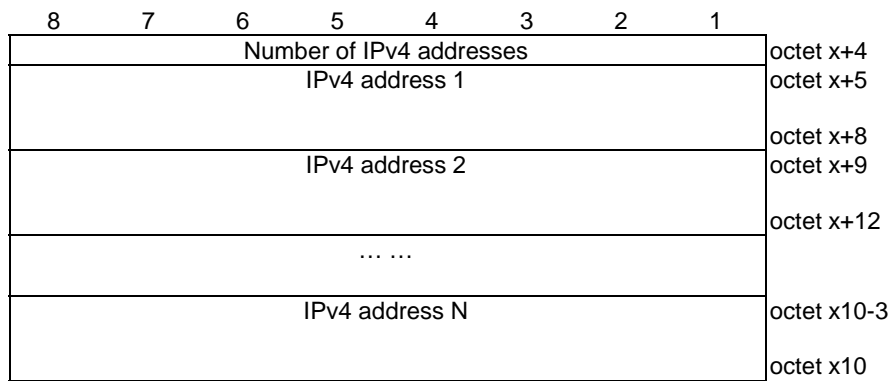


Figure 12.2.20: IPv4 address list

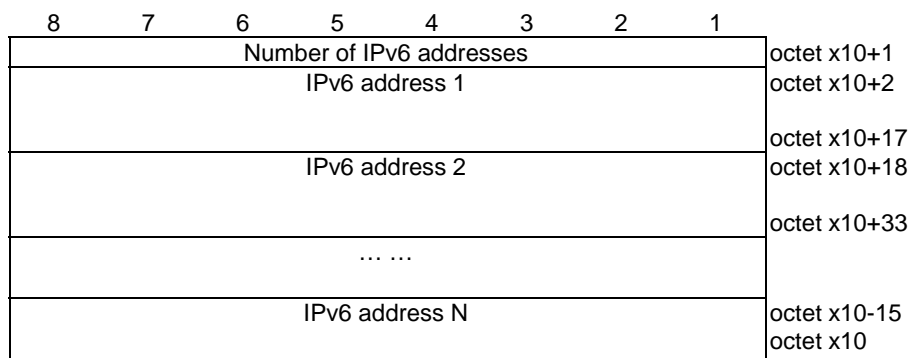


Figure 12.2.21: IPv6 address list

Table 12.2.19: SLPKMF address information

IPv4 addresses (IPv4add) (octet x+2 bit 1): (NOTE 1)
Bit
1
0 IPv4 address list is not present
1 IPv4 address list is present
IPv6 addresses (IPv6add) (octet x+2 bit 2): (NOTE 1)
Bit
2
0 IPv6 address list is not present
1 IPv6 address list is present
FQDN (octet x+3 bit 3): (NOTE 2)
Bit
3
0 FQDN is not present
1 FQDN is present
IPv4 address list (octet x+4 to octet o160)
IPv4 address list contains the IPv4 address(es) of the SLPKMF and shall be encoded as defined in figure 12.2.20.
IPv6 address list (octet x10+1 to octet x10)
IPv6 address list contains the IPv6 address(es) of the SLPKMF and shall be encoded as defined in figure 12.2.21.
FQDN (octet x10+1 to l)
FQDN field contains a sequence of one octet FQDN length field and an FQDN value of variable size. The FQDN value field shall be encoded as defined in clause 28.3.2.1 in 3GPP TS 23.003 [18].
NOTE 1: If multiple IPv4 addresses and/or IPv6 addresses are included, which one of these addresses is selected is implementation dependent.
NOTE 2: If the SLPKMF supports the SLPKMF Services with "https" URI scheme (i.e. use of TLS is mandatory), then the FQDN shall be used to construct the target URI.

13 List of system parameters

13.1 Overview

The description of timers in the following tables should be considered a brief summary. The precise details are found in clauses 4 to 8, which should be considered the definitive descriptions.

13.2 Timers of provisioning of parameters for ranging and sidelink positioning configuration procedures

Timers of provisioning of parameters for ranging and sidelink positioning configuration are shown in table 13.2.1.

NOTE: Timer T5040 is defined in 3GPP TS 24.587 [4].

Table 13.2.1: Timers of provisioning of parameters for ranging and sidelink positioning configuration – UE side

TIMER NUM.	TIMER VALUE	CAUSE OF START	NORMAL STOP	ON EXPIRY
T5151	Validity timer value for UE policies for ranging and sidelink positioning over PC5 (see clause 5.2).	Start using the new UE policies for ranging and sidelink positioning over PC5 received in MANAGE UE POLICY COMMAND message	Stop using the old UE policies for ranging and sidelink positioning over PC5	Initiate the UE-requested RSLPP provisioning procedure (NOTE)
NOTE: The timers expire only once.				

13.3 Timers for PC8* interface

Table 13.3.1: Timers for PC8* interface - UE side

TIMER NUM.	TIMER VALUE	CAUSE OF START	NORMAL STOP	ON EXPIRY
T5152	Expiration time of the Ranging and sidelink positioning discovery security parameters (see clause 8.2.1.2.2).	Reception of the 5G ProSe discovery security parameters for ranging and sidelink positioning.	Stop using the old 5G ProSe discovery security parameters for ranging and sidelink positioning.	Initiation of the ranging and sidelink positioning discovery key request procedure, requesting the 5G ProSe discovery security parameters for ranging and sidelink positioning.

3GPP

Annex A (informative): Change history

Change history							
Date	Meeting	TDoc	CR	R	Cat	Subject/Comment	New version
2023-04	CT1#141e	C1-232663				TS skeleton proposed by the rapporteur	0.0.0
2023-04	CT1#141e	C1-232639 C1-232665 C1-232783				Implementing the following p-CR agreed by CT1: C1-232639, C1-232665, C1-232783; and Editorial change from the rapporteur.	0.1.0
2023-05	CT1#142	C1-234000 C1-234011 C1-234207 C1-234208 C1-234209				Implementing the following p-CR agreed by CT1: C1-234000, C1-234011, C1-234207, C1-234208, C1-234209; and Editorial change from the rapporteur.	0.2.0
2023-08	CT1#143	C1-235869 C1-236094 C1-236095 C1-236101 C1-236102 C1-236348 C1-236367				Implementing the following p-CR agreed by CT1: C1-235869, C1-236094, C1-236095, C1-236101, C1-236102, C1- 236348, C1-236367; and Editorial change from the rapporteur.	0.3.0
2023-10	CT1#144	C1-237080 C1-238141 C1-238142 C1-238143 C1-238144 C1-238146 C1-238148 C1-238215 C1-238216				Implementing the following p-CR agreed by CT1: C1-237080, C1-238141, C1-238142, C1-238143, C1-238144, C1- 238146, C1-238148, C1-238215, C1-238216; and Editorial change from the rapporteur.	0.4.0
2023-11	CT1#145	C1-238572 C1-238574 C1-238710 C1-239449 C1-239451 C1-239452 C1-239453 C1-239456 C1-239457 C1-239458				Implementing the following p-CR agreed by CT1: C1-238572, C1-238574, C1-238710, C1-239449, C1-239451, C1- 239452, C1-239453, C1-239456, C1-239457, C1-239458; and Editorial change from the rapporteur.	0.5.0
2024-02	CT1#146e	C1-240104 C1-240322 C1-240341 C1-240342 C1-240367 C1-240369 C1-240370 C1-240371 C1-240372 C1-240373 C1-240374 C1-240400				Implementing the following p-CR agreed by CT1: C1-240104, C1-240322, C1-240341, C1-240342, C1-240367, C1- 240369, C1-240370, C1-240371, C1-240372, C1-240373, C1- 240374, C1-240400; and Editorial change from the rapporteur.	0.6.0
2024-03	CT1#147	C1-240697 C1-240698 C1-240703 C1-241522 C1-241523 C1-241578 C1-241579 C1-241583 C1-241584 C1-241586 C1-241587 C1-241606 C1-241607 C1-241637 C1-241639 C1-241611 C1-241624 C1-241580 C1-241588				Implementing the following p-CR agreed by CT1: C1-240697, C1-240698, C1-240703, C1-241522, C1-241523, C1- 241578, C1-241579, C1-241583, C1-241584, C1-241586, C1- 241587, C1-241606, C1-241607, C1-241637, C1-241639, C1- 241611, C1-241624, C1-241580, C1-241588; and Editorial change from the rapporteur.	1.0.0
2024-03	CT#103	CP-240232				Presentation to CT Plenary for information and approval	1.0.0
2024-03	CT#103					Approved in CT#103	18.0.0
2024-06	CT#103					Correction of the change history table. Other contents remain the same as version 18.0.0.	18.0.1
2024-06	CT#104	CP-241192	0010	-	F	Corrections to references	18.1.0
2024-06	CT#104	CP-241192	0026	-	F	Update timers used for rangingsl	18.1.0

2024-06	CT#104	CP-241192	0002	1	D	Fixing editorials in located UE selection	18.1.0
2024-06	CT#104	CP-241192	0024	1	F	Optional IEs description	18.1.0
2024-06	CT#104	CP-241192	0025	1	F	Update on PC5 messages	18.1.0
2024-06	CT#104	CP-241192	0011	1	F	Cleanup on provisioning of configuration information for 5G ProSe	18.1.0
2024-06	CT#104	CP-241192	0016	1	F	Sidelink positioning service reject	18.1.0
2024-06	CT#104	CP-241192	0013	1	F	Overview for ranging and sidelink positioning communication	18.1.0
2024-06	CT#104	CP-241192	0019	1	F	Resolve EN related to privacy check on UE side	18.1.0
2024-06	CT#104	CP-241192	0012	1	F	Ranging and sidelink positioning QoS parameters	18.1.0
2024-06	CT#104	CP-241192	0004	3	B	Resolving ENs related to SL reference UE selection	18.1.0
2024-06	CT#104	CP-241192	0014	2	F	Clarification on supplementary RSPP signaling procedures	18.1.0
2024-06	CT#104	CP-241192	0015	2	F	Corrections to supplementary RSPP signaling over PC5-U messages	18.1.0
2024-06	CT#104	CP-241192	0022	2	F	Update on ranging and sidelink positioning communication	18.1.0
2024-06	CT#104	CP-241192	0007	2	F	Corrections on IE coding of TS 24.514	18.1.0
2024-06	CT#104	CP-241192	0028	1	F	Update of abbreviation list	18.1.0
2024-06	CT#104	CP-241192	0029	1	F	Correction to the description on the discovered RPAUID	18.1.0
2024-06	CT#104	CP-241192	0030	1	F	Clarification on SL reference UE	18.1.0
2024-06	CT#104	CP-241192	0006	4	F	Resolution of ENs on UE selection	18.1.0
2024-06	CT#104	CP-241192	0032	3	F	Lack of description and use of the protocol architecture model for layer 3 for the protocols for ranging	18.1.0
2024-06	CT#104	CP-241192	0001	4	B	Sidelink positioning privacy check procedure	18.1.0
2024-06	CT#104	CP-241192	0031	1	F	Message definition and information elements coding for rangingsl discovery key request procedure	18.1.0
2024-06	CT#104	CP-241192	0023	2	F	Editorial corrections and alignments	18.1.0
2024-09	CT#105	CP-242193	0043	1	F	Update on message definition and PC5-U message type definition	18.2.0
2024-09	CT#105	CP-242193	0041	1	F	Aligning the extended PC5 signalling protocol for ranging and sidelink positioning usage across the specifications	18.2.0
2024-09	CT#105	CP-242193	0039	1	F	Correction to references	18.2.0
2024-09	CT#105	CP-242193	0047	1	F	Clarification on maximum number of devices in SLPP messages	18.2.0

History

Document history		
V18.0.1	June 2024	Publication
V18.1.0	August 2024	Publication
V18.2.0	October 2024	Publication