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Foreword

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1 Scope

The present document is a technical specification of the services provided by the physical layer of 5G-NR to upper layers.

2 References

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

[1]	3GPP TR 21.905: "Vocabulary for 3GPP Specifications"
[2]	3GPP TS 38.201: "NR; Physical Layer - General Description"
[3]	3GPP TS 38.211: "NR; Physical channels and modulation"
[4]	3GPP TS 38.212: "NR; Multiplexing and channel coding"
[5]	3GPP TS 38.213: "NR; Physical layer procedures for control"
[6]	3GPP TS 38.214: "NR; Physical layer procedures for data"
[7]	3GPP TS 38.215: "NR; Physical layer measurements"
[8]	3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 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 TR 21.905 [1].

3.2 Symbols

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

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 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 TR 21.905 [1].

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

ARQ	Automatic Repeat Request
BCH	Broadcast Channel
CA	Carrier Aggregation
CRC	Cyclic Redundancy Check
DC	Dual Connectivity
DL	Downlink
FEC	Forward Error Correction
GF	Grant-Free
MAC	Medium Access Control

MIMO	Multiple Input Multiple Output
PBCH	Physical Broadcast Channel

PCH Paging Channel

PDCCH Physical Downlink Control Channel
PDSCH Physical Downlink Shared Channel
PRACH Physical Random Access Channel
PUCCH Physical Uplink Control Channel
PUSCH Physical Uplink Shared Channel

RACH Random Access Channel

RF Radio Frequency

RNTI Radio Network Temporary Identifier

SCH Shared Channel
SI System Information
SPS Semi-Persistent Scheduling
SRS Sounding Reference Signal
TPC Transmit Power Control

UL Uplink

4 Services and functions of the physical layer

4.1 General

The physical layer offers data transport services to higher layers.

The access to these services is through the use of transport channels via the MAC sub-layer.

A transport block is defined as the data delivered by MAC layer to the physical layer and vice versa.

4.2 Overview of L1 functions

As mentioned in [2, TS 38.201], the physical layer is expected to perform the following functions to provide the data transport service:

- Error detection on the transport channel and indication to higher layers;
- FEC encoding/decoding of the transport channel;
- Hybrid ARQ soft-combining;
- Rate matching of the coded transport channel to physical channels;
- Mapping of the coded transport channel onto physical channels;
- Power weighting of physical channels;
- Modulation and demodulation of physical channels;
- Frequency and time synchronisation;
- Radio characteristics measurements and indication to higher layers;
- Multiple Input Multiple Output (MIMO) antenna processing;
- RF processing.

L1 functions are modelled for each transport channel in clause 5.

5 Model of physical layer of the UE

The 5G-NR physical-layer model captures those characteristics of the 5G-NR physical-layer that are relevant from the point-of-view of higher layers. More specifically, the physical-layer model captures:

- The structure of higher-layer data being passed down to or up from the physical layer;
- The means by which higher layers can configure the physical layer;
- The different indications (error indications, channel-quality indications, etc.) that are provided by the physical layer to higher layers.

5.1 Uplink model

5.1.1 Uplink shared channel

The physical-layer model for Uplink Shared Channel transmission is described based on the corresponding PUSCH physical-layer-processing chain, see Figure 5.1.1-1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue.

- Higher-layer data passed to/from the physical layer
- CRC and transport-block-error indication
- FEC and rate matching
- Data modulation
- Mapping to physical resource
- Multi-antenna processing
- Support of L1 control and Hybrid-ARQ-related signalling

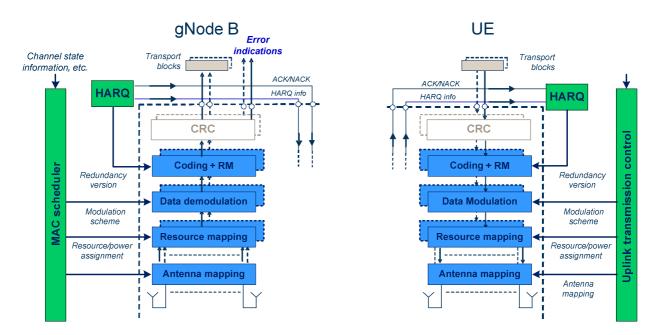


Figure 5.1.1-1: Physical-layer model for UL-SCH transmission

5.1.2 Random access channel

The physical-layer model for RACH transmission is characterized by a PRACH preamble format that consists of a cyclic prefix, a preamble, and a guard time during which nothing is transmitted.

5.2 Downlink model

5.2.1 Downlink shared channel

The physical-layer model for Downlink Shared Channel transmission is described based on the corresponding PDSCH physical-layer-processing chain, see Figure 5.2.1-1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue.

- Higher-layer data passed to/from the physical layer;
- CRC and transport-block-error indication;
- FEC and rate matching;
- Data modulation;
- Mapping to physical resource;
- Multi-antenna processing;
- Support of L1 control and Hybrid-ARQ-related signalling.

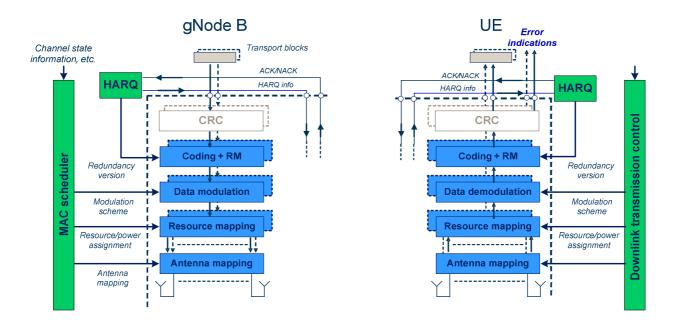


Figure 5.2.1-1: Physical-layer model for DL-SCH transmission

5.2.2 Broadcast channel

The physical-layer model for BCH transmission is characterized by a fixed pre-defined transport format. There is one transport block for the BCH every 80ms. The BCH physical-layer model is described based on the corresponding PBCH physical-layer-processing chain, see Figure 5.2.2-1:

- Higher-layer data passed to/from the physical layer;
- CRC and transport-block-error indication;
- FEC and rate matching;
- Data modulation;
- Mapping to physical resource;
- Multi-antenna processing.

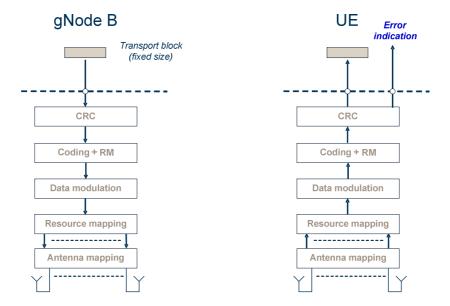


Figure 5.2.2-1: Physical-layer model for BCH transmission

5.2.3 Paging channel

The physical-layer model for PCH transmission is described based on the corresponding physical-layer-processing chain, see Figure 5.2.3-1. The PCH is carried on PDSCH. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue.

- Higher-layer data passed to/from the physical layer;
- CRC and transport-block-error indication;
- FEC and rate matching;
- Data modulation;
- Mapping to physical resource;
- Multi-antenna processing.

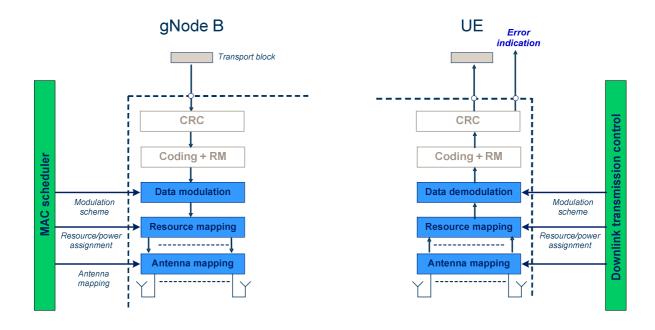


Figure 5.2.3-1: Physical-layer model for PCH transmission

5.3 Sidelink model

5.3.1 Sidelink shared channel

The physical-layer model for Sidelink Shared Channel transmission is described based on the corresponding SL-SCH physical-layer-processing chain, see Figure 5.3.1-1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue.

- Higher-layer data passed to/from the physical layer;
- CRC and transport-block-error indication;
- FEC and rate matching;
- Data modulation;
- Mapping to physical resource;
- Multi-antenna processing;
- Support of L1 control and Hybrid-ARQ-related signalling.

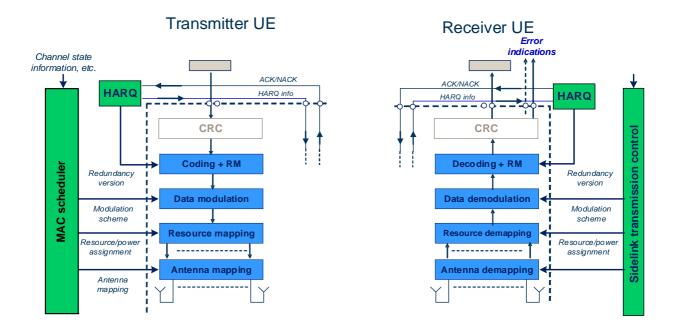


Figure 5.3.1-1: Physical-layer model for SL-SCH transmission

5.3.2 Broadcast channel

The physical-layer model for Sidelink Broadcast Channel transmission is characterized by a fixed pre-defined transport format. There is one transport block for every slot in which the UE transmits SL-BCH, if the UE is configured to transmit on SL-BCH. The SL-BCH physical-layer model is described based on the corresponding SL-BCH physical-layer-processing chain, see Figure 5.3.2-1:

- Higher-layer data passed to/from the physical layer;
- CRC and transport-block-error indication;
- FEC and rate matching;
- Data modulation;
- Mapping to physical resource;
- Multi-antenna processing.

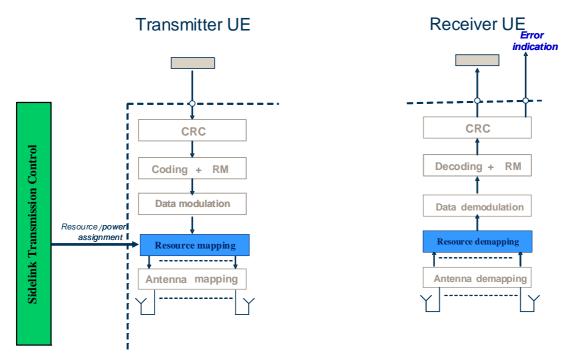


Figure 5.3.2-1: Physical-layer model for SL-BCH transmission

6 Simultaneous transmission and reception of physical channels and physical signals

This clause describes the requirements from the UE to send and receive multiple physical channels and physical signals simultaneously depending on the capabilities and service requirements. The following notation is used between both the uplink and downlink clauses below.

- p is the number of uplink carriers configured for the UE on which physical channels can be transmitted
- p' is the number of uplink carriers configured for the UE on which SRS can be transmitted
- q is the number of downlink carriers configured for the UE
- *j* is the number of cell groups configured for the UE.
- *k* is the number of PUCCH groups configured for the UE.

6.1 Uplink

The tables 6.1-1 and 6.1-2 describe the possible combinations of physical channels and SRS that can be sent in simultaneously in the uplink by one UE. Table 6.1-1 introduces notation for a "Transmission Type" which represents a physical channel or sounding reference signal, and any associated transport channel. Table 6.1-2 describes the combinations of these "Transmission Types" which are supported by the UE depending on capabilities [8, TS 38.306], and enumerates how many of each can be transmitted simultaneously.

Table 6.1-1: Uplink "Transmission Types"

"Transmission Type"	Physical Channel or SRS	Associated Transport Channel	Comment
турс		Transport Onamici	
Α	PRACH	RACH	Note 1, Note 3
В	PUCCH	N/A	
С	PUSCH	UL-SCH	Note 2, Note 3
D	SRS	N/A	
Note 1: RACH corresponds to contention based. Note 2: UCI on PUSCH without UL-SCH is possible.			

Table 6.1-2: Uplink "Transmission Type" combinations

Supported Combinations	Comment
j x A	Note 1
k x B	Note 2
pxC	Note 3, Note 4
ρ'x D	Note 3, Note 5
$\tilde{\jmath} \times A + \tilde{k} \times B$	Note 6
$\tilde{\jmath} \times A + \tilde{p} \times C$	Note 6
$\tilde{\jmath} \times A + \tilde{p}' \times D$	Note 6
$\hat{k} \times B + \hat{p} \times C$	Note 8
$B + \hat{p}' \times C$	Note 9
$\tilde{k} \times B + \tilde{p}' \times D$	Note 7
$\tilde{p} \times C + \tilde{p}' \times D$	Note 7

- Note 1: The number of cell groups *j* in the supported combination is subject to UE capability.
- Note 2: The number of PUCCH groups k in the supported combination is subject to UE capability.
- Note 3: The number of carriers p, and p' in the supported combinations are subject to UE capability.
- Note 4: In the case there is one SUL carrier, then *p*-1 would be supported.

Note 3: For SCell, MsgA PRACH and MsgA PUSCH is not supported.

- Note 5: UE may be configured with p' but may also have capability to simultaneously sound less than this number.
- Note 6: Simultaneous PRACH with PUCCH (or PUSCH or SRS) is supported only in the case of inter-band CA, with $\tilde{\jmath} \leq j$, $\tilde{k} \leq k$, $\tilde{p} \leq p$, and $\tilde{p}' \leq p'$ depending on the configuration, and subject to UE capability for parallel transmission.
- Note 7: Simultaneous SRS with PUCCH (or PUSCH) is supported only in the case of inter-band CA, with $\tilde{k} \leq k$, $\tilde{p} \leq p$, and $\tilde{p}' \leq p'$ depending on the configuration, and subject to UE capability for parallel transmission.
- Note 8: Simultaneous PUCCH and PUSCH(s) for the case that multiple PUCCH groups are configured and the respective PUCCH and PUSCH(s) are transmitted in the different PUCCH groups, with $\hat{k} < k$ and $\hat{p} \le p$. k and p are subject to UE capability for supported number of PUCCH groups and UL carriers, respectively. \hat{k} and \hat{p} depend on configuration.
- Note 9: Simultaneous PUCCH and PUSCH(s) within the same PUCCH group in the case of inter-band CA, \hat{p}' depending on the configuration, and subject to UE capability for parallel transmission of PUCCH and PUSCH within the same PUCCH group.

6.2 Downlink

The tables 6.2-1, 6.2-2 describe the possible combinations of physical channels that can be received simultaneously in the downlink by one UE. Table 6.2-1 introduces notation for a "Reception Type" which represents a physical channel and any associated transport channel. Table 6.2-2 describes the combinations of these "Reception Types" which are supported by the UE depending on capabilities [8, TS 38.306], and enumerates how many of each can be received simultaneously. The UE shall be able to receive all TBs according to the indication on PDCCH. Any subset of the combinations specified in table 6.2-2 is also supported.

Table 6.2-1: Downlink "Reception Types"

B F CO F C1 F D0 F D1 F D2 F D3 F	PBCH PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH PDCCH PDCCH PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH PDCCH	N/A SI-RNTI P-RNTI P-RNTI RA-RNTI or Temporary C- RNTI or MsgB-RNTI C-RNTI, CS-RNTI, MCS-C- RNTI C-RNTI, CS-RNTI, MCS-C- RNTI G-RNTI, G-CS-RNTI G-CS-RNTI	BCH DL-SCH N/A PCH DL-SCH DL-SCH DL-SCH DL-SCH	Note 1 Note 1, Note 2 Note 1 Note 3
C0 F C1 F D0 F D1 F D2 F D3 F	PDCCH PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH PDCCH PDCCH PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH	P-RNTI P-RNTI RA-RNTI or Temporary C- RNTI or MsgB-RNTI C-RNTI, CS-RNTI, MCS-C- RNTI C-RNTI, CS-RNTI, MCS-C- RNTI G-RNTI, G-CS-RNTI G-CS-RNTI	N/A PCH DL-SCH DL-SCH DL-SCH	Note 1, Note 2 Note 1 Note 3
C1 F D0 F D1 F D2 F D3 F	PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH PDCCH PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH	P-RNTI RA-RNTI or Temporary C- RNTI or MsgB-RNTI C-RNTI, CS-RNTI, MCS-C- RNTI C-RNTI, CS-RNTI, MCS-C- RNTI G-RNTI, G-CS-RNTI G-CS-RNTI	PCH DL-SCH DL-SCH DL-SCH	Note 1 Note 3
D0 F D1 F D2 F D3 F	PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH PDCCH+PDSCH	RA-RNTI or Temporary C-RNTI or MsgB-RNTI C-RNTI, CS-RNTI, MCS-C-RNTI C-RNTI, CS-RNTI, MCS-C-RNTI G-RNTI, G-CS-RNTI G-CS-RNTI	DL-SCH DL-SCH DL-SCH	Note 3
D1 F D2 F D3 F	PDCCH+PDSCH PDCCH PDCCH+PDSCH PDCCH PDCCH+PDSCH	RNTI or MsgB-RNTI C-RNTI, CS-RNTI, MCS-C-RNTI C-RNTI, CS-RNTI, MCS-C-RNTI G-RNTI, G-CS-RNTI G-CS-RNTI	DL-SCH DL-SCH	
D2 F	PDCCH PDCCH+PDSCH PDCCH PDCCH+PDSCH	RNTI C-RNTI, CS-RNTI, MCS-C- RNTI G-RNTI, G-CS-RNTI G-CS-RNTI	DL-SCH	Note C
D3 F	PDCCH+PDSCH PDCCH PDCCH+PDSCH	RNTI G-RNTI, G-CS-RNTI G-CS-RNTI		Note 6
	PDCCH PDCCH+PDSCH	G-CS-RNTI	DL-SCH	Note C
D4 I F	PDCCH+PDSCH			
		MACCHI DALITI	N/A	Note 7
		MCCH-RNTI	DL-SCH	Note 8
	PDCCH+PDSCH	G-RNTI	DL-SCH	Note 9
E F	PDCCH	C-RNTI	N/A	Note 4
F0 F	PDCCH	Temporary C-RNTI	UL-SCH	Note 3
F1 F	PDCCH	C-RNTI, CS-RNTI, MCS-C- RNTI	UL-SCH	
G F	PDCCH	SFI-RNTI	N/A	
H F	PDCCH	INT-RNTI	N/A	
JO F	PDCCH	TPC-PUSCH-RNTI	N/A	
J1 F	PDCCH	TPC-PUCCH-RNTI	N/A	
J2 F	PDCCH	TPC-SRS-RNTI	N/A	
K F	PDCCH	SP-CSI-RNTI	N/A	
L0 F	PDCCH	SL-RNTI	SL-SCH	
L1 F	PDCCH	SL-CS-RNTI	SL-SCH	
M F	PDCCH	SL Semi-Persistent Scheduling V-RNTI	SL-SCH	Note 5
N F	PDCCH	PS-RNTI	N/A	
O F	PDCCH	AI-RNTI	N/A	
P F	PDCCH	CI-RNTI	N/A	
<u>Q</u> <u>F</u>	PDCCH	PEI-RNTI	N/A	Note 1

Note 1: These are received from PCell only.

Note 2: In some cases UE is only required to monitor the short message within the DCI for P-RNTI.

Note 3: These are received from PCell or PSCell.

Note 4: This corresponds to PDCCH-ordered PRACH.

Note 5: This corresponds to PDCCH scheduling LTE PC5.

Note 6: This is for multicast in RRC connected state.

Note 7: This corresponds to DL Semi-Persistent Scheduling release for multicast in RRC connected state.

Note 8: This is for broadcast MCCH.

Note 9: This is for broadcast MTCH. UE is not required to decode more than one PDSCH for MTCH simultaneously.

Table 6.2-2: Downlink "Reception Type" combinations

	Sı	upported Combinations		Comment
PCell		PSCell	SCell	
1. RRC_IDLE	1			
1.1 All UEs				
A + (B and/or (C1 D0) + F				Note 1
1.2 UEs supporting	MBS broadcast red	ception		
A+	D5			
2. RRC_INACTIVE				•
2.1 All UEs				
A + (B and/or (C1 D0) + F				Note 1
2.2 UEs supporting	MBS broadcast red	ception		
A+	D5			
3. RRC_CONNECT	ED	•		
(A + C0 + (B and/or (D0 or (m1*D1+m2*D2+m3*D3+m4*D4))) + E + F0 + n*F1 + G + H + J0 + J1 + J2 + K + O + L0 + L1 + M + N + P)		(A + (D0 or (m1*D1+m2*D2)) + E + F0 + n*F1 + G + H + J0 + J1 + J2 + K + O + N + P)	m1*D1 + m2*D2 + (m3*D3+m4*D4) + E + n*F1 + G + H + J0 + J1 + J2 + K + O + L0 + L1 + M + P	Note 2, Note 3, Note 4, Note 5, Note 6, Note 7, Note 8, Note 9, Note 10
Note 2: For PCell Note 3: Supporte group TP Note 4: The value Note 5: Support of to UE cap Note 6: The value Note 7: In Active Note 8: The PDC Note 9: For a UE and appli Note 10: For a UE	are received is up, UE is not required combinations are C commands, preses of m2 ≥ 0 and not formation and the combility. The commands of monitoring PDC combility. The commands of m1 ≥ 1 in the commands of m2 in the commands of m1 ≥ 1 in the command	to UE implementation. Indicate to decode SI-RNTI PDSCH size subject to UE capabilities for contemption indication and dynamic ≥ 0 in the supported combination CH with SL-RNTI, SL-CS-RNTI, supported combinations are subsequented to monitor the DCI form PS-RNTI can only be configure multicast reception, the values of nected UEs. If m3 = 1, then m1	ons are subject to the UE capabing SL Semi-Persistent Scheduling object to the UE capability. The properties of the PDCCH scrambled by the properties of the PCell and PSCell. If $1 \ge m3 \ge 0$ and $m4 \ge 0$ are subsequents.	CH, unless in FR1. ation, receiving of lity. V-RNTI are subject y PS-RNTI. ject to UE capability

6.3 Sidelink

The tables 6.3-1 and 6.3-2 describe the possible combinations of physical channels that can be sent simultaneously in the sidelink by a UE. Table 6.3-1 introduces notation for a sidelink "Transmission Type" which represents a physical channel, and any associated transport channel. Table 6.3-2 describes the combinations of these "Transmission Types" which are supported by the UE depending on capabilities [8, TS 38.306], and enumerates how many of each can be transmitted simultaneously.

Table 6.3-1: Sidelink "Transmission Types"

"Transmission Type"	Physical Channel	Associated Transport Channel	Comment
Α	PSBCH	SL-BCH	
В	PSSCH	SL-SCH	
С	PSCCH	SL-SCH	
D	PSFCH	N/A	

Table 6.3-2: Sidelink "Transmission Type" combinations

	Supported Combinations	Comment
	А	
	В	
	С	
	$N \times D$	
	B+C	
Note:	Depending on the UE capability, the UE may be able to perform simultaneous Uplinitransmissions. If the simultaneous transmission of Sidelink and Uplink is beyond the prioritized can be dropped according to [TS 38.321.	

The tables 6.3-3 and 6.3-4 describe the possible combinations of physical channels that can be received simultaneously in the sidelink by a UE. Table 6.3-3 introduces notation for a sidelink "Reception Type" which represents a physical channel, and any associated transport channel. Table 6.3-4 describes the combinations of these "Transmission Types" which are supported by the UE depending on capabilities [8, TS 38.306], and enumerates how many of each can be received simultaneously.

Table 6.3-3: Sidelink "Reception Types"

"Transmission Type"	Physical Channel	Associated Transport Channel	Comment
Α	PSBCH	SL-BCH	
В	PSSCH	SL-SCH	
С	PSCCH	SL-SCH	
D	PSFCH	N/A	

Table 6.3-4: Sidelink "Reception Type" combinations

Supported Combinations	Comment
A	
В	Note 1
С	Note 1
$M \times D$	
B+C	Note 1
Note 1: Corresponds to simultaneous reception within one sub-channel	

7 Measurements provided by the physical layer

7.1 UE measurements

The list and detailed definition of UE measurements is provided in [7, TS 38.215].

Annex A (informative): Change history

Date Meeting TDoc CR Rev Cat Subject/Comment		Change history									
2017-07 AH, 1706 R1-1712013 Update for agreements from meetings up to RAN1 NR AH2	New	Subject/Comment	Cat	Rev	CR	TDoc	Meeting	Date			
2017-07 AH. 1706 R1-1712013 Update for agreements from meetings up to RAN1 NR AH2 2017-08 RAN1#90 R1-1714655 Update for agreements from meetings up to RAN1 NR AH2 2017-09 RAN1#90 R1-1714655 Update with change marks removed for RAN1 #90 endorsement 2017-09 RAN1#90 R1-1715320 Updated with minor editorial changes for review after RAN1 #90 2017-10 RAN1#90b R1-1719209 Updated with minor editorial changes for review after RAN1 #90 2017-11 RAN1#90b R1-1721047 Updated for agreements from meetings up to RAN1 #90 2017-12 RAN1#91 R1-1721047 Updated for agreements from meetings up to RAN1 #90 2017-12 RAN1#91 R1-1721340 Updated after email discussion 2017-12 RAN1#91 R1-1721340 Updated or agreements from RAN1 #91 2017-12 RAN1#98 RP-172530 Lendorsed version for approval by plenary 2017-12 RAN1#98 RP-172630 Lendorsed version for approval by plenary 2018-03 RAN1#91 R1-1721340 Lendorsed version for approval by plenary 2017-12 RAN1#80 RP-181257	version										
2017-08	0.0.0		<u> </u>								
2017-08 RAN1#90 R1-1714655 Update with change marks removed for RAN1 #90 endorsement 2017-09 RAN1#90 R1-1715320 Updated with minor editorial changes for review after RAN1 #90 P17-100 RAN1#90 R1-1719209 For information to plenary 2017-10 RAN1#90 R1-1719229 Updated for agreements from meetings up to RAN1 #90 R1-1719229 Updated for agreements from meetings up to RAN1 #90 R1-1719229 Updated for agreements from RAN1 #90 R1-1719229 Updated for agreements from RAN1 #91 R1-1721047 Updated for agreements from RAN1 #91 R1-1721340 Updated to reflect agreements from RAN1 #91 R1-1721340 Endorsed version for approval by plenary Approved by plenary - Rel-15 spec under change control agreements	0.0.1		<u> </u>	ļ							
2017-09 RAN#90 R-1-1715220	0.0.2		<u> </u>	ļ							
2017-10 RAN#77 RP-172006 For information to plenary 2017-11 RAN1#90 R1-1719229 Updated for agreements from meetings up to RAN1 #90b 2017-11 RAN1#91 R1-1721047 Updated after email discussion 2017-12 RAN1#91 R1-1721047 Updated of reflect agreements from RAN1 #91 R1-1721040 Updated version for approval by plenary 2017-12 RAN#78 RP-172630 Endorsed version for approval by plenary 2017-12 RAN#78 RP-180200 Double version for approval by plenary R1-15 spec under change control CR capturing the Jan18 ad-hoc and RAN1#92 meeting agreements 2018-06 RAN#80 RP-181172 DOUBLE RAN#80 RP-181172 DOUBLE RAN#80 RP-181257 DOUBLE RAN#80 RP-181257 DOUBLE RAN#80 RP-181257 DOUBLE RAN#80 RP-181259 DOUBLE RAN#80 RP-191277 DOUBLE RAN#80 RP-191277 DOUBLE RAN#80 RP-191277 DOUBLE RAN#80 RP-192630 DOUBLE RAN#80 RP-192641 DOUBLE RAN#80 RP-201800 DOUBLE RAN			<u> </u>	ļ							
Updated for agreements from meetings up to RAN1 #90b	0.1.1										
2017-12 RAN1#91 R1-1721047 Updated after email discussion	1.0.0		<u> </u>	ļ							
Description	1.0.1	Updated for agreements from meetings up to RAN1 #90b	<u> </u>		<u> </u>						
Endorsed version for approval by plenary 2017-12 RAN#78 RP-180200 0001 - F CR capturing the Jan18 ad-hoc and RAN1#92 meeting agreements 2018-06 RAN#80 RP-181172 0002 1 F CR to 38.202 capturing the RAN1#92bis and RAN1#93 meeting agreements 2018-06 RAN#80 RP-181185 0003 - B CR to 38.202 capturing the RAN1#92bis and RAN1#93 meeting agreements 2018-09 RAN#81 RP-181189 0004 - B CR to 38.202 capturing RAN1#94 meeting agreements 2018-09 RAN#81 RP-181257 0005 - F CR to 38.202 capturing RAN1#94 meeting agreements 2019-06 RAN#84 RP-191277 0006 - F CR to 38.202 capturing RAN1#95 meeting agreements 2019-06 RAN#84 RP-191277 0006 - F Correction to simultaneous reception of DL Channels 2019-12 RAN#86 RP-192633 0009 - B Introduction of two-step RACH 2019-12 RAN#86 RP-192635 0009 - B Introduction of two-step RACH 2019-12 RAN#86 RP-192639 0011 - B Introduction of MIMO enhancements for URLLC 2019-12 RAN#86 RP-192639 0012 - B Introduction of MIMO enhancements 2019-12 RAN#86 RP-192639 0012 - B Introduction of UP Power Savings 2019-12 RAN#86 RP-192641 0013 - B Introduction of UP Power Savings 2020-09 RAN#89-e RP-201810 0017 - F Corrections to MIMO enhancements 2020-09 RAN#89-e RP-201807 0018 - F Corrections to MIMO enhancements 2020-09 RAN#89-e RP-201807 0018 - F Corrections of SV2X sidelink features 2021-12 RAN#94-e RP-212968 0020 - B Introduction of Introduction of militorial captures 2021-12 RAN#94-e RP-212968 0020 - B Introduction of multicast and broadcast services 2021-12 RAN#94-e RP-212968 0020 - B Introduction of multicast and broadcast services 2021-12 RAN#94-e RP-212969 0019 - F Alignment CR for TS 38.202 2021-12 RAN#94-e RP-212969 0020 - B Introduction of multicast and broadcast services 2021-12 RAN#94-e RP-212979 0021 - B Introduction of multicast and broadc	1.1.0		<u> </u>	ļ							
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monitoring monitoring monitoring	16.1.0	Corrections to MIMO enhancements	F	-	0015	RP-200692	RAN#88-e	2020-06			
2021-12 RAN#94-e RP-212960 0019 - F Alignment CR for TS 38.202 2021-12 RAN#94-e RP-212968 0020 - B Introduction of IIoT/URLLC enhancements in NR 2021-12 RAN#94-e RP-212979 0021 - B Introduction of multicast and broadcast services	16.2.0		F	-	0017	RP-201810	RAN#89-e	2020-09			
2021-12 RAN#94-e RP-212960 0019 - F Alignment CR for TS 38.202 2021-12 RAN#94-e RP-212968 0020 - B Introduction of IIoT/URLLC enhancements in NR 2021-12 RAN#94-e RP-212979 0021 - B Introduction of multicast and broadcast services	16.2.0	Corrections on EC V2V cidelink features			0019	DD 201907	DAN#90 o	2020.00			
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	17.0.0	Introduction of IIoT/URLLC enhancements in NR	В	-	0020	RP-212968	RAN#94-e	2021-12			
	17.0.0	Introduction of multicast and broadcast services	В	-	0021	RP-212979	RAN#94-e	2021-12			
2022-03 RAN#95-e RP-220263 0022 - F Corrections to NR support of multicast and broadcast services	17.1.0	Corrections to NR support of multicast and broadcast services	F	-	0022	RP-220263	RAN#95-e	2022-03			
2022-03 RAN#95-e RP-220256 0023 - F Corrections on NR UE Power Saving Enhancements	17.1.0	Corrections on NR UE Power Saving Enhancements	F	-	0023	RP-220256	RAN#95-e	2022-03			

History

Document history								
V17.1.0	April 2022	Publication						