

ETSI TS 138 212 V18.6.0 (2025-04)



**5G;
NR;
Multiplexing and channel coding
(3GPP TS 38.212 version 18.6.0 Release 18)**

[ETSI TS 138 212 V18.6.0 \(2025-04\)](https://standards.iteh.ai/catalog/standards/etsi/9a25ae5c-e440-4771-9e74-b29e8cf30146/etsi-ts-138-212-v18-6-0-2025-04)

<https://standards.iteh.ai/catalog/standards/etsi/9a25ae5c-e440-4771-9e74-b29e8cf30146/etsi-ts-138-212-v18-6-0-2025-04>



ReferenceRTS/TSGR-0138212vi60

Keywords5G

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 repository](#).

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 2025.
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 IPR online database](#).

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™**, **LTE™** and **5G™** logo 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 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. (2025-04)

The cross reference between 3GPP and ETSI identities can be found at [3GPP to ETSI numbering cross-referencing](#).

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.....	6
1 Scope	8
2 References	8
3 Definitions of terms, symbols and abbreviations	8
3.1 Terms.....	8
3.2 Symbols.....	8
3.3 Abbreviations	9
4 Mapping to physical channels	10
4.1 Uplink.....	10
4.2 Downlink.....	10
4.3 Sidelink	10
5 General procedures.....	11
5.1 CRC calculation	11
5.2 Code block segmentation and code block CRC attachment	12
5.2.1 Polar coding.....	12
5.2.2 Low density parity check coding	12
5.3 Channel coding.....	14
5.3.1 Polar coding.....	15
5.3.1.1 Interleaving	15
5.3.1.2 Polar encoding.....	16
5.3.2 Low density parity check coding	19
5.3.3 Channel coding of small block lengths	24
5.3.3.1 Encoding of 1-bit information.....	24
5.3.3.2 Encoding of 2-bit information.....	24
5.3.3.3 Encoding of other small block lengths	25
5.4 Rate matching.....	26
5.4.1 Rate matching for Polar code.....	26
5.4.1.1 Sub-block interleaving	26
5.4.1.2 Bit selection.....	27
5.4.1.3 Interleaving of coded bits.....	27
5.4.2 Rate matching for LDPC code.....	28
5.4.2.1 Bit selection.....	28
5.4.2.2 Bit interleaving.....	32
5.4.3 Rate matching for channel coding of small block lengths	32
5.5 Code block concatenation	32
6 Uplink transport channels and control information.....	33
6.1 Random access channel.....	33
6.2 Uplink shared channel	33
6.2.1 Transport block CRC attachment.....	33
6.2.2 LDPC base graph selection.....	33
6.2.3 Code block segmentation and code block CRC attachment	33
6.2.4 Channel coding of UL-SCH.....	34
6.2.5 Rate matching	34
6.2.6 Code block concatenation.....	34
6.2.7 Data and control multiplexing	35
6.3 Uplink control information.....	46
6.3.1 Uplink control information on PUCCH.....	46
6.3.1.1 UCI bit sequence generation	46
6.3.1.1.1 HARQ-ACK/SR only.....	46

6.3.1.1.2	CSI only.....	46
6.3.1.1.3	HARQ-ACK/SR and CSI	64
6.3.1.1.4	UCI with different priority indexes	65
6.3.1.2	Code block segmentation and CRC attachment	65
6.3.1.2.1	UCI encoded by Polar code	65
6.3.1.2.2	UCI encoded by channel coding of small block lengths.....	66
6.3.1.3	Channel coding of UCI	66
6.3.1.3.1	UCI encoded by Polar code.....	66
6.3.1.3.2	UCI encoded by channel coding of small block lengths.....	66
6.3.1.4	Rate matching	66
6.3.1.4.1	UCI encoded by Polar code.....	66
6.3.1.4.2	UCI encoded by channel coding of small block lengths.....	67
6.3.1.4.3	UCI with different priority indexes encoded by Polar code	68
6.3.1.4.4	UCI with different priority indexes encoded by channel coding of small block lengths.....	68
6.3.1.5	Code block concatenation	69
6.3.1.6	Multiplexing of coded UCI bits to PUCCH	69
6.3.2	Uplink control information on PUSCH	71
6.3.2.1	UCI bit sequence generation	72
6.3.2.1.1	HARQ-ACK.....	72
6.3.2.1.2	CSI.....	72
6.3.2.1.3	CG-UCI	94
6.3.2.1.3A	UTO-UCI.....	95
6.3.2.1.4	HARQ-ACK and CG-UCI/UTO-UCI	95
6.3.2.1.5	UCI with different priority indexes	96
6.3.2.2	Code block segmentation and CRC attachment	98
6.3.2.2.1	UCI encoded by Polar code.....	98
6.3.2.2.2	UCI encoded by channel coding of small block lengths.....	98
6.3.2.3	Channel coding of UCI	98
6.3.2.3.1	UCI encoded by Polar code.....	98
6.3.2.3.2	UCI encoded by channel coding of small block lengths.....	98
6.3.2.4	Rate matching	98
6.3.2.4.1	UCI encoded by Polar code.....	98
6.3.2.4.2	UCI encoded by channel coding of small block lengths.....	112
6.3.2.5	Code block concatenation	115
6.3.2.6	Multiplexing of coded UCI bits to PUSCH.....	115
6.3.2.7	Multiplexing of coded UCI bits with different priority indexes to PUSCH.....	115
7	Downlink transport channels and control information.....	116
7.1	Broadcast channel.....	116
7.1.1	PBCH payload generation	116
7.1.2	Scrambling	117
7.1.3	Transport block CRC attachment.....	118
7.1.4	Channel coding	118
7.1.5	Rate matching	119
7.2	Downlink shared channel and paging channel	119
7.2.1	Transport block CRC attachment.....	119
7.2.2	LDPC base graph selection.....	119
7.2.3	Code block segmentation and code block CRC attachment	119
7.2.4	Channel coding	119
7.2.5	Rate matching	120
7.2.6	Code block concatenation.....	120
7.3	Downlink control information.....	120
7.3.1	DCI formats	120
7.3.1.0	DCI size alignment.....	122
7.3.1.0.1	DCI size alignment for DCI formats for scheduling of sidelink.....	125
7.3.1.1	DCI formats for scheduling of PUSCH.....	125
7.3.1.1.1	Format 0_0	125
7.3.1.1.2	Format 0_1	129
7.3.1.1.3	Format 0_2	199
7.3.1.1.4	Format 0_3	213
7.3.1.2	DCI formats for scheduling of PDSCH.....	223
7.3.1.2.1	Format 1_0	223

7.3.1.2.2	Format 1_1	227
7.3.1.2.3	Format 1_2	254
7.3.1.2.4	Format 1_3	259
7.3.1.3	DCI formats for other purposes.....	268
7.3.1.3.1	Format 2_0	268
7.3.1.3.2	Format 2_1	268
7.3.1.3.3	Format 2_2	268
7.3.1.3.4	Format 2_3	269
7.3.1.3.5	Format 2_4	270
7.3.1.3.6	Format 2_5	270
7.3.1.3.7	Format 2_6	270
7.3.1.3.8	Format 2_7	270
7.3.1.3.9	Format 2_8	271
7.3.1.3.10	Format 2_9	271
7.3.1.4	DCI formats for scheduling of sidelink.....	272
7.3.1.4.1	Format 3_0	272
7.3.1.4.2	Format 3_1	273
7.3.1.4.3	Format 3_2	273
7.3.1.5	DCI formats for scheduling of MBS	274
7.3.1.5.1	Format 4_0	274
7.3.1.5.2	Format 4_1	274
7.3.1.5.3	Format 4_2	275
7.3.2	CRC attachment.....	277
7.3.3	Channel coding	277
7.3.4	Rate matching	277
8	Sidelink transport channels and control information.....	277
8.1	Sidelink broadcast channel	277
8.1.1	Void	278
8.2	Sidelink shared channel	278
8.2.1	Data and control multiplexing	278
8.3	Sidelink control information on PSCCH.....	279
8.3.1	1 st -stage SCI formats.....	279
8.3.1.1	SCI format 1-A.....	279
8.3.1.2	SCI format 1-B.....	281
8.3.2	CRC attachment.....	282
8.3.3	Channel coding	282
8.3.4	Rate Matching.....	282
8.4	Sidelink control information on PSSCH	282
8.4.1	2 nd -stage SCI formats.....	282
8.4.1.1	SCI format 2-A.....	282
8.4.1.2	SCI format 2-B.....	283
8.4.1.3	SCI format 2-C.....	284
8.4.1.4	SCI format 2-D.....	285
8.4.2	CRC attachment.....	286
8.4.3	Channel coding	286
8.4.4	Rate Matching.....	286
8.4.5	Multiplexing of coded 2 nd -stage SCI bits to PSSCH.....	287
Annex A (informative):	Change history	288
History		295

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