
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.

The present document is part 4 of a multi-part Technical Specification (TS) covering the New Radio (NR) User Equipment (UE) conformance specification, which is divided in the following parts:

FFS.

1 Scope

The present document specifies the measurement procedures for the conformance test of the user equipment (UE) that contain performance requirements as part of 5G-NR.

The requirements are listed in different clauses only if the corresponding parameters deviate. More generally, tests are only applicable to those mobiles that are intended to support the appropriate functionality. To indicate the circumstances in which tests apply, this is noted in the "*definition and applicability*" part of the test.

For example only Release 15 and later UE declared to support 5G-NR shall be tested for this functionality. In the event that for some tests different conditions apply for different releases, this is indicated within the text of the test itself.

2 References

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

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

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".
- [3] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".
- [4] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".
- [5] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".
- [6] 3GPP TS 38.508-1: "5GS; User Equipment (UE) conformance specification; Part 1: Common test environment".
- [7] 3GPP TS 38.521-1: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone".
- [8] 3GPP TS 38.521-2: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 Standalone".
- [9] 3GPP TS 38.211: "NR; Physical channels and modulation".
- [10] 3GPP TS 38.212: "NR; Multiplexing and channel coding".
- [11] 3GPP TS 38.213: "NR; Physical layer procedures for control".
- [12] 3GPP TS 38.214: "NR; Physical layer procedures for data".
- [13] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity", Stage 2.
- [14] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".
- [15] 3GPP TR 38.901: "Study on channel model for frequencies from 0.5 to 100 GHz".

- [16] 3GPP TS 36.521-1: "E-UTRA; User Equipment (UE) conformance specification; Radio transmission and reception; Part1: conformance testing"
- [17] 3GPP TS 36.211: "Physical Channels and Modulation".
- [18] Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".
- [19] 3GPP TS 36.508: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Common test environments for User Equipment (UE) conformance testing".
- [20] 3GPP TS 38.331: "Radio Resource Control (RRC) protocol specification".
- [21] 3GPP TS 38.521-3: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".
- [22] 3GPP TS 38.509: "5GS; Special conformance testing functions for User Equipment (UE)".
- [23] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".
- [24] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".
- [25] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

aggregated channel bandwidth: The RF bandwidth in which a UE transmits and receives multiple contiguously aggregated carriers.

carrier aggregation: Aggregation of two or more component carriers in order to support wider transmission bandwidths.

carrier aggregation band: A set of one or more operating bands across which multiple carriers are aggregated with a specific set of technical requirements.

carrier aggregation bandwidth class: A class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE.

carrier aggregation configuration: A combination of CA operating band(s) and CA bandwidth class(es) supported by a UE.

DL BWP: DL bandwidth part as defined in TS 38.213 [11].

EN-DC: E-UTRA-NR Dual Connectivity as defined in TS 37.340 [13, clause 4.1.2].

FR1: Frequency range 1 as defined in TS 38.101-3 [4] clause 5.1.

FR2: Frequency range 2 as defined in TS 38.101-3 [4] clause 5.1.

PDSCH mapping type A or B: A type of PDSCH allocation sent in the RRC message which defines the time domain allocation of PDSCH DMRS symbols. PDSCH mapping type A is slot based assignment with fixed starting OFDM symbol with variable length. PDSCH mapping type B is non-slot based assignment used for configuring min-slots.

SSB: SS/PBCH block as defined in TS 38.211 [9] clause 7.8.3.

3.2 Symbols

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

μ	Subcarrier spacing configuration as defined in TS 38.211 [9] clause 4.2]
N_{oc}	The power spectral density of a white noise source with average power per RE normalized to the subcarrier spacing as defined in Section 4.4.3 for conducted requirements and Section 4.5.3 for radiated requirements

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].

CA	Carrier Aggregation
CC	Component Carrier
CCE	Control Channel Element
CORESET	Control Resource Set
CP	Cyclic Prefix
CSI	Channel-State Information
CSI-IM	CSI Interference Measurement
CSI-RS	CSI Reference Signal
CW	Codeword
CQI	Channel Quality Indicator
CRC	Cyclic Redundancy Check
CRI	CSI-RS Resource Indicator
DC	Dual Connectivity
DCI	Downlink Control Information
DL	Downlink
DMRS	Demodulation Reference Signal
DPS	Dynamic Point Selection
EPRE	Energy Per Resource Element
EN-DC	E-UTRA-NR Dual Connectivity
FR	Frequency Range
FRC	Fixed Reference Channel
HARQ	Hybrid Automatic Repeat Request
HST	High Speed Train
HST-SFN	High Speed Train Single Frequency Network
LI	Layer Indicator
MAC	Medium Access Control
MCS	Modulation and Coding Scheme
MIB	Master Information Block
NR	New Radio
NE-DC	NR-E-UTRA Dual Connectivity
NR/5GC	NR connected to 5GC NSA Non-Standalone Operation Mode
OCNG	OFDMA Channel Noise Generator
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
PBCH	Physical Broadcast Channel
Pcell	Primary Cell
PDCCH	Physical Downlink Control Channel
PDSCH	Physical Downlink Shared Channel
PMI	Precoding Matrix Indicator
PRB	Physical Resource Block
PRG	Physical resource block group
PSS	Primary Synchronization Signal
PTRS	Phase Tracking Reference Signal
PUCCH	Physical Uplink Control Channel
PUSCH	Physical Uplink Shared Channel
QCL	Quasi Co-location

RB	Resource Block
RBG	Resource Block Group
RE	Resource Element
REG	Resource Element Group
RI	Rank Indicator
RRC	Radio Resource Control
SA	Standalone operation mode
SCS	Subcarrier Spacing
SINR	Signal-to-Interference-and-Noise Ratio
SNR	Signal-to-Noise Ratio
SS	Synchronization Signal
SSB	Synchronization Signal Block
SSS	Secondary Synchronization Signal
TCI	Transmission Configuration Indicator
TDM	Time division multiplexing
TTI	Transmission Time Interval
UL	Uplink
VRB	Virtual Resource Block

4 General

4.1 Relationship between minimum requirements and test requirements

TS 38.101-4 [5] is a Single-RAT and interwork specification for NR UE, covering minimum performance requirements of both conducted and radiated requirements. Conformance to the TS 38.101-4 [5] is demonstrated by fulfilling the test requirements specified in the present document.

The Minimum Requirements given in TS 38.101-4 [5] makes no allowance for measurement uncertainty (MU). The present document defines test tolerances (TT). These test tolerances are individually calculated for each test. The test tolerances are used to relax the minimum requirements in TS 38.101-4 [5] to create test requirements. For some requirements, including regulatory requirements, the test tolerance is set to zero.

The measurement results returned by the test system are compared - without any modification - against the test requirements as defined by various levels of "Shared Risk" principle as described below

- a) Core specification value is not relaxed by any relaxation value ($TT=0$). For each single measurement, the probability of a borderline good UE being judged as FAIL equals the probability of a borderline bad UE being judged as PASS.
 - Test tolerances equal to 0 ($TT=0$) are considered in this specification.
- b) Core specification value is relaxed by a relaxation value ($TT>0$). For each single measurement, the probability of a borderline bad UE being judged as PASS is greater than the probability of a borderline good UE being judged as FAIL.
 - Test tolerances lower than measurement uncertainty and greater than 0 ($0 < TT < MU$) are considered in this specification.
 - Test tolerances high up to measurement uncertainty ($TT = MU$) are considered in this specification which is also known as "Never fail a good DUT" principle.
- c) Core specification value is tightened by a stringent value ($TT<0$). For each single measurement, the probability of a borderline good UE being judged as FAIL is greater than the probability of a borderline bad UE being judged as PASS.

Test tolerances lower than 0 ($TT<0$) are not considered in this specification..

The "Never fail a good DUT" and the "Shared Risk" principles are defined in Recommendation ITU-R M.1545 [18].

4.2 Applicability of minimum requirements

The applicability of each requirement is described under each clause in 5.1, 6.1, 7.1, 8.1, 9.1 and 10.1 of TS 38.101-4.

The conducted minimum requirements specified in the present document shall be met in all applicable scenarios for FR1. The radiated minimum requirements specified in the present document shall be met in all applicable scenarios for FR2. The interwork minimum requirement specified in the present document shall be met in all applicable scenarios for NR interworking operation.

All minimum performance requirements defined in Sections 5-8 are applicable to NR/5GC, EN-DC and NE-DC unless otherwise explicitly stated in Section 9 and 10.

All minimum performance requirements defined in Sections 5-10 are applicable to all UE power classes unless otherwise stated.

For radiated minimum requirements specified in the specification, if maximum achievable SNR in the TE chamber for certain test conditions is less than the defined SNR requirement for those tests, those tests will not be tested.

4.3 Specification suffix information

Unless stated otherwise the following suffixes are used for indicating at 2nd level clause, shown in table 4.3-1.

Table 4.3-1: Definition of suffixes

Clause suffix	Variant
None	Single Carrier
A	Carrier Aggregation (CA)
B	Dual-Connectivity (DC)
C	Supplement Uplink (SUL)

A terminal which supports the above features needs to meet the requirement defined in the additional clause (suffix A, B, C) in clauses 5, 6, 7, 8, 9, 10.

4.4 Conducted requirements

4.4.0 Introduction

The requirements are defined for the following modes:

- Mode 1: Conditions with external noise source
 - Wanted signal with power level E_s is transmitted.
 - External white noise source with power spectral density N_{oc} is used.
 - E_s and N_{oc} levels are selected to achieve target SNR as described in Clause 4.4.2.
- Mode 2: Noise free conditions
 - Wanted signal with power level E_s is transmitted.
 - No external noise transmitted.

4.4.1 Reference point

The reference point for SNR, E_s and N_{oc} of DL signal is the UE antenna connector or connectors.

4.4.2 SNR definition

For Mode 1 conditions conducted UE demodulation and CSI requirements, the SNR is defined as:

$$SNR = \frac{\sum_{j=1}^{N_{RX}} E_s^{(j)}}{\sum_{j=1}^{N_{RX}} N_{oc}^{(j)}}$$

Where:

- N_{RX} denotes the number of receiver antenna connectors and the superscript receiver antenna connector j .
- The above SNR definition assumes that the REs are not precoded, and does not account for any gain which can be associated to the precoding operation.
- Unless otherwise stated, the SNR refers to the SSS wanted signal.
- The downlink SSS transmit power is defined as the linear average over the power contributions in [W] of all resource elements that carry the SSS within the operating system bandwidth.
- The power ratio of other wanted signals to the SSS is defined in clause C.3.1..

4.4.3 Noc

4.4.3.1 Introduction

This clause describes the Noc power level for Mode 1 conditions conducted testing of demodulation and CSI requirements.

Unless otherwise stated for CA and EN-DC testing, the same Noc level shall be provided on different component carriers.

4.4.3.2 Noc for NR operating bands in FR1

The Noc power spectrum density shall be larger or equal to the minimum Noc power level for each operating band supported by the UE as defined in clause 4.4.3.2.1.

Unless otherwise stated, a fixed Noc power level of -134 dBm/Hz shall be used for all operating bands.

4.4.3.2.1 Derivation of Noc values for NR operating bands in FR1

The minimum Noc power level for an operating band, subcarrier spacing and channel bandwidth is derived based on the following equation:

$$Noc_{Band_X, SCS_Y, CBW_Z} = REFSENS_{Band_X, SCS_Y, CBW_Z} - 10 * \log_{10}(12 * SCS_Y * nPRB) + D - SNR_{REFSENS} + \Delta_{thermal}$$

where

- $REFSENS_{Band_X, SCS_Y, CBW_Z}$ is the REFSENS value in dBm for Band X, SCS Y and CBW Z specified in Table 7.3.2-1 of TS 38.101-1 [2]
- 12 is the number of subcarriers in a PRB
- SCS Y is the subcarrier spacing associated with the REFSENS value
- nPRB is the maximum number of PRB for SCS Y and CBW Z associated with the REFSENS value, and is specified in Table 5.3.2-1 of TS 38.101-1 [2]
- D is diversity gain equal to 3 dB
- $SNR_{REFSENS} = -1$ dB is the SNR used for simulation of REFSENS
- $\Delta_{thermal}$ is the amount of dB that the wanted noise is set above UE thermal noise, giving a defined rise in total noise. $\Delta_{thermal} = 16$ dB, giving a rise in total noise of 0.1 dB, regarded as insignificant.

The calculated Noc value for the baseline of Band n12, 15 kHz SCS, 15 MHz CBW is -135.5 dBm/Hz.

An allowance of 1.5dB is made for CA and for future bands, giving an Noc power level of -134 dBm/Hz.

4.4.4 Es

4.4.4.1 Introduction

This clause describes the Es power level for Mode 2 conditions conducted testing of demodulation and CSI requirements.

Unless otherwise stated for CA and EN-DC testing, the same Es level shall be provided on different component carriers.

4.4.4.2 Es for NR operating bands in FR1

The Es power spectrum density shall be larger or equal to the minimum Es power level for each operating band supported by the UE as defined in Clause 4.4.4.2.1.

Unless otherwise stated, a fixed Es power level of -112 dBm/Hz shall be used for all operating bands.

4.4.4.2.1 Derivation of Es values for NR operating bands in FR1

The minimum Es power level for an operating band, subcarrier spacing and channel bandwidth is derived based on the following equation:

$$E_{S_{\text{Band}_X, \text{SCS}_Y, \text{CBW}_Z}} = \text{REFSENS}_{\text{Band}_X, \text{SCS}_Y, \text{CBW}_Z} - 10 \cdot \log_{10}(12 \cdot \text{SCS}_Y \cdot n_{\text{PRB}}) + D - \text{SNR}_{\text{REFSENS}} + \text{dB}_{\text{EVM}} + \Delta_{\text{thermal}}$$

where:

- $\text{REFSENS}_{\text{Band}_X, \text{SCS}_Y, \text{CBW}_Z}$ is the REFSENS value in dBm for Band X, SCS Y and CBW Z specified in Table 7.3.2-1 of TS 38.101-1 [2]
- 12 is the number of subcarriers in a PRB
- SCS Y is the subcarrier spacing associated with the REFSENS value
- n_{PRB} is the maximum number of PRB for SCS Y and CBW Z associated with the REFSENS value, and is specified in Table 5.3.2-1 of TS 38.101-1 [2]
- D is diversity gain equal to 3 dB
- $\text{SNR}_{\text{REFSENS}} = -1$ dB is the SNR used for simulation of REFSENS
- dB_{EVM} is the SNR of the applied signal due to EVM impairment on the wanted Es. An allowed EVM of 3% gives a dB_{EVM} of 30.5dB, derived as $20 \cdot \log_{10}(1/0.03)$.
- Δ_{thermal} is the amount of dB that the impairment due to EVM on the wanted Es is set above UE thermal noise, giving a defined rise in total impairment. $\Delta_{\text{thermal}} = 7.6$ dB, giving a rise in total impairment of 0.7dB, regarded as acceptable.

The calculated Es value for the baseline of Band n12, 15kHz SCS, 15MHz CBW is -113.5 dBm/Hz.

An allowance of 1.5dB is made for CA and for future bands, giving an Es power level of -112 dBm/Hz.

4.5 Radiated requirements

4.5.0 Introduction

The requirements are defined for the following modes:

- Mode 1: conditions with external noise source
 - Wanted signal with power level Es is transmitted.
- External white noise source with power spectral density Noc is used.

- E_s and N_{oc} levels are selected to achieve target SNR as described in Clause 4.5.2.
- Mode 2: Noise free conditions
 - Wanted signal with power level E_s is transmitted.
 - No external noise transmitted.

4.5.1 Reference point

The reference point for SNR, E_s and N_{oc} of DL signal from the UE perspective is the input of UE antenna array.

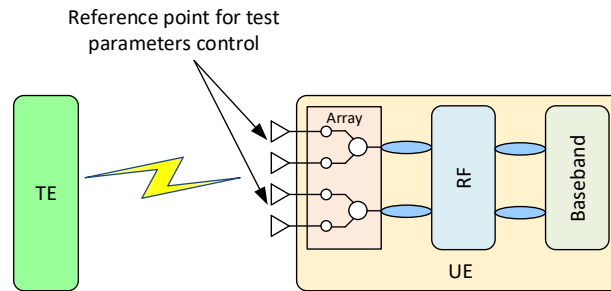


Figure 4.5.1-1: Reference point for radiated Demodulation and CSI requirements

4.5.2 SNR definition

For Mode 1 conditions UE demodulation and CSI requirements, the Minimum performance requirement in clause 7, 8, 9 and 10 are defined relative to the baseband SNR level SNR_{BB} . The SNR at the reference point is defined as

$$SNR = SNR_{BB} + \Delta_{BB}$$

where Δ_{BB} is specified in clause 4.5.3.

The reference point SNR is defined as:

$$SNR = \frac{\sum_{j=1}^{N_{RX}} E_s^{(j)}}{\sum_{j=1}^{N_{RX}} N_{oc}^{(j)}}$$

- N_{RX} denotes the number of receiver reference points, and the super script receiver reference point j .
- The above SNR definition assumes that the REs are not precoded, and does not account for any gain which can be associated to the precoding operation.
- Unless otherwise stated, the SNR refers to the SSS wanted signal.
- The downlink SSS transmit power is defined as the linear average over the power contributions in [W] of all resource elements that carry the SSS within the operating system bandwidth.
- The power ratio of other wanted signals to the SSS is defined in clause C.3.1.

4.5.3 Noc

4.5.3.1 Introduction

For Mode 1 conditions radiated testing of demodulation and CSI requirements it is not feasible in practice to use signal levels high enough to make the noise contribution of the UE negligible. Demodulation requirements are therefore specified with the applied noise higher than the UE peak EIS level in TS 38.101-2 [3] by a defined amount, so that the impact of UE noise floor is limited to no greater than a value Δ_{BB} at the specified N_{oc} level. As UEs have EIS levels that are dependent on operating band and power class, N_{oc} level is dependent on operating band and power class.

The Noc power level for test case execution shall be further increased by 5.19dB for UE power class 3 on top of the Noc power level defined in 4.5.3.2.

4.5.3.2 Noc for NR operating bands in FR2

Values for Noc according to operating band and power class for single carrier requirements are specified in Table 4.5.3.2-1 for $\Delta_{BB} = 1\text{dB}$.

Table 4.5.3.2-1: Noc power level for different UE power classes and frequency bands

Operating band	UE Power class			
	1	2	3	4
n257	-166.8	-163.8	-157.6	-166.3
n258	-166.8	-163.8	-157.6	-166.3
n260	-163.8		-155.0	-164.3
n261	-166.8	-163.8	-157.6	-166.3
Note 1: Noc levels are specified in dBm/Hz				

For PC3 multi-band devices, the Noc power level (Noc_{MB}) shall increase by multi-band relaxation defined in TS 38.101-2 [3] Table 6.2.1.3-4.

$$Noc_{MB} = Noc_{SB} + \Sigma MB_P$$

- Noc_{SB} is the Noc defined in Table 4.5.3.2-1
- ΣMB_P values are specified in TS 38.101-2 [3].

For CA case, the Noc power level (Noc_{CA}) shall increase by a relaxation factor defined in TS 38.101-2 [3] Table 7.3A.2.1-1:

$$Noc_{CA} = Noc_{SC} + \Delta R_{IB}$$

- Noc_{SC} is derived by assuming UE supports single carrier.
- ΔR_{IB} values are specified in TS 38.101-2 [3].

4.5.3.3 Derivation of Noc values for NR operating bands in FR2

The Noc values in Table 4.5.3.2-1 are based on REFSSENS for the operating band and on the UE Power class, and taking a baseline of UE Power class 3 in Band n260.

$$Noc = REFSSENS_{PC3, n260, 50MHz} - 10\text{Log}_{10}(SCS_{REFSENS} \times PRB_{REFSENS} \times 12) - SNR_{REFSENS} + \Delta_{thermal}$$

where:

- $REFSENS_{PC3, n260, 50MHz}$ is the REFSSENS value in dBm specified for Power Class 3 UE in Band n260 for 50MHz Channel bandwidth in TS 38.101-2 [3] Table 7.3.2.3-1.
- $SCS_{REFSENS}$ is a subcarrier spacing associated with N_{RB} for 50MHz in TS 38.101-2 [3] Table 5.3.2-1, chosen as 120 kHz.
- $PRB_{REFSENS}$ is N_{RB} associated with subcarrier spacing 120 kHz for 50MHz in TS 38.101-2 [3] Table 5.3.2-1 and is 32.
- 12 is the number of subcarriers in a PRB
- $SNR_{REFSENS} = -1\text{ dB}$ is the SNR used for simulation of R EFSSENS.
- $\Delta_{thermal}$ is the amount of dB that the wanted noise is set above UE thermal noise, giving a rise in total noise of Δ_{BB} . $\Delta_{thermal} = 6\text{ dB}$, giving a rise in total noise of 1 dB.

The calculated Noc value for the baseline of UE Power class 3 in Band n260 is rounded to -155 dBm/Hz.

The following methodology to define the Noc level for UE power class X (PC_X) and operating band Y (Band_Y) is used for the single carrier case and single band devices:

$$\text{Noc}(\text{PC_X}, \text{Band_Y}) = -155 \text{ dBm/Hz} + \text{REFSENS}_{\text{PC_X}, \text{Band_Y}, 50\text{MHz}} - \text{REFSENS}_{\text{PC3}, \text{n260}, 50\text{MHz}}$$

where REFSENS values are specified in TS 38.101-2 [3].

4.5.4 Angle of arrival

Unless otherwise stated, the downlink signal and noise are aligned to arrive in the UE Rx beam peak direction as defined in TS 38.101-2 [3].

4.5.5 Es

For Mode 2 the test system shall transmit the wanted signal with power level Es which is the best achievable power level by the test system.

The test system shall be able to determine achievable Es level and the maximum achievable SNR level

4.6 Test coverage across 5G NR connectivity options

The test cases in the present document cover both NR/5GC (including FR1+FR2 CA or FR1+FR2 NR-DC) as well as EN-DC, NE-DC and NGEN-DC testing. Below shall be the understanding with respect to coverage across 5G NR connectivity options:

- 1) Unless otherwise stated within the test case, it shall be understood that test requirements are agnostic of the NR/5GC, EN-DC, NE-DC and NGEN-DC connectivity options configured within the test. The test coverage across the NR/5GC, EN-DC, NE-DC and NGEN-DC connectivity options shall be considered fulfilled by executing the test case in one of these connectivity options.
- 2) Except for sustained data rate test cases, NR/5GC, EN-DC, NE-DC and NGEN-DC connectivity option types are utilized in the definition of each test case within this test specification. NR/5GC is the default connectivity option if supported.

Editor's Note: Generic procedure parameter to be used in Initial Conditions for NE-DC and NGEN-DC is FFS

- 3) If UE supports NR/5GC in addition to other connectivity options, it suffices to test the requirements using NR/5GC connectivity option for all test cases. Additionally for sustained data rate test case, if UE supports EN-DC and NE-DC, test coverage is fulfilled by testing the UE using EN-DC connectivity option.

Table 4.6-1: Void

Table 4.6-2: Void

5 Demodulation performance requirements (Conducted requirements)

5.1 General

5.1.1 Applicability of requirements

5.1.1.1 General

The minimum performance requirements are applicable to all FR1 operating bands defined in TS 38.101-1 [2].

The minimum performance requirements in Clause 5 are mandatory for UE supporting NR operation, except test cases listed in Clauses 5.1.1.3, 5.1.1.4.

5.1.1.2 Applicability of requirements for different number of RX antenna ports

The number of RX antenna ports for different RF operating bands is up to UE declaration.

The UE shall support 2 or 4 RX antenna ports for different RF operating bands. The operating bands, where 4 RX antenna ports shall be the baseline, are defined in Clause 7.2 of TS 38.101-1 [3]. The UE requirements applicability for UEs with different number of RX antenna ports is defined in Table 5.1.1.2-1.

Table 5.1.1.2-1: Requirements applicability

Supported RX antenna ports	Test type	Test list
UE supports only 2RX	PDSCH	All tests in Clause 5.2.2
	PDCCCH	All tests in Clause 5.3.2
	PBCH	All tests in Clause 5.4.2
UE supports only 4RX or both 2RX and 4RX	PDSCH	All tests in Clause 5.2.3
	PDCCCH	All tests in Clause 5.3.3
	PBCH	All tests in Clause 5.4.2 or 5.4.3 ^{Note 1}
Note 1: Requirements for PBCH with 4Rx is up to UE declaration		

5.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 5.1.1.3-1 shall apply for UEs which support optional UE features only.

Table 5.1.1.3-1: Requirements applicability for optional UE features

UE feature/capability [14]	Test type		Test list	Applicability notes
SU-MIMO Interference Mitigation advanced receiver	FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Test 3-1) Clause 5.2.3.1.1 (Test 5-1)	
	FR1 TDD	PDSCH	Clause 5.2.2.2.1 (Test 3-1) Clause 5.2.3.2.1 (Test 5-1)	
Alternative additional DMRS position for co-existence with LTE CRS (<i>additionalDMRS-DL-Alt</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.4 (Test 1-2) Clause 5.2.3.1.4 (Test 1-2)	
	FR1 TDD	PDSCH	Clause 5.2.2.2.4 (Test 1-2) Clause 5.2.3.2.4 (Test 1-2)	

Basic DL NR-NR CA operation (<i>supportedBandCombinationList</i>)	NR CA	SDR	Clause 5.5A.1	1) Up to 16 DL carriers 2) Same numerology across carrier for data/control channel at a given time
Enhanced demodulation processing for HST-SFN joint transmission scheme with velocity up to 500km/h	FR1 FDD	PDSCH	Clause 5.2.2.1.9 (Test 1-1) Clause 5.2.3.1.9 (Test 1-1)	
	FR1 TDD	PDSCH	Clause 5.2.2.2.9 (Test 1-1) Clause 5.2.3.2.9 (Test 1-1)	
Single DCI based SDM transmission for multi-TRxP (<i>singleDCI-SDM-scheme-r16</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.11 Clause 5.2.3.1.11	
	FR1 TDD	PDSCH	Clause 5.2.2.2.11 Clause 5.2.3.2.11	
Multi DCI based multi-TRxP support (<i>multiDCI-MultiTRP-r16</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.12 Clause 5.2.3.1.12	
	FR1 TDD	PDSCH	Clause 5.2.2.2.12 Clause 5.2.3.2.12	
Single DCI based FDM Scheme-A for multi-TRxP (<i>supportFDM-SchemeA-r16</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.13 Clause 5.2.3.1.13	
	FR1 TDD	PDSCH	Clause 5.2.2.2.13 Clause 5.2.3.2.13	
Single DCI based inter-slot TDM for multi-TRxP (<i>supportInter-slotTDM-r16</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.14 Clause 5.2.3.1.14	
	FR1 TDD	PDSCH	Clause 5.2.2.2.14 Clause 5.2.3.2.14	
Maximum number of TCI states in Single-DCI based inter-slot TDM (<i>maxNumberTCI-states-r16</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.14 Clause 5.2.3.1.14	The requirements apply only when <i>maxNumberTCI-states-r16</i> = 2.
	FR1 TDD	PDSCH	Clause 5.2.2.2.14 Clause 5.2.3.2.14	
Alternative 64QAM MCS table for PDSCH New 64QAM MCS table for PDSCH (<i>dl-64QAM-MCS-TableAlt</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.5 Clause 5.2.3.1.5 Clause 5.2.2.1.6 Clause 5.2.3.1.6	
	FR1 TDD	PDSCH	Clause 5.2.2.2.5 Clause 5.2.3.2.5 Clause 5.2.2.2.6 Clause 5.2.3.2.6	
CQI table with target BLER of 10 ⁻⁵ New CQI table (<i>cqi-TableAlt</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.5 Clause 5.2.3.1.5	
	FR1 TDD	PDSCH	Clause 5.2.2.2.5 Clause 5.2.3.2.5	
PDSCH repetitions over multiple slots (<i>pdsch-RepetitionMultiSlots</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.6 Clause 5.2.3.1.6	
	FR1 TDD	PDSCH	Clause 5.2.2.2.6 Clause 5.2.3.2.6	
UE PDSCH processing capability #2 (<i>pdsch-ProcessingType2</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.7 Clause 5.2.3.1.7	
	FR1 TDD	PDSCH	Clause 5.2.2.2.7 Clause 5.2.3.2.7	
Pre-emption indication for DL (<i>pre-EmptIndication-DL</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.8 Clause 5.2.3.1.8	
	FR1 TDD	PDSCH	Clause 5.2.2.2.8 Clause 5.2.3.2.8	

5.1.1.4 Applicability of requirements for mandatory UE features with capability signalling

The performance requirements in Table 5.1.1.4-1 shall apply for UEs which support mandatory UE features with capability signalling only.

Table 5.1.1.4-1: Requirements applicability for mandatory features with UE capability signalling

UE feature/capability [14]	Test type		Test list	Applicability notes
256QAM modulation scheme for PDSCH for FR1 (<i>pdsch-256QAM-FR1</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Test 1-3) Clause 5.2.3.1.1 (Test 1-3)	
	FR1 TDD	PDSCH	Clause 5.2.2.2.1 (Test 1-3) Clause 5.2.3.2.1 (Test 1-3)	
PDSCH mapping type B (<i>pdsch-MappingTypeB</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.3 Clause 5.2.3.1.3 Clause 5.2.2.1.7 Clause 5.2.3.1.7	
	FR1 TDD	PDSCH	Clause 5.2.2.2.3 Clause 5.2.3.2.3 Clause 5.2.2.2.7 Clause 5.2.3.2.7	
Rate-matching around LTE CRS (<i>rateMatchingLTE-CRS</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.4 Clause 5.2.3.1.4	For UEs supporting “Alternative additional DMRS position for co-existence with LTE CRS”, if Test 1-2 is tested, the test coverage can be considered fulfilled without executing Test 1-1. Otherwise, only Test 1-1 is tested.
	FR1 TDD	PDSCH	Clause 5.2.2.2.4 Clause 5.2.3.2.4	
Supported maximum number of ports across all configured NZP-CSI-RS resources per CC (<i>maxConfigNumberPortsAcrossNZP-CSI-RS-PerCC</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.4 (Tests 1-1, 1-2) Clause 5.2.3.1.1 (Tests 3-1, 4-1, 5-1) Clause 5.2.3.1.4 (Tests 1-1, 1-2)	The requirements apply only in case the number of NZP-CSI-RS ports in the test case satisfies UE capability on maximum number of NZP-CSI-RS ports
	FR1 TDD	PDSCH	Clause 5.2.3.2.1 (Tests 3-1, 4-1, 5-1)	

Supported maximum number of PDSCH MIMO layers (<i>maxNumberMIMO-LayersPDSCH</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Tests 2-1, 2-2, 3-1) Clause 5.2.2.1.2 Clause 5.2.3.1.1 (Tests 2-1, 2-2, 3-1, 4- 1, 5-1) Clause 5.2.3.1.2	The requirements apply only in case the PDSCH MIMO rank in the test case does not exceed UE PDSCH MIMO layers capability
	FR1 TDD	PDSCH	Clause 5.2.2.2.1 (Tests 2-1, 2-2, 3-1) Clause 5.2.2.2.2 Clause 5.2.3.2.1 (Tests 2-1, 2-2, 3-1, 4- 1, 5-1) Clause 5.2.3.2.2	
Support number of active TCI states per BWP per CC, including control and data (<i>maxNumberActiveTCI-PerBWP</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.10 (Test 1-2) Clause 5.2.3.1.10 (Test 1-2)	The requirements apply only when <i>maxNumberActiveTCI-PerBWP</i> is other than n1.
	FR1 TDD	PDSCH	Clause 5.2.2.2.10 (Test 1-2) Clause 5.2.3.2.10 (Test 1-2)	
Support for maximum number of TRS resource sets per CC which the UE can track simultaneously (<i>maxSimultaneousResourceSetsPerCC</i>)	FR1 FDD	PDSCH	Clause 5.2.2.1.10 (Test 1-2) Clause 5.2.3.1.10 (Test 1-2) Clause 5.2.2.1.11 Clause 5.2.2.1.12 Clause 5.2.2.1.13 Clause 5.2.2.1.14 Clause 5.2.3.1.11 Clause 5.2.3.1.12 Clause 5.2.3.1.13 Clause 5.2.3.1.14	The requirements apply only when <i>maxSimultaneousResourceSetsPerCC</i> ≥ 2

	FR1 TDD	PDSCH	Clause 5.2.2.2.10 (Test 1-2) Clause 5.2.3.2.10 (Test 1-2) Clause 5.2.2.2.11 Clause 5.2.2.2.12 Clause 5.2.2.2.13 Clause 5.2.2.2.14 Clause 5.2.3.2.11 Clause 5.2.3.2.12 Clause 5.2.3.2.13 Clause 5.2.3.2.14	
--	------------	-------	--	--

5.1.1.5 Applicability of CA requirements

5.1.1.5.1 Definition of CA capability

The definition with respect to CA capabilities is given as in Table 5.1.1.5.1-1.

Table 5.1.1.5.1-1: Definition of CA capability

CA Capability	CA Capability Description
CA_C	Intra-band contiguous CA
CA_N	Intra-band non-contiguous CA
CA_AX	Inter-band CA (X bands)
NOTE 1: CA_C corresponds to NR CA configurations and bandwidth combination sets defined in Section 5.5A.1 of TS 38.101-1[2]. CA_N corresponds to NR CA configurations and bandwidth combination sets defined in Section 5.5A.2 of TS 38.101-1[2]. CA_AX corresponds to NR CA configurations and bandwidth combination sets defined in Section 5.5A.3 of TS 38.101-1[2].	

5.1.1.5.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Section 5.2A are defined independent of CA configurations and bandwidth combination sets specified in Section 5.5A of TS 38.101-1[2]. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined in Table 5.1.1.5.2-1 and Table 5.1.1.5.2-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 5.1.1.5.2-1: Applicability and test rules for CA UE demodulation tests

Tests	CA capability where the tests apply	CA configuration from the selected CA capability where the tests apply	CA Bandwidth combination to be tested in priority order	PCell CC configuration
Test 1 in Section 5.2A.2.1 and 5.2A.3.1	CA_C, CA_N, CA_AX	Table 5.1.1.5.2-2	Largest aggregated CA bandwidth combination	Any of CCs
Test 2 in Section 5.2A.2.1 and 5.2A.3.1	CA_C, CA_N, CA_AX	Table 5.1.1.5.2-2	Largest aggregated CA bandwidth combination	Any of CCs
Test 3 in Section 5.2A.2.1 and 5.2A.3.1	CA_AX	Table 5.1.1.5.2-2	Largest aggregated CA bandwidth combination	TDD CC if supported, otherwise FDD CC
Test 4 in Section 5.2A.2.1 and 5.2A.3.1 (NOTE 2)	CA_AX	Table 5.1.1.5.2-2	Largest aggregated CA bandwidth combination	Any of CCs
Test 5 in Section 5.2A.2.1 and 5.2A.3.1 (NOTE 3)	CA_AX	Table 5.1.1.5.2-2	Largest aggregated CA bandwidth combination	15 kHz CC if supported, otherwise 30 kHz CC
NOTE 1: In case CA_AX with different number of X is supported then one or two CA configurations are selected based on procedure from Table 5.1.1.5.2-2.				
NOTE 2: These scenarios are only tested for UEs which are not verified with Test 3 in Section 5.2A.2.1 and 5.2A.3.1				
NOTE 3: These scenarios are only tested for UEs which are not verified with Test 4 in Section 5.2A.2.1 and 5.2A.3.1				

Table 5.1.1.5.2-2: Selection of CA configurations

CA capability	Step 1	Step 2	Step 3	Step 4
CA_C or CA_N	Select the CA configurations with the maximum number of CCs, for which the supported maximum number of MIMO layers is not lower than 2.	Select any one of CA configurations, which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate is not lower than the tested data rate, among all the selected CA configurations from Step 1.	N/A	N/A
CA_AX	Select the CA configurations with the maximum number of CCs, for which the supported maximum number of MIMO layers is not lower than 2.	Select any one of CA configurations, which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate is not lower than the tested data rate, among all the selected CA configurations from Step 1.	Select the CA configurations with the largest number of bands and with the maximum number of CCs, for which the supported maximum number of MIMO layers is not lower than 2.	Select any one of CA configurations, which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate is not lower than the tested data rate, among all the selected CA configurations from Step 3.
NOTE 1: For CA_AX capability, if CA configuration from step 2 is CA configuration with the largest number of bands then Step 3 and Step 4 are skipped. Otherwise, the two CA configurations selected from Step 2 and Step 4 are used for testing.				
NOTE 2: Maximum supported data rate for Step 2 and Step 4 is calculated based clause 4.1.2 of TS 38.306 [14].				
NOTE 3: Tested data rate for Step 2 and Step 4 is calculated based on the equation $DataRate = 10^{-3} \sum_{j=1}^J TBS_j 2^{\mu_j}$ and FRCs used in the test.				

5.1.1.5.3 Applicability rule and antenna connection for CA tests with 4 RX

Within the CA configuration if any of the PCell and/or the SCells is a 2Rx supported RF band, 2 out of the 4Rx should be connected with data source from system simulator, depending on UE's declaration and AP configuration. Requirements from Clause 5.2A.2.1 are applied.

Within the CA configuration if any of the PCell and/or the SCells is a 4Rx supported RF band, all 4Rx should be connected with data source from system simulator. Requirements from Clause 5.2A.3.1 are applied.

For 4Rx capable UEs, the 2Rx supported RF bands and 4Rx supported RF bands are up to UE's declaration.

5.1.1.6 Applicability and test rules for PDSCH performance requirements with power imbalance for intra-band contiguous CA

For UE passing the FDD and TDD CA power imbalance performance requirements with 2 DL CCs as defined in sections 5.2A.2.2 and 5.2A.3.2, the test coverage can be considered fulfilled with FDD or TDD intra-band contiguous CA with 3 or more DL CCs supported by the UE. During the test, UE is required to test the supported intra-band contiguous CA configurations with 2 DL CCs covering the lowest and highest operating bands.

The channel bandwidth combination for testing is determined by following procedure:

- First select the bandwidth combinations with the same bandwidth in each carrier.
- If there is no such bandwidth combination, select the bandwidth combinations with smallest bandwidth difference between the two carriers, and the carrier with smaller bandwidth will be used for test.
- Among the bandwidth combinations selected, select the CA combination with largest aggregated bandwidth combination.

5.1.1.7 Applicability of different requirements for HST

The applicability rules for different HST requirements in section 5 are specified in Table 5.1.1.7-1.

Table 5.1.1.7-1: Applicability of requirements for HST

If UE has passed			UE can skip			Applicability notes
Test type	Test list		Test type	Test list		
FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Test 1-6)	FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Test 1-5)	
FR1 TDD	PDSCH	Clause 5.2.2.2.1 (Test 1-11)	FR1 TDD	PDSCH	Clause 5.2.2.2.1 (Test 1-7)	
FR1 FDD	PDSCH	Clause 5.2.3.1.1 (Test 1-6)	FR1 FDD	PDSCH	Clause 5.2.3.1.1 (Test 1-5)	
FR1 TDD	PDSCH	Clause 5.2.3.2.1 (Test 1-11)	FR1 TDD	PDSCH	Clause 5.2.3.2.1 (Test 1-7)	
FR1 FDD	PDSCH	Clause 5.2.2.1.9 (Test 1-1)	FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Test 1-5)	
FR1 TDD	PDSCH	Clause 5.2.2.2.9 (Test 1-1)	FR1 TDD	PDSCH	Clause 5.2.2.2.1 (Test 1-7 and 1-11)	
FR1 FDD	PDSCH	Clause 5.2.3.1.9 (Test 1-1)	FR1 FDD	PDSCH	Clause 5.2.3.1.1 (Test 1-5)	
FR1 TDD	PDSCH	Clause 5.2.3.2.9 (Test 1-1)	FR1 TDD	PDSCH	Clause 5.2.3.2.1 (Test 1-7 and 1-11)	
FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Test 1-7)	FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Test 1-1)	
FR1 FDD	PDSCH	Clause 5.2.3.1.1 (Test 1-7)	FR1 FDD	PDSCH	Clause 5.2.3.1.1 (Test 1-1)	
FR1 FDD	PDSCH	Clause 5.2.2.1.10 (Test 1-1 or 1-2)	FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Test 1-5)	
FR1 TDD	PDSCH	Clause 5.2.2.2.10 (Test 1-1 or 1-2)	FR1 TDD	PDSCH	Clause 5.2.2.2.1 (Test 1-7 and 1-11)	
FR1 FDD	PDSCH	Clause 5.2.3.1.10 (Test 1-1 or 1-2)	FR1 FDD	PDSCH	Clause 5.2.3.1.1 (Test 1-5)	
FR1 TDD	PDSCH	Clause 5.2.3.2.10 (Test 1-1 or 1-2)	FR1 TDD	PDSCH	Clause 5.2.3.2.1 (Test 1-7 and 1-11)	
FR1 FDD	PDSCH	Clause 5.2.2.1.10 (Test 1-2)	FR1 FDD	PDSCH	Clause 5.2.2.1.10 (Test 1-1)	
FR1 TDD	PDSCH	Clause 5.2.2.2.10 (Test 1-2)	FR1 TDD	PDSCH	Clause 5.2.2.2.10 (Test 1-1)	
FR1 FDD	PDSCH	Clause 5.2.3.1.10 (Test 1-2)	FR1 FDD	PDSCH	Clause 5.2.3.1.10 (Test 1-1)	
FR1 TDD	PDSCH	Clause 5.2.3.2.10 (Test 1-2)	FR1 TDD	PDSCH	Clause 5.2.3.2.10 (Test 1-1)	

5.1.1.8 Applicability of different requirements with Multi-TRxP

The applicability rules for requirements with multi-TRxP transmission schemes in section 5 are specified in Table 5.1.1.8-1.

Table 5.1.1.8-1: Applicability of requirements with Multi-TRxP Transmission

If UE has passed			UE can skip			Applicability notes
Test type	Test list		Test type	Test list		
FR1 FDD	PDSCH	Clause 5.2.2.1.12 (Test 1-1)	FR1 FDD	PDSCH	Clause 5.2.2.1.11 (Test 1-1)	
FR1 FDD	PDSCH	Clause 5.2.2.1.12 (Test 1-1)	FR1 FDD	PDSCH	Clause 5.2.2.1.13 (Test 1-1)	
FR1 FDD	PDSCH	Clause 5.2.2.1.6 (Test 1-1)	FR1 FDD	PDSCH	Clause 5.2.2.1.14 (Test 1-1)	
FR1 TDD	PDSCH	Clause 5.2.2.2.12 (Test 1-1)	FR1 TDD	PDSCH	Clause 5.2.2.2.11 (Test 1-1)	
FR1 TDD	PDSCH	Clause 5.2.2.2.12 (Test 1-1)	FR1 TDD	PDSCH	Clause 5.2.2.2.13 (Test 1-1)	
FR1 TDD	PDSCH	Clause 5.2.2.2.6 (Test 1-1)	FR1 TDD	PDSCH	Clause 5.2.2.2.14 (Test 1-1)	
FR1 FDD	PDSCH	Clause 5.2.3.1.12 (Test 1-1)	FR1 FDD	PDSCH	Clause 5.2.3.1.11 (Test 1-1)	
FR1 FDD	PDSCH	Clause 5.2.3.1.12 (Test 1-1)	FR1 FDD	PDSCH	Clause 5.2.3.1.13 (Test 1-1)	
FR1 FDD	PDSCH	Clause 5.2.3.1.6 (Test 1-1)	FR1 FDD	PDSCH	Clause 5.2.3.1.14 (Test 1-1)	
FR1 TDD	PDSCH	Clause 5.2.3.2.12 (Test 1-1)	FR1 TDD	PDSCH	Clause 5.2.3.2.11 (Test 1-1)	
FR1 TDD	PDSCH	Clause 5.2.3.2.12 (Test 1-1)	FR1 TDD	PDSCH	Clause 5.2.3.2.13 (Test 1-1)	
FR1 TDD	PDSCH	Clause 5.2.3.2.6 (Test 1-1)	FR1 TDD	PDSCH	Clause 5.2.3.2.14 (Test 1-1)	

5.2 PDSCH demodulation requirements

The parameters specified in Table 5.2-1 are valid for all PDSCH tests unless otherwise stated.

Table 5.2-1: Common test parameters

Parameter		Unit	Value
PDSCH transmission scheme			Transmission scheme 1
Carrier configuration	Offset between Point A and the lowest usable subcarrier on this carrier (Note 2)	RBs	0
	Subcarrier spacing	kHz	15 or 30
DL BWP configuration #1	Cyclic prefix		Normal
	RB offset	RBs	0
	Number of contiguous PRB	PRBs	Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing
Common serving cell parameters	Physical Cell ID		0
	SSB position in burst		First SSB in Slot #0
	SSB periodicity	ms	20
PDCCH configuration	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH	Symbols	0, 1
	Number of PRBs in CORESET		Table 5.2-2 for tested channel bandwidth and subcarrier spacing
	Number of PDCCH candidates and aggregation levels		1/AL8
	CCE-to-REG mapping type		Non-interleaved
	DCI format		1_1
	TCI state		TCI state #1
	PDCCH & PDCCH DMRS Precoding configuration		Single Panel Type I, Random per slot with equal probability of each applicable i_1, i_2 combination, and with REG bundling granularity for number of Tx larger than 1
Cross carrier scheduling			Not configured
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		$k_0=0$ for CSI-RS resource 1,2,3,4
	First OFDM symbol in the PRB used for CSI-RS		$l_0 = 6$ for CSI-RS resource 1 and 3 $l_0 = 10$ for CSI-RS resource 2 and 4
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
	Density (ρ)		3 for CSI-RS resource 1,2,3,4
	CSI-RS periodicity	Slots	15 kHz SCS: 20 for CSI-RS resource 1,2,3,4 30 kHz SCS: 40 for CSI-RS resource 1,2,3,4
	CSI-RS offset	Slots	15 kHz SCS: 10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4 30 kHz SCS: 20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
	Frequency Occupation		Start PRB 0 Number of PRB = BWP size
	QCL info		TCI state #0
	NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS	
First OFDM symbol in the PRB used for CSI-RS			$l_0 = 12$
Number of CSI-RS ports (X)			Same as number of transmit antenna
CDM Type			'No CDM' for 1 transmit antenna 'FD-CDM2' for 2 and 4 transmit antenna
Density (ρ)			1
CSI-RS periodicity		Slots	15 kHz SCS: 20 30 kHz SCS: 40
CSI-RS offset		Slots	0
Frequency Occupation			Start PRB 0 Number of PRB = BWP size
QCL info			TCI state #1

ZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS		$k_0 = 4$
	First OFDM symbol in the PRB used for CSI-RS		$l_0 = 12$
	Number of CSI-RS ports (X)		4
	CDM Type		'FD-CDM2'
	Density (ρ)		1
	CSI-RS periodicity	Slots	15 kHz SCS: 20 30 kHz SCS: 40
	CSI-RS offset	Slots	0
	Frequency Occupation		Start PRB 0 Number of PRB = BWP size
PDSCH DMRS configuration	Antenna ports indexes		{1000} for Rank 1 tests {1000, 1001} for Rank 2 tests {1000-1002} for Rank 3 tests {1000-1003} for Rank 4 tests
	Position of the first DMRS for PDSCH mapping type A		2
	Number of PDSCH DMRS CDM group(s) without data		1 for Rank 1 and Rank 2 tests 2 for Rank 3 and Rank 4 tests
TCI state #0	Type 1 QCL information	SSB index	SSB #0
		QCL Type	Type C
	Type 2 QCL information	SSB index	N/A
		QCL Type	N/A
TCI state #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration
		QCL Type	Type A
	Type 2 QCL information	CSI-RS resource	N/A
		QCL Type	N/A
PT-RS configuration			PT-RS is not configured
Maximum number of code block groups for ACK/NACK feedback			1
Maximum number of HARQ transmission			4
HARQ ACK/NACK bundling			Multiplexed
Redundancy version coding sequence			{0,2,3,1}
PDSCH & PDSCH DMRS Precoding configuration			Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i_1, i_2 combination, and with PRB bundling granularity
Symbols for all unused REs			OCNG Annex A.5
Physical signals, channels mapping and precoding			As specified in Annex B.4.1
Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission.			
Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing.			

Table 5.2-2: Number of PRBs in CORESET

SCS (kHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	100 MHz
15	24	48	78	102	132	156	216	270	N/A	N/A	N/A
30	6	24	36	48	60	78	102	132	162	216	270

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2

5.2.1 1RX requirements (Void)

5.2.2 2RX requirements

5.2.2.1 FDD

5.2.2.1.1 2Rx FDD FR1 PDSCH mapping Type A performance

5.2.2.1.1.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.1.0-3 and Table 5.2.2.1.1.0-4, with the test parameters defined in table 5.2.2.1.1.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.1.0-1.

Table 5.2.2.1.1.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers	1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 2-1, 2-2
Verify the PDSCH mapping Type A HARQ soft combining performance under 2 receive antenna conditions.	1-4
Verify the PDSCH mapping Type A performance requirements for Enhanced Receiver Type 1 under 2 receive antenna conditions.	3-1

Table 5.2.2.1.1.0-2: Test Parameters for Testing

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		4 for Test 1-1 2 for other tests
	Resource allocation type		Test 1-2: Type 1 with start RB = 23, L _{RBs} = 6 Other tests: Type 0
	RBG size		Test 1-2: N/A Other tests: Config2
	VRB-to-PRB mapping type		Non-interleaved
VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		2 for Tests 1-1, 1-5, 1-6, 1-7 1 for other tests
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CSI-RS for tracking	CSI-RS periodicity	Slots	Test 1-5, 1-6, 1-7: 10 for CSI-RS resource 1,2,3,4. Other tests: Table 5.2-1.
	CSI-RS offset	Slots	Test 1-5, 1-6, 1-7: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4. Other tests: Table 5.2-1.

Number of HARQ Processes		8 for Test 1-4 4 for other tests
The number of slots between PDSCH and corresponding HARQ-ACK information		2

Table 5.2.2.1.1.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.1 FDD	10 / 15	QPSK, 0.30	TDLB100-400	2x2, ULA Low	70	-0.8
1-2	R.PDSCH.1-1.2 FDD	10 / 15	QPSK, 0.30	TDLC300-100	2x2, ULA Low	70	0.2
1-3	R.PDSCH.1-4.1 FDD	10 / 15	256QAM, 0.82	TDLA30-10	2x2, ULA Low	70	24.6
1-4	R.PDSCH.1-2.1 FDD	10 / 15	16QAM, 0.48	TDLC300-100	2x2, ULA Low	30	1.1
1-5	R.PDSCH.1-8.1 FDD	10 / 15	16QAM, 0.48	HST-750	1x2	70	6.2
1-6	R.PDSCH.1-8.2 FDD	10 / 15	64QAM, 0.43	HST-972	1x2	70	[9.9]
1-7	R.PDSCH.1-8.1 FDD	10 / 15	16QAM, 0.48	TDLC300-600	2x2	70	[8.6]

Table 5.2.2.1.1.0-4: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
2-1	R.PDSCH.1-3.1 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	19.4
2-2	R.PDSCH.2-1.1 FDD	20 / 30	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	19.7

Table 5.2.2.1.1.0-5: Minimum performance for Rank 2 and Enhanced Receiver Type 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
3-1	R.PDSCH.1-2.2 FDD	10 / 15	16QAM, 0.48	TDLA30-10	2x2, ULA Medium	70	17.6

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.1.

5.2.2.1.1_1 2Rx FDD FR1 PDSCH mapping Type A performance - 2x2 MIMO with baseline receiver for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- SNR in test requirements table is within square brackets for test point 1-6, 1-7.

5.2.2.1.1_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 1 and Rank 2 scenarios.

5.2.2.1.1_1.2 Test applicability

This test applies to all types of UE release 15 and forward supporting NR/5GC.

This test also applies to all types of UE release 15 and forward supporting EN-DC.

5.2.2.1.1_1.3 Test description

5.2.2.1.1_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.1.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for NR/5GC with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On, Test Mode On* for EN-DC according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.1_1.3.3.

5.2.2.1.1_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2.2.1.1_1.4-1 and 5.2.2.1.1_1.4-2. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.1_1.4-1 and 5.2.2.1.1_1.4-2 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.1.1_1.4-1 and 5.2.2.1.1_1.4-2 as appropriate.

5.2.2.1.1_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.1_1.3.3_1 Message exceptions for NR/5GC

Table 5.2.2.1.1_1.3.3_1-1: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	n4, n2 Not present	n4 for test 1-1 n2 will be used by default	test 1-1 test point other than test 1-1
}			
}			
}			

Table 5.2.2.1.1_1.3.3_1-2: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	For test 1-1, 1-5, 1-6 and 1-7	
	pos1	For other tests	
}			

Table 5.2.2.1.1_1.3.3_1-3: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n8, n4	n8 for Test 1-4 n4 for other tests	
}			

Table 5.2.2.1.1_1.3.3_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE { slots10	1 (for CSI-RS resources 1 and 2) 2 (for CSI-RS resources 3 and 4)	For test 1-5, 1-6, 1-7: CSI-RS offset: 1 for CSI-RS resources 1 and 2 2 for CSI-RS resources 3 and 4 CSI-RS periodicity: 10 slots	
slots40	20 (for CSI-RS resources 1 and 2) 21 (for CSI-RS resources 3 and 4)	For test 2-2: CSI-RS offset: 20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4 CSI-RS periodicity: 40 slots	
slots20	10 (for CSI-RS resources 1 and 2) 11 (for CSI-RS resources 3 and 4)	For other tests: CSI-RS offset: 10 for CSI-RS resources 1 and 2 11 for CSI-RS resources 3 and 4 CSI-RS periodicity: 20 slots	
}			

5.2.2.1.1_1.3.3_2 Message exceptions for EN-DC

Same as 5.2.2.1.1_1.3.3_1

5.2.2.1.1_1.4 Test requirement

Tables 5.2.2.1.1_1.4-1 and 5.2.2.1.1_1.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.1_1.4-1 and Table 5.2.2.1.1_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.1_1.4-1: Test Requirements for Rank 1

Test num.	Reference channel	Modulation format	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.1 FDD	QPSK, 0.30	TDLB100-400	2x2, ULA Low	70	0.1
1-2	R.PDSCH.1-1.2 FDD	QPSK, 0.30	TDLC300-100	2x2, ULA Low	70	1.1
1-3	R.PDSCH.1-4.1 FDD	256AM, 0.82	TDLA30-10	2x2, ULA Low	70	25.6
1-4	R.PDSCH.1-2.1 FDD	16QAM, 0.48	TDLC300-100	2x2, ULA Low	30	2
1-5	R.PDSCH.1-8.1 FDD	16QAM, 0.48	HST-750	1x2	70	7.1
1-6	R.PDSCH.1-8.2 FDD	64QAM, 0.43	HST-972	1x2	70	[10.5]

Table 5.2.2.1.1_1.4-2: Test Requirements for Rank 2

Test num.	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
2-1	R.PDSCH.1-3.1 FDD	64QAM, 0.51	TDLA30-10	2x2, ULA Low	70	20.4
2-2	R.PDSCH.2-1.1 FDD	64QAM, 0.51	TDLA30-10	2x2, ULA Low	70	20.7

5.2.2.1.1_2 2Rx FDD FR1 PDSCH mapping Type A performance - 2x2 MIMO with enhanced receiver type 1 for both SA and NSA

5.2.2.1.1_2.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with enhanced receiver type 1 configuration, for Rank 2 scenarios.

5.2.2.1.1_2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting NR enhanced receiver type 1.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and NR enhanced receiver type 1.

5.2.2.1.1_2.3 Test description

Same test description as in clause 5.2.2.1.1_1.3.

5.2.2.1.1_2.3.1 Initial conditions

Same initial conditions as in clause 5.2.2.1.1_1.3.1.

5.2.2.1.1_2.3.2 Test procedure

Same test procedure as in clause 5.2.2.1.1_1.3.2.

5.2.2.1.1_2.3.3 Message contents

Same message contents as in clause 5.2.2.1.1_1.3.3.

5.2.2.1.1_2.3.3_1 Message exceptions for SA

Same message exceptions for SA as in clause 5.2.2.1.1_1.3.3_1.

5.2.2.1.1_2.3.3_2 Message exceptions for NSA

Same message exceptions for NSA as in clause 5.2.2.1.1_1.3.3_2.

5.2.2.1.1_2.3.4 Test requirement

Same test requirement as in clause 5.2.2.1.1_1.3.4.

Table 5.2.2.1.1_2.3.4-1: Test Requirements for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)

3-1	R.PDSCH.1-2.2 FDD	10 / 15	16QAM, 0.48	TDLA30-10	2x2, ULA Medium	70	18.6
-----	-------------------	---------	-------------	-----------	-----------------	----	------

5.2.2.1.2 2Rx FDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance

5.2.2.1.2.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.2.0-3, with the addition of test parameters in table 5.2.2.1.2.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.2.0-1.

Table 5.2.2.1.2.0-1: Tests purpose

Purpose	Test index
[Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and CSI-RS overlapped with PDSCH]	1-1

Table 5.2.2.1.2.0-2: Test parameters

Parameter	Unit	Value	
Duplex mode		FDD	
Active DL BWP index		1	
PDSCH configuration	Mapping type	Type A	
	k0	0	
	Starting symbol (S)	2	
	Length (L)	12	
	PDSCH aggregation factor	1	
	PRB bundling type	Static	
	PRB bundling size	2	
	PRB size	Config2	
	Resource allocation type	Type 0	
	VRB-to-PRB mapping type	Non-interleaved	
VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	DMRS Type	Type 1	
	Number of additional DMRS	1	
	Length	1	
NZP CSI-RS for CSI acquisition	OFDM symbols in the PRB used for CSI-RS	$l_0 = 13$	
	CSI-RS periodicity	Slots	5
ZP CSI-RS for CSI acquisition	Subcarrier index in the PRB used for CSI-RS		$(k_0, k_1, k_2, k_3) = (2, 4, 6, 8)$
	Number of CSI-RS ports (X)		8
	CSI-RS periodicity	Slots	5
Number of HARQ Processes		4	
K1 value (PDSCH-to-HARQ-timing-indicator)		2	

Table 5.2.2.1.2.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-5.1 FDD	10 / 15	16QAM, 0.48	TDLC300-100	2x2, ULA Low	70	14.8

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.2.1.2.

5.2.2.1.2_1 2Rx FDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.2_1.1 Test purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and CSI-RS overlapped with PDSCH

5.2.2.1.2_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.1.2_1.3 Test description

5.2.2.1.2_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [8].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.6.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.1.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.2_1.3.3.

5.2.2.1.2_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.1.2_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.2_1.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Annex G.1.4.

5.2.2.1.2_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.2_1.3.3_1 Message exceptions for SA

Same as for test number 1-2 in 5.2.2.1.1_1.3.3_1 with following exceptions:

Table 5.2.2.1.2_1.3.3_1-1: NZP CSI-RS-ResourceMapping for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	13	$l_0 = 13$	
}			

Table 5.2.2.1.2_1.3.3_1-2: CSI-ResourcePeriodicityAndOffset for ZP and NZP CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots5	0	CSI-RS offset: 0 CSI-RS periodicity: 5 slots	
}			

Table 5.2.2.1.2_1.3.3_1-3: ZP CSI-RS-ResourceMapping for CSI Acquisition

Derivation Path: TS 38.508-1 [6], clause 5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	011110	(k_0, k_1, k_2, k_3)=(2, 4, 6, 8)	
}			
nrofPorts	P8	Number of CSI-RS ports (X) = 8	
firstOFDMSymbolInTimeDomain	12	$l_0 = 12$	
cdm-Type	fd-CDM2		
density CHOICE {			
one	NULL	Density (ρ) = 1	
}			
freqBand	CSI-FrequencyOccupation	Frequency Occupation: Start PRB 0 (see Table 4.6.3-33 in TS 38.508-1) Number of PRB = 52 (see Table 5.4.2.0-23 in TS 38.508-1 [6]).	
}			

Table 5.2.2.1.2_1.3.3_1-4: Void

5.2.2.1.2_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.2_1.3.3_1

5.2.2.1.2_1.4 Test requirement

Table 5.2.2.1.2.0-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.2_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.2_1.4-1: Test Requirements for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-5.1 FDD	10 / 15	16QAM, 0.48	TDLC300-100	2x2, ULA Low	70	15.7

5.2.2.1.3 2Rx FDD FR1 PDSCH mapping Type B performance

5.2.2.1.3.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.3.0-3, with the addition of test parameters in Table 5.2.2.1.3.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.3.0-1.

Table 5.2.2.1.3.0-1: Tests purpose

Purpose	Test index
Verify PDSCH mapping Type B performance under 2 receive antenna conditions	1-1

Table 5.2.2.1.3.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type B
	k0	0
	Starting symbol (S)	5
	Length (L)	7
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	1
	Maximum number of OFDM symbols for DL front loaded DMRS	1
Number of HARQ Processes		4
The number of slots between PDSCH and corresponding HARQ-ACK information		2

Table 5.2.2.1.3.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)

1-1	R.PDSCH.1-1.3 FDD	10 / 15	QPSK, 0.30	TDLA30-10	2x2, ULA Low	70	-0.9
-----	----------------------	---------	------------	-----------	--------------	----	------

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.3.

5.2.2.1.3_1 2Rx FDD FR1 PDSCH mapping Type B performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.3_1.1 Test purpose

To verify PDSCH mapping Type B performance under 2 receive antenna conditions.

5.2.2.1.3_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and PDSCH mapping type B.

5.2.2.1.3_1.3 Test description

5.2.2.1.3_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.3.4 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.3.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.2.1.3_1.3.3.

5.2.2.1.3_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.1.3_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.3_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.3_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1.

5.2.2.1.3_1.3.3_1 Message exceptions for SA

Table 5.2.2.1.3_1.3.3_1-1: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n4		
}			

Table 5.2.2.1.3_1.3.3_1-2: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
K0	Not present		
mappingType	typeB		
startSymbolAndLength	89	Start symbol(S)=5, Length(L)=7	
}			
PDSCH-TimeDomainResourceAllocation[2]			
SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

Table 5.2.2.1.3_1.3.3_1-3: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-100			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
dmrs-DownlinkForPDSCH-MappingTypeB CHOICE			
{			
setup	DMRS-DownlinkConfig		
}			
}			

5.2.2.1.3_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.3_1.3.3_1

5.2.2.1.3_1.4 Test requirement

Table 5.2.2.1.3_1.4-1 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.3_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.3_1.4-1: Test Requirements for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.3 FDD	10 / 15	QPSK, 0.30	TDLA30-10	2x2, ULA Low	70	0.1

5.2.2.1.4 2Rx FDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance

5.2.2.1.4.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.4.0-3, with the addition of test parameters in Table 5.2.2.1.4.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.4.0-1.

Table 5.2.2.1.4.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions with CRS rate matching configured	1-1, 1-2

Table 5.2.2.1.4.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
NR UL transmission with a 7.5 kHz shift to the LTE raster			true
PDCCH configuration	Symbols with PDCCH		Symbol# 2
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		3
	Length (L)		9 for Test 1-1 11 for Test 1-2
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	DMRS Type		Type 1
	Position of the first DM-RS for downlink		3
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CRS for rate matching (Note 1)	LTE carrier centre subcarrier location		Same as NR carrier centre subcarrier location
	LTE carrier BW	MHz	10
	Number of antenna ports		4
	v-shift		0
Number of HARQ Processes			4
The number of slots between PDSCH and corresponding HARQ-ACK information			2
Note 1: No MBSFN is configured on LTE carrier			

Table 5.2.2.1.4.0-3: Minimum performance for Rank 1

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-7.1 FDD	10 / 15	QPSK, 0.30	TDLA30-10	4x2, ULA Low	70	-1.0
1-2	R.PDSCH.1-7.2 FDD	10 / 15	QPSK, 0.30	TDLA30-10	4x2, ULA Low	70	-1.0

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.4.

5.2.2.1.4_1 2Rx FDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance - 4x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.4_1.1 Test purpose

To verify the Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions with CRS rate matching configured.

5.2.2.1.4_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 15 and forward supporting capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-1 also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-2 applies to all types of NR UE release 15 and forward supporting capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

Test 1-2 also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

5.2.2.1.4_1.3 Test description

5.2.2.1.4_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.6 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.4.0-2 and Table 5.2.2.1.4.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.4_1.3.3.

5.2.2.1.4_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.1.4.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.4_1.3.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

NOTE: In the test using the NR/5GC connectivity option, collisions between NR SIB1 scheduling and LTE CRS can occur. However, these do not impact the throughput.

5.2.2.1.4_1.3.3 Message contents

5.2.2.1.4_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.4_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		FR1
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
k0	Not present		
mappingType	typeA		
startSymbolAndLength	94	Start symbol(S)=3, Length(L)=9 for Test 1-1	
	66	Start symbol(S)=3, Length(L)=11 for Test 1-2	
}			
PDSCH-TimeDomainResourceAllocation[2]			
SEQUENCE {			
k0	Not present		
mappingType	typeA		
startSymbolAndLength	66	Start symbol(S)=3, Length(L)=11 for Test 1-2	
}			
}			

Table 5.2.2.1.4_1.3.3_1-2: SearchSpace

Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1_10MHz, Long_DCI			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
controlResourceSetId	2		
monitoringSymbolsWithinSlot	00100000000000		
}			

Table 5.2.2.1.4_1.3.3_1-3: ServingCellConfigCommon

Derivation Path: TS 38.508-1 [6], Table 5.4.2-1			
Information Element	Value/remark	Comment	Condition
ServingCellConfigCommon ::= SEQUENCE {			
dmrs-TypeA-Position	pos3		
lte-CRS-ToMatchAround	RateMatchPatternLTE-CRS		
}			

Table 5.2.2.1.4_1.3.3_1-4: RateMatchPatternLTE-CRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2-20			
Information Element	Value/remark	Comment	Condition
RateMatchPatternLTE-CRS ::= SEQUENCE {			
carrierFreqDL	Same as NR carrier centre subcarrier location		
carrierBandwidthDL	n50	10MHz	
mbsfn-SubframeConfigList	Not present		
nrofCRS-Ports	n4		
v-Shift	n0		
}			

Table 5.2.2.1.4_1.3.3_1-5: Void

Table 5.2.2.1.4_1.3.3_1-6: FrequencyInfoUL-SIB

Derivation Path: TS 38.508-1 [6], Table 4.6.3-62			
Information Element	Value/remark	Comment	Condition
FrequencyInfoUL-SIB SEQUENCE {			
frequencyShift7p5khz	true		
}			

Table 5.2.2.1.4_1.3.3_1-7: PDCCH-ControlResourceSet

Derivation Path: Table TS 38.508-1 [6], 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	2		SA
duration	1	SearchSpace duration of 1 symbol from third symbol	
}			

Table 5.2.2.1.4_1.3.3_1-8: Void

Table 5.2.2.1.4_1.3.3_1-9: SearchSpace for CSS

Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0.7 using condition CSS, FR1_10MHz, Long_DCI			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
searchSpaceId	SearchSpaceId with condition CSS		CSS
controlResourceSetId	1		
monitoringSlotPeriodicityAndOffset CHOICE {			
sl1	NULL		
}			
duration	Not present	1 slot per default	
monitoringSymbolsWithinSlot	00100000000000		
nrofCandidates SEQUENCE {			SA
aggregationLevel2	n1		
aggregationLevel8	n0		
}			

Table 5.2.2.1.4_1.3.3_1-10: PDCCH-ConfigCommon

Derivation Path: TS 38.508-1 [6], Table 4.6.3-96			
Information Element	Value/remark	Comment	Condition
PDCCH-ConfigCommon ::= SEQUENCE {			
commonControlResourceSet ::= SEQUENCE {			SA
controlResourceSetId	1		
frequencyDomainResources	01110000 00000000 00000000 00000000 00000000 000000		
Duration	1		
cce-REG-MappingType CHOICE {			
nonInterleaved	Null		
}			
precoderGranularity	sameAsREG-bundle		
}			
}			

Table 5.2.2.1.4_1.3.3_1-11: SearchSpace for USS

Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1_10MHz, Long_DCI			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			SA
searchSpaceId	2		
controlResourceSetId	2		
monitoringSymbolsWithinSlot	00100000000000		
}			

5.2.2.1.4_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.4_1.3.3_1 with the following exceptions:

Table 5.2.2.1.4_1.3.3_2-1: SearchSpace

Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1_10MHz, Long_DCI			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
controlResourceSetId	1		
monitoringSymbolsWithinSlot	00100000000000		
}			

Table 5.2.2.1.4_1.3.3_2-2: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	1		
duration	1	SearchSpace duration of 1 symbol from third symbol	
}			

5.2.2.1.4_1.3.4 Test requirement

Table 5.2.2.1.4.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.4_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.4_1.3.4-1: Test requirement for Rank 1

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-7.1 FDD	10 / 15	QPSK, 0.30	TDLA30-10	4x2, ULA Low	70	0.0
1-2	R.PDSCH.1-7.2 FDD	10 / 15	QPSK, 0.30	TDLA30-10	4x2, ULA Low	70	0.0

5.2.2.1.5 2Rx FDD FR1 PDSCH 0.001% BLER performance

5.2.2.1.5.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.5.0-3, with the addition of test parameters in Table 5.2.2.1.5.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.5.0-1.

Table 5.2.2.1.5.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH 0.001% BLER performance under 2 receive antenna conditions	1-1

Table 5.2.2.1.5.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
PDSCH DMRS configuration	VRB-to-PRB mapping interleaver bundle size	N/A
	DMRS Type	Type 1
	Number of additional DMRS	1
	Maximum number of OFDM symbols for DL front loaded DMRS	1
Maximum number of HARQ transmission		1
Number of HARQ Processes		4
The number of slots between PDSCH and corresponding HARQ-ACK information		2

Table 5.2.2.1.5.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Target BLER	SNR (dB)
1-1	R.PDSCH.1-1.4 FDD	10 / 15	QPSK, 0.59	AWGN	1x2, ULA Low	0.001%	3.2

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.5.

5.2.2.1.5_1 2Rx FDD FR1 PDSCH 0.001% BLER performance - 1x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.5_1.1 Test purpose

To verify the PDSCH 0.001% BLER performance under 2 receive antenna conditions.

5.2.2.1.5_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *dl-64QAM-MCS-TableAlt* and capability IE *cqi-TableAlt*.

5.2.2.1.5_1.3 Test description

5.2.2.1.5_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.5.0-2 and Table 5.2.2.1.5.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.5_1.3.3.

5.2.2.1.5_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.1.5.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.5_1.3.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.4. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.4.3-1 in Annex G.

5.2.2.1.5_1.3.3 Message contents

5.2.2.1.5_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.5_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		FR1
mcs-Table	qam64LowSE		
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
k0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

5.2.2.1.5_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.5_1.3.3_1.

5.2.2.1.5_1.3.4 Test requirement

Table 5.2.2.1.5.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.5_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.5_1.3.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Target BLER	SNR (dB)
1-1	R.PDSCH.1-1.4 FDD	10 / 15	QPSK, 0.59	AWGN	1x2, ULA Low	0.001%	3.8

5.2.2.1.6 2Rx FDD FR1 PDSCH repetitions over multiple slots performance

5.2.2.1.6.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.6.0-3, with the addition of test parameters in Table 5.2.2.1.6-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.6.0-1.

Table 5.2.2.1.6.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH repetitions over multiple slots performance under 2 receive antenna conditions	1-1

Table 5.2.2.1.6.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	2
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
VRB-to-PRB mapping interleaver bundle size	N/A	
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	1
	Maximum number of OFDM symbols for DL front loaded DMRS	1
Number of HARQ Processes		4
The number of slots between final repetition of PDSCH and corresponding HARQ-ACK information		2

Table 5.2.2.1.6.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Target BLER	SNR (dB)
1-1	R.PDSCH.1-11.1 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x2, ULA Low	1% (Note 1)	1.6
Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.							

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.6.

5.2.2.1.6_1 2Rx FDD FR1 PDSCH repetitions over multiple slots performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.6_1.1 Test purpose

To Verify the PDSCH repetitions over multiple slots performance under 2 receive antenna conditions.

5.2.2.1.6_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-RepetitionMultiSlots-r16*.

5.2.2.1.6_1.3 Test description

5.2.2.1.6_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.6.0-2 and Table 5.2.2.1.6.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.6_1.3.3.

5.2.2.1.6_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.1.5.0-3. The SS sends downlink MAC padding bits on the DL RMC. The UE may expect that the TB is repeated with same symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.5_1.3.4-1.
3. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport blocks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.5 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.2.1.6_1.3.3 Message contents

5.2.2.1.6_1.3.3_1 Message exceptions for SA & NSA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.6_1.3.3_1-1: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
pdsch-AggregationFactor	2		
}			

5.2.2.1.6_1.3.4 Test requirement

Table 5.2.2.1.6.0-3 defines the primary level settings.

The target BLER percentage for the downlink reference measurement channels specified in Annex 3.2.1 for each BLER test shall meet or exceed the specified value in Table 5.2.2.1.6_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.6_1.3.4-1: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Target BLER	SNR (dB)
1-1	R.PDSCH.1-11.1 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x2, ULA Low	1% (Note 1)	[2.3]
Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.							

5.2.2.1.7 2Rx FDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance

5.2.2.1.7.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.7.0-3, with the addition of test parameters in Table 5.2.2.1.7.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.7.0-1.

Table 5.2.2.1.7.0-1: Tests purpose

Purpose	Test index
Verify PDSCH mapping Type B performance and UE processing capability 2 under two receive antenna conditions	1-1

Table 5.2.2.1.7.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type B
	k0		0
	Starting symbol (S)		2
	Length (L)		2
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		0
	Maximum number of OFDM symbols for DL front loaded DMRS		1
Maximum number of HARQ transmission			1
Number of HARQ Processes			2
The number of slots between PDSCH and corresponding HARQ-ACK information			0

Table 5.2.2.1.7.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-12.1 FDD	10 / 15	QPSK, 0.30	TDLA30-10	2x2, ULA Low	70	0.8

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.7.

5.2.2.1.7_1 2Rx FDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.7_1.1 Test purpose

To verify PDSCH mapping Type B performance and UE processing capability 2 under two receive antenna conditions.

5.2.2.1.7_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-ProcessingType2*.

5.2.2.1.7_1.3 Test description

5.2.2.1.7_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.7.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.7_1.3.3.

5.2.2.1.7_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.1.7.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.7_1.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.7_1.3.3 Message contents

5.2.2.1.7_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.7_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entries		FR1
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
k0	Not present		
mappingType	typeB		
startSymbolAndLength	16	Start symbol(S)=2, Length(L)=2	
}			
}			

Table 5.2.2.1.7_1.3.3_1-2: PUCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-112			
Information Element	Value/remark	Comment	Condition
PUCCH-Config ::= SEQUENCE {			FR1
dl-DataToUL-ACK SEQUENCE (SIZE (1)) OF	1 entry		
INTEGER {			
INTEGER[1]	0	entry 1	
}			
}			

Table 5.2.2.1.7_1.3.3_1-3: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
PDSCH-to-HARQ_feedback timing indicator	K1=0 as per dl-DataToUL-ACK in Table 5.2.2.1.7_1.3.3_1-3	"000"	

5.2.2.1.7_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.7_1.3.3_1.

5.2.2.1.7_1.4 Test requirement

Table 5.2.2.1.7.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.7_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.7_1.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-12.1 FDD	10 / 15	QPSK, 0.30	TDLA30-10	2x2, ULA Low	70	1.8

5.2.2.1.8 2Rx FDD FR1 PDSCH pre-emption performance

5.2.2.1.8.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.8.0-3, with the addition of test parameters in Table 5.2.2.1.8.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.8.0-1.

Table 5.2.2.1.8.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH pre-emption performance under 2 receive antenna conditions	1-1

Table 5.2.2.1.8.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
PDCCH configuration (Note 4)	Symbols with PDCCH		0, 1
	DCI format		2_1
	timeFrequencySet		14x1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
Pre-emption configuration (Note 2)	Starting symbol (S)		3
	Length (L)		2
	Pre-emption periodicity and offset (Note 3)	Slots	10/1
Number of HARQ Processes			4
The number of slots between PDSCH and corresponding HARQ-ACK information			2
Note 1: Void			
Note 2: Interference modelled as random data on pre-empted REs.			
Note 3: Pre-emption is scheduled with a fixed scheduling with 10% probability within 10ms periodicity.			
Note 4: In addition to PDCCH configuration in Table 5.2-1.			

Table 5.2.2.1.8.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 1-2.5 FDD	10 / 15	16QAM 0.64	TDLA30-10	2x2, ULA Low	70	10.5

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.8.

5.2.2.1.8_1 2Rx FDD FR1 PDSCH pre-emption performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.8_1.1 Test purpose

To Verify the PDSCH pre-emption performance under 2 receive antenna conditions.

5.2.2.1.8_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pre-emptIndication-DL-r16*.

5.2.2.1.6_1.3 Test description

5.2.2.1.6_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.8.0-2 and Table 5.2.2.1.8.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.8_1.3.3.

5.2.2.1.8_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.1.8.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. SS transmits PDCCH DCI format 2_1 for int_RNTI with 10% probability to transmit the DL Preemption indication according to Table 5.2.2.1.8.0-2. In the time and frequency set indicated by PDCCH DCI format 2_1, SS stops transmission of PDSCH.
3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.8_1.3.4-1.
4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.8_1.3.3 Message contents

5.2.2.1.8_1.3.3_1 Message exceptions for SA

Table 5.2.2.1.8_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE (1..maxNrofDL-Allocations)) OF {	2 entry		FR1
PDSCH-TimeDomainResourceAllocation [1]			
SEQUENCE {			
k0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

Table 5.2.2.1.8_1.3.3_1-2: PDCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-95			
Information Element	Value/remark	Comment	Condition
PDCCH-Config ::= SEQUENCE {			
DownlinkPreemption ::= SEQUENCE {	SS arbitrarily selects a value between '0001'H and 'FFEF'H different from the MCG (and SCG) RNTI-Value.		
int-RNTI			
timeFrequencySet	set0		
dci-PayloadSize	14		
Int-ConfigurationPerServingCell SEQUENCE (SIZE (1..maxNrofServingCells)) OF SEQUENCE {			
servingCellId	ServCellIndex		
positionInDCI	0		
}			
}			

Table 5.2.2.1.8_1.3.3_1-3: Physical layer parameters for DCI format 2_1

Parameter	Value	Value in binary	Condition
Pre-emption indication 1	Indicating symbols 3 and 4	01100000000000	

5.2.2.1.8_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.8_1.3.3_1.

5.2.2.1.8_1.3.4 Test requirement

Table 5.2.2.1.8.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.8_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.8_1.3.4-1: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 1-2.5 FDD	10 / 15	16QAM 0.64	TDLA30-10	2x2, ULA Low	70	11.5

5.2.2.1.9 2Rx FDD FR1 HST-SFN performance

5.2.2.1.9.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.9.0-3, with the test parameters defined in Table 5.2.2.1.9.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.9.0-1.

Table 5.2.2.1.9.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when highSpeedDemodFlag-r16 IE [20] is configured	1-1

Table 5.2.2.1.9.0-2: Test Parameters for Testing

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	2
	Maximum number of OFDM symbols for DL front loaded DMRS	1
CSI-RS for tracking	CSI-RS periodicity	Slots 10 for CSI-RS resource 1,2,3,4.
	CSI-RS offset	Slots 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4.
Number of HARQ Processes		4
The number of slots between PDSCH and corresponding HARQ-ACK information		2

Table 5.2.2.1.9.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)

1-1	R.PDSCH.1-8.3 FDD	10 / 15	16QAM, 0.48	HST-SFN	2x2	70	13.0
-----	----------------------	---------	----------------	---------	-----	----	------

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.9.

5.2.2.1.9_1 2Rx FDD FR1 HST-SFN performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.9_1.1 Test purpose

To verify the PDSCH performance under 2 receive antennas conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* IE [20] is configured and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.2.1.9_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC that supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

5.2.2.1.9_1.3 Test description

5.2.2.1.9_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.9.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.9_1.3.3.

5.2.2.1.9_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2.2.1.9_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.9_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.1.9_1.4-1 as appropriate.

5.2.2.1.9_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.9_1.3.3_1 Message exceptions for SA

Table 5.2.2.1.9_1.3.3_1-1: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present	n2 for test 1-1	
}			
}			
}			

Table 5.2.2.1.9_1.3.3_1-2: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	for test 1-1	
}			

Table 5.2.2.1.9_1.3.3_1-3: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n4	for test 1-1	
}			

Table 5.2.2.1.9_1.3.3_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots10	1 for CSI-RS resource #1 and #2 2 for CSI-RS resource #3 and #4	For test 1-1: offset = 1 for CSI-RS resource 1 and 2 offset =2 for CSI-RS resource 3 and 4.	
}			

5.2.2.1.9_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.9_1.3.3_1

5.2.2.1.9_1.4 Test requirement

Tables 5.2.2.1.9_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.9_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.9_1.4-1: Test Requirements for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-8.3 FDD	10 / 15	16QAM, 0.48	HST-SFN	2x2	70	13.6

5.2.2.1.10 2Rx FDD FR1 HST DPS performance

5.2.2.1.10.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.10.0-3, with the test parameters defined in Table 5.2.2.1.10.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.10.0-1.

Table 5.2.2.1.10.0-1: Tests purpose

Purpose	Test index
Verify UE performance in the HST-DPS scenario defined in B.3.3	1-1, 1-2

Table 5.2.2.1.10.0-2: Test Parameters for Testing

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
PDCCH configuration	TCI state		Note 1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
	TCI state		Note 1
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		2
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CSI-RS for tracking	Resource set #1	First OFDM symbol in the PRB used for CSI-RS	$l_0 = 5$ for CSI-RS resource 1 and 3 $l_0 = 9$ for CSI-RS resource 2 and 4
		CSI-RS periodicity	Slots 10 for CSI-RS resource 1,2,3,4.
		CSI-RS offset	Slots 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4
		QCL info	TCI state #2
	Resource set #2	First OFDM symbol in the PRB used for CSI-RS	$l_0 = 6$ for CSI-RS resource 5 and 6 $l_0 = 10$ for CSI-RS resource 7 and 8
		CSI-RS periodicity	Slots 10 for CSI-RS resource 5,6,7,8.
		CSI-RS offset	Slots 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8
		QCL info	TCI state #3
NZP CSI-RS for CSI acquisition	Resource set #3	First OFDM symbol in the PRB used for CSI-RS	$l_0 = 12$
		CSI-RS periodicity	Slots 20
		CSI-RS offset	Slots 0
		QCL info	TCI state #0
	Resource set #4	First OFDM symbol in the PRB used for CSI-RS	$l_0 = 13$
		CSI-RS periodicity	Slots 20
		CSI-RS offset	Slots 0
		QCL info	TCI state #1
TCI state #0	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration
		QCL Type	Type A
	Type 2 QCL information	CSI-RS resource	N/A
		QCL Type	N/A
TCI state #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration
		QCL Type	Type A
	Type 2 QCL information	CSI-RS resource	N/A
		QCL Type	N/A
TCI state #2	Type 1 QCL information	SSB index	SSB #0
		QCL Type	Type C
	Type 2 QCL information	SSB index	N/A

TCI state #3	Type 1 QCL information	QCL Type	N/A
		SSB index	SSB #1
	Type 2 QCL information	QCL Type	Type C
		SSB index	N/A
		QCL Type	N/A
Number of HARQ Processes			4
The number of slots between PDSCH and corresponding HARQ-ACK information			2
<p>Note 1: SSB # (k mod 2) , CSI-RS (for tracking) resource set # ((k mod 2) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 2) + 3) are transmitted by kth RRH.</p> <p>For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy mod(i, 2n) = n. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#</p> $\max [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}} + T_{\text{firstTRS}} + T_{\text{TRS proc}}, 0]$ <p>to slot#</p> $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$ <p>PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.</p> <p>For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy mod(i, 2n) = n. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#</p> $\max [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}}, 0]$ <p>to slot#</p> $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$ <p>Where k=0, 1, 2... is the RRH number, n = 2520 is half of the number of slots between two RRH, T_{HARQ} = 2 is the number of slots between PDSCH and corresponding HARQ-ACK information, T_{MAC proc} = 3 is the number of slots for MAC CE processing, T_{firstTRS} = 6 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, T_{TRS proc} = 2 is the number of slots for TRS processing.</p>			

Table 5.2.2.1.10.0-3: Minimum performance for HST-DPS

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-8.4 FDD	10 / 15	64QAM, 0.43	HST-DPS	1	2x2	70	13.4
1-2	R.PDSCH.1-8.4 FDD	10 / 15	64QAM, 0.43	HST-DPS	2	2x2	70	13.4

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.10.

5.2.2.1.10_1 2Rx FDD FR1 HST-DPS performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.10_1.1 Test purpose

To verify UE performance in the HST-DPS scenario defined in B.3.3 and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.2.1.10_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.1.10_1.3 Test description

5.2.2.1.10_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.10.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.10_1.3.3.

5.2.2.1.10_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2.2.1.10_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.10_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.1.10_1.4-1 as appropriate.

5.2.2.1.10_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.10_1.3.3_1 Message exceptions for SA

Table 5.2.2.1.10_1.3.3_1-1: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present	n2 is used	test 1-1, 1-2
}			
}			
}			

Table 5.2.2.1.10_1.3.3_1-2: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	for test 1-1, 1-2	
}			

Table 5.2.2.1.10_1.3.3_1-3: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n4	for test 1-1, 1-2	
}			

Table 5.2.2.1.10_1.3.3_1-4: NZP-CSI-RS-Resource for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
nzp-CSI-RS-ResourceId	i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8	for test 1-1, 1-2	
qcl-InfoPeriodicCSI-RS	2 for CSI-RS resource #1, #2, #3, #4 3 for CSI-RS resource #5, #6, #7, #8	for test 1-1, 1-2: TCI-StateId for TCI- State #2 for CSI-RS resource #1, #2, #3, #4 TCI-StateId for TCI- State #3 for CSI-RS resource #5, #6, #7, #8	
}			

Table 5.2.2.1.10_1.3.3_1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.2.1.10_1.3.3_1-4)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	5 for CSI-RS resource #1 and #3 9 for CSI-RS resource #2 and #4 6 for CSI-RS resource #5 and #6 10 for CSI-RS resource #7 and #8	for test 1-1, 1-2: l ₀ = 5 for CSI-RS resource 1 and 3 l ₀ = 9 for CSI-RS resource 2 and 4 l ₀ = 6 for CSI-RS resource 5 and 6 l ₀ = 10 for CSI-RS resource 7 and 8	
}			

Table 5.2.2.1.10_1.3.3_1-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking (Table 5.2.2.1.10_1.3.3_1-4)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE { slots10	1 for CSI-RS resource #1, #2, #5, #6 2 for CSI-RS resource #3 #4, #7, #8	For test 1-1, 1-2: periodicity: 10 slots. offset: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8	
}			

Table 5.2.2.1.10_1.3.3_1-6: NZP-CSI-RS-ResourceSet for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-ResourceSet ::= SEQUENCE { nzp_CSI_ResourceSetId	0 for Resource set #1 1 for Resource set #2	For test 1-1, 1-2	
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { NZP-CSI-RS-ResourceId[1]	0	entry 1 CSI-RS resource #1	Resource set #1
NZP-CSI-RS-ResourceId[2]	1	entry 2 CSI-RS resource #2	
NZP-CSI-RS-ResourceId[3]	2	entry 3 CSI-RS resource #3	
NZP-CSI-RS-ResourceId[4]	3	entry 4 CSI-RS resource #4	
}			
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { NZP-CSI-RS-ResourceId[1]	4	entry 1 CSI-RS resource #5	Resource set #2
NZP-CSI-RS-ResourceId[2]	5	entry 2 CSI-RS resource #6	
NZP-CSI-RS-ResourceId[3]	6	entry 3 CSI-RS resource #7	
NZP-CSI-RS-ResourceId[4]	7	entry 4 CSI-RS resource #8	
}			
}			

Table 5.2.2.1.10_1.3.3_1-7: NZP-CSI-RS-Resource for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
nzp-CSI-RS-ResourceId	8 for CSI-RS resource #9 9 for CSI-RS resource #10	for test 1-1, 1-2	
qcl-InfoPeriodicCSI-RS	0 for CSI-RS resource #9 1 for CSI-RS resource #10	for test 1-1, 1-2: TCI-State #0 for CSI-RS resource #9 TCI-State #1 for CSI-RS resource #10	
}			

Table 5.2.2.1.10_1.3.3_1-8: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.2.1.10_1.3.3_1-7)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	12 for CSI-RS resource #9 13 for CSI-RS resource #10	for test 1-1, 1-2 $l_0=12$ for CSI-RS resource #9 $l_0=13$ for CSI-RS resource #10	
}			

Table 5.2.2.1.10_1.3.3_1-9: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.2.1.10_1.3.3_1-7)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots20	0	For test 1-1, 1-2: periodicity = 20 slots. offset = 0 slots	
}			

Table 5.2.2.1.10_1.3.3_1-10: NZP-CSI-RS-ResourceSet for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-ResourceSet ::= SEQUENCE {			
nzp_CSI_ResourceSetId	2 for Resource set #3 3 for Resource set #4	For test 1-1, 1-2	
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	1 entry	For test 1-1, 1-2	Resource set #3
NZP-CSI-RS-ResourceId[1]	8	entry 1 CSI-RS resource #9	
}			
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	1 entry	For test 1-1, 1-2	Resource set #4
NZP-CSI-RS-ResourceId[1]	9	entry 1 CSI-RS resource #10	
}			
}			

Table 5.2.2.1.10_1.3.3_1-10: TCI-State

Derivation Path: TS 38.508-1 [6], Table 4.6.3-190			
Information Element	Value/remark	Comment	Condition
TCI-State ::= SEQUENCE {			
tci-StateId	0 for TCI state #0 1 for TCI state #1 2 for TCI state #2 3 for TCI state #3	For test 1-1, 1-2	
qcl-Type1 SEQUENCE {			
bwp-Id	BWP-Id of active BWP		TCI state #0, TCI state #1
	Not present		TCI state #2, TCI state #3
referenceSignal CHOICE {			
csi-rs	0	CSI-RS resource #1	TCI state #0
	4	CSI-RS resource #5	TCI state #1
ssb	0	SSB #0	TCI state #2
	1	SSB #1	TCI state #3
}			
qcl-Type	typeA		TCI state #0, TCI state #1
	typeC		TCI state #2, TCI state #3
}			
}			

5.2.2.1.10_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.10_1.3.3_1

5.2.2.1.10_1.4 Test requirement

Tables 5.2.2.1.10_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.10_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.10_1.4-1: Test Requirements for HST-DPS

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-8.4 FDD	10 / 15	64QAM, 0.43	HST-DPS	1	2x2	70	14.0
1-2	R.PDSCH.1-8.4 FDD	10 / 15	64QAM, 0.43	HST-DPS	2	2x2	70	14.0

5.2.2.1.11 2Rx FDD FR1 PDSCH Single-DCI based SDM scheme performance

5.2.2.1.11.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.11.0-3, with the addition of test parameters in Table 5.2.2.1.11.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.11.0-1.

Table 5.2.2.1.11.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance with Single-DCI based SDM scheme under 2 receive antenna conditions	1-1,1-2

Table 5.2.2.1.11.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		0	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	20	
	CSI-RS offset	Slots	10 for CSI-RS resources 1 and 2 11 for CSI-RS resources 3 and 4	10 for CSI-RS resources 5 and 6 11 for CSI-RS resources 7 and 8
QCL info			TCI state #0	
Duplex mode			FDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PRB bundling type		Static	
	PRB bundling size		2	
	Resource allocation type		Type 1	
RBG size			Config2	

	VRB-to-PRB mapping type			Non-interleaved	
	VRB-to-PRB mapping interleaver bundle size			N/A	
PDSCH DMRS configuration	Antenna port indexes			1000	1002
	TCI state			TCI State #1	TCI State #2
	DMRS Type			Type 1	
	Number of additional DMRS			1	
	Maximum number of OFDM symbols for DL front loaded DMRS			1	
TCI State #1	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type		Type A	N/A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource		N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type		N/A	Type A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
Resource allocation				Full-overlapping	
Timing offset of the second TRxP from the first TRxP			us	-0.5 for test 1-1 2 for test 1-2	
Frequency offset of the second TRxP from the first TRxP			Hz	200 for test 1-1 0 for test 1-2	
Number of HARQ Processes				4	
The number of slots between PDSCH and corresponding HARQ-ACK information				2	
Precoding configuration				SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs (PDSCH Layer 0 is transmitted from TRxP #1 and PDSCH layer 1 is transmitted from TRxP #2)					

Table 5.2.2.1.11.0-3: Minimum performance

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Not e 1)	Correlation matrix and antenna configuration(Not e 2)	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)(Not e 3)
1-1	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	20.7
1-2	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	20.1
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent							
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2							
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP							

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.11.

5.2.2.1.11_1 2Rx FDD FR1 PDSCH Single-DCI based SDM scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.1.11_1.1 Test purpose

To verify the PDSCH performance with Single-DCI based SDM scheme under 2 receive antenna conditions.

5.2.2.1.11_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *singleDCI-SDM-scheme-r16*.

5.2.2.1.11_1.3 Test description

5.2.2.1.11_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.11.0-2 and Table 5.2.2.1.11.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.11_1.3.3.

5.2.2.1.11_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.1.11_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.11_1.3.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Table 5.2.2.1.11_1.3.4-1 as appropriate.

5.2.2.1.11_1.3.3 Message contents

5.2.2.1.11_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.11_1.3.3_1-1: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
PDSCH-to-HARQ_feedback timing indicator	K1 = 2	"010"	
Antenna port(s)	DMRS port 0 and 2	"1011"	
Transmission configuration indication	TCI state 1 and 2	"000"	

Table 5.2.2.1.11_1.3.3_1-2: *CellGroupConfig*

Derivation Path: TS 38.508-1 [6], Table 4.6.3-19			
Information Element	Value/remark	Comment	Condition
CellGroupConfig ::= SEQUENCE {			
simultaneousTCI-UpdateList1-r16 SEQUENCE {			
ServCellIndex [1]	ServCellIndex		
}			
}			

Table 5.2.2.1.11_1.3.3_1-3: *ControlResourceSet*

Derivation Path: TS 38.508-1 [6], Table 4.6.3-28			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
tci-PresentInDCI	enabled		
}			

Table 5.2.2.1.11_1.3.3_1-4: *PDSCH-Config*

Derivation Path: TS 38.508-1 [6], Table 4.6.3-100			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1]	TCI-State with condition TCI-state-0		
TCI-State[2]	TCI-State with condition TCI-state-1		
TCI-State[3]	TCI-State with condition TCI-state-2		
}			
rbg-Size	config2		
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present		
}			
}			
}			

Table 5.2.2.1.11_1.3.3_1-5: TCI-State

Derivation Path: TS 38.508-1 [6], Table 4.6.3-190			
Information Element	Value/remark	Comment	Condition
TCI-State ::= SEQUENCE {			
tci-StateId	0		TCI-state-0
	1		TCI-state-1
	2		TCI-state-2
qcl-Type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		TCI-state-0
csi-rs	1		TCI-state-1
	5		TCI-state-2
}			
qcl-Type	typeA		
}			
qcl-Type2	Not present		
}			

Table 5.2.2.1.11_1.3.3_1-6: NZP-CSI-RS-Resource

Derivation Path: TS 38.508-1 [6], Table 4.6.3-85			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
resourceMapping SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
cdm-Type	noCDM		
density CHOICE {			
three	NULL		
}			
periodicityAndOffset CHOICE {			
slots20	10	For CSI-RS resources 1,2,5,6	
	11	For CSI-RS resources 3,4,7,8	
}			
qcl-InfoPeriodicCSI-RS	0		
}			

5.2.2.1.11_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.11_1.3.3_1.

5.2.2.1.11_1.3.4 Test requirement

Table 5.2.2.1.11.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.11_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.11_1.3.4-1: Test requirement

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Not e 1)	Correlation matrix and antenna configuration(Not e 2)	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)(Not e 3)
1-1	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	21.7
1-2	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	21.1
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent							
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2							
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP							

5.2.2.1.12 2Rx FDD FR1 PDSCH Multi-DCI based transmission scheme performance

5.2.2.1.12.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.12.0-3, with the addition of test parameters in Table 5.2.2.1.12.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.12.0-1.

Table 5.2.2.1.12.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs	1-1

Table 5.2.2.1.12.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	TCI State #2
	CORESETPoolIndex		0,1	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
CSI-RS periodicity	Slots	20		

		CSI-RS offset	Slots	10 for CSI-RS resources 1 and 2 11 for CSI-RS resources 3 and 4	10 for CSI-RS resources 5 and 6 11 for CSI-RS resources 7 and 8
		QCL info		TCI state #0	
Duplex mode				FDD	
Active DL BWP index				1	
PDSCH configuration	Mapping type			Type A	
	k0			0	
	Starting symbol (S)			2	
	Length (L)			12	
	PRB bundling type			Static	
	PRB bundling size			2	
	Resource allocation type			Type 1	
	RBG size			Config2	
	VRB-to-PRB mapping type			Non-interleaved	
VRB-to-PRB mapping interleaver bundle size			N/A		
PDSCH DMRS configuration	Antenna port indexes			{1000,1001}	{1002,1003}
	TCI state			TCI State #1	TCI State #2
	DMRS Type			Type 1	
	Number of additional DMRS			1	
	Maximum number of OFDM symbols for DL front loaded DMRS			1	
TCI State #1	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type		Type A	N/A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource		N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type		N/A	Type A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
Resource allocation				Non-overlapping	
Timing offset of the second TRxP from the first TRxP			us	-0.5	
Frequency offset of the second TRxP from the first TRxP			Hz	200	
Number of HARQ Processes				4	
The number of slots between PDSCH and corresponding HARQ-ACK information				2	
Precoding configuration				SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs. Transmission from TRxP #1 uses CORESETPoolIndex 0 and transmission from TRxP #2 uses CORESETPoolIndex 1					

Table 5.2.2.1.12.0-3: Minimum performance

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Note 1)	Correlation matrix and antenna configuration(Note 2)	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)(Note 3)

	TRxP #1	TRxP #2						
1-1	R.PDSCH. 1-3.3 FDD	R.PDSCH. 1-3.4 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	20.6
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent								
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2								
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.12.

5.2.2.1.12_1 2Rx FDD FR1 PDSCH Multiple-DCI based transmission scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.1.12_1.1 Test purpose

To verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs.

5.2.2.1.12_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *multiDCI-MultiTRP-r16*.

5.2.2.1.12_1.3 Test description

5.2.2.1.12_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.12.0-2 and Table 5.2.2.1.12.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.12_1.3.3.

5.2.2.1.12_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 via PDCCH DCI format 1_1 for C_RNTI in ControlResourceSetid1 (Table 5.2.2.1.12_1.3.3_1-2), and transmits PDSCH in TRxP#2 via PDCCH DCI format 1_1 for C_RNTI in ControlResourceSetid2 (Table 5.2.2.1.12_1.3.3_1-3), to transmit the DL RMC according to Table 5.2.2.1.12_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.2.1.12_1.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.12_1.3.3 Message contents

5.2.2.1.12_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.12_1.3.3_1-1: PDCCH-Config (Preamble)

Derivation Path: TS 38.508-1 [4], Table 4.6.3-95			
Information Element	Value/remark	Comment	Condition
PDCCH-Config ::= SEQUENCE {			
controlResourceSetToAddModList	2 entries		
SEQUENCE(SIZE (1..3)) OF ControlResourceSet {			
ControlResourceSet[1]	ControlResourceSetid1	entry 1	
ControlResourceSet[2]	ControlResourceSetid2	entry 2	
}			
}			

Table 5.2.2.1.12_1.3.3_1-2: ControlResourceSetId1 (Table 5.2.2.1.12_1.3.3_1-1: PDCCH-Config)

Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	1		
frequencyDomainResources	11110000 00000000 00000000 00000000 00000000 000000	CORESET to use the least significant 24 RBs of the BWP	
tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId {			
TCI-StateId[1]	1		
}			
tci-PresentInDCI	enabled		
coresetPoolIndex-r16	0		
}			

Table 5.2.2.1.12_1.3.3_1-3: ControlResourceSetId2 (Table 5.2.2.1.12_1.3.3_1-1: PDCCH-Config)

Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	2		
frequencyDomainResources	00001111 00000000 00000000 00000000 00000000 000000	CORESET to use the RBs 24~47 of the BWP	
tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId {			
TCI-StateId[1]	2		
}			
tci-PresentInDCI	enabled		
coresetPoolIndex-r16	1		
}			

Table 5.2.2.1.12_1.3.3_1-4: Physical layer parameters for DCI format 1_1 in ControlResourceSetid1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 0 and 1	"0111"	
Transmission configuration indication	TCI State #1	"000"	

Table 5.2.2.1.12_1.3.3_1-5: Physical layer parameters for DCI format 1_1 in ControlResourceSetid2

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 2 and 3	"1000"	
Transmission configuration indication	TCI State #2	"001"	

Table 5.2.2.1.12_1.3.3_1-6: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE (1..maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1] SEQUENCE {		TCI-state-0	
tci-StateId	0		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		
}			
qcl-Type	typeC		
}			
TCI-State[2]		TCI-state-1	
tci-StateId	1		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	1		
}			
qcl-Type	typeA		
}			
TCI-State[3]		TCI-state-2	
tci-StateId	2		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	5		
}			
qcl-Type	typeA		
}			
}			
}			

Table 5.2.2.1.12_1.3.3_1-7: CSI-RS-ResourceMapping for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMsymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
}			

Table 5.2.2.1.12_1.3.3_1-8: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots20	10	For CSI-RS resources 1,2,5,6	
slots20	11	For CSI-RS resources 3,4,7,8	
}			

5.2.2.1.12_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.12_1.3.3_1.

5.2.2.1.12_1.4 Test requirement

Table 5.2.2.1.12.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.12_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.12_1.4-1: Test requirement

Test num.	Reference channel		Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB) (Note 3)
	TRxP #1	TRxP #2						
1-1	R.PDSCH. 1-3.3 FDD	R.PDSCH. 1-3.4 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	21.6
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2 Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

5.2.2.1.13 2Rx FDD FR1 PDSCH Single-DCI based FDM scheme A performance

5.2.2.1.13.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.13.0-3, with the addition of test parameters in Table 5.2.2.1.13.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.13.0-1.

Table 5.2.2.1.13.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 2 receive antenna conditions when UE is configured with "FDMSchemeA" in "RepetitionScheme-r16" defined in clause 5.1 of TS 38.214 [12]	1-1

Table 5.2.2.1.13.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		Not configured	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	20	
	CSI-RS offset	Slots	10 for CSI-RS resources 1 and 2 11 for CSI-RS resources 3 and 4	10 for CSI-RS resources 5 and 6 11 for CSI-RS resources 7 and 8
	QCL info		TCI state #0	
Duplex mode			FDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PRB bundling type		Static	
	PRB bundling size		Wideband	
	Resource allocation type		Type 0	
	RBG size		Config2	
	VRB-to-PRB mapping type		Non-interleaved	
VRB-to-PRB mapping interleaver bundle size		N/A		
PDSCH DMRS configuration	Antenna port indexes		1000,1001	1000,1001
	TCI state		TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
	Maximum number of OFDM symbols for DL front loaded DMRS		1	

TCI State #1	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type		Type A	N/A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource		N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type		N/A	Type A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
Timing offset of the second TRxP from the first TRxP			us	-0.5	
Frequency offset of the second TRxP from the first TRxP			Hz	200	
Number of HARQ Processes				4	
The number of slots between PDSCH and corresponding HARQ-ACK information				2	
Precoding configuration				SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs					

Table 5.2.2.1.13.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
						Fraction of maximum throughput (%)	SNR (dB) (Note 3)
1-1	R.PDSCH.1-2.5 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x2, ULA Low	70	17.3
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.							
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.							
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2							

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.13.

5.2.2.1.13_1 2Rx FDD FR1 PDSCH Single-DCI based FDM scheme A performance - 2x2 MIMO for both SA and NSA

5.2.2.1.13_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16”.

5.2.2.1.13_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportFDM-SchemeA-r16*.

5.2.2.1.13_1.3 Test description

5.2.2.1.13_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.13.0-2 and Table 5.2.2.1.13.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, *Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, *Test Mode On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.13_1.3.3.

5.2.2.1.13_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 and TRxP#2 via PDCCH DCI format 1_1 for C_RNTI (Table 5.2.2.1.13_1.3.3_1-2), to transmit the DL RMC according to Table 5.2.2.1.13_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.2.1.13_1.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.13_1.3.3 Message contents

5.2.2.1.13_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.13_1.3.3_1-1: PDCCH-ControlResourceSet (Preamble)

Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
tci-PresentInDCI	enabled		
}			

Table 5.2.2.1.13_1.3.3_1-2: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 0 and 1	"0111"	
Transmission configuration indication	TCI codepoint 0, corresponding to TCI State #1 and #2	"000"	

Table 5.2.2.1.13_1.3.3_1-3: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE (1..maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1] SEQUENCE {		TCI-state-0	
tci-StateId	0		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		
}			
qcl-Type	typeC		
}			
TCI-State[2]		TCI-state-1	
tci-StateId	1		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	1		
}			
qcl-Type	typeA		
}			
TCI-State[3]		TCI-state-2	
tci-StateId	2		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	5		
}			
qcl-Type	typeA		
}			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	wideband		
}			
repetitionSchemeConfig-r16 CHOICE {			
setup SEQUENCE {			
fdm-TDM-r16 CHOICE {			
setup SEQUENCE {			
repetitionScheme-r16	fdmSchemeA		
startingSymbolOffsetK-r16	Not present		
}			
}			
}			
}			
}			

Table 5.2.2.1.13_1.3.3_1-4: CSI-RS-ResourceMapping for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
}			

Table 5.2.2.1.13_1.3.3_1-5: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots20	10	For CSI-RS resources 1,2,5,6	
slots20	11	For CSI-RS resources 3,4,7,8	
}			

5.2.2.1.13_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.13_1.3.3_1.

5.2.2.1.13_1.4 Test requirement

Table 5.2.2.1.13.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.13_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.13_1.4-1: Test requirement for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
						Fraction of maximum throughput (%)	SNR (dB) (Note 3)
1-1	R.PDSCH.1-2.5 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x2, ULA Low	70	18.3
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2							

5.2.2.1.14 2Rx FDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance

5.2.2.1.14.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.14.0-3, with the addition of test parameters in Table 5.2.2.1.14.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.14.0-1.

Table 5.2.2.1.14.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 2 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states defined in clause 5.1 of TS 38.214 [12]	1-1

Table 5.2.2.1.14.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		Not configured	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	20	
	CSI-RS offset	Slots	10 for CSI-RS resources 1 and 2 11 for CSI-RS resources 3 and 4	10 for CSI-RS resources 5 and 6 11 for CSI-RS resources 7 and 8
	QCL info		TCI state #0	
Duplex mode			FDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	Repetition number		2	
	PRB bundling type		Static	
	PRB bundling size		2	
	Resource allocation type		Type 0	
	RBG size		Config2	
	VRB-to-PRB mapping type		Non-interleaved	
VRB-to-PRB mapping interleaver bundle size		N/A		
PDSCH DMRS configuration	Antenna port indexes		1000	1000
	TCI state		TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
	Maximum number of OFDM symbols for DL front loaded DMRS		1	

TCI State #1	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type		Type A	N/A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource		N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type		N/A	Type A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
Timing offset of the second TRxP from the first TRxP			us	2	
Frequency offset of the second TRxP from the first TRxP			Hz	200	
Number of HARQ Processes				4	
The number of slots between PDSCH and corresponding HARQ-ACK information				2	
Precoding configuration				SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs					

Table 5.2.2.1.14.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
						BLER (%)	SNR (dB) (Note 4)
1-1	R.PDSCH.1-11.2 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x2, ULA Low	1 (Note 3)	2.9
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2							

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.14.

5.2.2.1.14_1 2Rx FDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.1.14_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states.

5.2.2.1.14_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportTDM-SchemeA-r16*.

5.2.2.1.14_1.3 Test description

5.2.2.1.14_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.14.0-2 and Table 5.2.2.1.14.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.14_1.3.3.

5.2.2.1.14_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 and TRxP#2 via PDCCH DCI format 1_1 for C_RNTI (Table 5.2.2.1.14_1.3.3_1-2), to transmit the DL RMC according to Table 5.2.2.1.14_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.2.1.14_1.4-1.
3. Measure the residual BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport blocks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.4 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.2.1.14_1.3.3 Message contents

5.2.2.1.14_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.14_1.3.3_1-1: PDCCH-ControlResourceSet (Preamble)

Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
tci-PresentInDCI	enabled		
}			

Table 5.2.2.1.14_1.3.3_1-2: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 0	"0000"	
Transmission configuration indication	TCI codepoint 0, corresponding to TCI State #1 and #2	"000"	

Table 5.2.2.1.14_1.3.3_1-3: *PDSCH-Config*

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE(1..maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1] SEQUENCE {		TCI-state-0	
tci-StateId	0		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		
}			
qcl-Type	typeC		
}			
TCI-State[2]		TCI-state-1	
tci-StateId	1		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	1		
}			
qcl-Type	typeA		
}			
TCI-State[3]		TCI-state-2	
tci-StateId	2		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	5		
}			
qcl-Type	typeA		
}			
}			
pdsch-TimeDomainAllocationList	Not present		
pdsch-TimeDomainAllocationList-r16 CHOICE {			
setup SEQUENCE (SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation-r16 {			
PDSCH-TimeDomainResourceAllocation-r16[1] SEQUENCE {			
k0-r16	Not present		
mappingType-r16	typeA		
startSymbolAndLength-r16	44	Start symbol(S) =2, Length(L)= 4	For Slot i, if mod(i, 10) = 7 for i from {0,...,39}
repetitionNumber-r16	2		
}			
PDSCH-TimeDomainResourceAllocation-r16[2] SEQUENCE {			
k0-r16	Not present		
mappingType-r16	typeA		
startSymbolAndLength-r16	53	Start symbol(S) =2, Length(L)= 12	For Slot i, if mod(i, 10) = {0,1,2,3,4,5,} for i from {1,...,39}
repetitionNumber-r16	2		
}			
}			
}			

}			
}			
}			

Table 5.2.2.1.14_1.3.3_1-4: CSI-RS-ResourceMapping for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
}			

Table 5.2.2.1.14_1.3.3_1-5: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots20	10	For CSI-RS resources 1,2,5,6	
slots20	11	For CSI-RS resources 3,4,7,8	
}			

5.2.2.1.14_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.14_1.3.3_1.

5.2.2.1.14_1.4 Test requirement

Table 5.2.2.1.14.0-3 defines the primary level settings.

The residual BLER specified in Note 3 of Table 5.2.2.1.14_1.4-1 test shall meet or be lower than the specified value in Table 5.2.2.1.14_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.14_1.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
						BLER (%)	SNR (dB) (Note 4)

1-1	R.PDSCH.1-11.2 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x2, ULA Low	1 (Note 3)	3.9
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2							

5.2.2.2 TDD

5.2.2.2.1 2Rx TDD FR1 PDSCH mapping Type A performance

5.2.2.2.1.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.1.0-3 and Table 5.2.2.2.1.0-4, with the addition of test parameters in Table 5.2.2.2.1.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.2.1.0-1.

Table 5.2.2.2.1.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers	1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-11, 2-1, 2-2
Verify the PDSCH mapping Type A HARQ soft combining performance under 2 receive antenna conditions.	1-4
Verify the PDSCH mapping Type A performance requirements for Enhanced Receiver Type 1 under 2 receive antenna conditions.	3-1

Table 5.2.2.2.1.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	Specific to each Reference channel
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	4 for Tests 1-1, 1-8, 1-9 2 for other tests
	Resource allocation type	Test 1-2: Type 1 with start RB = 50, $L_{RBs} = 6$ Other tests: Type 0
	RBG size	Test 1-2: N/A Other tests: Config2
	VRB-to-PRB mapping type	Non-interleaved
VRB-to-PRB mapping interleaver bundle size	N/A	
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	2 for Tests 1-1, 1-7, 1-8, 1-9, 1-10, 1-11 1 for other tests
	Maximum number of OFDM symbols for DL front loaded DMRS	1

CSI-RS for tracking	First OFDM symbol in the PRB used for CSI-RS		Tests 1-8, 1-9: l0 = 4 for CSI-RS resource 1 and 3 l0 = 8 for CSI-RS resource 2 and 4 Other tests; Table 5.2-1.
	CSI-RS periodicity	Slots	Test 1-7, 1-10, 1-11: 20 for CSI-RS resource 1,2,3,4. Other tests: Table 5.2-1.
	CSI-RS offset	Slots	Test 1-7: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4. Other tests: Table 5.2-1.
	Frequency Occupation		Test 1-7, 1-10, 1-11: Start PRB 0 Number of PRB = 52 Other tests: Table 5.2-1.
Number of HARQ Processes			16 for Test 1-4 10 for Test 1-9 8 for other tests
The number of slots between PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.2.2.1.0-3: Minimum performance for Rank 1

Test num .	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-1.1 TDD	40 / 30	QPSK, 0.30	FR1.30-1A	TDLB100-400	2x2, ULA Low	70	-1.1
1-2	R.PDSCH.2-1.2 TDD	40 / 30	QPSK, 0.30	FR1.30-1	TDLC300-100	2x2, ULA Low	70	0.2
1-3	R.PDSCH.2-4.1 TDD	40 / 30	256QAM, 0.82	FR1.30-1	TDLA30-10	2x2, ULA Low	70	25.3
1-4	R.PDSCH.2-2.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-100	2x2, ULA Low	30	1.6
1-5	R.PDSCH.2-5.1 TDD	40 / 30	QPSK, 0.30	FR1.30-2	TDLA30-10	2x2, ULA Low	70	-0.9
1-6	R.PDSCH.2-6.1 TDD	40 / 30	QPSK, 0.30	FR1.30-3	TDLA30-10	2x2, ULA Low	70	-0.8
1-7	R.PDSCH.2-10.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	HST-1000	1x2	70	6.4
1-8	R.PDSCH.2-11.1 TDD	40 / 30	QPSK, 0.30	FR1.30-5	TDLB100-400	2x2, ULA Low	70	-1.0
1-9	R.PDSCH.2-12.1 TDD	40 / 30	QPSK, 0.30	FR1.30-6	TDLB100-400	2x2, ULA Low	70	-1.1
1-10	R.PDSCH.2-10.2 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-1200	2x2	70	9.5
1-11	R.PDSCH.2-10.3 TDD	40 / 30	64QAM, 0.43	FR1.30-1	HST-1667	1x2	70	9.6

Table 5.2.2.2.1.0-4: Minimum performance for Rank 2

Test num .	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)

2-1	R.PDSCH.2-3.1 TDD	40 / 30	64QAM, 0.50	FR1.30-1	TDLA30-10	2x2, ULA Low	70	19.8
2-2	R.PDSCH.2-9.1 TDD	20 / 30	64QAM, 0.50	FR1.30-4	TDLA30-10	2x2, ULA Low	70	19.8

Table 5.2.2.2.1.0-5: Minimum performance for Rank 2 and EnhancedReceiver Type 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
3-1	R.PDSCH.2-2.2 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLA30-10	2x2, ULA Medium	70	18.0

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.2.2.1.0.

5.2.2.2.1_1 2Rx TDD FR1 PDSCH mapping Type A performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.1_1.1 Test Purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers

5.2.2.2.1_1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.2.1_1.3 Test Description

5.2.2.2.1_1.3.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of TS 38.521-1.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the NR cell are set up according to Table 5.2-1 and Table 5.2.2.2.1.0-2 and as appropriate.
3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions for the NR cell are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer MCG and SCG, *Connected without release*

On, Test Mode On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.1_1.4.3.

5.2.2.2.1_1.3.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.2.1_1.4-1 and Table 5.2.2.2.1_1.4-2. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.1_1.4-1 and 5.2.2.2.1_1.4-2 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Tables G.1.5-2 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Table 5.2.2.2.1_1.4-1 and Table 5.2.2.2.1_1.4-2 as appropriate.

5.2.2.2.1_1.3.3 Message Contents

Message contents are according to TS 38.508-1 [6] subclauses 4.6.1 and 5.4.2.

5.2.2.2.1_1.3.3_1 Message exceptions for SA

Table 5.2.2.2.1_1.3.3_1-1: Void

Table 5.2.2.2.1_1.3.3_1-2: Void

Table 5.2.2.2.1_1.3.3_1-3: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
dmrs-DownlinkForPDSCH-MappingTypeA CHOICE {			
setup	DMRS-DownlinkConfig		
}			
mcs-Table	qam256	256qam table for test 1-3	
	Not present	64qam table for all tests except test 1-3	
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	n4	n4 for test 1-1	test 1-1
	Not present	n2 for other tests n2 is used by default	all test points except test 1-1
}			
}			
}			

Table 5.2.2.2.1_1.3.3_1-4: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	For tests 1-1, 1-7, 1-8, 1-9, 1-10, and 1-11	
	pos1	For other tests	

}		
---	--	--

Table 5.2.2.2.1_1.3.3_1-5: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n16, n10, n8	n16 for Test 1-4, n10 for Test 1-9 n8 for other tests	
}			

Table 5.2.2.2.1_1.3.3_1-6: RACH-ConfigGeneric

Derivation Path: TS 38.508-1 [6], Table 4.6.3-130			
Information Element	Value/remark	Comment	Condition
RACH-ConfigGeneric ::= SEQUENCE {			
prach-ConfigurationIndex	163	Only for test 2-2	
}			

Table 5.2.2.2.1_1.3.3_1-7: CSI-ResourcePeriodicityAndOffset for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots20	1 (for CSI-RS resources 1 and 2) 2 (for CSI-RS resources 3 and 4)	For test 1-7, 1-10, 1-11: CSI-RS offset: 1 for CSI-RS resources 1 and 2 2 for CSI-RS resources 3 and 4 CSI-RS periodicity: 20 slots	
Slots40	20 (for CSI-RS resources 1 and 2) 21 (for CSI-RS resources 3 and 4)	For other tests: CSI-RS offset: 20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4 CSI-RS periodicity: 40 slots	
}			

Table 5.2.2.2.1_1.3.3_1-8: CSI-FrequencyOccupation for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-11			
Information Element	Value/remark	Comment	Condition
CSI-FrequencyOccupation ::= SEQUENCE {			
nrofRBs	52	52 for tests 1-7, 1-10, 1-11, 2-2	
	108	108 for other tests	
}			

Table 5.2.2.2.1_1.3.3_1-9: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-157			
Information Element	Value/remark	Comment	Condition
SchedulingRequestResourceConfig ::= SEQUENCE {			
periodicityAndOffset CHOICE {			
sl20	7	For test 1-9	
sl20	5	For test 2-2	
}			
}			

Table 5.2.2.2.1_1.3.3_1-10: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-1			
Parameter	Value	Value in binary	Condition
PUCCH resource indicator	<i>PUCCH-ResourceId</i> [1] = 6 in pucch-ResourceSetID[1] or <i>PUCCH-ResourceId</i> [1] = 14 in pucch-ResourceSetID[2] as defined in Table 4.6.3-112 (Mapping as per Table 9.2.3-2 in TS 38.213)	'110'B	Slot S1 for test 1-9

Table 5.2.2.2.1_1.3.3_1-11: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-27			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	3 entry		Test 1-5, Test 1-6
PDSCH-TimeDomainResourceAllocation[1] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	44	Start symbol(S)=2, Length(L)=4	
}			
PDSCH-TimeDomainResourceAllocation[2] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
PDSCH-TimeDomainResourceAllocation[3] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	5 entry		Test 1-9
PDSCH-TimeDomainResourceAllocation[1] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
PDSCH-TimeDomainResourceAllocation[2] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	100	Start symbol(S)=2, Length(L)=8	
}			
PDSCH-TimeDomainResourceAllocation[3] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	81	Start symbol(S)=2, Length(L)=10	
}			
PDSCH-TimeDomainResourceAllocation[4] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
PDSCH-TimeDomainResourceAllocation[5] SEQUENCE {			
K0	Not present		
mappingType	typeA		

startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

5.2.2.2.1_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.2.1_1.3.3_1.

5.2.2.2.1_1.4 Test Requirements

Table 5.2.2.2.1_1.3-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.1_1.4-1 and 1 and Table 5.2.2.2.1_1.4-2 for the specified SNR including test tolerances for all throughput tests

Table 5.2.2.2.1_1.4-1: Test requirement for Rank 1

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-1.1 TDD	40 / 30	QPSK, 0.30	FR1.30-1A	TDLB100-400	2x2, ULA Low	70	-0.2
1-2	R.PDSCH.2-1.2 TDD	40 / 30	QPSK, 0.30	FR1.30-1	TDLC300-100	2x2, ULA Low	70	1.1
1-3	R.PDSCH.2-4.1 TDD	40 / 30	256QAM, 0.82	FR1.30-1	TDLA30-10	2x2, ULA Low	70	26.3
1-4	R.PDSCH.2-2.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-100	2x2, ULA Low	30	2.5
1-5	R.PDSCH.2-5.1 TDD	40 / 30	QPSK, 0.30	FR1.30-2	TDLA30-10	2x2, ULA Low	70	0.1
1-6	R.PDSCH.2-6.1 TDD	40 / 30	QPSK, 0.30	FR1.30-3	TDLA30-10	2x2, ULA Low	70	0.2
1-7	R.PDSCH.2-10.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	HST-1000	1x2	70	7.3
1-8	R.PDSCH.2-11.1 TDD	40 / 30	QPSK, 0.30	FR1.30-5	TDLB100-400	2x2, ULA Low	70	-0.1
1-9	R.PDSCH.2-12.1 TDD	40 / 30	QPSK, 0.30	FR1.30-6	TDLB100-400	2x2, ULA Low	70	-0.2
1-10	R.PDSCH.2-10.2 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-1200	2x2	70	10.4
1-11	R.PDSCH.2-10.3 TDD	40 / 30	64QAM, 0.43	FR1.30-1	HST-1667	1x2	70	10.2

Table 5.2.2.2.1_1.4-2: Test requirement for Rank 2

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
2-1	R.PDSCH.2-3.1 TDD	40 / 30	64QAM, 0.50	FR1.30-1	TDLA30-10	2x2, ULA Low	70	20.8
2-2	R.PDSCH.2-9.1 TDD	20 / 30	64QAM, 0.50	FR1.30-4	TDLA30-10	2x2, ULA Low	70	20.8

5.2.2.2.1_2 2Rx TDD FR1 PDSCH mapping Type A performance - 2x2 MIMO with enhanced receiver type 1 for both SA and NSA

5.2.2.2.1_2.1 Test Purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers

5.2.2.2.1_2.2 Test Applicability

This test applies to all types of NR UE release 15 and forward supporting NR enhanced receiver type 1.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and NR enhanced receiver type 1.

5.2.2.2.1_2.3 Test Description

Same test description as in clause 5.2.2.2.1_1.4 with the following exception:

- Table 5.2.2.2.1_2.4-1 instead of 5.2.2.2.1_1.4-1

5.2.2.2.1_2.4 Test Requirements

Table 5.2.2.2.1_1.3-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.1.4.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.1_2.4-1: Test requirement for Rank 2 and EnhancedReceiver Type 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
3-1	R.PDSCH.2-2.2 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLA30-10	2x2, ULA Medium	70	19.0

5.2.2.2.2 2Rx TDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance

5.2.2.2.2_1 2Rx TDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.2_1.1 Test Purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and CSI-RS overlapped with PDSCH

5.2.2.2.2_1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.2.2_1.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.2_1.3-3, with the addition of test parameters in table 5.2.2.2.2_1.3-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.2.2_1.3-1.

Table 5.2.2.2.2_1.3-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and CSI-RS overlapped with PDSCH	1-1

Table 5.2.2.2.2_1.3-2: Test parameters

Parameter	Unit	Value	
Duplex mode		TDD	
Active DL BWP index		1	
PDSCH configuration	Mapping type	Type A	
	k ₀	0	
	Starting symbol (S)	2	
	Length (L)	Specific to each Reference channel	
	PDSCH aggregation factor	1	
	PRB bundling type	Static	
	PRB bundling size	2	
	Resource allocation type	Type 0	
	RBG size	Config2	
	VRB-to-PRB mapping type	Non-interleaved	
PDSCH DMRS configuration	DMRS Type	Type 1	
	Number of additional DMRS	1	
	Length	1	
NZP CSI-RS for CSI acquisition	OFDM symbols in the PRB used for CSI-RS	$l_0 = 13$	
	CSI-RS periodicity	Slots	5
ZP CSI-RS for CSI acquisition	Subcarrier index in the PRB used for CSI-RS		$(k_0, k_1, k_2, k_3) = (2, 4, 6, 8)$
	Number of CSI-RS ports (X)		8
	CSI-RS periodicity	Slots	5
Number of HARQ Processes		8	
The number of slots between PDSCH and corresponding HARQ-ACK information		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2	

Table 5.2.2.2.2_1.3-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-7.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-100	2x2, ULA Low	70	14.8

The normative reference for this requirement is TS 38.101-4 [2] clause 5.2.2.1.2

5.2.2.2.2_1.4 Test Description

5.2.2.2.2_1.4.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-1.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 5.1.2.1 and 5.1.2.2.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.
2. The parameter settings for the NR cell are set up according to Table 5.2-1 and Table 5.2.2.2.2_1.3-2 and as appropriate.
3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions for the NR cell are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.2_1.4.3.

5.2.2.2.2_1.4.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.2.2_1.1-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.2_1.5-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Tables G.1.5-2 in Annex G clause G.1.5.

5.2.2.2.2_1.4.3 Message Contents

Message contents are according to TS 38.508-1 [6] subclauses 4.6.1 and 5.4.2.

5.2.2.2.2_1.4.3_1 Message exceptions for SA

Table 5.2.2.2.2_1.4.3_1-1: Void

Table 5.2.2.2.2_1.4.3_1-2: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
dataScramblingIdentityPDSCH	0		
dmrs-DownlinkForPDSCH-MappingTypeA CHOICE {			
Setup	DMRS-DownlinkConfig		
}			
resourceAllocation	resourceAllocationType0		Used_for_T ype0
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize		If a bundleSize(Set) value is absent, the UE applies the value n2.	
}			
}			
}			

Table 5.2.2.2.2_1.4.3_1-3: Void

Table 5.2.2.2.2_1.4.3_1-4: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
frequencyDomainResources	11111111 11111111 10000000 00000000 00000000 000000	CORESET to use the least significant 102 RBs of the BWP	
tci-StatesPDCCH-ToAddList {			
0		TCI State #0	
1		TCI State #1	
}			
}			

Table 5.2.2.2.2_1.4.3_1-5: Void

Table 5.2.2.2.2_1.4.3_1-6: NZP CSI-RS-ResourceMapping for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	13	$l_0 = 13$	
}			

Table 5.2.2.2.2_1.4.3_1-7: CSI-ResourcePeriodicityAndOffset for CSI Acquisition for NZP CSI-RS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots5	0	Periodicity 5 slots and offset 0	
}			

Table 5.2.2.2.2_1.4.3_1-8: ZP CSI-RS-ResourceMapping for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
nrofPorts	P8	Eight Ports	
}			

Table 5.2.2.2.2_1.4.3_1-9: DMRS-DownlinkConfig

Derivation Path: TS 38.508 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	Not present	pos2 If the field is absent, the UE applies the value pos2	FR1_TDD,
}			

Table 5.2.2.2.2_1.4.3_1-10: CSI-ResourcePeriodicityAndOffset for CSI Acquisition for ZP CSI-RS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-22			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots5	0	Periodicity 5 slots and offset 0	
}			

5.2.2.2.2_1.4.3_2 Message exceptions for NSA

Same as 5.2.2.2.2_1.4.3_2

5.2.2.2.2_1.5 Test Requirements

Table 5.2.2.2.2_1.3-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.2_1.3-3 for the specified SNR including test tolerances for all throughput tests

Table 5.2.2.2.2_1.5-1: Test requirement for Rank 2

Test num.	Reference channel	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)

1-1	R.PDSCH.2-7.1 TDD	16QAM, 0.48	FR1.30-1	TDLC300-100	2x2, ULA Low	70	15.7
-----	-------------------	-------------	----------	-------------	--------------	----	------

5.2.2.2.3 2Rx TDD FR1 PDSCH mapping Type B performance

5.2.2.2.3.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.3.0-3, with the addition of test parameters in Table 5.2.2.2.3.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.3.0-1.

Table 5.2.2.2.3.0-1: Tests purpose

Purpose	Test index
Verify PDSCH mapping Type B performance under 2 receive antenna conditions	1-1

Table 5.2.2.2.3.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type B
	k0	0
	Starting symbol (S)	5
	Length (L)	7
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
PDSCH DMRS configuration	VRB-to-PRB mapping interleaver bundle size	N/A
	DMRS Type	Type 1
	Number of additional DMRS	1
	Maximum number of OFDM symbols for DL front loaded DMRS	1
Number of HARQ Processes		8
The number of slots between PDSCH and corresponding HARQ-ACK information		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.2.2.3.0-3: Minimum performance for Rank 1

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-1.3 TDD	40 / 30	QPSK, 0.30	FR1.30-1	TDLA30-10	2x2, ULA Low	70	-0.9

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.2.2.3.

5.2.2.2.3_1 2Rx TDD FR1 PDSCH mapping Type B performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.3_1.1 Test purpose

To verify the PDSCH mapping Type B normal performance under 2 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.2.2.3_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and PDSCH mapping type B.

5.2.2.2.3_1.3 Test description

5.2.2.2.3_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.2.2.3.0-2 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.2.3_1.3.3.

5.2.2.2.3_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.2.3.0-2. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.3_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.2.3_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.2.2.3_1.3.3_1 Message exceptions for SA

Table 5.2.2.2.3_1.3.3_1-1: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-102			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	Not present		
}			

Table 5.2.2.2.3_1.3.3_1-2: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 4.6.3-103			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
K0	Not present		
mappingType	typeB		
startSymbolAndLength	89	Start symbol(S)=5, Length(L)=7	
}			
PDSCH-TimeDomainResourceAllocation[2]			
SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

5.2.2.2.3_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.2.3_1.3.3_1

5.2.2.2.3_1.4 Test requirement

Table 5.2.2.2.3.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.3_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.3_1.4-1: Test Requirement for Rank 1

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-1.3 TDD	40 / 30	QPSK, 0.30	FR1.30-1	TDLA30-10	2x2, ULA Low	70	0.1

5.2.2.2.4 2Rx TDD FR1 PDSCH mapping Type A and LTE-NR coexistence performance

5.2.2.2.4.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.4.0-3, with the addition of test parameters in Table 5.2.2.2.4.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.2.4.0-1.

Table 5.2.2.2.4.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions with CRS rate matching configured	1-1, 1-2

Table 5.2.2.2.4.0-2: Test parameters

Parameter	Unit	Value	
Duplex mode		TDD	
Active DL BWP index		1	
NR UL transmission with a 7.5 kHz shift to the LTE raster		true	
PDSCH configuration	Mapping type	Type A	
	k0	0	
	Starting symbol (S)	3	
	Length (L)	9 for Test 1-1 11 for Test 1-2	
	PDSCH aggregation factor	1	
	PRB bundling type	Static	
	PRB bundling size	2	
	Resource allocation type	Type 0	
	RBG size	Config2	
	VRB-to-PRB mapping type	Non-interleaved	
	VRB-to-PRB mapping interleaver bundle size	N/A	
PDSCH DMRS configuration	DMRS Type	Type 1	
	Position of the first DM-RS for downlink	3	
	Number of additional DMRS	1	
	Maximum number of OFDM symbols for DL front loaded DMRS	1	
CRS for rate matching (Note 1)	LTE carrier centre subcarrier location	Same as NR carrier centre subcarrier location	
	LTE carrier BW	MHz	10
	Number of antenna ports		4
	v-shift		0
Number of HARQ Processes		8	
The number of slots between PDSCH and corresponding HARQ-ACK information		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2	
Note 1: No MBSFN is configured on LTE carrier			

Table 5.2.2.2.4.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)

1-1	R.PDSCH.1-1.1 TDD	10 / 15	QPSK, 0.30	FR1.15-1	TDLA30-10	4x2, ULA Low	70	-0.8
1-2	R.PDSCH.1-1.2 TDD	10 / 15	QPSK, 0.30	FR1.15-1	TDLA30-10	4x2, ULA Low	70	-0.8

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.2.2.4.

5.2.2.2.4_1 2Rx TDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance - 4x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.4_1.1 Test purpose

To verify the PDSCH mapping Type A coexistence performance under 2 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.2.2.4_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 15 and forward supporting capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-1 also applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-2 applies to all types of NR UE release 15 and forward supporting capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

Test 1-2 also applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

5.2.2.2.4_1.3 Test description

5.2.2.2.4_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.6 for TE diagram and clause A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.2.2.4.0-2 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer MCG and SCG, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.2.2.4_1.3.3.

5.2.2.2.4_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.2.4.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.4_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

NOTE: In the test using the NR/5GC connectivity option, collisions between NR SIB1 scheduling and LTE CRS can occur. However, these do not impact the throughput.

5.2.2.2.4_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.2.2.4_1.3.3_1 Message exceptions for SA

Table 5.2.2.2.4_1.3.3_1-1: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-102			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n8		
}			

Table 5.2.2.2.4_1.3.3_1-2: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 4.6.3-103			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	94	Start symbol(S)=3, Length(L)=9	Test 1-1
	66	Start symbol(S)=3, Length(L)=11	Test 1-2
}			
PDSCH-TimeDomainResourceAllocation[2]			
SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	66	Start symbol(S)=3, Length(L)=11	Test 1-2
}			
}			

Table 5.2.2.2.4_1.3.3_1-3: SearchSpace

Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1_10MHz, Long_DCI			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
controlResourceSetId	2		
}			

Table 5.2.2.2.4_1.3.3_1-4: ServingCellConfigCommon

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-2			
Information Element	Value/remark	Comment	Condition
ServingCellConfigCommon ::= SEQUENCE {			
dmrs-TypeA-Position	pos3		
lte-CRS-ToMatchAround	RateMatchPatternLTE-CRS		
}			

Table 5.2.2.2.4_1.3.3_1-5: RateMatchPatternLTE-CRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-28			
Information Element	Value/remark	Comment	Condition
RateMatchPatternLTE-CRS ::= SEQUENCE {			
carrierFreqDL	Same as NR carrier centre subcarrier location		
carrierBandwidthDL	n50	10MHz	
mbsfn-SubframeConfigList	Not present		
nrofCRS-Ports	n4		
v-Shift	n0		
}			

Table 5.2.2.2.4_1.3.3_1-6: FrequencyInfoUL-SIB

Derivation Path: TS 38.508-1 [6], Table 4.6.3-62			
Information Element	Value/remark	Comment	Condition
FrequencyInfoUL-SIB SEQUENCE {			
frequencyShift7p5khz	true		
}			

Table 5.2.2.2.4_1.3.3_1-7: PDCCH-ControlResourceSet

Derivation Path: Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	2		
duration	1	SearchSpace duration of 1 symbol from third symbol	
}			

Table 5.2.2.2.4_1.3.3_1-8: PDCCH-ConfigCommon

Derivation Path: TS 38.508-1 [6], Table 4.6.3-96			
Information Element	Value/remark	Comment	Condition
PDCCH-ConfigCommon ::= SEQUENCE {			
commonControlResourceSet ::= SEQUENCE {			SA
controlResourceSetId	1		
frequencyDomainResources	01110000 00000000 00000000 00000000 00000000 00000		
Duration	1		
cce-REG-MappingType CHOICE {			
nonInterleaved	Null		
}			
precoderGranularity	sameAsREG-bundle		
}			
}			

Table 5.2.2.2.4_1.3.3_1-9: SearchSpace for CSS

Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition CSS, FR1_10MHz, Long_DCI			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
searchSpaceId	SearchSpaceId with condition CSS		CSS
controlResourceSetId	1		
monitoringSlotPeriodicityAndOffset CHOICE {			
s1	NULL		
}			
duration	Not present	1 slot per default	
monitoringSymbolsWithinSlot	00100000000000		
nrofCandidates SEQUENCE {			SA
aggregationLevel2	n1		
aggregationLevel8	n0		
}			

Table 5.2.2.2.4_1.3.3_1-10: SearchSpace for USS

Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1_10MHz, Long_DCI			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			SA
searchSpaceId	2		
controlResourceSetId	2		
monitoringSymbolsWithinSlot	00100000000000		
}			

Table 5.2.2.2.4_1.3.3_1-11: PUCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-112 and Table 5.4.2.0-41 using condition FR1.15-1			
Information Element	Value/remark	Comment	Condition
PUCCH-Config ::= SEQUENCE {			
dl-DataToUL-ACK SEQUENCE (SIZE (1..8)) OF INTEGER {	5 entries		FR1.15-1
INTEGER[1]	2	entry 1	
INTEGER[2]	3	entry 2	
INTEGER[3]	4	entry 3	
INTEGER[4]	6	entry 4	
INTEGER[5]	7	entry 5 This is a dummy setting for adjusting the bit length of "PDSCH-to-HARQ_feedback timing indicator" of DCI Format 1_1.	
}			
}			

5.2.2.2.4_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.2.4_1.3.3_1 with the following exceptions:

Table 5.2.2.2.4_1.3.3_2-1: SearchSpace

Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1_10MHz, Long_DCI			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
controlResourceSetId	1		
}			

Table 5.2.2.2.4_1.3.3_2-2: PDCCH-ControlResourceSet

Derivation Path: Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	1		
duration	1	SearchSpace duration of 1 symbol from third symbol	
}			

5.2.2.2.4_1.4 Test requirement

Table 5.2.2.2.4.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.4_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.4_1.4-1: Test Requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.1 TDD	10 / 15	QPSK, 0.30	FR1.15-1	TDLA30-10	4x2, ULA Low	70	0.1
1-2	R.PDSCH.1-1.2 TDD	10 / 15	QPSK, 0.30	FR1.15-1	TDLA30-10	4x2, ULA Low	70	0.1

5.2.2.2.5 2Rx TDD FR1 PDSCH 0.001% BLER performance

5.2.2.2.5.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.5.0-3, with the addition of test parameters in Table 5.2.2.2.5.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.5.0-1.

Table 5.2.2.2.5.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH 0.001% BLER performance under 2 receive antenna conditions	1-1

Table 5.2.2.2.5.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			TDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
PDSCH DMRS configuration	VRB-to-PRB mapping interleaver bundle size		N/A
	DMRS Type		Type 1
	Number of additional DMRS		1
Maximum number of OFDM symbols for DL front loaded DMRS			1
Maximum number of HARQ transmission			1
Number of HARQ Processes			8
The number of slots between PDSCH and corresponding HARQ-ACK information			Defined in Annex A.1.2 for TDD pattern FR1.30-1

Table 5.2.2.2.5.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Target BLER	SNR (dB)

1-1	R.PDSCH.2-1.4 TDD	40 / 30	QPSK, 0.59	FR1.30-1	AWGN	1x2, ULA Low	0.001%	3.3
-----	----------------------	---------	------------	----------	------	--------------	--------	-----

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.5.

5.2.2.2.5_1 2Rx TDD FR1 PDSCH 0.001% BLER performance - 1x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.5_1.1 Test purpose

To verify the PDSCH 0.001% BLER performance under 2 receive antenna conditions.

5.2.2.2.5_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *dl-64QAM-MCS-TableAlt* and capability IE *cqi-TableAlt*.

5.2.2.2.5_1.3 Test description

5.2.2.2.5_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.2.5.0-2 and Table 5.2.2.2.5.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.5_1.3.3.

5.2.2.2.5_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.2.5.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.5_1.3.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.4. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.4.3-1 in Annex G.

5.2.2.2.5_1.3.3 Message contents

5.2.2.2.5_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.2.5_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		FR1
mcs-Table	qam64LowSE		
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
k0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

5.2.2.2.5_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.2.5_1.3.3_1.

5.2.2.2.5_1.3.4 Test requirement

Table 5.2.2.2.5.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.5_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.5_1.3.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Target BLER	SNR (dB)
1-1	R.PDSCH.2-1.4 TDD	40 / 30	QPSK, 0.59	FR1.30-1	AWGN	1x2, ULA Low	0.001%	3.9

5.2.2.2.6 2Rx TDD FR1 PDSCH repetitions over multiple slots performance

5.2.2.2.6.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.6.0-3, with the addition of test parameters in Table 5.2.2.2.6.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.6.0-1.

Table 5.2.2.2.6.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH repetitions over multiple slots performance under 2 receive antenna conditions	1-1

Table 5.2.2.6.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			TDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type A
	k ₀		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		2
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
Number of HARQ Processes			4
The number of slots between final repetition of PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 (Note 1)
Note 1: ACK/NACK feedback is generated for PDSCH on slot i , where $\text{mod}(i,10) = \{2, 4, 6\}$.			

Table 5.2.2.1.6.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Target BLER	SNR (dB)
1-1	R.PDSCH.1-16.1 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x2, ULA Low	1% (Note 1)	1.4
Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.6.

5.2.2.2.6_1 2Rx TDD FR1 PDSCH repetitions over multiple slots performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.6_1.1 Test purpose

To Verify the PDSCH repetitions over multiple slots performance under 2 receive antenna conditions.

5.2.2.2.6_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-RepetitionMultiSlots-r16*.

5.2.2.2.6_1.3 Test description

5.2.2.2.6_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.6.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.6_1.3.3.

5.2.2.2.6_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.2.6.0-3. The SS sends downlink MAC padding bits on the DL RMC. The UE may expect that the TB is repeated with same symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.6_1.3.4-1.
3. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport blocks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.5 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.2.2.6_1.3.3 Message contents

5.2.2.2.6_1.3.3_1 Message exceptions for SA

Same as 5.2.2.1.6_1.3.3_1.

5.2.2.2.6_1.3.3_2 Message exceptions for SA

Same as 5.2.2.1.6_1.3.3_1.

5.2.2.2.6_1.3.4 Test requirement

Table 5.2.2.2.6.0-3 defines the primary level settings.

The target BLER percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each BLER test shall meet or exceed the specified value in Table 5.2.2.2.6_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.6_1.3.4-1: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Target BLER	SNR (dB)

1-1	R.PDSCH.2-16.1 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x2, ULA Low	1% (Note 1)	[2.1]
Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.								

5.2.2.2.7 2Rx TDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance

5.2.2.2.7.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.7.0-3, with the addition of test parameters in Table 5.2.2.2.7.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.7.0-1.

Table 5.2.2.2.7.0-1: Tests purpose

Purpose	Test index
Verify PDSCH mapping Type B performance and UE processing capability 2 under two receive antenna conditions	1-1

Table 5.2.2.2.7.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type B
	k0	0
	Starting symbol (S)	2
	Length (L)	2
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	0
	Maximum number of OFDM symbols for DL front loaded DMRS	1
Maximum number of HARQ transmission		1
Number of HARQ Processes		2
The number of slots between PDSCH and corresponding HARQ-ACK information		0

Table 5.2.2.2.7.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-17.1 TDD	40 / 30	QPSK, 0.30	FR1.30-2	TDLA30-10	2x2, ULA Low	70	0.6

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.7.

5.2.2.2.7_1 2Rx TDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.7_1.1 Test purpose

To verify PDSCH mapping Type B performance and UE processing capability 2 under two receive antenna conditions.

5.2.2.2.7_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-ProcessingType2*.

5.2.2.2.7_1.3 Test description

5.2.2.2.7_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.2.7.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.7_1.3.3.

5.2.2.2.7_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.2.7.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.7_1.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.2.7_1.3.3 Message contents

5.2.2.2.7_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.2.7_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE (1..maxNrofDL-Allocations)) OF {	2 entries		FR1
PDSCH-TimeDomainResourceAllocation [1]			
SEQUENCE {			
k0	Not present		
mappingType	typeB		
startSymbolAndLength	16	Start symbol(S)=2, Length(L)=2	
}			
}			

Table 5.2.2.2.7_1.3.3_1-2: PUCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-112			
Information Element	Value/remark	Comment	Condition
PUCCH-Config ::= SEQUENCE {			FR1
dl-DataToUL-ACK SEQUENCE (SIZE (1)) OF INTEGER {	1 entry		
INTEGER [1]	0	entry 1	
}			
}			

Table 5.2.2.2.7_1.3.3_1-3: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
PDSCH-to-HARQ_feedback timing indicator	K1=0 as per dl-DataToUL-ACK in Table 5.2.2.2.7_1.3.3_1-3	"000"	

5.2.2.2.7_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.2.7_1.3.3_1.

5.2.2.2.7_1.4 Test requirement

Table 5.2.2.2.7.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.7_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.7_1.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-17.1 TDD	40 / 30	QPSK, 0.30	FR1.30-2	TDLA30-10	2x2, ULA Low	70	1.6

5.2.2.2.8 2Rx TDD FR1 PDSCH pre-emption performance

5.2.2.2.8.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.8.0-3, with the addition of test parameters in Table 5.2.2.2.8.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.8.0-1.

Table 5.2.2.2.8.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH pre-emption performance under 2 receive antenna conditions	1-1

Table 5.2.2.2.8.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			TDD
Active DL BWP index			1
PDCCH configuration (Note 4)	Symbols with PDCCH		0, 1
	DCI format		2_1
	timeFrequencySet		14x1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
	Pre-emption configuration (Note 2)		3
Pre-emption configuration (Note 2)	Length (L)		2
	Pre-emption periodicity and offset	Slots	40/(1,12,23,34) (Note 3)
	Number of HARQ Processes		8
The number of slots between PDSCH and corresponding HARQ-ACK information			FR1.30-1
Note 1: Void			
Note 2: Interference modelled as random data on pre-empted REs.			
Note 3: Pre-emption is scheduled with 10% probability within 20ms periodicity.			
Note 4: In addition to PDCCH configuration in Table 5.2-1.			

Table 5.2.2.2.8.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 2-2.5 TDD	40 / 30	16QAM 0.48	FR1.30-1	TDLA30-10	2x2, ULA Low	70	12.5

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.8.

5.2.2.2.8_1 2Rx TDD FR1 PDSCH pre-emption performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.8_1.1 Test purpose

To Verify the PDSCH pre-emption performance under 2 receive antenna conditions.

5.2.2.2.8_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pre-EmptIndication-DL-r16*.

5.2.2.2.6_1.3 Test description

5.2.2.2.6_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.2.8.0-2 and Table 5.2.2.2.8.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.8_1.3.3.

5.2.2.2.8_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.2.8.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. SS transmits PDCCH DCI format 2_1 for int_RNTI with 10% probability to transmit the DL Preemption indication according to Table 5.2.2.2.8.0-2. In the time and frequency set indicated by PDCCH DCI format 2_1, SS stops transmission of PDSCH.
3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.8_1.3.4-1.
4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.2.8_1.3.3 Message contents

5.2.2.2.8_1.3.3_1 Message exceptions for SA

Same as 5.2.2.1.8_1.3.3_1

5.2.2.1.8_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.8_1.3.3_1

5.2.2.2.8_1.3.4 Test requirement

Table 5.2.2.2.8.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.8_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.8_1.3.4-1: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 2-2.5 TDD	40 / 30	16QAM 0.48	FR1.30-1	TDLA30-10	2x2, ULA Low	70	13.5

5.2.2.2.9 2Rx TDD FR1 HST-SFN performance

5.2.2.2.9.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.9.0-3, with the test parameters defined in Table 5.2.2.2.9.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.9.0-1.

Table 5.2.2.2.9.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when <i>highSpeedDemodFlag-r16</i> [17] is configured	1-1

Table 5.2.2.2.9.0-2: Test Parameters for Testing

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
VRB-to-PRB mapping interleaver bundle size		N/A

PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		2
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CSI-RS for tracking	CSI-RS periodicity	Slots	20 for CSI-RS resource 1,2,3,4
	CSI-RS offset	Slots	1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4
	Frequency Occupation		Start PRB 0 Number of PRB = 52
Number of HARQ Processes			8
The number of slots between PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.2.9.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-10.4 TDD	40 / 30	16QAM, 0.48	FR1.30-1	HST-SFN	2x2	70	14.2

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.9.

5.2.2.2.9_1 2Rx TDD FR1 HST-SFN performance - 2x2 MIMO with baseline receiver for both SA and NSA

Editor's note: The minimum test time value is in []

5.2.2.2.9_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* IE [20] is configured and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.2.2.9_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC that supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

5.2.2.2.9_1.3 Test description

5.2.2.2.9_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.2.9.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.9_1.3.3.

5.2.2.2.9_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2.2.2.9_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.9_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.2.9_1.4-1 as appropriate.

5.2.2.2.9_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.9_1.3.3_1 Message exceptions for SA

Table 5.2.2.2.9_1.3.3_1-1: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present	n2 for test 1-1	
}			
}			
}			

Table 5.2.2.2.9_1.3.3_1-2: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	for test 1-1	
}			

Table 5.2.2.2.9_1.3.3_1-3: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n8	for test 1-1	
}			

Table 5.2.2.2.9_1.3.3_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots20	1 for CSI-RS resource #1 and #2 2 for CSI-RS resource #3 and #4	For test 1-1: offset = 1 for CSI-RS resource 1 and 2 offset =2 for CSI-RS resource 3 and 4.	
}			

5.2.2.2.9_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.2.9_1.3.3_1

5.2.2.2.9_1.4 Test requirement

Tables 5.2.2.2.9_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.9_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.9_1.4-1: Test Requirements for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-10.4 TDD	40 / 30	16QAM, 0.48	FR1.30-1	HST-SFN	2x2	70	14.8

5.2.2.2.10 2Rx TDD FR1 HST DPS performance

5.2.2.2.10.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.10.0-3, with the test parameters defined in Table 5.2.2.2.10.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.10.0-1.

Table 5.2.2.2.10.0-1: Tests purpose

Purpose	Test index
Verify UE performance in the HST-DPS scenario defined in B.3.3	1-1, 1-2

Table 5.2.2.2.10.0-2: Test Parameters for Testing

Parameter		Unit	Value		
Duplex mode			TDD		
Active DL BWP index			1		
PDCCH configuration	TCI state		Note 1		
PDSCH configuration	Mapping type		Type A		
	k0		0		
	Starting symbol (S)		2		
	Length (L)		Specific to each Reference channel		
	PDSCH aggregation factor		1		
	PRB bundling type		Static		
	PRB bundling size		2		
	Resource allocation type		Type 0		
	RBG size		Config2		
	VRB-to-PRB mapping type		Non-interleaved		
	VRB-to-PRB mapping interleaver bundle size		N/A		
	TCI state		Note 1		
PDSCH DMRS configuration	DMRS Type		Type 1		
	Number of additional DMRS		2		
	Maximum number of OFDM symbols for DL front loaded DMRS		1		
CSI-RS for tracking	Resource set #1	First OFDM symbol in the PRB used for CSI-RS		$l_0 = 5$ for CSI-RS resource 1 and 3 $l_0 = 9$ for CSI-RS resource 2 and 4	
		CSI-RS periodicity	Slots	20 for CSI-RS resource 1,2,3,4	
		CSI-RS offset	Slots	1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4	
		QCL info		TCI state #2	
		Frequency Occupation		Start PRB 0 Number of PRB = 52	
		Resource set #2	First OFDM symbol in the PRB used for CSI-RS		$l_0 = 6$ for CSI-RS resource 5 and 6 $l_0 = 10$ for CSI-RS resource 7 and 8
	CSI-RS periodicity		Slots	20 for CSI-RS resource 5,6,7,8.	
	CSI-RS offset		Slots	1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8	
	QCL info			TCI state #3	
	Frequency Occupation			Start PRB 0 Number of PRB = 52	
	NZP CSI-RS for CSI acquisition		Resource set #3	First OFDM symbol in the PRB used for CSI-RS	
		CSI-RS periodicity		Slots	40
CSI-RS offset		Slots		0	
QCL info				TCI state #0	
Resource set #4		First OFDM symbol in the PRB used for CSI-RS		$l_0 = 13$	
		CSI-RS periodicity	Slots	40	
		CSI-RS offset	Slots	0	
		QCL info		TCI state #1	
TCI state #0	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration	
		QCL Type		Type A	
	Type 2 QCL information	CSI-RS resource		N/A	
		QCL Type		N/A	
TCI state #1	Type 1 QCL information	CSI-RS resource		CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration	
		QCL Type		Type A	
	Type 2 QCL information	CSI-RS resource		N/A	
		QCL Type		N/A	
TCI state #2	Type 1 QCL information	SSB index		SSB #0	
		QCL Type		Type C	
	Type 2 QCL information	SSB index		N/A	
		QCL Type		N/A	
TCI state #3	Type 1 QCL information	SSB index		SSB #1	
		QCL Type		Type C	
		SSB index		N/A	

	Type 2 QCL information	QCL Type		N/A
Number of HARQ Processes				8
The number of slots between PDSCH and corresponding HARQ-ACK information				Specific to each TDD UL-DL pattern and as defined in Annex A.1.2
<p>Note 1: SSB # $(k \bmod 2)$, CSI-RS (for tracking) resource set # $((k \bmod 2) + 1)$ and CSI-RS (for CSI acquisition) resource set # $((k \bmod 2) + 3)$ are transmitted by k^{th} RRH.</p> <p>For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy $\text{mod}(i, 2n) = n$. PDCCH and PDSCH associated with TCI # $(k \bmod 2)$ is transmitted by k^{th} RRH from slot# $\max [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}} + T_{\text{firstTRS}} + T_{\text{TRS proc}}, 0]$ to slot# $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$.</p> <p>PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.</p> <p>For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy $\text{mod}(i, 2n) = n$. PDCCH and PDSCH associated with TCI # $(k \bmod 2)$ is transmitted by k^{th} RRH from slot# $\max [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}}, 0]$ to slot# $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$.</p> <p>Where $k=0, 1, 2, \dots$ is the RRH number, $n = 5040$ is half of the number of slots between two RRH, $T_{\text{HARQ}} = 8$ is the number of slots between PDSCH and corresponding HARQ-ACK information, $T_{\text{MAC proc}} = 6$ is the number of slots for MAC CE processing, $T_{\text{firstTRS}} = 7$ is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, $T_{\text{TRS proc}} = 4$ is the number of slots for TRS processing.</p>				

Table 5.2.2.2.10.0-3: Minimum performance for HST-DPS

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-10.5 TDD	40 / 30	64QAM, 0.43	HST-DPS	1	2x2	70	13.0
1-2	R.PDSCH.2-10.5 TDD	40 / 30	64QAM, 0.43	HST-DPS	2	2x2	70	13.0

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.10.

5.2.2.2.10_1 2Rx TDD FR1 HST-DPS performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.10_1.1 Test purpose

To verify UE performance in the HST-DPS scenario defined in B.3.3 and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.2.2.10_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.2.10_1.3 Test description

5.2.2.2.10_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.2.10.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.10_1.3.3.

5.2.2.2.10_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2.2.2.10_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.10_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.2.10_1.4-1 as appropriate.

5.2.2.2.10_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.10_1.3.3_1 Message exceptions for SA

Table 5.2.2.2.10_1.3.3_1-1: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present	n2 is used	test 1-1, 1-2
}			
}			
}			

Table 5.2.2.2.10_1.3.3_1-2: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	for test 1-1, 1-2	
}			

Table 5.2.2.2.10_1.3.3_1-3: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n8	for test 1-1, 1-2	
}			

Table 5.2.2.2.10_1.3.3_1-4: NZP-CSI-RS-Resource for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
nzp-CSI-RS-ResourceId	i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8	for test 1-1, 1-2	
qcl-InfoPeriodicCSI-RS	2 for CSI-RS resource #1, #2, #3, #4 3 for CSI-RS resource #5, #6, #7, #8	for test 1-1, 1-2: TCI-StateId for TCI- State #2 for CSI-RS resource #1, #2, #3, #4 TCI-StateId for TCI- State #3 for CSI-RS resource #5, #6, #7, #8	
}			

Table 5.2.2.2.10_1.3.3_1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.2.2.10_1.3.3_1-4)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	5 for CSI-RS resource #1 and #3 9 for CSI-RS resource #2 and #4 6 for CSI-RS resource #5 and #6 10 for CSI-RS resource #7 and #8	for test 1-1, 1-2: l ₀ = 5 for CSI-RS resource 1 and 3 l ₀ = 9 for CSI-RS resource 2 and 4 l ₀ = 6 for CSI-RS resource 5 and 6 l ₀ = 10 for CSI-RS resource 7 and 8	
}			

Table 5.2.2.2.10_1.3.3_1-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking (Table 5.2.2.2.10_1.3.3_1-4)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE { Slots20	1 for CSI-RS resource #1, #2, #5, #6 2 for CSI-RS resource #3 #4, #7, #8	For test 1-1, 1-2: periodicity: 20 slots. offset: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8	
}			

Table 5.2.2.2.10_1.3.3_1-6: NZP-CSI-RS-ResourceSet for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-ResourceSet ::= SEQUENCE { nzp_CSI_ResourceSetId	0 for Resource set #1 1 for Resource set #2	For test 1-1, 1-2	
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { NZP-CSI-RS-ResourceId[1]	0	entry 1 CSI-RS resource #1	Resource set #1
NZP-CSI-RS-ResourceId[2]	1	entry 2 CSI-RS resource #2	
NZP-CSI-RS-ResourceId[3]	2	entry 3 CSI-RS resource #3	
NZP-CSI-RS-ResourceId[4]	3	entry 4 CSI-RS resource #4	
}			
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { NZP-CSI-RS-ResourceId[1]	4	entry 1 CSI-RS resource #5	Resource set #2
NZP-CSI-RS-ResourceId[2]	5	entry 2 CSI-RS resource #6	
NZP-CSI-RS-ResourceId[3]	6	entry 3 CSI-RS resource #7	
NZP-CSI-RS-ResourceId[4]	7	entry 4 CSI-RS resource #8	
}			
}			

Table 5.2.2.2.10_1.3.3_1-7: NZP-CSI-RS-Resource for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
nzp-CSI-RS-ResourceId	8 for CSI-RS resource #9 9 for CSI-RS resource #10	for test 1-1, 1-2	
qcl-InfoPeriodicCSI-RS	0 for CSI-RS resource #9 1 for CSI-RS resource #10	for test 1-1, 1-2: TCI-State #0 for CSI-RS resource #9 TCI-State #1 for CSI-RS resource #10	
}			

Table 5.2.2.2.10_1.3.3_1-8: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.2.2.10_1.3.3_1-7)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	12 for CSI-RS resource #9 13 for CSI-RS resource #10	for test 1-1, 1-2 l ₀ =12 for CSI-RS resource #9 l ₀ =13 for CSI-RS resource #10	
}			

Table 5.2.2.2.10_1.3.3_1-9: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.2.2.10_1.3.3_1-7)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots40	0	For test 1-1, 1-2: periodicity = 40 slots. offset = 0 slots	
}			

Table 5.2.2.2.10_1.3.3_1-10: NZP-CSI-RS-ResourceSet for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-ResourceSet ::= SEQUENCE {			
nzp_CSI_ResourceSetId	2 for Resource set #3 3 for Resource set #4	For test 1-1, 1-2	
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	1 entry	For test 1-1, 1-2	Resource set #3
NZP-CSI-RS-ResourceId[1]	8	entry 1 CSI-RS resource #9	
}			
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	1 entry	For test 1-1, 1-2	Resource set #4
NZP-CSI-RS-ResourceId[1]	9	entry 1 CSI-RS resource #10	
}			
}			

Table 5.2.2.2.10_1.3.3_1-11: TCI-State

Derivation Path: TS 38.508-1 [6], Table 4.6.3-190			
Information Element	Value/remark	Comment	Condition
TCI-State ::= SEQUENCE {			
tci-StateId	0 for TCI state #0 1 for TCI state #1 2 for TCI state #2 3 for TCI state #3	For test 1-1, 1-2	
qcl-Type1 SEQUENCE {			
bwp-Id	BWP-Id of active BWP		TCI state #0, TCI state #1
	Not present		TCI state #2, TCI state #3
referenceSignal CHOICE {			
csi-rs	0	CSI-RS resource #1	TCI state #0
	4	CSI-RS resource #5	TCI state #1
ssb	0	SSB #0	TCI state #2
	1	SSB #1	TCI state #3
}			
qcl-Type	typeA		TCI state #0, TCI state #1
	typeC		TCI state #2, TCI state #3
}			
}			

5.2.2.2.10_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.2.10_1.3.3_1

5.2.2.2.10_1.4 Test requirement

Tables 5.2.2.2.10_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.10_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.10_1.4-1: Test Requirements for HST-DPS

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-10.5 TDD	40 / 30	64QAM, 0.43	HST-DPS	1	2x2	70	13.6
1-2	R.PDSCH.2-10.5 TDD	40 / 30	64QAM, 0.43	HST-DPS	2	2x2	70	13.6

5.2.2.2.11 2Rx TDD FR1 PDSCH Single-DCI based SDM scheme performance

5.2.2.2.11.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.11.0-3, with the addition of test parameters in Table 5.2.2.2.11.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.11.0-1.

Table 5.2.2.2.11.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance with Single-DCI based SDM scheme under 2 receive antenna conditions	1-1,1-2

Table 5.2.2.2.11.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		0	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	40	
	CSI-RS offset	Slots	20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4	20 for CSI-RS resources 5 and 6 21 for CSI-RS resources 7 and 8
QCL info			TCI state #0	
Duplex mode			TDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PRB bundling type		Static	
	PRB bundling size		2	
	Resource allocation type		Type 1	
RBG size			Config2	

	VRB-to-PRB mapping type		Non-interleaved	
	VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	Antenna port indexes		1000	1002
	TCI state		TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
	Maximum number of OFDM symbols for DL front loaded DMRS		1	
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type	Type A	N/A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type	N/A	Type A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
Resource allocation			Full-overlapping	
Timing offset of the second TRxP from the first TRxP			us	-0.25 for test 1-1 1 for test 1-2
Frequency offset of the second TRxP from the first TRxP			Hz	300 for test 1-1 0 for test 1-2
Number of HARQ Processes			8	
The number of slots between PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2	
Precoding configuration			SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs (PDSCH Layer 0 is transmitted from TRxP #1 and PDSCH layer 1 is transmitted from TRxP #2)				

Table 5.2.2.2.11.0-3: Minimum performance

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition(No te 1)	Correlation matrix and antenna configuration(N ote 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)(Not e 3)
1-1	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x2, ULA Low	70	20.2
1-2	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x2, ULA Low	70	20.0
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent								
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2								
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.11.

5.2.2.2.11_1 2Rx TDD FR1 PDSCH Single-DCI based SDM scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.2.11_1.1 Test purpose

To verify the PDSCH performance with Single-DCI based SDM scheme under 2 receive antenna conditions.

5.2.2.2.11_1.2 Test applicability

Test applies to all types of NR UE release 16 and forward supporting capability IE *singleDCI-SDM-scheme-r16*.

5.2.2.2.11_1.3 Test description

5.2.2.2.11_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.2.11.0-2 and Table 5.2.2.2.11.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.11_1.3.3.

5.2.2.2.11_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.2.2.11_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.11_1.3.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Table 5.2.2.2.11_1.3.4-1 as appropriate.

5.2.2.2.11_1.3.3 Message contents

5.2.2.2.11_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.2.11_1.3.3_1-1: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 0 and 2	"1011"	
Transmission configuration indication	TCI state 1 and 2	"000"	

Table 5.2.2.2.11_1.3.3_1-2: CellGroupConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-19			
Information Element	Value/remark	Comment	Condition
CellGroupConfig ::= SEQUENCE {			
simultaneousTCI-UpdateList1-r16 SEQUENCE {			
ServCellIndex [1]	ServCellIndex		
}			
}			

Table 5.2.2.2.11_1.3.3_1-3: ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 4.6.3-28			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
tci-PresentInDCI	enabled		
}			

Table 5.2.2.2.11_1.3.3_1-4: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-100			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1]	TCI-State with condition TCI-state-0		
TCI-State[2]	TCI-State with condition TCI-state-1		
TCI-State[3]	TCI-State with condition TCI-state-2		
}			
rbg-Size	config2		
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present		
}			
}			
}			

Table 5.2.2.2.11_1.3.3_1-5: TCI-State

Derivation Path: TS 38.508-1 [6], Table 4.6.3-190			
Information Element	Value/remark	Comment	Condition
TCI-State ::= SEQUENCE {			
tci-StateId	0		TCI-state-0
	1		TCI-state-1
	2		TCI-state-2
qcl-Type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		TCI-state-0
csi-rs	1		TCI-state-1
	5		TCI-state-2
}			
qcl-Type	typeA		
}			
qcl-Type2	Not present		
}			

Table 5.2.2.2.11_1.3.3_1-6: NZP-CSI-RS-Resource

Derivation Path: TS 38.508-1 [6], Table 4.6.3-85			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
resourceMapping SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
cdm-Type	noCDM		
density CHOICE {			
three	NULL		
}			
periodicityAndOffset CHOICE {			
slots40	20	For CSI-RS resources 1,2,5,6	
slots40	21	For CSI-RS resources 3,4,7,8	
}			
qcl-InfoPeriodicCSI-RS	0		
}			

5.2.2.2.11_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.2.11_1.3.3_1.

5.2.2.2.11_1.3.4 Test requirement

Table 5.2.2.2.11.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.11_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.11_1.3.4-1: Test requirement

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition(Note 1)	Correlation matrix and antenna configuration(Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)(Note 3)
1-1	R.PDSCH.2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.30-1	TDLA30-10	2x2, ULA Low	70	21.2
1-2	R.PDSCH.2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.30-1	TDLA30-10	2x2, ULA Low	70	21.0

Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP

5.2.2.2.12 2Rx TDD FR1 PDSCH Multi-DCI based transmission scheme performance

5.2.2.2.12.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.12.0-3, with the addition of test parameters in Table 5.2.2.2.12.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.12.0-1.

Table 5.2.2.2.12.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs	1-1

Table 5.2.2.2.12.0-2: Test parameters

Parameter	Unit	Value	
		TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB		TRxP #1	
PDCCH configuration	TCI state	TCI State #1	TCI State #2
	CORESETPoolIndex	0,1	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS	k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS	l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)	1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type	'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density	3	
	CSI-RS periodicity	Slots	40

		CSI-RS offset	Slots	20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4	20 for CSI-RS resources 5 and 6 21 for CSI-RS resources 7 and 8
		QCL info		TCI state #0	
Duplex mode				TDD	
Active DL BWP index				1	
PDSCH configuration	Mapping type			Type A	
	k0			0	
	Starting symbol (S)			2	
	Length (L)			12	
	PRB bundling type			Static	
	PRB bundling size			2	
	Resource allocation type			Type 1	
	RBG size			Config2	
	VRB-to-PRB mapping type			Non-interleaved	
VRB-to-PRB mapping interleaver bundle size			N/A		
PDSCH DMRS configuration	Antenna port indexes			{1000,1001}	{1002,1003}
	TCI state			TCI State #1	TCI State #2
	DMRS Type			Type 1	
	Number of additional DMRS			1	
Maximum number of OFDM symbols for DL front loaded DMRS				1	
TCI State #1	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type		Type A	N/A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource		N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type		N/A	Type A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
Resource allocation				Non-overlapping	
Timing offset of the second TRxP from the first TRxP			us	-0.25	
Frequency offset of the second TRxP from the first TRxP			Hz	300	
Number of HARQ Processes				8	
The number of slots between PDSCH and corresponding HARQ-ACK information				Specific to each TDD UL-DL pattern and as defined in Annex A.1.2	
Precoding configuration				SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs. Transmission from TRxP #1 uses CORESETPoolIndex 0 and transmission from TRxP #2 uses CORESETPoolIndex 1					

Table 5.2.2.2.12.0-3: Minimum performance

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)(Note 3)

	TRxP #1	TRxP #2							
1-1	R.PDSC H.2-3.3 TDD	R.PDSC H.2-3.4 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x2, ULA Low	70	20.4
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2 Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2									

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.12.

5.2.2.2.12_1 2Rx TDD FR1 PDSCH Multiple-DCI based transmission scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.2.12_1.1 Test purpose

To verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs.

5.2.2.2.12_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *multiDCI-MultiTRP-r16*.

5.2.2.2.12_1.3 Test description

Same test description as in clause 5.2.2.1.12_1.3 with the following exception:

- Table 5.2.2.2.12_1.4-1 instead of 5.2.2.1.12_1.4-1
- Table 5.2.2.2.12_1.3-1 instead of Table 5.2.2.1.12_1.3.3_1-8

Table 5.2.2.2.12_1.3-1: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots40	20	For CSI-RS resources 1,2,5,6	
Slots40	21	For CSI-RS resources 3,4,7,8	
}			

5.2.2.2.12_1.4 Test requirement

Table 5.2.2.2.12.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.12_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.12_1.4-1: Test requirement

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition(Note 1)	Correlation matrix and antenna configuration(Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)(Note 3)

	TRxP #1	TRxP #2							
1-1	R.PDSCH.2-3.3 TDD	R.PDSCH.2-3.4 TDD	40 / 30	64QAM, 0.50	FR1.30-1	TDLA30-10	2x2, ULA Low	70	21.4
Note 1:	The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent								
Note 2:	Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2								
Note 3:	SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

5.2.2.2.13 2Rx TDD FR1 PDSCH Single-DCI based FDM scheme A performance

5.2.2.2.13.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.13.0-3, with the addition of test parameters in Table 5.2.2.2.13.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.13.0-1.

Table 5.2.2.2.13.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 2 receive antenna conditions when UE is configured with "FDMSchemeA" in "RepetitionScheme-r16" defined in clause 5.1 of TS 38.214 [12]	1-1

Table 5.2.2.2.13.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		Not configured	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	40	
	CSI-RS offset	Slots	20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4	20 for CSI-RS resources 5 and 6 21 for CSI-RS resources 7 and 8
QCL info			TCI state #0	
Duplex mode			TDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PRB bundling type		Static	
	PRB bundling size		Wideband	
	Resource allocation type		Type 0	
	RBG size		Config2	
	VRB-to-PRB mapping type		Non-interleaved	
VRB-to-PRB mapping interleaver bundle size		N/A		

PDSCH DMRS configuration	Antenna port indexes		1000,1001	1000,1001
	TCI state		TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
	Maximum number of OFDM symbols for DL front loaded DMRS		1	
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type	Type A	N/A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type	N/A	Type A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
Timing offset of the second TRxP from the first TRxP		us	-0.25	
Frequency offset of the second TRxP from the first TRxP		Hz	300	
Number of HARQ Processes			8	
The number of slots between PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2	
Precoding configuration			SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs				

Table 5.2.2.2.13.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB) (Note 3)
1-1	R.PDSCH.2-2.5 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x2, ULA Low	70	17.6
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.13.

5.2.2.2.13_1 2Rx TDD FR1 PDSCH Single-DCI based FDM scheme A performance - 2x2 MIMO for both SA and NSA

5.2.2.2.13_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16”.

5.2.2.2.13_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportFDM-SchemeA-r16*.

5.2.2.2.13_1.3 Test description

Same test description as in clause 5.2.2.1.13_1.3 with the following exception:

- Table 5.2.2.2.13_1.4-1 instead of 5.2.2.1.13_1.4-1

- Table 5.2.2.2.13_1.3-1 instead of Table 5.2.2.1.13_1.3.3_1-5

Table 5.2.2.2.13_1.3-1: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots40	20	For CSI-RS resources 1,2,5,6	
Slots40	21	For CSI-RS resources 3,4,7,8	
}			

5.2.2.2.13_1.4 Test requirement

Table 5.2.2.2.13.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.13_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.13_1.4-1: Test requirement

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB) (Note 3)
1-1	R.PDSCH.2-2.5 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x2, ULA Low	70	18.6
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

5.2.2.2.14 2Rx TDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance

5.2.2.2.14.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.14.0-3, with the addition of test parameters in Table 5.2.2.2.14.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.14.0-1.

Table 5.2.2.2.14.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 2 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states defined in clause 5.1 of TS 38.214 [12]	1-1

Table 5.2.2.2.14.0-2: Test parameters

Parameter	Unit	Value	
		TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB		TRxP #1	
PDCCH configuration	TCI state	TCI State #1	
	CORESETPoolIndex	Not configured	

CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8	
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8	
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8	
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8		
	Density		3		
	CSI-RS periodicity		Slots	40	
	CSI-RS offset		Slots	20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4	20 for CSI-RS resources 5 and 6 21 for CSI-RS resources 7 and 8
QCL info		TCI state #0			
Duplex mode		TDD			
Active DL BWP index		1			
PDSCH configuration	Mapping type		Type A		
	k0		0		
	Starting symbol (S)		2		
	Length (L)		12		
	Repetition number		2		
	PRB bundling type		Static		
	PRB bundling size		2		
	Resource allocation type		Type 0		
	RBG size		Config2		
	VRB-to-PRB mapping type		Non-interleaved		
VRB-to-PRB mapping interleaver bundle size		N/A			
PDSCH DMRS configuration	Antenna port indexes		1000	1000	
	TCI state		TCI State #1	TCI State #2	
	DMRS Type		Type 1		
	Number of additional DMRS		1		
	Maximum number of OFDM symbols for DL front loaded DMRS		1		
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A	
		QCL Type	Type A	N/A	
	Type 2 QCL information	CSI-RS resource	N/A	N/A	
		QCL Type	N/A	N/A	
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration	
		QCL Type	N/A	Type A	
	Type 2 QCL information	CSI-RS resource	N/A	N/A	
		QCL Type	N/A	N/A	
Timing offset of the second TRxP from the first TRxP		us	1		
Frequency offset of the second TRxP from the first TRxP		Hz	300		
Number of HARQ Processes		4			
The number of slots between PDSCH and corresponding HARQ-ACK information		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 (Note 2)			
Precoding configuration		SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity			
Note 1: PDSCH transmission is done from both TRxPs					
Note 2: ACK/NACK feedback is generated for PDSCH on slot i, where mod(i,10) = {2, 4, 6}.					

Table 5.2.2.2.14.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							BLER (%)	SNR (dB) (Note 4)
1-1	R.PDSCH.2-16.2 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x2, ULA Low	1 (Note 3)	2.8
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.14.

5.2.2.2.14_1 2Rx TDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.2.14_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states.

5.2.2.2.14_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportTDM-SchemeA-r16*.

5.2.2.2.14_1.3 Test description

Same test description as in clause 5.2.2.1.14_1.3 with the following exception:

- Table 5.2.2.2.14_1.4-1 instead of 5.2.2.1.14_1.4-1
- Table 5.2.2.2.14_1.3-1 instead of Table 5.2.2.1.14_1.3.3_1-5

Table 5.2.2.2.14_1.3-1: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots40	20	For CSI-RS resources 1,2,5,6	
Slots40	21	For CSI-RS resources 3,4,7,8	
}			

5.2.2.2.14_1.4 Test requirement

Table 5.2.2.2.14.0-3 defines the primary level settings.

The residual BLER specified in Note 3 of Table 5.2.2.2.14_1.4-1 test shall meet or be lower than the specified value in Table 5.2.2.2.14_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.14_1.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							BLER (%)	SNR (dB) (Note 4)
1-1	R.PDSCH.2-16.2 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x2, ULA Low	1 (Note 3)	3.8
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

5.2.3 4RX requirements

5.2.3.1 FDD

5.2.3.1.1 4Rx FDD FR1 PDSCH mapping Type A performance

5.2.3.1.1.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.1.0-3, Table 5.2.3.1.1.0-4, Table 5.2.3.1.1.0-5, Table 5.2.3.1.1.0-6 and Table 5.2.3.1.1.0-7, with the addition of test parameters in Table 5.2.3.1.1.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.1.1.0-1.

Table 5.2.3.1.1.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers	1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 2-1, 2-2, 3-1, 4-1
Verify the PDSCH mapping Type A HARQ soft combining performance under 4 receive antenna conditions.	1-4
Verify the PDSCH mapping Type A performance requirements for Enhanced Receiver Type 1 under 4 receive antenna conditions.	5-1

Table 5.2.3.1.1.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	4 for Test 1-1 WB for Test 3-1 2 for other tests
	Resource allocation type	Test 1-2: Type 1 with start RB = 23, L _{RBs} = 6 Other test: Type 0
	RBG size	Test 1-2: N/A Other tests: Config2
	VRB-to-PRB mapping type	Non-interleaved
VRB-to-PRB mapping interleaver bundle size	N/A	

Parameter		Unit	Value
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		2 for Test 1-1, 1-5, 1-6, 1-7 1 for other tests
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CSI-RS for tracking	CSI-RS periodicity	Slots	Test 1-5, 1-6, 1-7: 10 for CSI-RS resource 1,2,3,4. Other tests: Table 5.2-1.
	CSI-RS offset	Slots	Test 1-5, 1-6, 1-7: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4. Other tests: Table 5.2-1.
Number of HARQ Processes			8 for Test 1-4, 2-1 4 for other tests
The number of slots between PDSCH and corresponding HARQ-ACK information			2

Table 5.2.3.1.1.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.1 FDD	10 / 15	QPSK, 0.30	TDLB100-400	2x4, ULA Low	70	-3.5
1-2	R.PDSCH.1-1.2 FDD	10 / 15	QPSK, 0.30	TDLC300-100	2x4, ULA Low	70	-2.9
1-3	R.PDSCH.1-4.1 FDD	10 / 15	256QAM, 0.82	TDLA30-10	2x4, ULA Low	70	21.0
1-4	R.PDSCH.1-2.1 FDD	10 / 15	16QAM, 0.48	TDLC300-100	2x4, ULA Low	30	-1.5
1-5	R.PDSCH.1-8.1 FDD	10 / 15	16QAM, 0.48	HST-750	1x4	70	3.3
1-6	R.PDSCH.1-8.2 FDD	10 / 15	64QAM, 0.43	HST-972	1x4	70	[6.8]
1-7	R.PDSCH.1-8.1 FDD	10 / 15	16QAM, 0.48	TDLC300-600	2x4	70	[5.8]

Table 5.2.3.1.1.0-4: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
2-1	R.PDSCH.1-3.1 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	13.5
2-2	R.PDSCH.2-1.1 FDD	20 / 30	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	13.7

Table 5.2.3.1.1.0-5: Minimum performance for Rank 3

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)

3-1	R.PDSCH.1-2.3 FDD	10 / 15	16QAM, 0.48	TDLA30-10	4x4, ULA Low	70	11.0
-----	-------------------	---------	-------------	-----------	--------------	----	------

Table 5.2.3.1.1.0-6: Minimum performance for Rank 4

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
4-1	R.PDSCH.1-2.4 FDD	10 / 15	16QAM, 0.48	TDLA30-10	4x4, ULA Low	70	15.6

Table 5.2.3.1.1.0-7: Minimum performance for Rank 3 and Enhanced Receiver Type 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5-1	R.PDSCH.1-2.3 FDD	10 / 15	16QAM, 0.48	TDLA30-10	4x4, ULA Medium A	70	22.3

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.1.1.

5.2.3.1.1_1 4Rx FDD FR1 PDSCH mapping Type A performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.1_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 1 and Rank 2 scenarios.

5.2.3.1.1_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.1.1_1.3 Test description

5.2.3.1.1_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.1.1.0-2 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or (EN-DC, DC bearer *MCG* and *SCG, Connected without release On*) for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.1_1.3.3.

5.2.3.1.1_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.1.1.0-3 and Table 5.2.3.1.1.0-4. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.1_1.4-1 and 5.2.3.1.1_1.4-2 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 4 for each subtest in Tables 5.2.3.1.1_1.4-1 and 5.2.3.1.1_1.4-2 as appropriate.

5.2.3.1.1_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.1_1.3.3_1 Message exceptions for SA

Table 5.2.3.1.1_1.3.3_1-1: BWP

Derivation Path: TS 38.508-1 [6], Table 4.6.3-8			
Information Element	Value/remark	Comment	Condition
BWP ::= SEQUENCE {			
locationAndBandwidth	13750	For Test 2-2 (20MHz BW, SCS 30kHz)	
	14025	For other tests (10MHz BW, SCS 15kHz)	
}			

Table 5.2.3.1.1_1.3.3_1-2: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType0	resourceAllocation Type0 for all tests except test 1-2	
	resourceAllocationType1	resourceAllocation Type1 for test 1-2	
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	n4	n4 for test 1-1	
	wideband	wideband for test 3-1	
	Not present	n2 for other tests	

}			
}			
}			

Table 5.2.3.1.1_1.3.3_1-3: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos1	pos1 for all tests except test 1-1, 1-5, 1-6, 1-7	
	Not present	pos2 for test 1-1, 1-5, 1-6, 1-7	
}			

Table 5.2.3.1.1_1.3.3_1-4: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	Not present	n8 for test 1-4, 2.1	
	n4	n4 for other tests	
}			

Table 5.2.3.1.1_1.3.3_1-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 4.6.3-43			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots10	1 (for CSI-RS resources 1 and 2) 2 (for CSI-RS resources 3 and 4)	Periodicity 10 slots and offset 1/2 for test 1-5, 1-6, 1-7	
}			

5.2.3.1.1_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.1_1.3.3_1

5.2.3.1.1_1.4 Test requirement

Table 5.2.3.1.1.0-3 and Table 5.2.3.1.1.0-4 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.1_1.4-1 and Table 5.2.3.1.1_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.1_1.4-1: Test Requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)

1-1	R.PDSCH.1-1.1 FDD	10 / 15	QPSK, 0.30	TDLB100-400	2x4, ULA Low	70	-2.6
1-2	R.PDSCH.1-1.2 FDD	10 / 15	QPSK, 0.30	TDLC300-100	2x4, ULA Low	70	-2.0
1-3	R.PDSCH.1-4.1 FDD	10 / 15	256QAM, 0.82	TDLA30-10	2x4, ULA Low	70	22.0
1-4	R.PDSCH.1-2.1 FDD	10 / 15	16QAM, 0.48	TDLC300-100	2x4, ULA Low	30	-0.6
1-5	R.PDSCH.1-8.1 FDD	10 / 15	16QAM, 0.48	HST-750	1x4	70	4.2
1-6	R.PDSCH.1-8.2 FDD	10 / 15	64QAM, 0.43	HST-972	1x4	70	7.7
1-7	R.PDSCH.1-8.1 FDD	10 / 15	16QAM, 0.48	TDLC300-600	2x4	70	6.7

Table 5.2.3.1.1_1.4-2: Test Requirement for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
2-1	R.PDSCH.1-3.1 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	14.5
2-2	R.PDSCH.2-1.1 FDD	20 / 30	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	14.7

5.2.3.1.1_2 4Rx FDD FR1 PDSCH mapping Type A performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.1_2.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 3 and Rank 4 scenarios.

5.2.3.1.1_2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.1.1_2.3 Test description

Same test description as in clause 5.2.3.1.1_1.3 with the following exception:

- Step 1 of test procedure to call for Tables 5.2.3.1.1.0-5 and 5.2.3.1.1.0-6 instead of Tables 5.2.3.1.1.0-3 and 5.2.3.1.1.0-4

Table 5.2.3.1.1_2.4-1 instead of 5.2.3.1.1_1.4-1

- Table 5.2.3.1.1_2.4-2 instead of 5.2.3.1.1_1.4-2

- Figure A.3.1.7.5 instead of A.3.1.7.4

5.2.3.1.1_2.4 Test requirement

Table 5.2.3.1.1.0-5 and Table 5.2.3.1.1.0-6 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.1_2.4-1 and Table 5.2.3.1.1_2.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.1_2.4-1: Test Requirement for Rank 3

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
3-1	R.PDSCH.1-2.3 FDD	10 / 15	16QAM, 0.48	TDLA30-10	4x4, ULA Low	70	12.0

Table 5.2.3.1.1_2.4-2: Test Requirement for Rank 4

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
4-1	R.PDSCH.1-2.4 FDD	10 / 15	16QAM, 0.48	TDLA30-10	4x4, ULA Low	70	16.6

5.2.3.1.1_3 FFS

5.2.3.1.1_4 4Rx FDD FR1 PDSCH mapping Type A performance - 4x4 MIMO with enhanced receiver type 1 for both SA and NSA

5.2.3.1.1_4.1 Test purpose

To verify the PDSCH mapping Type A enhanced performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default enhanced receiver type 1 configuration, for Rank 3 scenario.

5.2.3.1.1_4.2 Test applicability

This test applies to all types of NR UE Rel-15 and forward supporting 4 Rx antenna ports and NR enhanced receiver type 1.

This test also applies to all types of EUTRA UE Rel-15 and forward supporting EN-DC, 4 Rx antenna ports and NR enhanced receiver type 1.

5.2.3.1.1_4.3 Test description

Same test description as in clause 5.2.3.1.1_1.3 with the following exception:

- Figure A.3.1.7.5 instead of A.3.1.7.4

Step 1 and 2 of Test procedure as in clause 5.2.3.1.1_1.3.2 are replaced by:

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.1.1.0-7. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.1_4.4-1 as appropriate.

5.2.3.1.1_4.4 Test requirement

Table 5.2.3.1.1.0-7 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.1_4.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.1_4.4-1: Test Requirement for Rank 3 and Enhanced Receiver Type 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5-1	R.PDSCH.1-2.3 FDD	10 / 15	16QAM, 0.48	TDLA30-10	4x4, ULA Medium A	70	23.3

5.2.3.1.2 4Rx FDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance

5.2.3.1.2.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.2.0-3, with the addition of test parameters in Table 5.2.3.1.2.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.2.0-1.

Table 5.2.3.1.2.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and CSI-RS overlapped with PDSCH	1-1

Table 5.2.3.1.2.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
VRB-to-PRB mapping interleaver bundle size	N/A	
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	1
	Maximum number of OFDM symbols for DL front loaded DMRS	1
NZP CSI-RS for CSI acquisition	OFDM symbols in the PRB used for CSI-RS	$l_0 = 13$
	CSI-RS periodicity	Slots 5
ZP CSI-RS for CSI acquisition	Subcarrier index in the PRB used for CSI-RS	$(k_0, k_1, k_2, k_3) = (2, 4, 6, 8)$
	Number of CSI-RS ports (X)	8
	CSI-RS periodicity	Slots 5
Number of HARQ Processes		4
The number of slots between PDSCH and corresponding HARQ-ACK information		2

Table 5.2.3.1.2.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-5.1 FDD	10 / 15	16QAM, 0.48	TDLC300-100	4x4, ULA Low	70	9.1

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.1.2.

5.2.3.1.2_1 4Rx FDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.2_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration for CSI-RS overlapped with PDSCH scenario.

5.2.3.1.2_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.1.2_1.3 Test description

5.2.3.1.2_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.5 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.1.2.0-2 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.1.2_1.3.3.

5.2.3.1.2_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.1.2.0-2. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.2_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-12 in Annex G clause G.1.5.

5.2.3.1.2_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.3.1.2_1.3.3_1 Message exceptions for SA

Table 5.2.3.1.2_1.3.3_1-1: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n4		
}			

Table 5.2.3.1.2_1.3.3_1-2: NZP CSI-RS-ResourceMapping for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row4	001	$k_0=0$	
}			
firstOFDMSymbolInTimeDomain	13	$l_0 = 13$	
}			

Table 5.2.3.1.2_1.3.3_1-3: CSI-ResourcePeriodicityAndOffset for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots5	0	Periodicity 5 slots and offset 0	
}			

Table 5.2.3.1.2_1.3.3_1-4: ZP CSI-RS-ResourceMapping for CSI Acquisition

Derivation Path: TS 38.508-1 [6], clause5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	011110	$(k_0, k_1, k_2, k_3)=(2, 4, 6, 8)$	
}			
nrofPorts	P8	Eight Ports	
firstOFDMSymbolInTimeDomain	12	$l_0 = 12$	
cdm-Type	fd-CDM2		
density CHOICE {			
one	NULL		
}			
freqBand	CSI-FrequencyOccupation		
}			

5.2.3.1.2_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.2_1.3.3_1

5.2.3.1.2_1.4 Test requirement

Table 5.2.3.1.2.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.2_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.2_1.4-1: Test Requirement for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-5.1 FDD	10 / 15	16QAM, 0.48	TDLC300-100	4x4, ULA Low	70	10

5.2.3.1.3 4Rx FDD FR1 PDSCH mapping Type B performance

5.2.3.1.3.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.3.0-3, with the addition of test parameters in Table 5.2.3.1.3.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.3.0-1.

Table 5.2.3.1.3.0-1: Tests purpose

Purpose	Test index
PDSCH mapping Type B performance under 4 receive antenna conditions	1-1

Table 5.2.3.1.3.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type B
	k0		0
	Starting symbol (S)		5
	Length (L)		7
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
Number of HARQ Processes			4
The number of slots between PDSCH and corresponding HARQ-ACK information			2

Table 5.2.3.1.3.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.3 FDD	10 / 15	QPSK, 0.30	TDLA30-10	2x4, ULA Low	70	-3.8

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.1.3.

5.2.3.1.3_1 4Rx FDD FR1 PDSCH mapping Type B performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.3_1.1 Test purpose

To verify the PDSCH mapping Type B normal performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.3.1.3_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports and PDSCH mapping type B.

5.2.3.1.3_1.3 Test description

5.2.3.1.3_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.1.3.0-2 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.1.3_1.3.3.

5.2.3.1.3_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.1.3.0-2. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.3_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.3_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.3.1.3_1.3.3_1 Message exceptions for SA

Table 5.2.3.1.3_1.3.3_1-1: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n4		
}			

Table 5.2.3.1.3_1.3.3_1-2: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
K0	Not present		
mappingType	typeB		
startSymbolAndLength	89	Start symbol(S)=5, Length(L)=7	
}			
PDSCH-TimeDomainResourceAllocation[2]			
SEQUENCE {			
K0	Not present		
mappingType	TypeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

5.2.3.1.3_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.3_1.3.3_1

5.2.3.1.3_1.4 Test requirement

Table 5.2.3.1.3.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.3_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.3_1.4-1: Test Requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.3 FDD	10 / 15	QPSK, 0.30	TDLA30-10	2x4, ULA Low	70	-2.8

5.2.3.1.4 4Rx FDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance

5.2.3.1.4.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.4.0-3, with the addition of test parameters in Table 5.2.3.1.4.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.1.4.0-1.

Table 5.2.3.1.4.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions with CRS rate matching configured	1-1, 1-2

Table 5.2.3.1.4.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
NR UL transmission with a 7.5 kHz shift to the LTE raster			true
PDCCH configuration	Symbols with PDCCH		Symbol# 2
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		3
	Length (L)		9 for Test 1-1 11 for Test 1-2
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Position of the first DM-RS for downlink		3
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CRS for rate matching (Note 1)	LTE carrier centre subcarrier location		Same as NR carrier centre subcarrier location
	LTE carrier BW	MHz	10
	Number of antenna ports		4
	v-shift		0

Number of HARQ Processes		4
The number of slots between PDSCH and corresponding HARQ-ACK information		2
Note 1: No MBSFN is configured on LTE carrier		

Table 5.2.3.1.4.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-7.1 FDD	10 / 15	QPSK, 0.30	TDLA30-10	4x4, ULA Low	70	-4.0
1-2	R.PDSCH.1-7.2 FDD	10 / 15	QPSK, 0.30	TDLA30-10	4x4, ULA Low	70	-4.0

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.4.

5.2.3.1.4_1 4Rx FDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.4_1.1 Test purpose

Same as 5.2.2.1.4_1.1.

5.2.3.1.4_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test1-1 also applies to all types of EUTRA UE release 15 and forward supporting EN-DC supporting 4 Rx antenna ports and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-2 applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

Test 1-2 also applies to all types of EUTRA UE release 15 and forward supporting EN-DC supporting 4 Rx antenna ports and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

5.2.3.1.4_1.3 Test description

5.2.3.1.4_1.3.1 Initial conditions

Same as 5.2.2.1.4_1.3.1 with the following exceptions:

- Use Figure A.3.1.7.4 for TE diagram
- Use Figure A.3.2.5 for UE diagram
- Instead of 5.2.2.1.4.x → refer 5.2.2.3.4.x

5.2.3.1.4_1.3.2 Test procedure

Same as 5.2.2.1.4_1.3.2 with the following exceptions:

- Instead of 5.2.2.1.4.x → refer 5.2.2.3.4.x

5.2.3.1.4_1.3.3 Message contents

Same as 5.2.2.1.4_1.3.3.

5.2.3.1.4_1.3.4 Test requirement

Table 5.2.3.1.4.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.4_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.4_1.3.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-7.1 FDD	10 / 15	QPSK, 0.30	TDLA30-10	4x4, ULA Low	70	-3.0
1-2	R.PDSCH.1-7.2 FDD	10 / 15	QPSK, 0.30	TDLA30-10	4x4, ULA Low	70	-3.0

5.2.3.1.5 4Rx FDD FR1 PDSCH 0.001% BLER performance

5.2.3.1.5.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.5.0-3, with the addition of test parameters in Table 5.2.3.1.5.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.5.0-1.

Table 5.2.3.1.5.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH 0.001% BLER performance under 4 receive antenna conditions	1-1

Table 5.2.3.1.5.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
VRB-to-PRB mapping interleaver bundle size	N/A	
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	1
	Maximum number of OFDM symbols for DL front loaded DMRS	1
Maximum number of HARQ transmission		1
Number of HARQ Processes		4
The number of slots between PDSCH and corresponding HARQ-ACK information		2

Table 5.2.3.1.5.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Target BLER	SNR (dB)
1-1	R.PDSCH.1-1.4 FDD	10 / 15	QPSK, 0.59	AWGN	1x4, ULA Low	0.001%	0.7

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.5.

5.2.3.1.5_1 4Rx FDD FR1 PDSCH 0.001% BLER performance - 1x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.5_1.1 Test purpose

To verify the PDSCH 0.001% BLER performance under 4 receive antenna conditions.

5.2.3.1.5_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *dl-64QAM-MCS-TableAlt* and capability IE *cqi-TableAlt*.

5.2.3.1.5_1.3 Test description

5.2.3.1.5_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.5.0-2 and Table 5.2.3.1.5.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.5_1.3.3.

5.2.3.1.5_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.1.5.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.5_1.3.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.4. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.4.3-1 in Annex G.

5.2.3.1.5_1.3.3 Message contents

5.2.3.1.5_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.5_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		FR1
mcs-Table	qam64LowSE		
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
k0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

5.2.3.1.5_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.5_1.3.3_1.

5.2.3.1.5_1.3.4 Test requirement

Table 5.2.3.1.5.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.5_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.5_1.3.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Target BLER	SNR (dB)
1-1	R.PDSCH.1-1.4 FDD	10 / 15	QPSK, 0.59	AWGN	1x4, ULA Low	0.001%	1.3

5.2.3.1.6 4Rx FDD FR1 PDSCH repetitions over multiple slots performance

5.2.3.1.6.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.6.0-3, with the addition of test parameters in Table 5.2.3.1.6.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.6.0-1.

Table 5.2.3.1.6.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH repetitions over multiple slots performance under 4 receive antenna conditions	1-1

Table 5.2.3.1.6.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	2
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
	VRB-to-PRB mapping interleaver bundle size	N/A
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	1
	Maximum number of OFDM symbols for DL front loaded DMRS	1
Number of HARQ Processes		4
The number of slots between final repetition of PDSCH and corresponding HARQ-ACK information		2

Table 5.2.3.1.6.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Target BLER	SNR (dB)
1-1	R.PDSCH.1-11.1 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x4, ULA Low	1% (Note 1)	-2.3
Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.							

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.6.

5.2.3.1.6_1 4Rx FDD FR1 PDSCH repetitions over multiple slots performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.6_1.1 Test purpose

To Verify the PDSCH repetitions over multiple slots performance under 4 receive antenna conditions.

5.2.3.1.6_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-RepetitionMultiSlots-r16*.

5.2.3.1.6_1.3 Test description

5.2.3.1.6_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.6.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.6_1.3.3.

5.2.3.1.6_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.1.6.0-3. The SS sends downlink MAC padding bits on the DL RMC. The UE may expect that the TB is repeated with same symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.6_1.3.4-1.
3. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport blocks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.5 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.3.1.6_1.3.3 Message contents

5.2.3.1.6_1.3.3_1 Message exceptions for SA

Same as 5.2.2.1.6_1.3.3_1.

5.2.3.1.6_1.3.3_2 Message exceptions for SA

Same as 5.2.2.1.6_1.3.3_1.

5.2.3.1.6_1.3.4 Test requirement

Table 5.2.3.1.6.0-3 defines the primary level settings.

The target BLER for the downlink reference measurement channels specified in Annex A.3.2.1 for each BLER test shall meet or exceed the specified value in Table 5.2.3.1.6_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.6_1.3.4-1: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Target BLER	SNR (dB)
1-1	R.PDSCH.1-11.1 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x4, ULA Low	1% (Note 1)	[-1.6]
Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.							

5.2.3.1.7 4Rx FDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance

5.2.3.1.7.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.7.0-3, with the addition of test parameters in Table 5.2.3.1.7.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.7.0-1.

Table 5.2.3.1.7.0-1: Tests purpose

Purpose	Test index
Verify PDSCH mapping Type B performance and UE processing capability 2 under four receive antenna conditions	1-1

Table 5.2.3.1.7.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type B
	k0	0
	Starting symbol (S)	2
	Length (L)	2
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
PDSCH DMRS configuration	VRB-to-PRB mapping interleaver bundle size	N/A
	DMRS Type	Type 1
	Number of additional DMRS	0
	Maximum number of OFDM symbols for DL front loaded DMRS	1
	Maximum number of HARQ transmission	1
	Number of HARQ Processes	2
	The number of slots between PDSCH and corresponding HARQ-ACK information	0

Table 5.2.3.1.7.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-12.1 FDD	10 / 15	QPSK, 0.30	TDLA30-10	2x4, ULA Low	70	-2.3

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.7.

5.2.3.1.7_1 4Rx FDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.7_1.1 Test purpose

To verify PDSCH mapping Type B performance and UE processing capability 2 under four receive antenna conditions.

5.2.3.1.7_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-ProcessingType2*.

5.2.3.1.7_1.3 Test description

5.2.3.1.7_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.7.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.7_1.3.3.

5.2.3.1.7_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.1.7.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.7_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.7_1.3.3 Message contents

5.2.3.1.7_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.7_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entries		FR1
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
k0	Not present		
mappingType	typeB		
startSymbolAndLength	16	Start symbol(S)=2, Length(L)=2	
}			
}			

Table 5.2.3.1.7_1.3.3_1-2: PUCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-112			
Information Element	Value/remark	Comment	Condition
PUCCH-Config ::= SEQUENCE {			FR1
dl-DataToUL-ACK SEQUENCE (SIZE (1)) OF	1 entry		
INTEGER {			
INTEGER[1]	0	entry 1	
}			
}			

Table 5.2.3.1.7_1.3.3_1-3: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
PDSCH-to-HARQ_feedback timing indicator	K1=0 as per dl-DataToUL-ACK in Table 5.2.3.1.7_1.3.3_1-3	"000"	

5.2.3.1.7_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.7_1.3.3_1.

5.2.3.1.7_1.4 Test requirement

Table 5.2.3.1.7.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.7_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.7_1.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-12.1 FDD	10 / 15	QPSK, 0.30	TDLA30-10	2x4, ULA Low	70	-1.4

5.2.3.1.8 4Rx FDD FR1 PDSCH pre-emption performance

5.2.3.1.8.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.8.0-3, with the addition of test parameters in Table 5.2.3.1.8.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.8.0-1.

Table 5.2.3.1.8.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH pre-emption performance under 4 receive antenna conditions	1-1

Table 5.2.3.1.8.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
PDCCH configuration (Note 4)	Symbols with PDCCH		0, 1
	DCI format		2_1
	timeFrequencySet		14x1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
Pre-emption configuration (Note 2)	Starting symbol (S)		3
	Length (L)		2
	Pre-emption periodicity and offset (Note 3)	Slots	10/1
Number of HARQ Processes			4
The number of slots between PDSCH and corresponding HARQ-ACK information			2
Note 1: Void			
Note 2: Interference modelled as random data on pre-empted REs.			
Note 3: Pre-emption is scheduled with a fixed scheduling with 10% probability within 10ms periodicity.			
Note 4: In addition to PDCCH configuration in Table 5.2-1.			

Table 5.2.3.1.8.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 1-2.6 FDD	10 / 15	16QAM 0.64	TDLA30-10	2x4, ULA Low	70	6.6

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.8.

5.2.3.1.8_1 4Rx FDD FR1 PDSCH pre-emption performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.8_1.1 Test purpose

To Verify the PDSCH pre-emption performance under 4 receive antenna conditions.

5.2.3.1.8_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pre-emptIndication-DL-r16*.

5.2.3.1.8_1.3 Test description

5.2.3.1.8_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.8.0-2 and Table 5.2.3.1.8.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.8_1.3.3.

5.2.3.1.8_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.1.8.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. SS transmits PDCCH DCI format 2_1 for int_RNTI with 10% probability to transmit the DL Preemption indication according to Table 5.2.3.1.8.0-2. In the time and frequency set indicated by PDCCH DCI format 2_1, SS stops transmission of PDSCH.
3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.8_1.3.4-1.
4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.8_1.3.3 Message contents

5.2.3.1.8_1.3.3_1 Message exceptions for SA

Same as 5.2.2.1.8_1.3.3_1.

5.2.3.1.8_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.8_1.3.3_1.

5.2.3.1.8_1.3.4 Test requirement

Table 5.2.3.1.8.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.8_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.8_1.3.4-1: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 1-2.6 FDD	10 / 15	16QAM 0.64	TDLA30-10	2x4, ULA Low	70	7.6

5.2.3.1.9 4Rx FDD FR1 HST-SFN performance

5.2.3.1.9.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.9.0-3, with the test parameters defined in Table 5.2.3.1.9.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.1.9.0-1.

Table 5.2.3.1.9.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when highSpeedDemodFlag-r16 IE [20] is configured	1-1

Table 5.2.3.1.9.0-2: Test Parameters for Testing

Parameter	Unit	Value
Duplex mode		FDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
VRB-to-PRB mapping interleaver bundle size	N/A	
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	2
	Maximum number of OFDM symbols for DL front loaded DMRS	1
CSI-RS for tracking	CSI-RS periodicity	Slots 10 for CSI-RS resource 1,2,3,4.
	CSI-RS offset	Slots 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4.
Number of HARQ Processes		4
The number of slots between PDSCH and corresponding HARQ-ACK information		2

Table 5.2.3.1.9.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-8.3 FDD	10 / 15	16QAM, 0.48	HST-SFN	2x4	70	10.4

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.9.

5.2.3.1.9_1 4Rx FDD FR1 HST-SFN performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.9_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* IE [20] is configured and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.3.1.9_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

5.2.3.1.9_1.3 Test description

5.2.3.1.9_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.1.9.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.9_1.3.3.

5.2.3.1.9_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2.3.1.9_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.9_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.1.9_1.4-1 as appropriate.

5.2.3.1.9_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.9_1.3.3_1 Message exceptions for SA

Table 5.2.3.1.9_1.3.3_1-1: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present	n2 for test 1-1	
}			
}			
}			

Table 5.2.3.1.9_1.3.3_1-2: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	for test 1-1	
}			

Table 5.2.3.1.9_1.3.3_1-3: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n4	for test 1-1	
}			

Table 5.2.3.1.9_1.3.3_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots10	1 for CSI-RS resource #1 and #2 2 for CSI-RS resource #3 and #4	For test 1-1: offset = 1 for CSI-RS resource 1 and 2 offset =2 for CSI-RS resource 3 and 4.	
}			

5.2.3.1.9_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.9_1.3.3_1

5.2.3.1.9_1.4 Test requirement

Tables 5.2.3.1.9_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.9_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.9_1.4-1: Test Requirements for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-8.3 FDD	10 / 15	16QAM, 0.48	HST-SFN	2x4	70	11

5.2.3.1.10 4Rx FDD FR1 HST DPS performance

5.2.3.1.10.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.10.0-3, with the test parameters defined in Table 5.2.3.1.10.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.1.10.0-1.

Table 5.2.3.1.10.0-1: Tests purpose

Purpose	Test index
Verify UE performance in the HST-DPS scenario defined in B.3.3	1-1, 1-2

Table 5.2.3.1.10.0-2: Test Parameters for Testing

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
PDCCH configuration	TCI state		Note 1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
	TCI state		Note 1
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		2
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CSI-RS for tracking	Resource set #1	First OFDM symbol in the PRB used for CSI-RS	$l_0 = 5$ for CSI-RS resource 1 and 3 $l_0 = 9$ for CSI-RS resource 2 and 4
		CSI-RS periodicity	Slots 10 for CSI-RS resource 1,2,3,4.
		CSI-RS offset	Slots 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4
		QCL info	TCI state #2
	Resource set #2	First OFDM symbol in the PRB used for CSI-RS	$l_0 = 6$ for CSI-RS resource 5 and 6 $l_0 = 10$ for CSI-RS resource 7 and 8
		CSI-RS periodicity	Slots 10 for CSI-RS resource 5,6,7,8.
		CSI-RS offset	Slots 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8
		QCL info	TCI state #3
NZP CSI-RS for CSI acquisition	Resource set #3	First OFDM symbol in the PRB used for CSI-RS	$l_0 = 12$
		CSI-RS periodicity	Slots 20
		CSI-RS offset	Slots 0
		QCL info	TCI state #0
	Resource set #4	First OFDM symbol in the PRB used for CSI-RS	$l_0 = 13$
		CSI-RS periodicity	Slots 20
		CSI-RS offset	Slots 0
		QCL info	TCI state #1
TCI state #0	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration
		QCL Type	Type A
	Type 2 QCL information	CSI-RS resource	N/A
		QCL Type	N/A
TCI state #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration
		QCL Type	Type A
	Type 2 QCL information	CSI-RS resource	N/A
		QCL Type	N/A
TCI state #2	Type 1 QCL information	SSB index	SSB #0
		QCL Type	Type C
	Type 2 QCL information	SSB index	N/A

TCI state #3	Type 1 QCL information	QCL Type	N/A
		SSB index	SSB #1
		QCL Type	Type C
	Type 2 QCL information	SSB index	N/A
		QCL Type	N/A
Number of HARQ Processes			4
The number of slots between PDSCH and corresponding HARQ-ACK information			2
<p>Note 1: SSB # ($k \bmod 2$), CSI-RS (for tracking) resource set # ($(k \bmod 2) + 1$) and CSI-RS (for CSI acquisition) resource set # ($(k \bmod 2) + 3$) are transmitted by k^{th} RRH. For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy $\text{mod}(i, 2n) = n$. PDCCH and PDSCH associated with TCI # ($k \bmod 2$) is transmitted by k^{th} RRH from slot# $\max\{i; [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}} + T_{\text{firstTRS}} + T_{\text{TRS proc}}, 0]$ to slot# $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$ PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered. For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy $\text{mod}(i, 2n) = n$. PDCCH and PDSCH associated with TCI # ($k \bmod 2$) is transmitted by k^{th} RRH from slot# $\max\{i; [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}}, 0]$ to slot# $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$ Where $k=0, 1, 2, \dots$ is the RRH number, $n = 2520$ is half of the number of slots between two RRH, $T_{\text{HARQ}} = 2$ is the number of slots between PDSCH and corresponding HARQ-ACK information, $T_{\text{MAC proc}} = 3$ is the number of slots for MAC CE processing, $T_{\text{firstTRS}} = 6$ is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, $T_{\text{TRS proc}} = 2$ is the number of slots for TRS processing.</p>			

Table 5.2.3.1.10.0-3: Minimum performance for HST-DPS

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-8.4 FDD	10 / 15	64QAM, 0.43	HST-DPS	1	2x4	70	10.6
1-2	R.PDSCH.1-8.4 FDD	10 / 15	64QAM, 0.43	HST-DPS	2	2x4	70	10.6

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.10.

5.2.3.1.10_1 4Rx FDD FR1 HST-DPS performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.10_1.1 Test purpose

To verify UE performance in the HST-DPS scenario defined in B.3.3 and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.3.1.10_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.3.1.10_1.3 Test description

5.2.3.1.10_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.1.10.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.10_1.3.3.

5.2.3.1.10_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2.3.1.10_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.10_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.1.10_1.4-1 as appropriate.

5.2.3.1.10_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.10_1.3.3_1 Message exceptions for SA

Table 5.2.3.1.10_1.3.3_1-1: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present	n2 is used	test 1-1, 1-2
}			
}			
}			

Table 5.2.3.1.10_1.3.3_1-2: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	for test 1-1, 1-2	
}			

Table 5.2.3.1.10_1.3.3_1-3: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n4	for test 1-1, 1-2	
}			

Table 5.2.3.1.10_1.3.3_1-4: NZP-CSI-RS-Resource for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
nzp-CSI-RS-ResourceId	i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8	for test 1-1, 1-2	
qcl-InfoPeriodicCSI-RS	2 for CSI-RS resource #1, #2, #3, #4 3 for CSI-RS resource #5, #6, #7, #8	for test 1-1, 1-2: TCI-StateId for TCI- State #2 for CSI-RS resource #1, #2, #3, #4 TCI-StateId for TCI- State #3 for CSI-RS resource #5, #6, #7, #8	
}			

Table 5.2.3.1.10_1.3.3_1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.3.1.10_1.3.3_1-4)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	5 for CSI-RS resource #1 and #3 9 for CSI-RS resource #2 and #4 6 for CSI-RS resource #5 and #6 10 for CSI-RS resource #7 and #8	for test 1-1, 1-2: l ₀ = 5 for CSI-RS resource 1 and 3 l ₀ = 9 for CSI-RS resource 2 and 4 l ₀ = 6 for CSI-RS resource 5 and 6 l ₀ = 10 for CSI-RS resource 7 and 8	
}			

Table 5.2.3.1.10_1.3.3_1-6: CSI-ResourcePeriodicityAndOffset for TRS (Table 5.2.3.1.10_1.3.3_1-4)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE { slots10	1 for CSI-RS resource #1, #2, #5, #6 2 for CSI-RS resource #3 #4, #7, #8	For test 1-1, 1-2: periodicity: 10 slots. offset: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8	
}			

Table 5.2.3.1.10_1.3.3_1-7: NZP-CSI-RS-ResourceSet for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-ResourceSet ::= SEQUENCE { nzp_CSI_ResourceSetId	0 for Resource set #1 1 for Resource set #2	For test 1-1, 1-2	
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { NZP-CSI-RS-ResourceId[1]	0	entry 1 CSI-RS resource #1	Resource set #1
NZP-CSI-RS-ResourceId[2]	1	entry 2 CSI-RS resource #2	
NZP-CSI-RS-ResourceId[3]	2	entry 3 CSI-RS resource #3	
NZP-CSI-RS-ResourceId[4]	3	entry 4 CSI-RS resource #4	
}			
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { NZP-CSI-RS-ResourceId[1]	4	entry 1 CSI-RS resource #5	Resource set #2
NZP-CSI-RS-ResourceId[2]	5	entry 2 CSI-RS resource #6	
NZP-CSI-RS-ResourceId[3]	6	entry 3 CSI-RS resource #7	
NZP-CSI-RS-ResourceId[4]	7	entry 4 CSI-RS resource #8	
}			
}			

Table 5.2.3.1.10_1.3.3_1-8: NZP-CSI-RS-Resource for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
nzp-CSI-RS-ResourceId	8 for CSI-RS resource #9 9 for CSI-RS resource #10	for test 1-1, 1-2	
qcl-InfoPeriodicCSI-RS	0 for CSI-RS resource #9 1 for CSI-RS resource #10	for test 1-1, 1-2: TCI-State #0 for CSI-RS resource #9 TCI-State #1 for CSI-RS resource #10	
}			

Table 5.2.3.1.10_1.3.3_1-9: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.3.1.10_1.3.3_1-8)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	12 for CSI-RS resource #9 13 for CSI-RS resource #10	for test 1-1, 1-2 $l_0=12$ for CSI-RS resource #9 $l_0=13$ for CSI-RS resource #10	
}			

Table 5.2.3.1.10_1.3.3_1-10: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.3.1.10_1.3.3_1-8)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots20	0	For test 1-1, 1-2: periodicity = 20 slots. offset = 0 slots	
}			

Table 5.2.3.1.10_1.3.3_1-11: NZP-CSI-RS-ResourceSet for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-ResourceSet ::= SEQUENCE {			
nzp_CSI_ResourceSetId	2 for Resource set #3 3 for Resource set #4	For test 1-1, 1-2	
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	1 entry	For test 1-1, 1-2	Resource set #3
NZP-CSI-RS-ResourceId[1]	8	entry 1 CSI-RS resource #9	
}			
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	1 entry	For test 1-1, 1-2	Resource set #4
NZP-CSI-RS-ResourceId[1]	9	entry 1 CSI-RS resource #10	
}			
}			

Table 5.2.3.1.10_1.3.3_1-12: TCI-State

Derivation Path: TS 38.508-1 [6], Table 4.6.3-190			
Information Element	Value/remark	Comment	Condition
TCI-State ::= SEQUENCE {			
tci-StateId	0 for TCI state #0 1 for TCI state #1 2 for TCI state #2 3 for TCI state #3	For test 1-1, 1-2	
qcl-Type1 SEQUENCE {			
bwp-Id	BWP-Id of active BWP		TCI state #0, TCI state #1
	Not present		TCI state #2, TCI state #3
referenceSignal CHOICE {			
csi-rs	0	CSI-RS resource #1	TCI state #0
	4	CSI-RS resource #5	TCI state #1
ssb	0	SSB #0	TCI state #2
	1	SSB #1	TCI state #3
}			
qcl-Type	typeA		TCI state #0, TCI state #1
	typeC		TCI state #2, TCI state #3
}			
}			

5.2.3.1.10_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.10_1.3.3_1

5.2.3.1.10_1.4 Test requirement

Tables 5.2.3.1.10_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.10_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.10_1.4-1: Test Requirements for HST-DPS

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-8.4 FDD	10 / 15	64QAM, 0.43	HST-DPS	1	2x4	70	11.2
1-2	R.PDSCH.1-8.4 FDD	10 / 15	64QAM, 0.43	HST-DPS	2	2x4	70	11.2

5.2.3.1.11 4Rx FDD FR1 PDSCH Single-DCI based SDM scheme performance

5.2.3.1.11.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.11.0-3, with the addition of test parameters in Table 5.2.3.1.11.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.11.0-1.

Table 5.2.3.1.11.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance with Single-DCI based SDM scheme under 4 receive antenna conditions	1-1,1-2

Table 5.2.3.1.11.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		0	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	20	
	CSI-RS offset	Slots	10 for CSI-RS resources 1 and 2 11 for CSI-RS resources 3 and 4	10 for CSI-RS resources 5 and 6 11 for CSI-RS resources 7 and 8
QCL info			TCI state #0	
Duplex mode			FDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PRB bundling type		Static	
	PRB bundling size		2	
	Resource allocation type		Type 1	
RBG size		Config2		

	VRB-to-PRB mapping type		Non-interleaved	
	VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	Antenna port indexes		1000	1002
	TCI state		TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
	Maximum number of OFDM symbols for DL front loaded DMRS		1	
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type	Type A	N/A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type	N/A	Type A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
Resource allocation			Full-overlapping	
Timing offset of the second TRxP from the first TRxP			us	-0.5 for test 1-1 2 for test 1-2
Frequency offset of the second TRxP from the first TRxP			Hz	200 for test 1-1 0 for test 1-2
Number of HARQ Processes			4	
The number of slots between PDSCH and corresponding HARQ-ACK information			2	
Precoding configuration			SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs (PDSCH Layer 0 is transmitted from TRxP #1 and PDSCH layer 1 is transmitted from TRxP #2)				

Table 5.2.3.1.11.0-3: Minimum performance

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Not e 1)	Correlation matrix and antenna configuration(Not e 2)	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)(Not e 3)
1-1	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	14.6
1-2	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	13.9
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent							
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2							
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP							

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.11.

5.2.3.1.11_1 4Rx FDD FR1 PDSCH Single-DCI based SDM scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.1.11_1.1 Test purpose

To verify the PDSCH performance with Single-DCI based SDM scheme under 4 receive antenna conditions.

5.2.3.1.11_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *singleDCI-SDM-scheme-r16*.

5.2.3.1.11_1.3 Test description

5.2.3.1.11_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.11.0-2 and Table 5.2.3.1.11.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.11_1.3.3.

5.2.3.1.11_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.1.11_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.11_1.3.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Table 5.2.3.1.11_1.3.4-1 as appropriate.

5.2.3.1.11_1.3.3 Message contents

5.2.3.1.11_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.11_1.3.3_1-1: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
PDSCH-to-HARQ_feedback timing indicator	K1 = 2	"010"	
Antenna port(s)	DMRS port 0 and 2	"1011"	
Transmission configuration indication	TCI state 1 and 2	"000"	

Table 5.2.3.1.11_1.3.3_1-2: CellGroupConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-19			
Information Element	Value/remark	Comment	Condition
CellGroupConfig ::= SEQUENCE {			
simultaneousTCI-UpdateList1-r16 SEQUENCE {			
ServCellIndex [1]	ServCellIndex		
}			
}			

Table 5.2.3.1.11_1.3.3_1-3: ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 4.6.3-28			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
tci-PresentInDCI	enabled		
}			

Table 5.2.3.1.11_1.3.3_1-4: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-100			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1]	TCI-State with condition TCI-state-0		
TCI-State[2]	TCI-State with condition TCI-state-1		
TCI-State[3]	TCI-State with condition TCI-state-2		
}			
rbg-Size	config2		
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present		
}			
}			
}			

Table 5.2.3.1.11_1.3.3_1-5: TCI-State

Derivation Path: TS 38.508-1 [6], Table 4.6.3-190			
Information Element	Value/remark	Comment	Condition
TCI-State ::= SEQUENCE {			
tci-StateId	0		TCI-state-0
	1		TCI-state-1
	2		TCI-state-2
qcl-Type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		TCI-state-0
csi-rs	1		TCI-state-1
	5		TCI-state-2
}			
qcl-Type	typeA		
}			
qcl-Type2	Not present		
}			

Table 5.2.3.1.11_1.3.3_1-6: NZP-CSI-RS-Resource

Derivation Path: TS 38.508-1 [6], Table 4.6.3-85			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
resourceMapping SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
cdm-Type	noCDM		
density CHOICE {			
three	NULL		
}			
periodicityAndOffset CHOICE {			
slots20	10	For CSI-RS resources 1,2,5,6	
	11	For CSI-RS resources 3,4,7,8	
}			
qcl-InfoPeriodicCSI-RS	0		
}			

5.2.3.1.11_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.11_1.3.3_1.

5.2.3.1.11_1.3.4 Test requirement

Table 5.2.3.1.11.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.11_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.11_1.3.4-1: Test requirement

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Not e 1)	Correlation matrix and antenna configuration(Not e 2)	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)(Not e 3)
1-1	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	15.6
1-2	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	14.9
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent							
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2							
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP							

5.2.3.1.12 4Rx FDD FR1 PDSCH Multi-DCI based transmission scheme performance

5.2.3.1.12.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.12.0-3, with the addition of test parameters in Table 5.2.3.1.12.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.12.0-1.

Table 5.2.3.1.12.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs	1-1

Table 5.2.3.1.12.0-2: Test parameters

Parameter	Unit	Value	
		TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB		TRxP #1	
PDCCH configuration	TCI state	TCI State #1	TCI State #2
	CORESETPoolIndex	0,1	
	First subcarrier index in the PRB used for CSI-RS	k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS	l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)	1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8

CSI-RS for tracking	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8		
	Density		3		
	CSI-RS periodicity		Slots	20	
	CSI-RS offset		Slots	10 for CSI-RS resources 1 and 2 11 for CSI-RS resources 3 and 4	10 for CSI-RS resources 5 and 6 11 for CSI-RS resources 7 and 8
	QCL info		TCI state #0		
Duplex mode			FDD		
Active DL BWP index			1		
PDSCH configuration	Mapping type		Type A		
	k0		0		
	Starting symbol (S)		2		
	Length (L)		12		
	PRB bundling type		Static		
	PRB bundling size		2		
	Resource allocation type		Type 1		
	RBG size		Config2		
	VRB-to-PRB mapping type		Non-interleaved		
	VRB-to-PRB mapping interleaver bundle size		N/A		
PDSCH DMRS configuration	Antenna port indexes		{1000,1001}	{1002,1003}	
	TCI state		TCI State #1	TCI State #2	
	DMRS Type		Type 1		
	Number of additional DMRS		1		
	Maximum number of OFDM symbols for DL front loaded DMRS		1		
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A	
		QCL Type	Type A	N/A	
	Type 2 QCL information	CSI-RS resource	N/A	N/A	
		QCL Type	N/A	N/A	
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration	
		QCL Type	N/A	Type A	
	Type 2 QCL information	CSI-RS resource	N/A	N/A	
		QCL Type	N/A	N/A	
Resource allocation			Non-overlapping		
Timing offset of the second TRxP from the first TRxP			us	-0.5	
Frequency offset of the second TRxP from the first TRxP			Hz	200	
Number of HARQ Processes			4		
The number of slots between PDSCH and corresponding HARQ-ACK information			2		
Precoding configuration			SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity		
Note 1: PDSCH transmission is done from both TRxPs. Transmission from TRxP #1 uses CORESETPoolIndex 0 and transmission from TRxP #2 uses CORESETPoolIndex 1					

Table 5.2.3.1.12.0-3: Minimum performance

Test num.	Reference channel		Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Note 1)	Correlation matrix and antenna configuration(Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)(Note 3)
	TRxP #1	TRxP #2						
1-1	R.PDSCH. 1-3.3 FDD	R.PDSCH. 1-3.4 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	14.6
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2 Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.12.

5.2.3.1.12_1 4Rx FDD FR1 PDSCH Multiple-DCI based transmission scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.1.12_1.1 Test purpose

To verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs.

5.2.3.1.12_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *multiDCI-MultiTRP-r16*.

5.2.3.1.12_1.3 Test description

5.2.3.1.12_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.12.0-2 and Table 5.2.3.1.12.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.12_1.3.3.

5.2.3.1.12_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 via PDCCH DCI format 1_1 for C_RNTI in ControlResourceSetId1 (Table 5.2.3.1.12_1.3.3_1-2), and transmits PDSCH in TRxP#2 via PDCCH DCI format 1_1 for C_RNTI in ControlResourceSetId2 (Table 5.2.3.1.12_1.3.3_1-3), to transmit the DL RMC according to Table 5.2.3.1.12_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.3.1.12_1.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.12_1.3.3 Message contents

5.2.3.1.12_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.12_1.3.3_1-1: PDCCH-Config (Preamble)

Derivation Path: TS 38.508-1 [4], Table 4.6.3-95			
Information Element	Value/remark	Comment	Condition
PDCCH-Config ::= SEQUENCE {			
controlResourceSetToAddModList	2 entries		
SEQUENCE(SIZE (1..3)) OF			
ControlResourceSet {			
ControlResourceSet[1]	ControlResourceSetId1	entry 1	
ControlResourceSet[2]	ControlResourceSetId2	entry 2	
}			
}			

Table 5.2.3.1.12_1.3.3_1-2: ControlResourceSetId1 (Table 5.2.3.1.12_1.3.3_1-1: PDCCH-Config)

Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	1		
frequencyDomainResources	11110000 00000000 00000000 00000000 00000000 00000	CORESET to use the least significant 24 RBs of the BWP	
tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId {			
TCI-StateId[1]	1		
}			
tci-PresentInDCI	enabled		
coresetPoolIndex-r16	0		
}			

Table 5.2.3.1.12_1.3.3_1-3: ControlResourceSetId2 (Table 5.2.3.1.12_1.3.3_1-1: PDCCH-Config)

Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	2		
frequencyDomainResources	00001111 00000000 00000000 00000000 00000000 00000	CORESET to use the RBs 24~47 of the BWP	
tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId {			
TCI-StateId[1]	2		
}			
tci-PresentInDCI	enabled		
coresetPoolIndex-r16	1		
}			

Table 5.2.3.1.12_1.3.3_1-4: Physical layer parameters for DCI format 1_1 in ControlResourceSetId1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 0 and 1	"0111"	
Transmission configuration indication	TCI State #1	"000"	

Table 5.2.3.1.12_1.3.3_1-5: Physical layer parameters for DCI format 1_1 in ControlResourceSetId2

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 2 and 3	"1000"	
Transmission configuration indication	TCI State #2	"001"	

Table 5.2.3.1.12_1.3.3_1-6: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE (1..maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1] SEQUENCE {		TCI-state-0	
tci-StateId	0		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		
}			
qcl-Type	typeC		
}			
TCI-State[2]		TCI-state-1	
tci-StateId	1		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	1		
}			
qcl-Type	typeA		
}			
TCI-State[3]		TCI-state-2	
tci-StateId	2		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	5		
}			
qcl-Type	typeA		
}			
}			
}			

Table 5.2.3.1.12_1.3.3_1-7: CSI-RS-ResourceMapping for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMsymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
}			

Table 5.2.3.1.12_1.3.3_1-8: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots20	10	For CSI-RS resources 1,2,5,6	
slots20	11	For CSI-RS resources 3,4,7,8	
}			

5.2.3.1.12_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.12_1.3.3_1.

5.2.3.1.12_1.4 Test requirement

Table 5.2.3.1.12.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.12_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.12_1.4-1: Test requirement

Test num.	Reference channel		Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB) (Note 3)
	TRxP #1	TRxP #2						
1-1	R.PDSCH. 1-3.3 FDD	R.PDSCH. 1-3.4 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	15.6
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2 Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

5.2.3.1.13 4Rx FDD FR1 PDSCH Single-DCI based FDM scheme A performance

5.2.3.1.13.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.13.0-3, with the addition of test parameters in Table 5.2.3.1.13.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.13.0-1.

Table 5.2.3.1.13.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 4 receive antenna conditions when UE is configured with "FDMSchemeA" in "RepetitionScheme-r16" defined in clause 5.1 of TS 38.214 [12]	1-1

Table 5.2.3.1.13.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		Not configured	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	20	
	CSI-RS offset	Slots	10 for CSI-RS resources 1 and 2 11 for CSI-RS resources 3 and 4	10 for CSI-RS resources 5 and 6 11 for CSI-RS resources 7 and 8
QCL info			TCI state #0	
Duplex mode			FDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PRB bundling type		Static	
	PRB bundling size		Wideband	
	Resource allocation type		Type 0	
	RBG size		Config2	
	VRB-to-PRB mapping type		Non-interleaved	
	VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	Antenna port indexes		1000,1001	1000,1001
	TCI state		TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
Maximum number of OFDM symbols for DL front loaded DMRS		1		
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type	Type A	N/A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type	N/A	Type A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A

Timing offset of the second TRxP from the first TRxP	us	-0.5
Frequency offset of the second TRxP from the first TRxP	Hz	200
Number of HARQ Processes		4
The number of slots between PDSCH and corresponding HARQ-ACK information		2
Precoding configuration		SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity
Note 1: PDSCH transmission is done from both TRxPs		

Table 5.2.3.1.13.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
						Fraction of maximum throughput (%)	SNR (dB) (Note 3)
1-1	R.PDSCH.1-2.5 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x4, ULA Low	70	10.9
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.							
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.							
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2							

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.13.

5.2.3.1.13_1 4Rx FDD FR1 PDSCH Single-DCI based FDM scheme A performance - 2x4 MIMO for both SA and NSA

5.2.3.1.13_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16”.

5.2.3.1.13_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportFDM-SchemeA-r16*.

5.2.3.1.13_1.3 Test description

5.2.3.1.13_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.13.0-2 and Table 5.2.3.1.13.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.13_1.3.3.

5.2.3.1.13_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 and TRxP#2 via PDCCH DCI format 1_1 for C_RNTI (Table 5.2.3.1.13_1.3.3_1-2), to transmit the DL RMC according to Table 5.2.3.1.13_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.3.1.13_1.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.13_1.3.3 Message contents

5.2.3.1.13_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.13_1.3.3_1-1: PDCCH-ControlResourceSet (Preamble)

Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
tci-PresentInDCI	enabled		
}			

Table 5.2.3.1.13_1.3.3_1-2: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 0 and 1	"0111"	
Transmission configuration indication	TCI codepoint 0, corresponding to TCI State #1 and #2	"000"	

Table 5.2.3.1.13_1.3.3_1-3: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE (1..maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1] SEQUENCE {		TCI-state-0	
tci-StateId	0		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		
}			
qcl-Type	typeC		
}			
TCI-State[2]		TCI-state-1	
tci-StateId	1		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	1		
}			
qcl-Type	typeA		
}			
TCI-State[3]		TCI-state-2	
tci-StateId	2		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	5		
}			
qcl-Type	typeA		
}			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	wideband		
}			
repetitionSchemeConfig-r16 CHOICE {			
setup SEQUENCE {			
fdm-TDM-r16 CHOICE {			
setup SEQUENCE {			
repetitionScheme-r16	fdmSchemeA		
startingSymbolOffsetK-r16	Not present		
}			
}			
}			
}			
}			

Table 5.2.3.1.13_1.3.3_1-4: CSI-RS-ResourceMapping for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
}			

Table 5.2.3.1.13_1.3.3_1-5: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots20	10	For CSI-RS resources 1,2,5,6	
slots20	11	For CSI-RS resources 3,4,7,8	
}			

5.2.3.1.13_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.13_1.3.3_1.

5.2.3.1.13_1.4 Test requirement

Table 5.2.3.1.13.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.13_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.13_1.4-1: Test requirement for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
						Fraction of maximum throughput (%)	SNR (dB) (Note 3)
1-1	R.PDSCH.1-2.5 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x2, ULA Low	70	11.9
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2							

5.2.3.1.14 4Rx FDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance

5.2.3.1.14.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.14.0-3, with the addition of test parameters in Table 5.2.3.1.14.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.14.0-1.

Table 5.2.3.1.14.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 4 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states defined in clause 5.1 of TS 38.214 [12]	1-1

Table 5.2.3.1.14.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		Not configured	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	20	
	CSI-RS offset	Slots	10 for CSI-RS resources 1 and 2 11 for CSI-RS resources 3 and 4	10 for CSI-RS resources 5 and 6 11 for CSI-RS resources 7 and 8
	QCL info		TCI state #0	
Duplex mode			FDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	Repetition number		2	
	PRB bundling type		Static	
	PRB bundling size		2	
	Resource allocation type		Type 0	
	RBG size		Config2	
	VRB-to-PRB mapping type		Non-interleaved	
VRB-to-PRB mapping interleaver bundle size		N/A		
PDSCH DMRS configuration	Antenna port indexes		1000	1000
	TCI state		TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
	Maximum number of OFDM symbols for DL front loaded DMRS		1	

TCI State #1	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type		Type A	N/A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource		N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type		N/A	Type A
	Type 2 QCL information	CSI-RS resource		N/A	N/A
		QCL Type		N/A	N/A
Timing offset of the second TRxP from the first TRxP			us	2	
Frequency offset of the second TRxP from the first TRxP			Hz	200	
Number of HARQ Processes				4	
The number of slots between PDSCH and corresponding HARQ-ACK information				2	
Precoding configuration				SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs					

Table 5.2.3.1.14.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
						BLER (%)	SNR (dB) (Note 4)
1-1	R.PDSCH.1-11.2 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x4, ULA Low	1 (Note 3)	-0.4
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2							

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.14.

5.2.3.1.14_1 4Rx FDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.1.14_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states.

5.2.3.1.14_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportTDM-SchemeA-r16*.

5.2.3.1.14_1.3 Test description

5.2.3.1.14_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.14.0-2 and Table 5.2.3.1.14.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.14_1.3.3.

5.2.3.1.14_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 and TRxP#2 via PDCCH DCI format 1_1 for C_RNTI (Table 5.2.3.1.14_1.3.3_1-2), to transmit the DL RMC according to Table 5.2.3.1.14_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.3.1.14_1.4-1.
3. Measure the residual BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport blocks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.4 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.3.1.14_1.3.3 Message contents

5.2.3.1.14_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.14_1.3.3_1-1: PDCCH-ControlResourceSet (Preamble)

Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
tci-PresentInDCI	enabled		
}			

Table 5.2.3.1.14_1.3.3_1-2: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 0	"0000"	
Transmission configuration indication	TCI codepoint 0, corresponding to TCI State #1 and #2	"000"	

Table 5.2.3.1.14_1.3.3_1-3: *PDSCH-Config*

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE(1..maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1] SEQUENCE {		TCI-state-0	
tci-StateId	0		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		
}			
qcl-Type	typeC		
}			
TCI-State[2]		TCI-state-1	
tci-StateId	1		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	1		
}			
qcl-Type	typeA		
}			
TCI-State[3]		TCI-state-2	
tci-StateId	2		
qcl-type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
csi-rs	5		
}			
qcl-Type	typeA		
}			
}			
pdsch-TimeDomainAllocationList	Not present		
pdsch-TimeDomainAllocationList-r16 CHOICE {			
setup SEQUENCE (SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation-r16 {			
PDSCH-TimeDomainResourceAllocation-r16[1] SEQUENCE {			
k0-r16	Not present		
mappingType-r16	typeA		
startSymbolAndLength-r16	44	Start symbol(S) =2, Length(L)= 4	For Slot i, if mod(i, 10) = 7 for i from {0,...,39}
repetitionNumber-r16	2		
}			
PDSCH-TimeDomainResourceAllocation-r16[2] SEQUENCE {			
k0-r16	Not present		
mappingType-r16	typeA		
startSymbolAndLength-r16	53	Start symbol(S) =2, Length(L)= 12	For Slot i, if mod(i, 10) = {0,1,2,3,4,5,} for i from {1,...,39}
repetitionNumber-r16	2		
}			
}			

}			
}			
}			

Table 5.2.3.1.14_1.3.3_1-4: CSI-RS-ResourceMapping for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMsymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
}			

Table 5.2.3.1.14_1.3.3_1-5: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots20	10	For CSI-RS resources 1,2,5,6	
slots20	11	For CSI-RS resources 3,4,7,8	
}			

5.2.3.1.14_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.1.14_1.3.3_1.

5.2.3.1.14_1.4 Test requirement

Table 5.2.3.1.14.0-3 defines the primary level settings.

The residual BLER specified in Note 3 of Table 5.2.3.1.14_1.4-1 test shall meet or be lower than the specified value in Table 5.2.3.1.14_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.14_1.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
						BLER (%)	SNR (dB) (Note 4)

1-1	R.PDSCH.1-11.2 FDD	10 / 15	16QAM, 0.54	TDLA30-10	2x4, ULA Low	1 (Note 3)	0.6
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2							

5.2.3.2 TDD

5.2.3.2.1 4Rx TDD FR1 PDSCH mapping Type A performance

5.2.3.2.1.0 Minimum conformance requirements for PDSCH Mapping Type A

The performance requirements are specified in Table 5.2.3.2.1.0-3, Table 5.2.3.2.1.0-4, Table 5.2.3.2.1.0-5 and Table 5.2.3.2.1.0-6, with the test parameters defined in Table 5.2.3.2.1.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.2.1.0-1.

Table 5.2.3.2.1.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers	1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-11, 2-1, 2-2, 3-1, 4-1
Verify the PDSCH mapping Type A HARQ soft combining performance under 4 receive antenna conditions.	1-4
Verify the PDSCH mapping Type A performance requirements for Enhanced Receiver Type 1 under 4 receive antenna conditions.	5-1

Table 5.2.3.2.1.0-2: Test Parameters for Testing

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	Specific to each Reference channel
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	4 for Tests 1-1, 1-8, 1-9 WB for Test 3-1 2 for other tests
	Resource allocation type	Test 1-2: Type 1 with start RB = 50, L _{RBs} = 6 Other tests: Type 0
	RBG size	Test 1-2: N/A Other tests: Config2
	VRB-to-PRB mapping type	Non-interleaved
	VRB-to-PRB mapping interleaver bundle size	N/A

PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		2 for Tests 1-1, 1-7, 1-8, 1-9, 1-10, 1-11 1 for other tests
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CSI-RS for tracking	First OFDM symbol in the PRB used for CSI-RS		Tests 1-8, 1-9: $l_0 = 4$ for CSI-RS resource 1 and 3 $l_0 = 8$ for CSI-RS resource 2 and 4 Other tests; Table 5.2-1.
	CSI-RS periodicity	Slots	Test 1-7, 1-10, 1-11: 20 for CSI-RS resource 1,2,3,4. Other tests: Table 5.2-1.
	CSI-RS offset	Slots	Test 1-7, 1-10, 1-11: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4. Other tests: Table 5.2-1.
	Frequency Occupation		Test 1-7, 1-10, 1-11: Start PRB 0 Number of PRB = 52 Other tests: Table 5.2-1.
Number of HARQ Processes			16 for Test 1-4 10 for Test 1-9 8 for other tests
The number of slots between PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.3.2.1.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)

1-1	R.PDSCH.2-1.1 TDD	40 / 30	QPSK, 0.30	FR1.30-1A	TDLB100-400	2x4, ULA Low	70	-4.1
1-2	R.PDSCH.2-1.2 TDD	40 / 30	QPSK, 0.30	FR1.30-1	TDLC300-100	2x4, ULA Low	70	-2.7
1-3	R.PDSCH.2-4.1 TDD	40 / 30	256QAM, 0.82	FR1.30-1	TDLA30-10	2x4, ULA Low	70	21.6
1-4	R.PDSCH.2-2.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-100	2x4, ULA Low	30	-1.2
1-5	R.PDSCH.2-5.1 TDD	40 / 30	QPSK, 0.30	FR1.30-2	TDLA30-10	2x4, ULA Low	70	-3.8
1-6	R.PDSCH.2-6.1 TDD	40 / 30	QPSK, 0.30	FR1.30-3	TDLA30-10	2x4, ULA Low	70	-3.6
1-7	R.PDSCH.2-10.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	HST-1000	1x4	70	3.4
1-8	R.PDSCH.2-11.1 TDD	40 / 30	QPSK, 0.30	FR1.30-5	TDLB100-400	2x4, ULA Low	70	-4.0
1-9	R.PDSCH.2-12.1 TDD	40 / 30	QPSK, 0.30	FR1.30-6	TDLB100-400	2x4, ULA Low	70	-4.0
1-10	R.PDSCH.2-10.2 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-1200	2x4	70	5.8
1-11	R.PDSCH.2-10.3 TDD	40 / 30	64QAM, 0.43	FR1.30-1	HST-1667	1x4	70	6.8

Table 5.2.3.2.1.0-4: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
2-1	R.PDSCH.2-3.1 TDD	40 / 30	64QAM, 0.50	FR1.30-1	TDLA30-10	2x4, ULA Low	70	13.6
2-2	R.PDSCH.2-9.1 TDD	20 / 30	64QAM, 0.50	FR1.30-4	TDLA30-10	2x4, ULA Low	70	13.7

Table 5.2.3.2.1.0-5: Minimum performance for Rank 3

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
3-1	R.PDSCH.2-2.3 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLA30-10	4x4, ULA Low	70	11.1

Table 5.2.3.2.1.0-6: Minimum performance for Rank 4

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
4-1	R.PDSCH.2-2.4 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLA30-10	4x4, ULA Low	70	15.4

Table 5.2.3.2.1.0-7: Minimum performance for Rank 3 and Enhanced Receiver Type 1

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
5-1	R.PDSCH.2-2.3 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLA30-10	4x4, ULA Medium A	70	22.9

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.1.

5.2.3.2.1_1 4Rx TDD FR1 PDSCH mapping Type A performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.1_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 1 and Rank 2 scenarios.

5.2.3.2.1_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward, supporting 4Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4Rx antenna ports.

5.2.3.2.1_1.3 Test description

5.2.3.2.1_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.1.0-2 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.1_1.4.3.

5.2.3.2.1_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.2.1.0-3 and Table 5.2.3.2.1.0-4. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.1_1.3.4-1 and 5.2.3.2.1_1.3.4-2 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.2.1_1.3.4-1 and 5.2.3.2.1_1.3.4-2 as appropriate.

5.2.3.2.1_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.1_1.3.3_1 Message exceptions for SA

Table 5.2.3.2.1_1.3.3_1-1: BWP

Derivation Path: TS 38.508-1 [6], Table 4.6.3-8			
Information Element	Value/remark	Comment	Condition
BWP ::= SEQUENCE {			
locationAndBandwidth	13750	For Test 2-2 (20MHz BW, SCS 30kHz)	
	28875	For other tests (40MHz BW, SCS 30kHz)	
}			

Table 5.2.3.2.1_1.3.3_1-2: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	n4	n4 for tests 1-1, 1- 8, 1-9	
	wideband	wideband for test 3-1	
	Not present	n2 for other tests	
}			
}			
}			

Table 5.2.3.2.1_1.3.3_1-3: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos1	pos1 for all tests except tests 1-1, 1-7, 1-8, 1-9	
	Not present	pos2 for tests 1-1, 1-7, 1-8, 1-9, 1- 10, 1-11	
}			

Table 5.2.3.2.1_1.3.3_1-4: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	Not present	n8 for other tests	
	n16	n16 for test 1-4	
	n10	n10 for test 1-9	
}			

Table 5.2.3.2.1_1.3.3_1-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 4.6.3-43			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots20	1 (for CSI-RS resources 1 and 2) 2 (for CSI-RS resources 3 and 4)	Periodicity 20 slots and offset 1/2 for test 1-7, 1-10, 1-11	
}			

Table 5.2.3.2.1_1.3.3_1-5A: CSI-RS-ResourceMapping for TRS

Derivation Path: TS 38.508-1 [6], Table 4.6.3-45			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMsymbolInTimeDomain	4	For Tests 1-8, 1-9: $l_0 = 4$ for CSI-RS resource 1 and 3	TRS
	8	For Tests 1-8, 1-9: $l_0 = 8$ for CSI-RS resource 2 and 4	TRS
}			

Table 5.2.3.2.1_1.3.3_1-6: CSI-FrequencyOccupation for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-11			
Information Element	Value/remark	Comment	Condition
CSI-FrequencyOccupation ::= SEQUENCE {			
nrofRBs	52	52 for tests 1-7, 1-10, 1-11, 2-2	TRS
	108	108 for other tests	TRS
}			

Table 5.2.3.2.1_1.3.3_1-7: RACH-ConfigGeneric

Derivation Path: TS 38.508-1 [6], Table 4.6.3-130			
Information Element	Value/remark	Comment	Condition
RACH-ConfigGeneric ::= SEQUENCE {			
prach-ConfigurationIndex	163	Only for test 2-2	
}			

Table 5.2.3.2.1_1.3.3_1-8: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-157			
Information Element	Value/remark	Comment	Condition
SchedulingRequestResourceConfig ::= SEQUENCE {			
periodicityAndOffset CHOICE {			
sl20	7	For test 1-9	
sl20	5	For test 2-2	
}			
}			

Table 5.2.3.2.1_1.3.3_1-9: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-1			
Parameter	Value	Value in binary	Condition
PUCCH resource indicator	<i>PUCCH-ResourceId</i> [1] = 6 in pucch-ResourceSetID[1] or <i>PUCCH-ResourceId</i> [1] = 14 in pucch-ResourceSetID[2] as defined in Table 4.6.3-112 (Mapping as per Table 9.2.3-2 in TS 38.213)	'110'B	Slot S1 for test 1-9

Table 5.2.3.2.1_1.3.3_1-10: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-27			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	3 entry		Test 1-5, Test 1-6
PDSCH-TimeDomainResourceAllocation[1] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	44	Start symbol(S)=2, Length(L)=4	
}			
PDSCH-TimeDomainResourceAllocation[2] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
PDSCH-TimeDomainResourceAllocation[3] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		Test 1-8
PDSCH-TimeDomainResourceAllocation[1] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
PDSCH-TimeDomainResourceAllocation[2] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	81	Start symbol(S)=2, Length(L)=10	
}			
PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	5 entry		Test 1-9
PDSCH-TimeDomainResourceAllocation[1] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
PDSCH-TimeDomainResourceAllocation[2] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	100	Start symbol(S)=2, Length(L)=8	
}			
PDSCH-TimeDomainResourceAllocation[3] SEQUENCE {			

K0	Not present		
mappingType	typeA		
startSymbolAndLength	81	Start symbol(S)=2, Length(L)=10	
}			
PDSCH-TimeDomainResourceAllocation[4] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
PDSCH-TimeDomainResourceAllocation[5] SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

5.2.3.2.1_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.2.1_1.3.3_1

5.2.3.2.1_1.4 Test requirement

Table 5.2.3.2.1.0-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A clause A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.1_1.4-1 and Table 5.2.3.2.1_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.1_1.4-1: Test Requirements for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)

1-1	R.PDSCH.2-1.1 TDD	40 / 30	QPSK, 0.30	FR1.30-1A	TDLB100-400	2x4, ULA Low	70	-3.1
1-2	R.PDSCH.2-1.2 TDD	40 / 30	QPSK, 0.30	FR1.30-1	TDLC300-100	2x4, ULA Low	70	-1.7
1-3	R.PDSCH.2-4.1 TDD	40 / 30	256QAM, 0.82	FR1.30-1	TDLA30-10	2x4, ULA Low	70	22.5
1-4	R.PDSCH.2-2.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-100	2x4, ULA Low	30	-0.3
1-5	R.PDSCH.2-5.1 TDD	40 / 30	QPSK, 0.30	FR1.30-2	TDLA30-10	2x4, ULA Low	70	-2.8
1-6	R.PDSCH.2-6.1 TDD	40 / 30	QPSK, 0.30	FR1.30-3	TDLA30-10	2x4, ULA Low	70	-2.6
1-7	R.PDSCH.2-10.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	HST-1000	1x4	70	4.3
1-8	R.PDSCH.2-11.1 TDD	40 / 30	QPSK, 0.30	FR1.30-5	TDLB100-400	2x4, ULA Low	70	-3.1
1-9	R.PDSCH.2-12.1 TDD	40 / 30	QPSK, 0.30	FR1.30-6	TDLB100-400	2x4, ULA Low	70	-3.1
1-10	R.PDSCH.2-10.2 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-1200	2x4	70	6.7
1-11	R.PDSCH.2-10.3 TDD	40 / 30	64QAM, 0.43	FR1.30-1	HST-1667	1x4	70	7.7

Table 5.2.3.2.1_1.4-2: Test Requirements for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
2-1	R.PDSCH.2-3.1 TDD	40 / 30	64QAM, 0.50	FR1.30-1	TDLA30-10	2x4, ULA Low	70	14.6
2-2	R.PDSCH.2-9.1 TDD	20 / 30	64QAM, 0.50	FR1.30-4	TDLA30-10	2x4, ULA Low	70	14.7

5.2.3.2.1_2 4Rx TDD FR1 PDSCH mapping Type A performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.1_2.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 3 and Rank 4 scenarios.

5.2.3.2.1_2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.2.1_2.3 Test description

Same test description as in clause 5.2.3.2.1_1.3 with the following exception:

- Figure A.3.1.7.5 instead of A.3.1.7.4
- Step 1 of Test procedure as in clause 5.2.3.2.1_1.3.2 to call for Tables 5.2.3.2.1.0-5 and 5.2.3.2.1.0-6 instead of Table 5.2.3.2.1.0-3 and 5.2.3.2.1.0-4.
- Step 2 and 4 of Test procedure as in clause 5.2.3.2.1_1.3.2 to call for Tables 5.2.3.2.1_2.3.4-1 and 5.2.3.2.1_2.4-2 instead of Tables 5.2.3.2.1_1.4-1 and 5.2.3.2.1_1.4-2.

5.2.3.2.1_2.3.1 Void

5.2.3.2.1_2.3.2 Void

5.2.3.2.1_2.3.3 Void

5.2.3.2.1_2.4 Test requirement

Table 5.2.3.2.1.0-5 and Table 5.2.3.2.1.0-6 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.1_2.4-1 and Table 5.2.3.2.1_2.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.1_2.4-1: Test Requirements for Rank 3

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
3-1	R.PDSCH.2-2.3 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLA30-10	4x4, ULA Low	70	12.1

Table 5.2.3.2.1_2.4-2: Test Requirements for Rank 4

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
4-1	R.PDSCH.2-2.4 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLA30-10	4x4, ULA Low	70	16.4

5.2.3.2.1_3 4Rx TDD FR1 PDSCH mapping Type A performance - 2x4 MIMO with enhanced receiver type 1 for both SA and NSA

FFS

5.2.3.2.1_4 4Rx TDD FR1 PDSCH mapping Type A performance - 4x4 MIMO with enhanced receiver type 1 for both SA and NSA

5.2.3.2.1_4.1 Test purpose

To verify the PDSCH mapping Type A enhanced performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default enhanced receiver type 1 configuration, for Rank 3 scenario.

5.2.3.2.1_4.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and NR enhanced receiver type 1.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC, 4 Rx antenna ports and NR enhanced receiver type1.

5.2.3.2.1_4.3 Test description

Same test description as in clause 5.2.3.2.1_2.3 with the following exception:

- Step 1 of Test procedure as in clause 5.2.3.2.1_1.3.2 to call for Table 5.2.3.2.1.0-7 instead of Table 5.2.3.2.1.0-3 and 5.2.3.2.1.0-4.
- Step 2 and 4 of Test procedure as in clause 5.2.3.2.1_1.3.2 to call for Table 5.2.3.2.1_4.4-1 instead of Tables 5.2.3.2.1_1.4-1 and 5.2.3.2.1_1.4-2.

5.2.3.2.1_4.3.1 Void

5.2.3.2.1_4.3.2 Void

5.2.3.2.1_4.3.3 Void

5.2.3.2.1_4.4 Test requirement

Table 5.2.3.2.1.0-7 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.1_4.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.1_4.4-1: Test Requirements for Rank 3 and Enhanced Receiver Type 1

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
5-1	R.PDSCH.2-2.3 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLA30-10	4x4, ULA Medium A	70	23.9

5.2.3.2.2 4Rx TDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance

5.2.3.2.2.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.2.0-3, with the addition of test parameters in Table 5.2.3.2.2.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.2.0-1.

Table 5.2.3.2.2.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and CSI-RS overlapped with PDSCH	1-1

Table 5.2.3.2.2.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
Resource allocation type		Type 0

	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
NZP CSI-RS for CSI acquisition	OFDM symbols in the PRB used for CSI-RS		$l_0 = 13$
	CSI-RS periodicity	Slots	5
ZP CSI-RS for CSI acquisition	Subcarrier index in the PRB used for CSI-RS		$(k_0, k_1, k_2, k_3) = (2, 4, 6, 8)$
	Number of CSI-RS ports (X)		8
	CSI-RS periodicity	Slots	5
Number of HARQ Processes			8
The number of slots between PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.3.2.2.0-3: Minimum performance for Rank 2

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-7.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-100	2x4, ULA Low	70	9.0

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.2.

5.2.3.2.2_1 4Rx TDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.2_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration for CSI-RS overlapped with PDSCH scenario.

5.2.3.2.2_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.2.2_1.3 Test description

5.2.3.2.2_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.2.2.0-2 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer MCG and SCG, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.2.2_1.3.3.

5.2.3.2.2_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.2.2.0-2. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.2_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-12 in Annex G clause G.1.5.

5.2.3.2.2_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.3.2.2_1.3.3_1 Message exceptions for SA

Table 5.2.3.2.2_1.3.3_1-1: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	Not present		
}			

Table 5.2.3.2.2_1.3.3_1-2: NZP CSI-RS-ResourceMapping for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	13	$l_0 = 13$	
}			

Table 5.2.3.2.2_1.3.3_1-3: CSI-ResourcePeriodicityAndOffset for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots5	0	Periodicity 5 slots and offset 0	
}			

Table 5.2.3.2.2_1.3.3_1-4: ZP CSI-RS-ResourceMapping for CSI Acquisition

Derivation Path: TS 38.508-1 [6], clause 5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	011110	(k0, k1, k2, k3)=(2, 4, 6, 8)	
}			
nrofPorts	P8	Eight Ports	
freqBand	CSI-FrequencyOccupation		
}			

Table 5.2.3.2.2_1.3.3_1-4A: ZP CSI-ResourcePeriodicityAndOffset for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots5	0	Periodicity 5 slots and offset 0	
}			

5.2.3.2.2_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.2.2_1.3.3_1

5.2.3.2.2_1.4 Test requirement

Table 5.2.3.2.2.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.2_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.2_1.4-1: Test Requirement for Rank 2

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-7.1 TDD	40 / 30	16QAM, 0.48	FR1.30-1	TDLC300-100	2x4, ULA Low	70	9.9

5.2.3.2.3 4Rx TDD FR1 PDSCH mapping Type B performance

5.2.3.2.3.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.3.0-3, with the addition of test parameters in Table 5.2.3.2.3.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.3.0-1.

Table 5.2.3.2.3.0-1: Tests purpose

Purpose	Test index
PDSCH mapping Type B performance under 4 receive antenna conditions	1-1

Table 5.2.3.2.3.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type B
	k0	0
	Starting symbol (S)	5
	Length (L)	7
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
	VRB-to-PRB mapping interleaver bundle size	N/A
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	1
	Maximum number of OFDM symbols for DL front loaded DMRS	1
Number of HARQ Processes		8
The number of slots between PDSCH and corresponding HARQ-ACK information		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.3.2.3.0-3: Minimum performance for Rank 1

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH,2-1.3 TDD	40 / 30	QPSK, 0.30	FR1.30-1	TDLA30-10	2x4, ULA Low	70	-3.9

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.3.

5.2.3.2.3_1 4Rx TDD FR1 PDSCH mapping Type B performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.3_1.1 Test purpose

To verify the PDSCH mapping Type B normal performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.3.2.3_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports and PDSCH mapping type B.

5.2.3.2.3_1.3 Test description

5.2.3.2.3_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.2.3.0-2 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer MCG and SCG, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.2.3_1.3.3.

5.2.3.2.3_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.2.3.0-2. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.3_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.3_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.3.2.3_1.3.3_1 Message exceptions for SA

Table 5.2.3.2.3_1.3.3_1-1: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	Not present		
}			

Table 5.2.3.2.3_1.3.3_1-2: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
K0	Not present		
mappingType	typeB		
startSymbolAndLength	89	Start symbol(S)=5, Length(L)=7	
}			
PDSCH-TimeDomainResourceAllocation[2]			
SEQUENCE {			
K0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

5.2.3.2.3_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.2.3_1.3.3_1

5.2.3.2.3_1.4 Test requirement

Table 5.2.3.2.3.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.3_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.3_1.4-1: Test Requirement for Rank 1

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH, 2-1.3 TDD	40 / 30	QPSK, 0.30	FR1.30-1	TDLA30-10	2x4, ULA Low	70	-2.9

5.2.3.2.4 4Rx TDD FR1 PDSCH mapping Type A performance

5.2.3.2.4.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.4.0-3, with the addition of test parameters in Table 5.2.3.2.4.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.4.0-1.

Table 5.2.3.2.4.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions with CRS rate matching configured	1-1, 1-2

Table 5.2.3.2.4.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			TDD
Active DL BWP index			1
NR UL transmission with a 7.5 kHz shift to the LTE raster			true
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		3
	Length (L)		9 for Test 1-1 11 for Test 1-2
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
PDSCH DMRS configuration	DMRS Type		Type 1
	Position of the first DM-RS for downlink		3
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CRS for rate matching (Note 1)	LTE carrier centre subcarrier location		Same as NR carrier centre subcarrier location
	LTE carrier BW	MHz	10
	Number of antenna ports		4
	v-shift		0
Number of HARQ Processes			8
The number of slots between PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2
Note 1: No MBSFN is configured on LTE carrier			

Table 5.2.3.2.4.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.1 TDD	10 / 15	QPSK, 0.30	FR1.15-1	TDLA30-10	4x4, ULA Low	70	-3.6
1-2	R.PDSCH.1-1.2 TDD	10 / 15	QPSK, 0.30	FR1.15-1	TDLA30-10	4x4, ULA Low	70	-3.5

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.4.

5.2.3.2.4_1 4Rx TDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.4_1.1 Test purpose

To verify the PDSCH mapping Type A coexistence performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.3.2.4_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-1 also applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-2 applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

Test 1-2 also applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports and and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

5.2.3.2.4_1.3 Test description

5.2.3.2.4_1.3.1 Initial conditions

Same as 5.2.2.2.4_1.3.1 with the following exceptions:

- Use Figure A.3.1.7.5 for TE diagram
- Use Figure A.3.2.5 for UE diagram
- Instead of 5.2.2.2.4.x → refer 5.2.3.2.4.x

5.2.3.2.4_1.3.2 Test procedure

Same as 5.2.2.2.4_1.3.2 with the following exceptions:

- Instead of 5.2.2.2.4.x → refer 5.2.3.2.4.x

5.2.3.2.4_1.3.3 Message contents

Same as 5.2.2.2.4_1.3.3

5.2.3.2.4_1.4 Test requirement

Table 5.2.3.2.4.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.4_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.4_1.4-1: Test Requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.1 TDD	10 / 15	QPSK, 0.30	FR1.15-1	TDLA30-10	4x4, ULA Low	70	-2.6
1-2	R.PDSCH.1-1.2 TDD	10 / 15	QPSK, 0.30	FR1.15-1	TDLA30-10	4x4, ULA Low	70	-2.5

5.2.3.2.5 4Rx TDD FR1 PDSCH 0.001% BLER performance

5.2.3.2.5.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.5.0-3, with the addition of test parameters in Table 5.2.3.2.5.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.5.0-1.

Table 5.2.3.2.5.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH 0.001% BLER performance under 4 receive antenna conditions	1-1

Table 5.2.3.2.5.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			TDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
Maximum number of HARQ transmission			1
Number of HARQ Processes			8
The number of slots between PDSCH and corresponding HARQ-ACK information			Defined in Annex A.1.2 for TDD pattern FR1.30-1

Table 5.2.3.2.5.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Target BLER	SNR (dB)
1-1	R.PDSCH.2-1.4 TDD	40 / 30	QPSK, 0.59	FR1.30-1	AWGN	1x4, ULA Low	0.001%	0.7

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.5.

5.2.3.2.5_1 4Rx TDD FR1 PDSCH 0.001% BLER performance - 1x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.5_1.1 Test purpose

To verify the PDSCH 0.001% BLER performance under 4 receive antenna conditions.

5.2.3.2.5_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *dl-64QAM-MCS-TableAlt* and capability IE *cqi-TableAlt*.

5.2.3.2.5_1.3 Test description

5.2.3.2.5_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.2.5.0-2 and Table 5.2.3.2.5.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.5_1.3.3.

5.2.3.2.5_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.2.5.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.5_1.3.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.4. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.4.3-1 in Annex G.

5.2.3.2.5_1.3.3 Message contents

5.2.3.2.5_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.2.5_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF {	2 entry		FR1
mcs-Table	qam64LowSE		
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
k0	Not present		
mappingType	typeA		
startSymbolAndLength	53	Start symbol(S)=2, Length(L)=12	
}			
}			

5.2.3.2.5_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.2.5_1.3.3_1.

5.2.3.2.5_1.3.4 Test requirement

Table 5.2.3.2.5.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.5_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.5_1.3.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Target BLER	SNR (dB)
1-1	R.PDSCH.2-1.4 TDD	40 / 30	QPSK, 0.59	FR1.30-1	AWGN	1x4, ULA Low	0.001%	1.3

5.2.3.2.6 4Rx TDD FR1 PDSCH repetitions over multiple slots performance

5.2.3.2.6.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.6.0-3, with the addition of test parameters in Table 5.2.3.2.6.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.6.0-1.

Table 5.2.3.2.6.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH repetitions over multiple slots performance under 4 receive antenna conditions	1-1

Table 5.2.3.2.6.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0

	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		2
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
Number of HARQ Processes			4
The number of slots between final repetition of PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 (Note 1)
Note 1: ACK/NACK feedback is generated for PDSCH on slot i , where $\text{mod}(i,10) = \{2, 4, 6\}$.			

Table 5.2.3.2.6.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Target BLER	SNR (dB)
1-1	R.PDSCH.1-16.1 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x4, ULA Low	1% (Note 1)	-2.6
Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.6.

5.2.3.2.6_1 4Rx TDD FR1 PDSCH repetitions over multiple slots performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.6_1.1 Test purpose

To Verify the PDSCH repetitions over multiple slots performance under 4 receive antenna conditions.

5.2.3.2.6_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-RepetitionMultiSlots-r16*.

5.2.3.2.6_1.3 Test description

5.2.3.2.6_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.2.3.2.6.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.6_1.3.3.

5.2.3.2.6_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.2.6.0-3. The SS sends downlink MAC padding bits on the DL RMC. The UE may expect that the TB is repeated with same symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.6_1.3.4-1.
3. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport blocks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.5 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.3.2.6_1.3.3 Message contents

5.2.3.2.6_1.3.3_1 Message exceptions for SA

Same as 5.2.2.1.6_1.3.3_1.

5.2.2.2.6_1.3.3_2 Message exceptions for SA

Same as 5.2.2.1.6_1.3.3_1.

5.2.3.2.6_1.3.4 Test requirement

Table 5.2.3.2.6.0-3 defines the primary level settings.

The target BLER percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each BLER test shall meet or exceed the specified value in Table 5.2.2.2.6_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.6_1.3.4-1: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Target BLER	SNR (dB)
1-1	R.PDSCH.2-16.1 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x4, ULA Low	1% (Note 1)	[-1.9]

Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.

5.2.3.2.7 4Rx TDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance

5.2.3.2.7.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.7.0-3, with the addition of test parameters in Table 5.2.3.2.7.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.7.0-1.

Table 5.2.3.2.7.0-1: Tests purpose

Purpose	Test index
Verify PDSCH mapping Type B performance and UE processing capability 2 under four receive antenna conditions	1-1

Table 5.2.3.2.7.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			TDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type B
	k0		0
	Starting symbol (S)		2
	Length (L)		2
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		0
	Maximum number of OFDM symbols for DL front loaded DMRS		1
Maximum number of HARQ transmission			1
Number of HARQ Processes			2
The number of slots between PDSCH and corresponding HARQ-ACK information			0

Table 5.2.3.2.7.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-17.1 TDD	40 / 30	QPSK, 0.30	FR1.30-2	TDLA30-10	2x4, ULA Low	70	-2.5

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.7.

5.2.3.2.7_1 4Rx TDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.7_1.1 Test purpose

To verify PDSCH mapping Type B performance and UE processing capability 2 under four receive antenna conditions.

5.2.3.2.7_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-ProcessingType2*.

5.2.3.2.7_1.3 Test description

5.2.3.2.7_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.2.7.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.7_1.3.3.

5.2.3.2.7_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.2.7.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.7_1.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.7_1.3.3 Message contents

5.2.3.2.7_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.2.7_1.3.3_1-1: PDSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [6], Table 5.4.2-19			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE (1..maxNrofDL-Allocations)) OF {	2 entry		FR1
PDSCH-TimeDomainResourceAllocation [1]			
SEQUENCE {			
k0	Not present		
mappingType	typeB		
startSymbolAndLength	16	Start symbol(S)=2, Length(L)=2	
}			
}			

Table 5.2.3.2.7_1.3.3_1-2: PUCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-112			
Information Element	Value/remark	Comment	Condition
PUCCH-Config ::= SEQUENCE {			FR1
dl-DataToUL-ACK SEQUENCE (SIZE (1)) OF INTEGER {	1 entry		
INTEGER [1]	0	entry 1	
}			
}			

Table 5.2.3.2.7_1.3.3_1-3: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
PDSCH-to-HARQ_feedback timing indicator	K1=0 as per dl-DataToUL-ACK in Table 5.2.3.2.7_1.3.3_1-3	"000"	

5.2.3.2.7_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.2.7_1.3.3_1.

5.2.3.2.7_1.4 Test requirement

Table 5.2.3.2.7.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.7_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.7_1.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-17.1 TDD	40 / 30	QPSK, 0.30	FR1.30-2	TDLA30-10	2x4, ULA Low	70	-1.5

5.2.3.2.8 4Rx TDD FR1 PDSCH pre-emption performance

5.2.3.2.8.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.8.0-3, with the addition of test parameters in Table 5.2.3.2.8.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.8.0-1.

Table 5.2.3.2.8.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH pre-emption performance under 4 receive antenna conditions	1-1

Table 5.2.3.2.8.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDCCH configuration (Note 4)	Symbols with PDCCH	0, 1
	DCI format	2_1
	timeFrequencySet	14x1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
PDSCH DMRS configuration	DMRS Type	Type 1
	Number of additional DMRS	1
	Maximum number of OFDM symbols for DL front loaded DMRS	1
	Pre-emption configuration (Note 2)	
Pre-emption configuration (Note 2)	Starting symbol (S)	3
	Length (L)	2
	Pre-emption periodicity and offset	Slots
Number of HARQ Processes		8
The number of slots between PDSCH and corresponding HARQ-ACK information		FR1.30-1
Note 1: Void		
Note 2: Interference modelled as random data on pre-empted REs.		
Note 3: Pre-emption is scheduled with 10% probability within 20ms periodicity.		
Note 4: In addition to PDCCH configuration in Table 5.2-1.		

Table 5.2.3.2.8.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 2-2.6 TDD	40 / 30	16QAM 0.64	FR1.30-1	TDLA30-10	2x4, ULA Low	70	8.7

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.8.

5.2.3.2.8_1 4Rx TDD FR1 PDSCH pre-emption performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.8_1.1 Test purpose

To Verify the PDSCH pre-emption performance under 4 receive antenna conditions.

5.2.3.2.8_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pre-EmptIndication-DL-r16*.

5.2.3.2.8_1.3 Test description

5.2.3.2.8_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.2.8.0-2 and Table 5.2.3.2.8.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, Test Mode *On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.8_1.3.3.

5.2.3.2.8_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.2.8.0-3. The SS sends downlink MAC padding bits on the DL RMC.
2. SS transmits PDCCH DCI format 2_1 for int_RNTI with 10% probability to transmit the DL Preemption indication according to Table 5.2.3.2.8.0-2. In the time and frequency set indicated by PDCCH DCI format 2_1, SS stops transmission of PDSCH.
3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.8_1.3.4-1.
4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.8_1.3.3 Message contents

5.2.3.2.8_1.3.3_1 Message exceptions for SA

Same as 5.2.2.1.8_1.3.3_1

5.2.3.2.8_1.3.3_2 Message exceptions for NSA

Same as 5.2.2.1.8_1.3.3_1

5.2.3.2.8_1.3.4 Test requirement

Table 5.2.3.2.8.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.8_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.8_1.3.4-1: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 2-2.6 TDD	40 / 30	16QAM 0.64	FR1.30-1	TDLA30-10	2x4, ULA Low	70	9.7

5.2.3.2.9 4Rx TDD FR1 HST-SFN performance

5.2.3.2.9.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.9.0-3, with the addition of test parameters in Table 5.2.3.2.9.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.9.0-1.

Table 5.2.3.2.9.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when <i>highSpeedDemodFlag-r16</i> [17] is configured.	1-1

Table 5.2.3.2.9.0-2: Test parameters

Parameter	Unit	Value
Duplex mode		TDD
Active DL BWP index		1
PDSCH configuration	Mapping type	Type A
	k0	0
	Starting symbol (S)	2
	Length (L)	12
	PDSCH aggregation factor	1
	PRB bundling type	Static
	PRB bundling size	2
	Resource allocation type	Type 0
	RBG size	Config2
	VRB-to-PRB mapping type	Non-interleaved
VRB-to-PRB mapping interleaver bundle size		N/A

PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		2
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CSI-RS for tracking	CSI-RS periodicity	Slots	20 for CSI-RS resource 1,2,3,4.
	CSI-RS offset	Slots	1 for CSI-RS resource 1 and 22 for CSI-RS resource 3 and 4.
	Frequency Occupation		Start PRB 0 Number of PRB = 52
Number of HARQ Processes			8
The number of slots between PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.3.2.9.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-10.4 TDD	40 / 30	16QAM, 0.48	FR1.30-1	HST-SFN	2x4	70	11.7

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.9.

5.2.3.2.9_1 4Rx TDD FR1 HST-SFN performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.9_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* IE [20] is configured and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.3.2.9_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

5.2.3.2.9_1.3 Test description

5.2.3.2.9_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.9.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.9_1.3.3.

5.2.3.2.9_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2.3.2.9_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.9_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.2.9_1.4-1 as appropriate.

5.2.3.2.9_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.9_1.3.3_1 Message exceptions for SA

Table 5.2.3.2.9_1.3.3_1-1: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present	n2 for test 1-1	
}			
}			
}			

Table 5.2.3.2.9_1.3.3_1-2: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	for test 1-1	
}			

Table 5.2.3.2.9_1.3.3_1-3: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n8	for test 1-1	
}			

Table 5.2.3.2.9_1.3.3_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots20	1 for CSI-RS resource #1 and #2 2 for CSI-RS resource #3 and #4	For test 1-1: offset = 1 for CSI-RS resource 1 and 2 offset =2 for CSI-RS resource 3 and 4.	
}			

5.2.3.2.9_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.2.9_1.3.3_1

5.2.3.2.9_1.4 Test requirement

Tables 5.2.3.2.9_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.9_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.9_1.4-1: Test Requirements for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-10.4 TDD	40 / 30	16QAM, 0.48	FR1.30-1	HST-SFN	2x4	70	12.3

5.2.3.2.10 4Rx TDD FR1 HST DPS performance

5.2.3.2.10.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.10.0-3, with the addition of test parameters in Table 5.2.3.2.10.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.10.0-1.

Table 5.2.3.2.10.0-1: Tests purpose

Purpose	Test index
Verify UE performance in the HST-DPS scenario defined in B.3.3	1-1, 1-2

Table 5.2.3.2.10.0-2: Test parameters

Parameter		Unit	Value		
Duplex mode			TDD		
Active DL BWP index			1		
PDCCH configuration	TCI state		Note 1		
PDSCH configuration	Mapping type		Type A		
	k ₀		0		
	Starting symbol (S)		2		
	Length (L)		Specific to each Reference channel		
	PDSCH aggregation factor		1		
	PRB bundling type		Static		
	PRB bundling size		2		
	Resource allocation type		Type 0		
	RBG size		Config2		
	VRB-to-PRB mapping type		Non-interleaved		
	VRB-to-PRB mapping interleaver bundle size		N/A		
PDSCH DMRS configuration	TCI state		Note 1		
	DMRS Type		Type 1		
	Number of additional DMRS		2		
CSI-RS for tracking	Resource set #1	First OFDM symbol in the PRB used for CSI-RS		l ₀ = 5 for CSI-RS resource 1 and 3 l ₀ = 9 for CSI-RS resource 2 and 4	
		CSI-RS periodicity	Slots	20 for CSI-RS resource 1,2,3,4	
		CSI-RS offset	Slots	1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4	
		QCL info		TCI state #2	
		Frequency Occupation		Start PRB 0 Number of PRB = 52	
	Resource set #2	First OFDM symbol in the PRB used for CSI-RS		l ₀ = 6 for CSI-RS resource 5 and 6 l ₀ = 10 for CSI-RS resource 7 and 8	
		CSI-RS periodicity	Slots	20 for CSI-RS resource 5,6,7,8.	
		CSI-RS offset	Slots	1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8	
		QCL info		TCI state #3	
		Frequency Occupation		Start PRB 0 Number of PRB = 52	
	NZP CSI-RS for CSI acquisition	Resource set #3	First OFDM symbol in the PRB used for CSI-RS		l ₀ = 12
			CSI-RS periodicity	Slots	40
			CSI-RS offset	Slots	0
		QCL info		TCI state #0	
Resource set #4		First OFDM symbol in the PRB used for CSI-RS		l ₀ = 13	
		CSI-RS periodicity	Slots	40	
		CSI-RS offset	Slots	0	
QCL info		TCI state #1			
TCI state #0	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration	
		QCL Type		Type A	
	Type 2 QCL information	CSI-RS resource		N/A	
		QCL Type		N/A	
TCI state #1	Type 1 QCL information	CSI-RS resource		CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration	
		QCL Type		Type A	
	Type 2 QCL information	CSI-RS resource		N/A	
		QCL Type		N/A	
TCI state #2	Type 1 QCL information	SSB index		SSB #0	
		QCL Type		Type C	
	Type 2 QCL information	SSB index		N/A	
		QCL Type		N/A	
TCI state #3	Type 1 QCL information	SSB index		SSB #1	
		QCL Type		Type C	

	Type 2 QCL information	SSB index QCL Type		N/A N/A
Number of HARQ Processes				8
The number of slots between PDSCH and corresponding HARQ-ACK information				Specific to each TDD UL-DL pattern and as defined in Annex A.1.2
<p>Note 1: SSB # $(k \bmod 2)$, CSI-RS (for tracking) resource set # $((k \bmod 2) + 1)$ and CSI-RS (for CSI acquisition) resource set # $((k \bmod 2) + 3)$ are transmitted by k^{th} RRH. For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy $\text{mod}(i, 2n) = n$. PDCCH and PDSCH associated with TCI # $(k \bmod 2)$ is transmitted by k^{th} RRH from slot# $\max [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}} + T_{\text{firstTRS}} + T_{\text{TRS proc}}, 0]$ to slot# $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$, PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered. For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy $\text{mod}(i, 2n) = n$. PDCCH and PDSCH associated with TCI # $(k \bmod 2)$ is transmitted by k^{th} RRH from slot# $\max [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}}, 0]$ to slot# $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$ Where $k=0, 1, 2, \dots$ is the RRH number, $n = 5040$ is half of the number of slots between two RRH, $T_{\text{HARQ}} = 8$ is the number of slots between PDSCH and corresponding HARQ-ACK information, $T_{\text{MAC proc}} = 6$ is the number of slots for MAC CE processing, $T_{\text{firstTRS}} = 7$ is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, $T_{\text{TRS proc}} = 4$ is the number of slots for TRS processing.</p>				

Table 5.2.3.2.10.0-3: Minimum performance for HST-DPS

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-10.5 TDD	40 / 30	64QAM, 0.43	HST-DPS	1	2x4	70	10.2
1-2	R.PDSCH.2-10.5 TDD	40 / 30	64QAM, 0.43	HST-DPS	2	2x4	70	10.2

5.2.3.2.10_1 4Rx TDD FR1 HST DPS performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.10_1.1 Test purpose

To verify UE performance in the HST-DPS scenario defined in B.3.3 and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.3.2.10_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.3.2.10_1.3 Test description

5.2.3.2.10_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.1.10.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.10_1.3.3.

5.2.3.2.10_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2.3.2.10_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.10_1.4-1 as appropriate.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.2.10_1.4-1 as appropriate.

5.2.3.2.10_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.10_1.3.3_1 Message exceptions for SA

Table 5.2.3.2.10_1.3.3_1-1: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	pos2	for test 1-1, 1-2	
}			

Table 5.2.3.2.10_1.3.3_1-2: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	Value/remark	Comment	Condition
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n8	for test 1-1, 1-2	
}			

Table 5.2.3.2.10_1.3.3_1-3: NZP-CSI-RS-Resource for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
nzp-CSI-RS-ResourceId	i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8	for test 1-1, 1-2	
qcl-InfoPeriodicCSI-RS	2 for CSI-RS resource #1, #2, #3, #4 3 for CSI-RS resource #5, #6, #7, #8	for test 1-1, 1-2: TCI-StateId for TCI- State #2 for CSI-RS resource #1, #2, #3, #4 TCI-StateId for TCI- State #3 for CSI-RS resource #5, #6, #7, #8	
}			

Table 5.2.3.2.10_1.3.3_1-4: CSI-RS-ResourceMapping for TRS (Table 5.2.3.2.10_1.3.3_1-3)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	5 for CSI-RS resource #1 and #3 9 for CSI-RS resource #2 and #4 6 for CSI-RS resource #5 and #6 10 for CSI-RS resource #7 and #8	for test 1-1, 1-2: l ₀ = 5 for CSI-RS resource 1 and 3 l ₀ = 9 for CSI-RS resource 2 and 4 l ₀ = 6 for CSI-RS resource 5 and 6 l ₀ = 10 for CSI-RS resource 7 and 8	
}			

Table 5.2.3.2.10_1.3.3_1-5: CSI-ResourcePeriodicityAndOffset for TRS (Table 5.2.3.2.10_1.3.3_1-3)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots20	1 for CSI-RS resource #1, #2, #5, #6 2 for CSI-RS resource #3 #4, #7, #8	For test 1-1, 1-2: periodicity: 10 slots. offset: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8	
}			

Table 5.2.3.2.10_1.3.3_1-6: NZP-CSI-RS-ResourceSet for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-ResourceSet ::= SEQUENCE {			
nzp_CSI_ResourceSetId	0 for Resource set #1 1 for Resource set #2	For test 1-1, 1-2	
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	4 entries	For test 1-1, 1-2	Resource set #1
NZP-CSI-RS-ResourceId[1]	0	entry 1 CSI-RS resource #1	
NZP-CSI-RS-ResourceId[2]	1	entry 2 CSI-RS resource #2	
NZP-CSI-RS-ResourceId[3]	2	entry 3 CSI-RS resource #3	
NZP-CSI-RS-ResourceId[4]	3	entry 4 CSI-RS resource #4	
}			
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	4 entries	For test 1-1, 1-2	Resource set #2
NZP-CSI-RS-ResourceId[1]	4	entry 1 CSI-RS resource #5	
NZP-CSI-RS-ResourceId[2]	5	entry 2 CSI-RS resource #6	
NZP-CSI-RS-ResourceId[3]	6	entry 3 CSI-RS resource #7	
NZP-CSI-RS-ResourceId[4]	7	entry 4 CSI-RS resource #8	
}			
}			

Table 5.2.3.2.10_1.3.3_1-7: NZP-CSI-RS-Resource for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
nzp-CSI-RS-ResourceId	8 for CSI-RS resource #9 9 for CSI-RS resource #10	for test 1-1, 1-2	
qcl-InfoPeriodicCSI-RS	0 for CSI-RS resource #9 1 for CSI-RS resource #10	for test 1-1, 1-2: TCI-State #0 for CSI-RS resource #9 TCI-State #1 for CSI-RS resource #10	
}			

Table 5.2.3.2.10_1.3.3_1-8: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.3.2.10_1.3.3_1-7)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
firstOFDMSymbolInTimeDomain	12 for CSI-RS resource #9 13 for CSI-RS resource #10	for test 1-1, 1-2 l ₀ =12 for CSI-RS resource #9 l ₀ =13 for CSI-RS resource #10	
}			

Table 5.2.3.2.10_1.3.3_1-9: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.3.2.10_1.3.3_1-7)

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots40	0	For test 1-1, 1-2: periodicity = 40 slots. offset = 0 slots	
}			

Table 5.2.3.2.10_1.3.3_1-10: NZP-CSI-RS-ResourceSet for CSI Acquisition

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-ResourceSet ::= SEQUENCE {			
nzp_CSI_ResourceSetId	2 for Resource set #3 3 for Resource set #4	For test 1-1, 1-2	
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	1 entry	For test 1-1, 1-2	Resource set #3
NZP-CSI-RS-ResourceId[1]	8	entry 1 CSI-RS resource #9	
}			
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId {	1 entry	For test 1-1, 1-2	Resource set #4
NZP-CSI-RS-ResourceId[1]	9	entry 1 CSI-RS resource #10	
}			
}			

Table 5.2.3.2.10_1.3.3_1-11: TCI-State

Derivation Path: TS 38.508-1 [6], Table 4.6.3-190			
Information Element	Value/remark	Comment	Condition
TCI-State ::= SEQUENCE {			
tci-StateId	0 for TCI state #0 1 for TCI state #1 2 for TCI state #2 3 for TCI state #3	For test 1-1, 1-2	
qcl-Type1 SEQUENCE {			
bwp-Id	BWP-Id of active BWP		TCI state #0, TCI state #1
	Not present		TCI state #2, TCI state #3
referenceSignal CHOICE {			
csi-rs	0	CSI-RS resource #1	TCI state #0
	4	CSI-RS resource #5	TCI state #1
ssb	0	SSB #0	TCI state #2
	1	SSB #1	TCI state #3
}			
qcl-Type	typeA		TCI state #0, TCI state #1
	typeC		TCI state #2, TCI state #3
}			
}			

5.2.3.2.10_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.2.10_1.3.3_1

5.2.3.2.10_1.4 Test requirement

Tables 5.2.3.2.10_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.10_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.10_1.4-1: Test Requirements for HST-DPS

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.2-10.5 TDD	40 / 30	64QAM, 0.43	HST-DPS	1	2x4	70	10.8
1-2	R.PDSCH.2-10.5 TDD	40 / 30	64QAM, 0.43	HST-DPS	2	2x4	70	10.8

5.2.3.2.11 4Rx TDD FR1 PDSCH Single-DCI based SDM scheme performance

5.2.3.2.11.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.11.0-3, with the addition of test parameters in Table 5.2.3.2.11.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.11.0-1.

Table 5.2.3.2.11.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance with Single-DCI based SDM scheme under 4 receive antenna conditions	1-1,1-2

Table 5.2.3.2.11.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		0	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	40	
	CSI-RS offset	Slots	20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4	20 for CSI-RS resources 5 and 6 21 for CSI-RS resources 7 and 8
QCL info			TCI state #0	
Duplex mode			TDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PRB bundling type		Static	
	PRB bundling size		2	
	Resource allocation type		Type 1	
	RBG size		Config2	
	VRB-to-PRB mapping type		Non-interleaved	
VRB-to-PRB mapping interleaver bundle size		N/A		
PDSCH DMRS configuration	Antenna port indexes		1000	1002
	TCI state	TCI state	TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
Maximum number of OFDM symbols for DL front loaded DMRS		1		
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type	Type A	N/A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type	N/A	Type A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A

Resource allocation		Full-overlapping
Timing offset of the second TRxP from the first TRxP	us	-0.25 for test 1-1 1 for test 1-2
Frequency offset of the second TRxP from the first TRxP	Hz	300 for test 1-1 0 for test 1-2
Number of HARQ Processes		8
The number of slots between PDSCH and corresponding HARQ-ACK information		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2
Precoding configuration		SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity
Note 1: PDSCH transmission is done from both TRxPs (PDSCH Layer 0 is transmitted from TRxP #1 and PDSCH layer 1 is transmitted from TRxP #2)		

Table 5.2.3.2.11.0-3: Minimum performance

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition(No te 1)	Correlation matrix and antenna configuration(No te 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)(No te 3)
1-1	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x4, ULA Low	70	14.5
1-2	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x4, ULA Low	70	13.9
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent								
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2								
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.11.

5.2.3.2.11_1 2Rx TDD FR1 PDSCH Single-DCI based SDM scheme performance - 2x2 MIMO for both SA and NSA

5.2.3.2.11_1.1 Test purpose

To verify the PDSCH performance with Single-DCI based SDM scheme under 4 receive antenna conditions.

5.2.3.2.11_1.2 Test applicability

Test applies to all types of NR UE release 16 and forward supporting capability IE *singleDCI-SDM-scheme-r16*.

5.2.3.2.11_1.3 Test description

5.2.3.2.11_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.2.11.0-2 and Table 5.2.3.2.11.0-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, *Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On*, *Test Mode On*, for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.11_1.3.3.

5.2.3.2.11_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.2.11_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.11_1.3.4-1.
3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.
4. Repeat steps from 1 to 3 for each subtest in Table 5.2.3.2.11_1.3.4-1 as appropriate.

5.2.3.2.11_1.3.3 Message contents

5.2.3.2.11_1.3.3_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.2.11_1.3.3_1-1: Physical layer parameters for DCI format 1_1

Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1			
Parameter	Value	Value in binary	Condition
Antenna port(s)	DMRS port 0 and 2	"1011"	
Transmission configuration indication	TCI state 1 and 2	"000"	

Table 5.2.3.2.11_1.3.3_1-2: CellGroupConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-19			
Information Element	Value/remark	Comment	Condition
CellGroupConfig ::= SEQUENCE {			
simultaneousTCI-UpdateList1-r16 SEQUENCE {			
ServCellIndex [1]	ServCellIndex		
}			
}			

Table 5.2.3.2.11_1.3.3_1-3: ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 4.6.3-28			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
tci-PresentInDCI	enabled		
}			

Table 5.2.3.2.11_1.3.3_1-4: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-100			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
tci-StatesToAddModList SEQUENCE(SIZE (1..maxNrofTCI-States)) OF TCI-State {	2 entries		
TCI-State[1]	TCI-State with condition TCI-state-0		
TCI-State[2]	TCI-State with condition TCI-state-1		
TCI-State[3]	TCI-State with condition TCI-state-2		
}			
rbg-Size	config2		
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present		
}			
}			
}			

Table 5.2.3.2.11_1.3.3_1-5: TCI-State

Derivation Path: TS 38.508-1 [6], Table 4.6.3-190			
Information Element	Value/remark	Comment	Condition
TCI-State ::= SEQUENCE {			
tci-StateId	0		TCI-state-0
	1		TCI-state-1
	2		TCI-state-2
qcl-Type1 SEQUENCE {			
cell	Not present		
bwp-Id	Not present		
referenceSignal CHOICE {			
ssb	SSB-Index		TCI-state-0
csi-rs	1		TCI-state-1
	5		TCI-state-2
}			
qcl-Type	typeA		
}			
qcl-Type2	Not present		
}			

Table 5.2.3.2.11_1.3.3_1-6: *NZP-CSI-RS-Resource*

Derivation Path: TS 38.508-1 [6], Table 4.6.3-85			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
resourceMapping SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	For CSI-RS resources 1, 2, 3, 4	
	0001	For CSI-RS resources 5,6,7,8	
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	6	For CSI-RS resources 1,3,5,7	
	10	For CSI-RS resources 2,4,6,8	
cdm-Type	noCDM		
density CHOICE {			
three	NULL		
}			
}			
periodicityAndOffset CHOICE {			
slots40	20	For CSI-RS resources 1,2,5,6	
slots40	21	For CSI-RS resources 3,4,7,8	
}			
qcl-InfoPeriodicCSI-RS	0		
}			

5.2.3.2.11_1.3.3_2 Message exceptions for NSA

Same as 5.2.3.2.11_1.3.3_1.

5.2.3.2.11_1.3.4 Test requirement

Table 5.2.3.2.11.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.11_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.11_1.3.4-1: Test requirement

Test num	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition(Notes 1)	Correlation matrix and antenna configuration(Notes 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB)(Notes 3)

1-1	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x4, ULA Low	70	15.5
1-27	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x4, ULA Low	70	14.9
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2 Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP								

5.2.3.2.12 4Rx TDD FR1 PDSCH Multi-DCI based transmission scheme performance

5.2.3.2.12.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.12.0-3, with the addition of test parameters in Table 5.2.3.2.12.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.12.0-1.

Table 5.2.3.2.12.0-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs	1-1

Table 5.2.3.2.12.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	TCI State #2
	CORESETPoolIndex		0,1	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	40	
	CSI-RS offset	Slots	20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4	20 for CSI-RS resources 5 and 6 21 for CSI-RS resources 7 and 8
QCL info			TCI state #0	
Duplex mode			TDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PRB bundling type		Static	
	PRB bundling size		2	
	Resource allocation type		Type 1	
	RBG size		Config2	
VRB-to-PRB mapping type		Non-interleaved		

	VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	Antenna port indexes		{1000,1001}	{1002,1003}
	TCI state		TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
	Maximum number of OFDM symbols for DL front loaded DMRS		1	
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type	Type A	N/A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type	N/A	Type A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
Resource allocation			Non-overlapping	
Timing offset of the second TRxP from the first TRxP		us	-0.25	
Frequency offset of the second TRxP from the first TRxP		Hz	300	
Number of HARQ Processes			8	
The number of slots between PDSCH and corresponding HARQ-ACK information			Specific to each TDD UL-DL pattern and as defined in Annex A.1.2	
Precoding configuration			SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs. Transmission from TRxP #1 uses CORESETPoolIndex 0 and transmission from TRxP #2 uses CORESETPoolIndex 1				

Table 5.2.3.2.12.0-3: Minimum performance

Test num.	Reference channel		Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition(Note 1)	Correlation matrix and antenna configuration(Note 2)	Reference value	
								Fraction of maximum throughput (%)	SNR (dB)(Note 3)
	TRxP #1	TRxP #2							
1-1	R.PDSCH H.2-3.3 TDD	R.PDSCH H.2-3.4 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x4, ULA Low	70	14.6
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent									
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2									
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2									

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.12.

5.2.3.2.12_1 4Rx TDD FR1 PDSCH Multiple-DCI based transmission scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.2.12_1.1 Test purpose

To verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs.

5.2.3.2.12_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *multiDCI-MultiTRP-r16*.

5.2.3.2.12_1.3 Test description

Same test description as in clause 5.2.3.1.12_1.3 with the following exception:

- Table 5.2.3.2.12_1.4-1 instead of 5.2.3.1.12_1.4-1
- Table 5.2.3.2.12_1.3-1 instead of Table 5.2.3.1.12_1.3.3_1-8

Table 5.2.3.2.12_1.3-1: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots40	20	For CSI-RS resources 1,2,5,6	
Slots40	21	For CSI-RS resources 3,4,7,8	
}			

5.2.3.2.12_1.4 Test requirement

Table 5.2.3.2.12.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.12_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.12_1.4-1: Test requirement

Test num.	Reference channel		Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
								Fraction of maximum throughput (%)	SNR (dB) (Note 3)
	TRxP #1	TRxP #2							
1-1	R.PDSC H.2-3.3 TDD	R.PDSC H.2-3.4 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x4, ULA Low	70	15.6
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2 Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2									

5.2.3.2.13 4Rx TDD FR1 PDSCH Single-DCI based FDM scheme A performance

5.2.3.2.13.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.13.0-3, with the addition of test parameters in Table 5.2.3.2.13.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.13.0-1.

Table 5.2.3.2.13.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 4 receive antenna conditions when UE is configured with "FDMSchemeA" in "RepetitionScheme-r16" defined in clause 5.1 of TS 38.214 [12]	1-1

Table 5.2.3.2.13.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		Not configured	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	40	
	CSI-RS offset	Slots	20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4	20 for CSI-RS resources 5 and 6 21 for CSI-RS resources 7 and 8
QCL info			TCI state #0	
Duplex mode			TDD	
Active DL BWP index			1	
PDSCH configuration	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PRB bundling type		Static	
	PRB bundling size		Wideband	
	Resource allocation type		Type 0	
	RBG size		Config2	
	VRB-to-PRB mapping type		Non-interleaved	
	VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	Antenna port indexes		1000,1001	1000,1001
	TCI state		TCI State #1	TCI State #2
	DMRS Type		Type 1	
	Number of additional DMRS		1	
	Maximum number of OFDM symbols for DL front loaded DMRS		1	
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type	Type A	N/A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type	N/A	Type A
		CSI-RS resource	N/A	N/A

	Type 2 QCL information	QCL Type		N/A	N/A
Timing offset of the second TRxP from the first TRxP			us	-0.25	
Frequency offset of the second TRxP from the first TRxP			Hz	300	
Number of HARQ Processes				8	
The number of slots between PDSCH and corresponding HARQ-ACK information				Specific to each TDD UL-DL pattern and as defined in Annex A.1.2	
Precoding configuration				SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity	
Note 1: PDSCH transmission is done from both TRxPs					

Table 5.2.3.2.13.0-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB) (Note 3)
1-1	R.PDSCH.2-2.5 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x4, ULA Low	70	10.5
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.								
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.								
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.13.

5.2.3.2.13_1 4Rx TDD FR1 PDSCH Single-DCI based FDM scheme A performance - 2x4 MIMO for both SA and NSA

5.2.3.2.13_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16”.

5.2.3.2.13_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportFDM-SchemeA-r16*.

5.2.3.2.13_1.3 Test description

Same test description as in clause 5.2.3.1.13_1.3 with the following exception:

- Table 5.2.3.2.13_1.4-1 instead of 5.2.3.1.13_1.4-1
- Table 5.2.3.2.13_1.3-1 instead of Table 5.2.3.1.13_1.3.3_1-5

Table 5.2.3.2.13_1.3-1: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots40	20	For CSI-RS resources 1,2,5,6	
Slots40	21	For CSI-RS resources 3,4,7,8	
}			

5.2.3.2.13_1.4 Test requirement

Table 5.2.3.2.13.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.13_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.13_1.4-1: Test requirement

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							Fraction of maximum throughput (%)	SNR (dB) (Note 3)
1-1	R.PDSCH.2-2.5 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x4, ULA Low	70	11.5
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.								
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.								
Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

5.2.3.2.14 4Rx TDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance

5.2.3.2.14.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.14.0-3, with the addition of test parameters in Table 5.2.3.2.14.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.14.0-1.

Table 5.2.3.2.14.0-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 4 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states defined in clause 5.1 of TS 38.214 [12]	1-1

Table 5.2.3.2.14.0-2: Test parameters

Parameter		Unit	Value	
			TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SSB			TRxP #1	
PDCCH configuration	TCI state		TCI State #1	
	CORESETPoolIndex		Not configured	
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k0=0 for CSI-RS resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8
	First OFDM symbol in the PRB used for CSI-RS		l0 = 6 for CSI-RS resources 1 and 3 l0 = 10 for CSI-RS resources 2 and 4	l0 = 6 for CSI-RS resources 5 and 7 l0 = 10 for CSI-RS resources 6 and 8
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4	1 for CSI-RS resource 5,6,7,8
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4,5,6,7,8	
	Density		3	
	CSI-RS periodicity	Slots	40	
CSI-RS offset	Slots	20 for CSI-RS resources 1 and 2 21 for CSI-RS resources 3 and 4	20 for CSI-RS resources 5 and 6 21 for CSI-RS resources 7 and 8	

	QCL info		TCI state #0	
Duplex mode		TDD		
Active DL BWP index		1		
PDSCH configuration	Mapping type	Type A		
	k0	0		
	Starting symbol (S)	2		
	Length (L)	12		
	Repetition number	2		
	PRB bundling type	Static		
	PRB bundling size	2		
	Resource allocation type	Type 0		
	RBG size	Config2		
	VRB-to-PRB mapping type	Non-interleaved		
VRB-to-PRB mapping interleaver bundle size	N/A			
PDSCH DMRS configuration	Antenna port indexes	1000	1000	
	TCI state	TCI State #1	TCI State #2	
	DMRS Type	Type 1		
	Number of additional DMRS	1		
	Maximum number of OFDM symbols for DL front loaded DMRS	1		
TCI State #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	N/A
		QCL Type	Type A	N/A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
TCI State #2	Type 1 QCL information	CSI-RS resource	N/A	CSI-RS resource 5 from 'CSI-RS for tracking' configuration
		QCL Type	N/A	Type A
	Type 2 QCL information	CSI-RS resource	N/A	N/A
		QCL Type	N/A	N/A
Timing offset of the second TRxP from the first TRxP		us	1	
Frequency offset of the second TRxP from the first TRxP		Hz	300	
Number of HARQ Processes		4		
The number of slots between PDSCH and corresponding HARQ-ACK information		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 (Note 2)		
Precoding configuration		SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity		
Note 1: PDSCH transmission is done from both TRxPs				
Note 2: ACK/NACK feedback is generated for PDSCH on slot i, where $\text{mod}(i,10) = \{2, 4, 6\}$.				

Table 5.2.3.2.14.0-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							BLER (%)	SNR (dB) (Note 4)
1-1	R.PDSCH.2-16.2 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x4, ULA Low	1 (Note 3)	-0.5
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.								
Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.								
Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.								
Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.14.

5.2.3.2.14_1 4Rx TDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.2.14_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states.

5.2.3.2.14_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportTDM-SchemeA-r16*.

5.2.3.2.14_1.3 Test description

Same test description as in clause 5.2.3.1.14_1.3 with the following exception:

- Table 5.2.3.2.14_1.4-1 instead of 5.2.3.1.14_1.4-1
- Table 5.2.3.2.14_1.3-1 instead of Table 5.2.3.1.14_1.3.3_1-5

Table 5.2.3.2.14_1.3-1: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots40	20	For CSI-RS resources 1,2,5,6	
Slots40	21	For CSI-RS resources 3,4,7,8	
}			

5.2.3.2.14_1.4 Test requirement

Table 5.2.3.2.14.0-3 defines the primary level settings.

The residual BLER specified in Note 3 of Table 5.2.3.2.14_1.4-1 test shall meet or be lower than the specified value in Table 5.2.3.2.14_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.14_1.4-1: Test requirement for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration (Note 2)	Reference value	
							BLER (%)	SNR (dB) (Note 4)
1-1	R.PDSCH.2-16.2 TDD	40 / 30	16QAM, 0.54	FR1.30-1	TDLA30-10	2x4, ULA Low	1 (Note 3)	0.5
Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent. Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2. Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2								

5.2A PDSCH demodulation requirements for CA

The parameters specified in Table 5.2-1 for PDSCH single carrier tests are reused for PDSCH CA tests unless otherwise stated.

Table 5.2A-1: Common test parameters for CA

Parameter		Unit	Value
Duplex mode			FDD and TDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		FDD: 12 TDD: Specific to each Reference channel
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
PDSCH DMRS configuration	VRB-to-PRB mapping interleaver bundle size		N/A
	DMRS Type		Type 1
	Number of additional DMRS		1
Maximum number of OFDM symbols for DL front loaded DMRS			1
Number of HARQ Processes			As defined in Table 5.2A-2
TDD UL-DL pattern			15kHz SCS: FR1.15-1 30kHz SCS: FR1.30-1
The number of slots between PDSCH and corresponding HARQ-ACK information			As defined in Table 5.2A-3
PUCCH format for HARQ-ACK feedback			PUCCH format 1 for cases with no more than 2 DL CCs PUCCH format 3 for cases with more than 2 DL CCs

Table 5.2A-2: Test parameters for number of HARQ processes

HARQ process number		CCs with the same duplex mode & SCS with Pcell	CCs with different duplex mode / SCS with Pcell
FDD 15 kHz + TDD 30 kHz CA	FDD PCell	4	8
	TDD PCell	8	8
FDD 15 kHz + TDD 15 kHz CA	FDD PCell	4	4
	TDD PCell	8	8
TDD 15 kHz + TDD 30 kHz CA	15kHz PCell	8	12
	30kHz PCell	8	8
FDD 15 kHz + FDD 15 kHz CA	FDD PCell	4	N/A
TDD 30 kHz + TDD 30 kHz CA	TDD PCell	8	N/A

Table 5.2A-3: Test parameters for K1 values

The number of slots between PDSCH and corresponding HARQ-ACK information		CCs with the same duplex mode and SCS with Pcell	CCs with different duplex mode and/or SCS with Pcell
FDD 15 kHz + TDD 30 kHz CA	FDD PCell	{2}	{2}
	TDD PCell	{8,7,6,5,5,4,3,2}	{7,5,4,11,9}
FDD 15 kHz + TDD 15 kHz CA	FDD PCell	{2}	{2}
	TDD PCell	{4,3,2,6}	{4,3,2,6,5}
TDD 15 kHz + TDD 30 kHz CA	15kHz PCell	{4,3,2,6}	{4,4,3,3,2,2,6,6}
	30kHz PCell	{8,7,6,5,5,4,3,2}	{7,5,4,11}
FDD 15 kHz + FDD 15 kHz CA	FDD PCell	{2}	N/A
TDD 30 kHz + TDD 30 kHz CA	TDD PCell	{8,7,6,5,5,4,3,2}	N/A

5.2A.1 1RX requirements (Void)

5.2A.2 2RX requirements

5.2A.2.1 Requirements for 2RX normal PDSCH

5.2A.2.1.0 Minimum conformance requirements for 2RX normal PDSCH

For CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.1.0-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.1.0-1 to Table 5.2A.2.1.0-3, with the parameters in Table 5.2A-1 to Table 5.2A-3 and the downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

Table 5.2A.2.1.0-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-9.1 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.6
10	R.PDSCH.1-2.2 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.6
15	R.PDSCH.1-9.2 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.6
20	R.PDSCH.1-9.3 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.8
25	R.PDSCH.1-9.4 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.0
30	R.PDSCH.1-9.5 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.8
40	R.PDSCH.1-10.1 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.0
50	R.PDSCH.1-10.2 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.4

Table 5.2A.2.1.0-2: Single carrier performance for TDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-2.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.6
10	R.PDSCH.1-2.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.8
15	R.PDSCH.1-2.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.8
20	R.PDSCH.1-2.4 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.9
25	R.PDSCH.1-2.5 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.0
30	R.PDSCH.1-3.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.9
40	R.PDSCH.1-3.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.2
50	R.PDSCH.1-3.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.5

Table 5.2A.2.1.0-3: Single carrier performance for TDD 30 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-13.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.6
10	R.PDSCH.2-13.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.6
15	R.PDSCH.2-13.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.6
20	R.PDSCH.2-13.4 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.7
25	R.PDSCH.2-13.5 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.7
30	R.PDSCH.2-14.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.7
40	R.PDSCH.2-2.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	13.9
50	R.PDSCH.2-14.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.1
60	R.PDSCH.2-14.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.0
80	R.PDSCH.2-14.4 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.5
90	R.PDSCH.2-14.5 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.3
100	R.PDSCH.2-15.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.7

Table 5.2A.2.1.0-4: Minimum performance for multiple CA configurations

Test number	CA duplex mode	Minimum performance requirements
1	FDD 15 kHz + FDD 15 kHz	As defined in Table 5.2A.2.1.0-1
2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.2.1.0-3
3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-3 per CC
4	FDD 15 kHz + TDD 15 kHz	As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-2 per CC
5	TDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.1.0-2 and Table 5.2A.2.1.0-3 per CC
Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.5.		

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.2.1.

5.2A.2.1.1 2Rx Normal PDSCH Demodulation Performance for CA (2DL CA)

5.2A.2.1.1.1 Test Purpose

To verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions for multiple CA configurations and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput per CC.

5.2A.2.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL CA.

5.2A.2.1.1.3 Test description

5.2A.2.1.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.2.1.1.3.1-1: Test point selection table

Test number	CA duplex mode	Configuration
1	FDD 15 kHz + FDD 15 kHz	As defined in Table 5.2A.2.1.0-1
2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.2.1.0-3
3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-3 per CC
4 (note 2)	FDD 15 kHz + TDD 15 kHz	As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-2 per CC
5 (note 3)	TDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.1.0-2 and Table 5.2A.2.1.0-3 per CC
Note 1: For each test point, select any one of the CA configurations which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate based on the equation $DataRate = 10^{-3} \sum_{j=1}^J TBS_j 2^{\mu_j}$		
Note 2: Test point 4 can be skipped if test point 3 is verified.		
Note 3: Test point 5 can be skipped if test point 3 or 4 is verified.		

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.6 for TE diagram and clause A.3.2.6 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.1.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.2.1.1.3.3.

5.2A.2.1.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.2.1.1.3.3.
3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.
5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCC.
6. Measure the average throughput per each component carrier for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.
7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.1.0-4 as appropriate.

5.2A.2.1.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.2.1.1.4 Test Requirement

Tables 5.2A.2.1.1.4-1, 5.2A.2.1.1.4-2 and 5.2A.2.1.1.4-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.2.1.1.4-1, 5.2A.2.1.1.4-2 and 5.2A.2.1.1.4-3 for the specified SNR including test tolerances for the test points listed in Table 5.2A.2.1.1.3.1-1.

Table 5.2A.2.1.1.4-1: Test requirements for FDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-9.1 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
10	R.PDSCH.1-2.2 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
15	R.PDSCH.1-9.2 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
20	R.PDSCH.1-9.3 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.8
25	R.PDSCH.1-9.4 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.0
30	R.PDSCH.1-9.5 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.8
40	R.PDSCH.1-10.1 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.0
50	R.PDSCH.1-10.2 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.4

Table 5.2A.2.1.1.4-2: Test requirements for TDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)

5	R.PDSCH.1-2.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
10	R.PDSCH.1-2.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.8
15	R.PDSCH.1-2.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.8
20	R.PDSCH.1-2.4 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.9
25	R.PDSCH.1-2.5 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.0
30	R.PDSCH.1-3.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.9
40	R.PDSCH.1-3.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.2
50	R.PDSCH.1-3.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.5

Table 5.2A.2.1.1.4-3: Test requirements for TDD 30 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-13.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
10	R.PDSCH.2-13.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
15	R.PDSCH.2-13.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
20	R.PDSCH.2-13.4 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.7
25	R.PDSCH.2-13.5 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.7
30	R.PDSCH.2-14.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.7
40	R.PDSCH.2-2.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.9
50	R.PDSCH.2-14.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.1
60	R.PDSCH.2-14.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.0
80	R.PDSCH.2-14.4 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.5
90	R.PDSCH.2-14.5 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.3
100	R.PDSCH.2-15.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.7

5.2A.2.1.2 2Rx Normal PDSCH Demodulation Performance for CA (3DL CA)

5.2A.2.1.2.1 Test Purpose

Same as 5.2A.2.1.1

5.2A.2.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 3DL CA.

5.2A.2.1.2.3 Test description**5.2A.2.1.2.3.1 Initial conditions**

Same as 5.2A.2.1.1.3.1

5.2A.2.1.2.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.2.1.2.3.3.
3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause 9.3).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.
5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCCs.
6. Measure the average throughput per each component carrier for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.
7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.1.0-4 as appropriate.

5.2A.2.1.2.3.3 Message contents

Same as 5.2A.2.1.1.3.3.

5.2A.2.1.2.4 Test Requirement

Same as 5.2A.2.1.1.4 evaluated per component carrier.

5.2A.2.1.3 2Rx Normal PDSCH Demodulation Performance for CA (4DL CA)**5.2A.2.1.3.1 Test Purpose**

Same as 5.2A.2.1.1

5.2A.2.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 4DL CA.

5.2A.2.1.3.3 Test description**5.2A.2.1.3.3.1 Initial conditions**

Same as 5.2A.2.1.1.3.1

5.2A.2.1.3.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.2.1.3.3.3.
3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.
5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCCs.
6. Measure the average throughput per each component carrier for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.
7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.1.0-4 as appropriate.

5.2A.2.1.3.3.3 Message contents

Same as 5.2A.2.1.1.3.3.

5.2A.2.1.3.4 Test Requirement

Same as 5.2A.2.1.1.4 evaluated per component carrier.

5.2A.2.2 Requirements for 2RX PDSCH carrier aggregation with power imbalance

5.2A.2.2.0 Minimum conformance requirements for 2RX PDSCH CA with power imbalance

The performance requirements are specified in Table 5.2A.2.2.0-3 and Table 5.2A.2.2.0-4, with the addition of test parameters in Table 5.2A.2.2.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2A.2.2.0-1.

Table 5.2A.2.2.0-1: Tests purpose

Purpose	Test index
Verify the ability of an intra-band adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only	

Table 5.2A.2.2.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD and TDD
Active DL BWP index			1
Propagation condition			Static propagation condition No external noise sources are applied
Antenna configuration			1x2
PDSCH configuration	Length (L)		FDD: 12TDD: 12 for DL slot, 4 for special slot
	PRB bundling size		WB

Modulation and code rate		64QAM, MCS 26
Number of HARQ Processes		FDD: 4 TDD: 8
Maximum number of HARQ transmission		1
Redundancy version coding sequence		{0}
TDD UL-DL pattern		30kHz SCS: FR1.30-1
The number of slots between PDSCH and corresponding HARQ-ACK information		As defined in Table A.1.2-2 for FR1.30-1
PUCCH format for HARQ-ACK feedback		PUCCH format 1
Overhead for TBS determination		0
SSB transmission		Slot#0 with periodicity 20ms
RB assignment		Full applicable test bandwidth as defined in Table 5.3.5-1 of TS 38.101-1 [2]

Table 5.2A.2.2.0-3: Minimum performance for FDD CA with 15 kHz SCS

Test Number	Bandwidth (MHz)		Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for SCell	PCell	SCell
1	Selected Channel bandwidth as per section 5.1.1.6		Derived as per section 5.1.3.2 of TS 38.214 [12]	NA	-112	-106	85	NA

Table 5.2A.2.2.0-4: Minimum performance for TDD CA with 30 kHz SCS

Test Number	Bandwidth (MHz)		Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for SCell	PCell	SCell
1	Selected Channel bandwidth as per section 5.1.1.6		Derived as per section 5.1.3.2 of TS 38.214 [12]	NA	-112	-106	85	NA

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.2.2.

5.2A.2.2.1 2Rx PDSCH Demodulation Performance for CA with power imbalance (2DL CA)

5.2A.2.2.1.1 Test Purpose

To verify the ability of an intra-band adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only.

5.2A.2.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL intra-band contiguous CA.

5.2A.2.2.1.3 Test description

5.2A.2.2.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

Band selection: Supported intra-band contiguous CA configurations covering the lowest and highest operating bands,

Channel BW combination to be tested: Select bandwidth combination with same bandwidth in each carrier. If not supported, select bandwidth combination with smallest bandwidth difference between the two carriers and the carrier with smaller bandwidth will be used for the test.

CA capability to be tested: Either FDD or TDD intra-band contiguous CA

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2A for TE diagram and clause A.3.2.3 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.1.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.2.2.1.3.3.

5.2A.2.2.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.2.2.1.3.3.
3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause 9.3).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the MCS according to Table 5.2A.2.2.0-2 on PCC. The SS sends downlink MAC padding bits on the DL RMC.
5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix according to Tables 5.2A.2.2.0-2 to 5.2A.2.2.0-4 as appropriate on both PCC and SCC.
6. Measure the average throughput on PCC for at least 300 frames.. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail based on measured throughput > 85% of the maximum scheduled throughput..

5.2A.2.2.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.2.2.1.4 Test Requirement

Table 5.2A.2.2.0-2, Table 5.2A.2.2.1.4-1 and Table 5.2A.2.2.1.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the MCS scheduled as specified in Table 5.2A.2.2.0-2 for the throughput test shall meet or exceed the specified value in Table 5.2A.2.2.1.4-1 or Table 5.2A.2.2.1.4-2 as applicable for the specified cell power levels.

Table 5.2A.2.2.1.4-1: Test Requirements for FDD CA with 15 kHz SCS

Test Number	Bandwidth (MHz)		Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for SCell	PCell	SCell
1	Selected Channel bandwidth as per section 5.1.1.6		Derived as per section 5.1.3.2 of TS 38.214 [12]	NA	-112	-106	85	NA

Table 5.2A.2.2.1.4-2: Test Requirements for TDD CA with 30 kHz SCS

Test Number	Bandwidth (MHz)		Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for SCell	PCell	SCell
1	Selected Channel bandwidth as per section 5.1.1.6		Derived as per section 5.1.3.2 of TS 38.214 [12]	NA	-112	-106	85	NA

5.2A.2.2.2 2Rx PDSCH Demodulation Performance for CA with power imbalance (3DL CA)
FFS

5.2A.2.2.3 2Rx PDSCH Demodulation Performance for CA with power imbalance (4DL CA)
FFS

5.2A.2.4 Requirements for 2RX HST-SFN CA

5.2A.2.4.0 Minimum conformance requirements for 2RX HST-SFN CA PDSCH

For HST-SFN CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.4.0-5 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.4.0-3 and Table 5.2A.2.4.0-4. Test parameters are specified in Table 5.2A.2.4.0-2, Table 5.2A-2, and Table 5.2A-3 with downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 5.2A.2.4.0-1.

Table 5.2A.2.4.0-1: Test purpose

Purpose	Test index
Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 with CA	1,2,3

Table 5.2A.2.4.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD and TDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
PDSCH DMRS configuration	VRB-to-PRB mapping interleaver bundle size		N/A
	DMRS Type		Type 1
	Number of additional DMRS		2
CSI-RS for tracking	Maximum number of OFDM symbols for DL front loaded DMRS		1
	CSI-RS periodicity	Slots	FDD: 10 for CSI-RS resource 1,2,3,4. TDD: 20 for CSI-RS resource 1,2,3,4.
	CSI-RS offset	Slots	1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4.
Number of HARQ Processes			As defined in Table 5.2A-2
TDD UL-DL pattern			15 kHz SCS: FR1.15-1 30 kHz SCS: FR1.30-1
The number of slots between PDSCH and corresponding HARQ-ACK information			As defined in Table 5.2A-3
Number of PUCCH ResourceGroups			1
PUCCH format for HARQ-ACK feedback			PUCCH format 1 for cases with no more than 2 DL CCs PUCCH format 3 for cases with more than 2 DL CCs

Table 5.2A.2.4.0-3: Single carrier performance for FDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-13.1 FDD	16QAM, 0.48	HST-SFN	2x2	70	[12.9]
10	R.PDSCH.1-8.3 FDD	16QAM, 0.48	HST-SFN	2x2	70	[13.1]
15	R.PDSCH.1-13.2 FDD	16QAM, 0.48	HST-SFN	2x2	70	[13.4]
20	R.PDSCH.1-13.3 FDD	16QAM, 0.48	HST-SFN	2x2	70	[13.9]
25	R.PDSCH.1-13.4 FDD	16QAM, 0.48	HST-SFN	2x2	70	[14.0]
30	R.PDSCH.1-13.5 FDD	16QAM, 0.48	HST-SFN	2x2	70	[13.9]
35	R.PDSCH.1-14.3 FDD	16QAM, 0.48	HST-SFN	2x2	70	TBA
40	R.PDSCH.1-14.1 FDD	16QAM, 0.48	HST-SFN	2x2	70	[14.3]
45	R.PDSCH.1-14.4 FDD	16QAM, 0.48	HST-SFN	2x2	70	TBA
50	R.PDSCH.1-14.2 FDD	16QAM, 0.48	HST-SFN	2x2	70	[14.0]

Table 5.2A.2.4.0-4: Single carrier performance for TDD 30 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-19.1 TDD	16QAM, 0.48	HST-SFN	2x2	70	[13.4]
10	R.PDSCH.2-19.2 TDD	16QAM, 0.48	HST-SFN	2x2	70	[13.7]
15	R.PDSCH.2-19.3 TDD	16QAM, 0.48	HST-SFN	2x2	70	[13.8]
20	R.PDSCH.2-19.4 TDD	16QAM, 0.48	HST-SFN	2x2	70	[13.8]
25	R.PDSCH.2-19.5 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.1]
30	R.PDSCH.2-20.1 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.4]
40	R.PDSCH.2-10.4 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.6]
50	R.PDSCH.2-20.2 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.7]
60	R.PDSCH.2-20.3 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.4]
80	R.PDSCH.2-20.4 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.9]
90	R.PDSCH.2-20.5 TDD	16QAM, 0.48	HST-SFN	2x2	70	[15.4]
100	R.PDSCH.2-21.1 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.8]

Table 5.2A.2.4.0-5: Minimum performance for multiple CA configurations

Test number	CA duplex mode	Minimum performance requirements
1	FDD 15 kHz + FDD 15 kHz	As defined in Table 5.2A.2.4.0-3
2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.2.4.0-4
3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.4.0-3 and Table 5.2A.2.4.0-4 per CC
Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7		

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.2.4.

5.2A.2.4.1 2Rx Normal Demodulation Performance for HST-SFN CA

Editor's Note: This test cases is incomplete in following aspects:

- SNR in test requirements table is within square brackets for test point 1,2 and 3.
- Test Tolerance (TT) in test requirements is to be defined.
- Message content is FFS

5.2A.2.4.1.1 Test Purpose

Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 with CA.

5.2A.2.4.1.2 Test applicability

This test applies to all types of NR UE release 17 and forward that supports 2DL CA.

5.2A.2.4.1.3 Test description

5.2A.2.4.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.2.4.1.3.1-1: Test point selection table

Test number	CA duplex mode	Minimum performance requirements
1	FDD 15 kHz + FDD 15 kHz	As defined in Table 5.2A.2.4.0-3
2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.2.4.0-4
3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.4.0-3 and Table 5.2A.2.4.0-4 per CC
Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7		

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.x for TE diagram and clause A.3.2.6 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.1.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.2.4.1.3.3.

5.2A.2.4.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.2.4.1.3.3.
3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[19], clause 9.3).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2A.2.4.0-2 to 5.2A.2.4.0-5 as appropriate on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.
5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to 5.2A.2.4.1.3.4-1 and 5.2A.2.4.1.3.4-2 as appropriate on both PCC and SCC.
6. Measure the average throughput per each component carrier for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.
7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.4.1.3.1-1 as appropriate.

5.2A.2.4.1.3.3 Message contents

FFS

5.2A.2.4.1.3.4 Test Requirement

Tables 5.2A.2.4.1.3.4-1 and 5.2A.2.4.1.3.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.2.4.1.3.4-1 and 5.2A.2.4.1.3.4-2 for the specified SNR including test tolerances for the test points listed in Table 5.2A.2.4.1.3.1-1.

Table 5.2A.2.4.1.3.4-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-13.1 FDD	16QAM, 0.48	HST-SFN	2x2	70	[12.9] + TT
10	R.PDSCH.1-8.3 FDD	16QAM, 0.48	HST-SFN	2x2	70	[13.1] + TT
15	R.PDSCH.1-13.2 FDD	16QAM, 0.48	HST-SFN	2x2	70	[13.4] + TT
20	R.PDSCH.1-13.3 FDD	16QAM, 0.48	HST-SFN	2x2	70	[13.9] + TT
25	R.PDSCH.1-13.4 FDD	16QAM, 0.48	HST-SFN	2x2	70	[14.0] + TT
30	R.PDSCH.1-13.5 FDD	16QAM, 0.48	HST-SFN	2x2	70	[13.9] + TT
35	R.PDSCH.1-14.3 FDD	16QAM, 0.48	HST-SFN	2x2	70	TBA
40	R.PDSCH.1-14.1 FDD	16QAM, 0.48	HST-SFN	2x2	70	[14.3] + TT
45	R.PDSCH.1-14.4 FDD	16QAM, 0.48	HST-SFN	2x2	70	TBA
50	R.PDSCH.1-14.2 FDD	16QAM, 0.48	HST-SFN	2x2	70	[14.0] + TT

Table 5.2A.2.4.1.3.4.1-2: Single carrier performance for TDD 30 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-19.1 TDD	16QAM, 0.48	HST-SFN	2x2	70	[13.4] + TT
10	R.PDSCH.2-19.2 TDD	16QAM, 0.48	HST-SFN	2x2	70	[13.7] + TT
15	R.PDSCH.2-19.3 TDD	16QAM, 0.48	HST-SFN	2x2	70	[13.8] + TT
20	R.PDSCH.2-19.4 TDD	16QAM, 0.48	HST-SFN	2x2	70	[13.8] + TT
25	R.PDSCH.2-19.5 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.1] + TT
30	R.PDSCH.2-20.1 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.4] + TT
40	R.PDSCH.2-10.4 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.6] + TT
50	R.PDSCH.2-20.2 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.7] + TT
60	R.PDSCH.2-20.3 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.4] + TT
80	R.PDSCH.2-20.4 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.9] + TT
90	R.PDSCH.2-20.5 TDD	16QAM, 0.48	HST-SFN	2x2	70	[15.4] + TT
100	R.PDSCH.2-21.1 TDD	16QAM, 0.48	HST-SFN	2x2	70	[14.8] + TT

5.2A.2.5 Requirements for 2RX PDSCH HST-DPS CA PDSCH

5.2A.2.5.0 Minimum conformance requirements for 2RX HST-DPS CA PDSCH

For HST-DPS CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.5.0-7 and Table 5.2A.2.5.0-8 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.5.0-3 ~ Table 5.2A.2.5.0-6, with the parameters in Table 5.2A.2.5.0-2, Table 5.2A-2 and Table 5.2A-3 and the downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 5.2A.2.5.0-1.

Table 5.2A.2.5.0-1: Test purpose

Purpose	Test index
Verify UE performance in the HST-DPS scenario defined in B.3.3 with CA with 1 active PDSCH TCI states	1-1, 1-2, 1-3
Verify UE performance in the HST-DPS scenario defined in B.3.3 with CA with 2 active PDSCH TCI states	2-1, 2-2, 2-3

Table 5.2A.2.5.0-2: Test parameters

Parameter		Unit	Value		
Duplex mode			FDD and TDD		
Active DL BWP index			1		
PDCCH configuration	TCI state		Note 1		
PDSCH configuration	Mapping type		Type A		
	k0		0		
	Starting symbol (S)		2		
	Length (L)		FDD: 12 TDD: Specific to each Reference channel		
	PDSCH aggregation factor		1		
	PRB bundling type		Static		
	PRB bundling size		2		
	Resource allocation type		Type 0		
	RBG size		Config2		
	VRB-to-PRB mapping type		Non-interleaved		
	VRB-to-PRB mapping interleaver bundle size		N/A		
PDSCH DMRS configuration	TCI state		Note 1		
	DMRS Type		Type 1		
	Number of additional DMRS		2		
CSI-RS for tracking	Resource set #1	Maximum number of OFDM symbols for DL front loaded DMRS		1	
		First OFDM symbol in the PRB used for CSI-RS		$l_0 = 5$ for CSI-RS resource 1 and 3 $l_0 = 9$ for CSI-RS resource 2 and 4	
		CSI-RS periodicity	Slots	15kHz SCS: 10 for CSI-RS resource 1,2,3,4. 30kHz SCS: 20 for CSI-RS resource 1,2,3,4	
		CSI-RS offset	Slots	1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4	
		QCL info		TCI state #2	
	Frequency Occupation		Start PRB 0 Number of PRB = $\min(52, \text{ceil}(\text{BWP size}/4)*4)$		
	Resource set #2	First OFDM symbol in the PRB used for CSI-RS		$l_0 = 6$ for CSI-RS resource 5 and 6 $l_0 = 10$ for CSI-RS resource 7 and 8	
		CSI-RS periodicity	Slots	15kHz SCS: 10 for CSI-RS resource 5,6,7,8. 30kHz SCS: 20 for CSI-RS resource 5,6,7,8.	
		CSI-RS offset	Slots	1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8	
		QCL info		TCI state #3	
		Frequency Occupation		Start PRB 0 Number of PRB = $\min(52, \text{ceil}(\text{BWP size}/4)*4)$	
	NZP CSI-RS for CSI acquisition	Resource set #3	First OFDM symbol in the PRB used for CSI-RS		$l_0 = 12$
			CSI-RS periodicity	Slots	15kHz SCS:20 30kHz SCS: 40
			CSI-RS offset	Slots	0
			QCL info		TCI state #0
Resource set #4		First OFDM symbol in the PRB used for CSI-RS		$l_0 = 13$	
		CSI-RS periodicity	Slots	15kHz SCS:20 30kHz SCS: 40	
		CSI-RS offset	Slots	0	
		QCL info		TCI state #1	
TCI state #0	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration	
		QCL Type		Type A	
	Type 2 QCL information	CSI-RS resource		N/A	
		QCL Type		N/A	

TCI state #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration
		QCL Type	Type A
	Type 2 QCL information	CSI-RS resource	N/A
		QCL Type	N/A
TCI state #2	Type 1 QCL information	SSB index	SSB #0
		QCL Type	Type C
	Type 2 QCL information	SSB index	N/A
		QCL Type	N/A
TCI state #3	Type 1 QCL information	SSB index	SSB #1
		QCL Type	Type C
	Type 2 QCL information	SSB index	N/A
		QCL Type	N/A
Number of HARQ Processes			As defined in Table 5.2A-2
TDD UL-DL pattern			15kHz SCS: FR1.15-1 30kHz SCS: FR1.30-1
The number of slots between PDSCH and corresponding HARQ-ACK information			As defined in Table 5.2A-3
Number of PUCCH ResourceGroups			1
PUCCH format for HARQ-ACK feedback			PUCCH format 1 for cases with no more than 2 DL CCs PUCCH format 3 for cases with more than 2 DL CCs
<p>Note 1: SSB # ($k \bmod 2$), CSI-RS (for tracking) resource set # ($(k \bmod 2) + 1$) and CSI-RS (for CSI acquisition) resource set # ($(k \bmod 2) + 3$) are transmitted by k^{th} RRH.</p> <p>For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy $\text{mod}(i, 2n) = n$. PDCCH and PDSCH associated with TCI # ($k \bmod 2$) is transmitted by k^{th} RRH from slot#</p> $\max [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}} + T_{\text{firstTRS}} + T_{\text{TRS proc}}, 0]$ <p>to slot#</p> $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$ <p>PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.</p> <p>For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy $\text{mod}(i, 2n) = n$. PDCCH and PDSCH associated with TCI # ($k \bmod 2$) is transmitted by k^{th} RRH from slot#</p> $\max [(2k - 1)n + 1 + T_{\text{HARQ}} + T_{\text{MAC proc}}, 0]$ <p>to slot#</p> $(2k + 1)n + T_{\text{HARQ}} + T_{\text{MAC proc}}$ <p>Where $k=0, 1, 2, \dots$ is the RRH number, $n = 2520$ is half of the number of slots between two RRH, $T_{\text{HARQ}} = 2$ is the number of slots between PDSCH and corresponding HARQ-ACK information, $T_{\text{MAC proc}} = 3$ is the number of slots for MAC CE processing, $T_{\text{firstTRS}} = 6$ is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, $T_{\text{TRS proc}} = 2$ is the number of slots for TRS processing.</p>			

Table 5.2A.2.5.0-3: Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-15.1	64QAM, 0.43	HST-DPS	1	2x2	70	13.2
10	R.PDSCH.1-8.4 FDD	64QAM, 0.43	HST-DPS	1	2x2	70	13.6
15	R.PDSCH.1-15.2	64QAM, 0.43	HST-DPS	1	2x2	70	13.6
20	R.PDSCH.1-15.3	64QAM, 0.43	HST-DPS	1	2x2	70	13.4
25	R.PDSCH.1-15.4	64QAM, 0.43	HST-DPS	1	2x2	70	13.6
30	R.PDSCH.1-15.5	64QAM, 0.43	HST-DPS	1	2x2	70	13.6
35	[R.PDSCH.1-16.3]	64QAM, 0.43	HST-DPS	1	2x2	70	13.4
40	R.PDSCH.1-16.1	64QAM, 0.43	HST-DPS	1	2x2	70	13.6
45	[R.PDSCH.1-16.4]	64QAM, 0.43	HST-DPS	1	2x2	70	13.4
50	R.PDSCH.1-16.2	64QAM, 0.43	HST-DPS	1	2x2	70	13.7

Table 5.2A.2.5.0-4: Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-15.1	64QAM, 0.43	HST-DPS	2	2x2	70	13.2
10	R.PDSCH.1-8.4 FDD	64QAM, 0.43	HST-DPS	2	2x2	70	13.6
15	R.PDSCH.1-15.2	64QAM, 0.43	HST-DPS	2	2x2	70	13.6
20	R.PDSCH.1-15.3	64QAM, 0.43	HST-DPS	2	2x2	70	13.4
25	R.PDSCH.1-15.4	64QAM, 0.43	HST-DPS	2	2x2	70	13.6
30	R.PDSCH.1-15.5	64QAM, 0.43	HST-DPS	2	2x2	70	13.6
35	[R.PDSCH.1-16.3]	64QAM, 0.43	HST-DPS	2	2x2	70	13.4
40	R.PDSCH.1-16.1	64QAM, 0.43	HST-DPS	2	2x2	70	13.6
45	[R.PDSCH.1-16.4]	64QAM, 0.43	HST-DPS	2	2x2	70	13.4
50	R.PDSCH.1-16.2	64QAM, 0.43	HST-DPS	2	2x2	70	13.7

Table 5.2A.2.5.0-5: Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-22.1	64QAM, 0.43	HST-DPS	1	2x2	70	13.3
10	R.PDSCH.2-22.2	64QAM, 0.43	HST-DPS	1	2x2	70	13.3
15	R.PDSCH.2-22.3	64QAM, 0.43	HST-DPS	1	2x2	70	13.2
20	R.PDSCH.2-22.4	64QAM, 0.43	HST-DPS	1	2x2	70	13.3
25	R.PDSCH.2-22.5	64QAM, 0.43	HST-DPS	1	2x2	70	13.4
30	R.PDSCH.2-23.1	64QAM, 0.43	HST-DPS	1	2x2	70	13.4
40	R.PDSCH.2-10.5 TDD	64QAM, 0.43	HST-DPS	1	2x2	70	13.3
50	R.PDSCH.2-23.2	64QAM, 0.43	HST-DPS	1	2x2	70	13.5
60	R.PDSCH.2-23.3	64QAM, 0.43	HST-DPS	1	2x2	70	13.5
80	R.PDSCH.2-23.4	64QAM, 0.43	HST-DPS	1	2x2	70	13.4
90	R.PDSCH.2-23.5	64QAM, 0.43	HST-DPS	1	2x2	70	13.6
100	R.PDSCH.2-24.1	64QAM, 0.43	HST-DPS	1	2x2	70	13.5

Table 5.2A.2.5.0-6: Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-22.1	64QAM, 0.43	HST-DPS	2	2x2	70	13.3
10	R.PDSCH.2-22.2	64QAM, 0.43	HST-DPS	2	2x2	70	13.3
15	R.PDSCH.2-22.3	64QAM, 0.43	HST-DPS	2	2x2	70	13.2
20	R.PDSCH.2-22.4	64QAM, 0.43	HST-DPS	2	2x2	70	13.3
25	R.PDSCH.2-22.5	64QAM, 0.43	HST-DPS	2	2x2	70	13.4
30	R.PDSCH.2-23.1	64QAM, 0.43	HST-DPS	2	2x2	70	13.4
40	R.PDSCH.2-10.5 TDD	64QAM, 0.43	HST-DPS	2	2x2	70	13.3
50	R.PDSCH.2-23.2	64QAM, 0.43	HST-DPS	2	2x2	70	13.5
60	R.PDSCH.2-23.3	64QAM, 0.43	HST-DPS	2	2x2	70	13.5
80	R.PDSCH.2-23.4	64QAM, 0.43	HST-DPS	2	2x2	70	13.4
90	R.PDSCH.2-23.5	64QAM, 0.43	HST-DPS	2	2x2	70	13.6
100	R.PDSCH.2-24.1	64QAM, 0.43	HST-DPS	2	2x2	70	13.5

Table 5.2A.2.5.0-7: Minimum performance for HST-DPS CA configurations with 1 active PDSCH TCI states

Test number	CA duplex mode	Minimum performance requirements
1-1	FDD 15 kHz + FDD 15 kHz	As defined in Table 5.2A.2.5.0-3
1-2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.2.5.0-5
1-3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.5.0-3 and Table 5.2A.2.5.0-5 per CC
Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7.4.		

Table 5.2A.2.5.0-8: Minimum performance for HST-DPS CA configurations with 2 active PDSCH TCI states

Test number	CA duplex mode	Minimum performance requirements
2-1	FDD 15 kHz + FDD 15 kHz	As defined in Table 5.2A.2.5.0-4
2-2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.2.5.0-6
2-3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.5.0-4 and Table 5.2A.2.5.0-6 per CC
Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7.4.		

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.2.5.

5.2A.2.5.1 2RX PDSCH Demodulation Performance for HST-DPS CA

Editor's Note: This test cases is incomplete in following aspects:

- Message content is FFS

5.2A.2.5.1.1 Test Purpose

To verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions in the HST-DPS scenario for multiple CA configurations and with different channel models, MCSs and SCS for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput per CC.

5.2A.2.5.1.2 Test applicability

This test applies to all types of NR UE release 17 and forward supporting 2DL CA.

5.2A.2.5.1.3 Test description

5.2A.2.5.1.3.1 Initial conditions

Same initial conditions as specified in clause 5.2A.2.1.1.3.1 with the following exception

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.2.5.1.3.1-1: Test point selection table

Test number	CA duplex mode	Minimum performance requirements
1	FDD 15 kHz + FDD 15 kHz	As defined in Table 5.2A.3.1.0-1
2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1.0-3
3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-3 per CC
4 (note 2)	FDD 15 kHz + TDD 15 kHz	As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-2 per CC
5 (note 3)	TDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1.0-2 and Table 5.2A.3.1.0-3 per CC
Note 1: For each test point, select any one of the CA configurations which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate based on the equation $DataRate = 10^{-3} \sum_{j=1}^J TBS_j 2^{\mu_j}$		
Note 2: Test point 4 can be skipped if test point 3 is verified.		
Note 3: Test point 5 can be skipped if test point 3 or 4 is verified.		

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.1.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.2.5.1.3.3.

5.2A.2.5.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.2.5.1.3.3.
3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2A.2.5.0-2 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.
5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to 5.2A.2.5.1.3.4-1 to 5.2A.2.5.1.3.4-4 as appropriate on both PCC and SCCs.
6. Measure the average throughput per each component carrier for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.
7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.5.1.3.1-1 as appropriate.

5.2A.2.5.1.3.3 Message contents

FFS

5.2A.2.5.1.3.4 Test Requirement

Tables 5.2A.2.5.1.3.4-1, 5.2A.2.5.1.3.4-2 and 5.2A.2.5.1.3.4-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.2.5.1.3.4-1, 5.2A.2.5.1.3.4-2 and 5.2A.2.5.1.3.4-3 for the specified SNR including test tolerances for the combination selected following the test rules outlined in 5.1.1.5.2-2.

Table 5.2A.2.5.1.3.4-1: Test requirements for Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-15.1	64QAM, 0.43	HST-DPS	1	2x2	70	13.8
10	R.PDSCH.1-8.4 FDD	64QAM, 0.43	HST-DPS	1	2x2	70	14.2
15	R.PDSCH.1-15.2	64QAM, 0.43	HST-DPS	1	2x2	70	14.2
20	R.PDSCH.1-15.3	64QAM, 0.43	HST-DPS	1	2x2	70	14.0
25	R.PDSCH.1-15.4	64QAM, 0.43	HST-DPS	1	2x2	70	14.2
30	R.PDSCH.1-15.5	64QAM, 0.43	HST-DPS	1	2x2	70	14.2
35	[R.PDSCH.1-16.3]	64QAM, 0.43	HST-DPS	1	2x2	70	14.0
40	R.PDSCH.1-16.1	64QAM, 0.43	HST-DPS	1	2x2	70	14.2
45	[R.PDSCH.1-16.4]	64QAM, 0.43	HST-DPS	1	2x2	70	14.0
50	R.PDSCH.1-16.2	64QAM, 0.43	HST-DPS	1	2x2	70	14.3

Table 5.2A.2.5.1.3.4-2: Test requirements for Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-15.1	64QAM, 0.43	HST-DPS	2	2x2	70	13.8
10	R.PDSCH.1-8.4 FDD	64QAM, 0.43	HST-DPS	2	2x2	70	14.2
15	R.PDSCH.1-15.2	64QAM, 0.43	HST-DPS	2	2x2	70	14.2
20	R.PDSCH.1-15.3	64QAM, 0.43	HST-DPS	2	2x2	70	14.0
25	R.PDSCH.1-15.4	64QAM, 0.43	HST-DPS	2	2x2	70	14.2
30	R.PDSCH.1-15.5	64QAM, 0.43	HST-DPS	2	2x2	70	14.2
35	[R.PDSCH.1-16.3]	64QAM, 0.43	HST-DPS	2	2x2	70	14.0
40	R.PDSCH.1-16.1	64QAM, 0.43	HST-DPS	2	2x2	70	14.2
45	[R.PDSCH.1-16.4]	64QAM, 0.43	HST-DPS	2	2x2	70	14.0
50	R.PDSCH.1-16.2	64QAM, 0.43	HST-DPS	2	2x2	70	14.3

Table 5.2A.2.5.1.3.4-3: Test requirements for Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-22.1	64QAM, 0.43	HST-DPS	1	2x2	70	13.9
10	R.PDSCH.2-22.2	64QAM, 0.43	HST-DPS	1	2x2	70	13.9
15	R.PDSCH.2-22.3	64QAM, 0.43	HST-DPS	1	2x2	70	13.8
20	R.PDSCH.2-22.4	64QAM, 0.43	HST-DPS	1	2x2	70	13.9
25	R.PDSCH.2-22.5	64QAM, 0.43	HST-DPS	1	2x2	70	14.0
30	R.PDSCH.2-23.1	64QAM, 0.43	HST-DPS	1	2x2	70	14.0
40	R.PDSCH.2-10.5 TDD	64QAM, 0.43	HST-DPS	1	2x2	70	13.9
50	R.PDSCH.2-23.2	64QAM, 0.43	HST-DPS	1	2x2	70	14.1
60	R.PDSCH.2-23.3	64QAM, 0.43	HST-DPS	1	2x2	70	14.1
80	R.PDSCH.2-23.4	64QAM, 0.43	HST-DPS	1	2x2	70	14.0
90	R.PDSCH.2-23.5	64QAM, 0.43	HST-DPS	1	2x2	70	14.2
100	R.PDSCH.2-24.1	64QAM, 0.43	HST-DPS	1	2x2	70	14.1

Table 5.2A.2.5.1.3.4-4: Test requirements for Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Number of active PDSCH TCI states	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-22.1	64QAM, 0.43	HST-DPS	2	2x2	70	13.9
10	R.PDSCH.2-22.2	64QAM, 0.43	HST-DPS	2	2x2	70	13.9
15	R.PDSCH.2-22.3	64QAM, 0.43	HST-DPS	2	2x2	70	13.8
20	R.PDSCH.2-22.4	64QAM, 0.43	HST-DPS	2	2x2	70	13.9
25	R.PDSCH.2-22.5	64QAM, 0.43	HST-DPS	2	2x2	70	14.0
30	R.PDSCH.2-23.1	64QAM, 0.43	HST-DPS	2	2x2	70	14.0
40	R.PDSCH.2-10.5 TDD	64QAM, 0.43	HST-DPS	2	2x2	70	13.9
50	R.PDSCH.2-23.2	64QAM, 0.43	HST-DPS	2	2x2	70	14.1
60	R.PDSCH.2-23.3	64QAM, 0.43	HST-DPS	2	2x2	70	14.1
80	R.PDSCH.2-23.4	64QAM, 0.43	HST-DPS	2	2x2	70	14.0
90	R.PDSCH.2-23.5	64QAM, 0.43	HST-DPS	2	2x2	70	14.2
100	R.PDSCH.2-24.1	64QAM, 0.43	HST-DPS	2	2x2	70	14.1

5.2A.3 4RX requirements

5.2A.3.1 Requirements for 4RX normal PDSCH

5.2A.3.1.0 Minimum conformance requirements for 4RX normal PDSCH

For CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.3.1.0-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.1.0-1 to Table 5.2A.3.1.0-3, with the parameters in Table 5.2A-1 to Table 5.2A-3 and the downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

Table 5.2A.3.1.0-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)

5	R.PDSCH.1-9.1 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.5
10	R.PDSCH.1-2.2 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.5
15	R.PDSCH.1-9.2 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.6
20	R.PDSCH.1-9.3 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.6
25	R.PDSCH.1-9.4 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.7
30	R.PDSCH.1-9.5 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.6
40	R.PDSCH.1-10.1 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.7
50	R.PDSCH.1-10.2 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.9

Table 5.2A.3.1.0-2: Single carrier performance for TDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-2.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.5
10	R.PDSCH.1-2.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.6
15	R.PDSCH.1-2.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.7
20	R.PDSCH.1-2.4 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.6
25	R.PDSCH.1-2.5 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.8
30	R.PDSCH.1-3.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.6
40	R.PDSCH.1-3.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.8
50	R.PDSCH.1-3.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.0

Table 5.2A.3.1.0-3: Single carrier performance for TDD 30 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)

5	R.PDSCH.2-13.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.5
10	R.PDSCH.2-13.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.5
15	R.PDSCH.2-13.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.5
20	R.PDSCH.2-13.4 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.6
25	R.PDSCH.2-13.5 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.6
30	R.PDSCH.2-14.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.6
40	R.PDSCH.2-2.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.7
50	R.PDSCH.2-14.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.9
60	R.PDSCH.2-14.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	8.8
80	R.PDSCH.2-14.4 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.1
90	R.PDSCH.2-14.5 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.0
100	R.PDSCH.2-15.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.3

Table 5.2A.3.1.0-4: Minimum performance for multiple CA configurations

Test number	CA duplex mode	Minimum performance requirements
1	FDD 15 kHz + FDD 15 kHz	As defined in Table 5.2A.3.1.0-1
2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1.0-3
3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-3 per CC
4	FDD 15 kHz + TDD 15 kHz	As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-2 per CC
5	TDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1.0-2 and Table 5.2A.3.1.0-3 per CC
Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.5.		

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.3.1.

5.2A.3.1.1 4Rx Normal PDSCH Demodulation Performance for CA (2DL CA)

5.2A.3.1.1.1 Test Purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions for multiple CA configurations and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput per CC.

5.2A.3.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 2DL CA and 4Rx antenna ports on each CC.

5.2A.3.1.1.3 Test description

5.2A.3.1.1.3.1 Initial conditions

Same initial conditions as specified in clause 5.2A.2.1.1.3.1 with the following exception

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.3.1.1.3.1-1: Test point selection table

Test number	CA duplex mode	Minimum performance requirements
1	FDD 15 kHz + FDD 15 kHz	As defined in Table 5.2A.3.1.0-1
2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1.0-3
3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-3 per CC
4 (note 2)	FDD 15 kHz + TDD 15 kHz	As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-2 per CC
5 (note 3)	TDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1.0-2 and Table 5.2A.3.1.0-3 per CC
Note 1: For each test point, select any one of the CA configurations which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate based on the equation $DataRate = 10^{-3} \sum_{j=1}^J TBS_j 2^{\mu_j}$		
Note 2: Test point 4 can be skipped if test point 3 is verified.		
Note 3: Test point 5 can be skipped if test point 3 or 4 is verified.		

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.7 for TE diagram and clause A.3.2.6 for UE diagram.

5.2A.3.1.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.3.1.1.3.3.
3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause 9.3).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.
5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs.
6. Measure the average throughput per each component carrier for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.
7. Repeat steps from 1 to 6 for each test points in Table 5.2A.3.1.0-4 as appropriate.

5.2A.3.1.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.3.1.1.4 Test Requirement

Tables 5.2A.3.1.1.4-1, 5.2A.3.1.1.4-2 and 5.2A.3.1.1.4-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.3.1.1.4-1, 5.2A.3.1.1.4-2 and 5.2A.3.1.1.4-3 for the specified SNR including test tolerances for the combination selected following the test rules outlined in 5.1.1.5.2-2.

Table 5.2A.3.1.1.4-1: Test requirements for FDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)

5	R.PDSCH.1-9.1 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
10	R.PDSCH.1-2.2 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
15	R.PDSCH.1-9.2 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
20	R.PDSCH.1-9.3 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
25	R.PDSCH.1-9.4 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.6
30	R.PDSCH.1-9.5 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
40	R.PDSCH.1-10.1 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.6
50	R.PDSCH.1-10.2 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.8

Table 5.2A.3.1.1.4-2: Test requirements for TDD 15 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-2.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
10	R.PDSCH.1-2.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
15	R.PDSCH.1-2.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.6
20	R.PDSCH.1-2.4 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
25	R.PDSCH.1-2.5 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.7
30	R.PDSCH.1-3.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
40	R.PDSCH.1-3.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.7
50	R.PDSCH.1-3.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.9

Table 5.2A.3.1.1.4-3: Test requirements for TDD 30 kHz SCS for CA configurations

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)

5	R.PDSCH.2-13.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
10	R.PDSCH.2-13.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
15	R.PDSCH.2-13.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
20	R.PDSCH.2-13.4 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
25	R.PDSCH.2-13.5 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
30	R.PDSCH.2-14.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
40	R.PDSCH.2-2.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.6
50	R.PDSCH.2-14.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.8
60	R.PDSCH.2-14.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.7
80	R.PDSCH.2-14.4 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	10.0
90	R.PDSCH.2-14.5 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.9
100	R.PDSCH.2-15.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	10.2

5.2A.3.1.2 4Rx Normal PDSCH Demodulation Performance for CA (3DL CA)

5.2A.3.1.2.1 Test Purpose

Same as 5.2A.3.1.1.1

5.2A.3.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 3DL CA and 4Rx antenna ports on each CC.

5.2A.3.1.2.3 Test description

5.2A.3.1.2.3.1 Initial conditions

Same as 5.2A.3.1.1.3.1

5.2A.3.1.2.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.3.1.2.3.3.
3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause 9.3).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.
5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs.
6. Measure the average throughput per each component carrier for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.
7. Repeat steps from 1 to 6 for each test points in Table 5.2A.3.1.0-4 as appropriate.

5.2A.3.1.2.3.3 Message contents

Same as 5.2A.3.1.1.3.3

5.2A.3.1.2.4 Test Requirement

Same as 5.2A.3.1.1.4 evaluated per component carrier.

5.2A.3.1.3 4Rx Normal PDSCH Demodulation Performance for CA (4DL CA)

5.2A.3.1.3.1 Test Purpose

Same as 5.2A.3.1.1.1

5.2A.3.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4DL CA and 4Rx antenna ports on each CC.

5.2A.3.1.3.3 Test description

5.2A.3.1.3.3.1 Initial conditions

Same as 5.2A.3.1.1.3.1

5.2A.3.1.3.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.3.1.3.3.3.
3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.
5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs.
6. Measure the average throughput per each component carrier for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.
7. Repeat steps from 1 to 6 for each test points in Table 5.2A.3.1.0-4 as appropriate.

5.2A.3.1.3.3.3 Message contents

Same as 5.2A.3.1.1.3.3

5.2A.3.1.3.4 Test Requirement

Same as 5.2A.3.1.1.3.4 evaluated per component carrier.

5.2A.3.2 Requirements for 4RX PDSCH carrier aggregation with power imbalance

5.2A.3.2.0 Minimum requirements for carrier aggregation with power imbalance

The performance requirements are specified in Table 5.2A.3.2.0-3 and Table 5.2A.3.2.0-4, with the addition of test parameters in Table 5.2A.3.2.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2A.3.2.0-1.

Table 5.2A.3.2.0-1: Tests purpose

Purpose	Test index
Verify the ability of an intra-band adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only	

Table 5.2A.3.2.0-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD and TDD
Active DL BWP index			1
Propagation condition			Static propagation condition No external noise sources are applied
Antenna configuration			1x4
PDSCH configuration	Length (L)		FDD: 12TDD: 12 for DL slot, 4 for special slot
	PRB bundling size		WB
Modulation and code rate			64QAM, MCS 27
Number of HARQ Processes			FDD: 4 TDD: 8
Maximum number of HARQ transmission			1
Redundancy version coding sequence			{0}
TDD UL-DL pattern			30kHz SCS: FR1.30-1
The number of slots between PDSCH and corresponding HARQ-ACK information			As defined in Table A.1.2-2 for FR1.30-1
PUCCH format for HARQ-ACK feedback			PUCCH format 1
Overhead for TBS determination			0
SSB transmission			Slot#0 with periodicity 20ms
RB assignment			Full applicable test bandwidth as defined in Table 5.3.5-1 of TS 38.101-1 [2]

Table 5.2A.3.2.0-3: Minimum performance for FDD CA with 15 kHz SCS

Test Number	Bandwidth (MHz)		Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for SCell	PCell	SCell
1	Selected Channel bandwidth as per section 5.1.1.6		Derived as per section 5.1.3.2 of TS 38.214 [12]	NA	-112	-106	85	NA

Table 5.2A.3.2.0-4: Minimum performance for TDD CA with 30 kHz SCS

Test Number	Bandwidth (MHz)		Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for SCell	PCell	SCell
1	Selected Channel bandwidth as per section 5.1.1.6		Derived as per section 5.1.3.2 of TS 38.214 [12]	NA	-112	-106	85	NA

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.3.2.

5.2A.3.2.1 4Rx PDSCH Demodulation Performance for CA with power imbalance (2DL CA)

5.2A.3.2.1.1 Test Purpose

To verify the ability of an intra-band adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only.

5.2A.3.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL intra-band contiguous CA and 4Rx antenna ports.

5.2A.3.2.1.3 Test description

5.2A.3.2.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 4.3.1.1.

Band selection: Supported intra-band contiguous CA configurations covering the lowest and highest operating bands,

Channel BW combination to be tested: Select bandwidth combination with same bandwidth in each carrier. If not supported, select bandwidth combination with smallest bandwidth difference between the two carriers and the carrier with smaller bandwidth will be used for the test.

CA capability to be tested: Either FDD or TDD intra-band contiguous CA

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2A for TE diagram and clause A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.1.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.3.2.1.3.3.

5.2A.3.2.1.3.2 Test procedure

Same test procedure as specified in clause 5.2A.2.2.1.3.2 with the following exception.

Instead of Table 5.2A.2.2.1.3.3 → 5.2A.3.2.1.3.3

Instead of Table 5.2A.2.2.0-2 → 5.2A.3.2.0-2

Instead of Table 5.2A.2.2.0-4 → 5.2A.3.2.0-4

5.2A.3.2.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.3.2.1.4 Test Requirement

Table 5.2A.3.2.0-2, Table 5.2A.3.2.1.4-1 and Table 5.2A.3.2.1.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the MCS scheduled as specified in Table 5.2A.3.2.0-2 for the throughput test shall meet or exceed the specified value in Table 5.2A.3.2.1.4-1 or Table 5.2A.3.2.1.4-2 as applicable for the specified cell power levels.

Table 5.2A.3.2.1.4-1: Test Requirements for FDD CA with 15 kHz SCS

Test Number	Bandwidth (MHz)		Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for SCell	PCell	SCell
1	Selected Channel bandwidth as per section 5.1.1.6		Derived as per section 5.1.3.2 of TS 38.214 [12]	NA	-112	-106	85	NA

Table 5.2A.3.2.1.4-2: Test Requirements for TDD CA with 30 kHz SCS

Test Number	Bandwidth (MHz)		Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for SCell	PCell	SCell
1	Selected Channel bandwidth as per section 5.1.1.6		Derived as per section 5.1.3.2 of TS 38.214 [12]	NA	-112	-106	85	NA

5.2A.3A 2Rx-4RX requirements

5.2A.3A.1 Requirements for 2Rx-4RX normal PDSCH

5.2A.3A.1.0 Minimum conformance requirements for 2Rx-4RX normal PDSCH

For UE supporting a combination of 2Rx and 4Rx antenna port per component carrier,

The 2Rx requirements are defined in Table 5.2A.2.1.0-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.1.0-1 to Table 5.2A.2.1.0-3.

The 4Rx requirements are defined in Table 5.2A.3.1.0-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.1.0-1 to Table 5.2A.3.1.0-3.

Parameters are specified in Table 5.2A-1 to Table 5.2A-3 and the downlink physical channel setup according to Annex C.2.1.

5.2A.3A.1.1 2Rx-4Rx Normal PDSCH Demodulation Performance for CA (2DL CA)

5.2A.3A.1.1.1 Test Purpose

To verify the PDSCH mapping Type A normal performance under combination of 2 and 4 receive antenna conditions for multiple CA configurations and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput per CC.

5.2A.3A.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 2DL CA and 4Rx antenna ports on some of the CC.

5.2A.3A.1.1.3 Test description

5.2A.3A.1.1.3.1 Initial conditions

Same initial conditions as specified in clause 5.2A.2.1.1.3.1 with the following exception

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.3A.1.1.3.1-1: Test point selection table

Test number	CA duplex mode	Configuration
1	FDD 15 kHz + FDD 15 kHz	For 2Rx CC, As defined in Table 5.2A.2.1.0-1 For 4Rx CC, as defined in Table 5.2A.3.1.0-1
2	TDD 30 kHz + TDD 30 kHz	For 2Rx CC, As defined in Table 5.2A.2.1.0-3 For 4Rx CC, as defined in Table 5.2A.3.1.0-3
3	FDD 15 kHz + TDD 30 kHz	For 2Rx CC, As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-3 per CC For 4Rx CC, as defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-3 per CC
4 (note 2)	FDD 15 kHz + TDD 15 kHz	For 2Rx CC, As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-2 per CC For 4Rx CC, as defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-2 per CC
5 (note 3)	TDD 15 kHz + TDD 30 kHz	For 2Rx CC, As defined in Table 5.2A.2.1.0-2 and Table 5.2A.2.1.0-3 per CC For 4Rx CC, as defined in Table 5.2A.3.1.0-2 and Table 5.2A.3.1.0-3 per CC
Note 1:	For each test point, select any one of the CA configurations which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate based on the equation $DataRate = 10^{-3} \sum_{j=1}^J TBS_j 2^{\mu_j}$	
Note 2:	Test point 4 can be skipped if test point 3 is verified.	
Note 3:	Test point 5 can be skipped if test point 3 or 4 is verified.	

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.6 and A.3.1.7.7 for TE diagram for 2Rx and 4Rx CC respectively and clause A.3.2.6 for UE diagram

5.2A.3A.1.1.3.2 Test procedure

Same test procedure as specified in clause 5.2A.2.1.1.3.2 for 2Rx CC and with the following exception for 4Rx CC

Instead of Table 5.2A.2.1.0-1 → 5.2A.3.1.0-1 for 4Rx CC

Instead of Table 5.2A.2.1.0-4 → 5.2A.3.1.0-4 for 4Rx CC

Instead of Table 5.2A.2.1.1.3.3 → 5.2A.3.1.1.3.3 for 4Rx CC

5.2A.3A.1.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.3A.1.1.3.4 Test Requirement

Tables 5.2A.3A.1.1.4-1, 5.2A.3A.1.1.4-2, 5.2A.3A.1.1.4-3, 5.2A.3A.1.1.4-4, 5.2A.3A.1.1.4-5, 5.2A.3A.1.1.4-6 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.3A.1.1.4-1, 5.2A.3A.1.1.4-2, 5.2A.3A.1.1.4-3, 5.2A.3A.1.1.4-4, 5.2A.3A.1.1.4-5, 5.2A.3A.1.1.4-6 for the specified SNR including test tolerances for the combination selected following the test rules outlined in 5.1.1.5.2-2.

Table 5.2A.3A.1.1.4-1: Test requirements for FDD 15 kHz SCS for CA configurations (2Rx CC)

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-9.1 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
10	R.PDSCH.1-2.2 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
15	R.PDSCH.1-9.2 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
20	R.PDSCH.1-9.3 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.8
25	R.PDSCH.1-9.4 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.0
30	R.PDSCH.1-9.5 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.8
40	R.PDSCH.1-10.1 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.0
50	R.PDSCH.1-10.2 FDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.4

Table 5.2A.3A.1.1.4-2: Test requirements for TDD 15 kHz SCS for CA configurations (2Rx CC)

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-2.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
10	R.PDSCH.1-2.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.8
15	R.PDSCH.1-2.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.8
20	R.PDSCH.1-2.4 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.9
25	R.PDSCH.1-2.5 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.0
30	R.PDSCH.1-3.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.9
40	R.PDSCH.1-3.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.2
50	R.PDSCH.1-3.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.5

Table 5.2A.3A.1.1.4-3: Test requirements for TDD 30 kHz SCS for CA configurations (2Rx CC)

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-13.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
10	R.PDSCH.2-13.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
15	R.PDSCH.2-13.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.6
20	R.PDSCH.2-13.4 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.7
25	R.PDSCH.2-13.5 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.7
30	R.PDSCH.2-14.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.7
40	R.PDSCH.2-2.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	14.9
50	R.PDSCH.2-14.2 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.1
60	R.PDSCH.2-14.3 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.0
80	R.PDSCH.2-14.4 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.5
90	R.PDSCH.2-14.5 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.3
100	R.PDSCH.2-15.1 TDD	16QAM, 0.48	TDLA30-10	2x2, ULA Low	70	15.7

Table 5.2A.3A.1.1.4-4: Test requirements for FDD 15 kHz SCS for CA configurations (4Rx CC)

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.1-9.1 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4 [
10	R.PDSCH.1-2.2 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
15	R.PDSCH.1-9.2 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
20	R.PDSCH.1-9.3 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
25	R.PDSCH.1-9.4 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.6
30	R.PDSCH.1-9.5 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
40	R.PDSCH.1-10.1 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.6
50	R.PDSCH.1-10.2 FDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.8

Table 5.2A.3A.1.1.4-5: Test requirements for TDD 15 kHz SCS for CA configurations (4Rx CC)

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)

5	R.PDSCH.1-2.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
10	R.PDSCH.1-2.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
15	R.PDSCH.1-2.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.6
20	R.PDSCH.1-2.4 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
25	R.PDSCH.1-2.5 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.7
30	R.PDSCH.1-3.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
40	R.PDSCH.1-3.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.7
50	R.PDSCH.1-3.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.9

Table 5.2A.3A.1.1.4-6: Test requirements for TDD 30 kHz SCS for CA configurations (4Rx CC)

Bandwidth (MHz)	Reference channel	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
					Fraction of maximum throughput (%)	SNR (dB)
5	R.PDSCH.2-13.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
10	R.PDSCH.2-13.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
15	R.PDSCH.2-13.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.4
20	R.PDSCH.2-13.4 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
25	R.PDSCH.2-13.5 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
30	R.PDSCH.2-14.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.5
40	R.PDSCH.2-2.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.6
50	R.PDSCH.2-14.2 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.8
60	R.PDSCH.2-14.3 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.7
80	R.PDSCH.2-14.4 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	10.0
90	R.PDSCH.2-14.5 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	9.9
100	R.PDSCH.2-15.1 TDD	16QAM, 0.48	TDLA30-10	2x4, ULA Low	70	10.2

5.2A.3A.1.2 2Rx-4Rx Normal PDSCH Demodulation Performance for CA (3DL CA)

5.2A.3A.1.2.1 Test Purpose

Same as 5.2A.3A.1.1.1

5.2A.3A.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 3DL CA and 4Rx antenna ports on some of the CC.

5.2A.3A.1.2.3 Test description

5.2A.3A.1.2.3.1 Initial conditions

Same as 5.2A.3A.1.1.3.1

5.2A.3A.1.2.3.2 Test procedure

Same as 5.2A.3A.1.1.3.2

5.2A.3A.1.1.3.3 Message contents

Same as 5.2A.3A.1.1.3.3

5.2A.3A.1.1.3.4 Test Requirement

Same as 5.2A.3A.1.1.4 evaluated per component carrier.

5.2A.3A.1.3 2Rx-4Rx Normal PDSCH Demodulation Performance for CA (4DL CA)

5.2A.3A.1.3.1 Test Purpose

Same as 5.2A.3A.1.1.1

5.2A.3A.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4DL CA and 4Rx antenna ports on some of the CC.

5.2A.3A.1.3.3 Test description

5.2A.3A.1.3.3.1 Initial conditions

Same as 5.2A.3A.1.1.3.1

5.2A.3A.1.3.3.2 Test procedure

Same as 5.2A.3A.1.1.3.2

5.2A.3A.1.3.3.3 Message contents

Same as 5.2A.3A.1.1.3.3

5.2A.3A.1.3.3.4 Test Requirement

Same as 5.2A.3A.1.1.4 evaluated per component carrier

5.3 PDCCH demodulation requirements

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

The parameters specified in Table 5.3-1 are valid for all PDCCH tests unless otherwise stated.

Table 5.3-1: Common test Parameters

Parameter		Unit	Value
Carrier configuration	Offset between Point A and the lowest usable subcarrier on this carrier (Note 1)		0
DL BWP configuration #1	Cyclic prefix		Normal
	RB offset	RBs	0
Common serving cell parameters	Physical Cell ID		0
	SSB position in burst		1
	SSB periodicity	ms	20
PDCCH configuration	Slots for PDCCH monitoring		Each slot
	Number of PDCCH candidates		1
	Frequency domain resource allocation for CORESET		Start from RB = 0 with contiguous RB allocation
	TCI state		TCI state #1
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS (k_0)		0
	First OFDM symbol in the PRB used for CSI-RS (l_0)		CSI-RS resource 1: 4 CSI-RS resource 2: 8 CSI-RS resource 3: 4 CSI-RS resource 4: 8
	Number of CSI-RS ports (X)		1
	CDM Type		No CDM
	Density (ρ)		3
	CSI-RS periodicity	Slots	15 kHz SCS: 20 30 kHz SCS: 40
	CSI-RS offset	Slots	15 kHz SCS: 10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4 30 kHz SCS: 20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
	Frequency Occupation		Start PRB 0 Number of PRB = BWP size
	QCL info		TCI state #0
TCI state #0	Type 1 QCL information	SSB index	SSB #0
		QCL Type	Type C
	Type 2 QCL information	SSB index	SSB #0
		QCL Type	Type D
TCI state #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration
		QCL Type	Type A
	Type 2 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration
		QCL Type	Type D

PDCCH & PDCCH DMRS Precoding configuration		Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i_1, i_2 combination with REG bundling granularity for number of Tx larger than 1
Physical signals, channels mapping and precoding		As specified in Annex B.4.1
Symbols for all unused REs		OP.1 FDD as defined in Annex A.5.1.1 OP.1 TDD as defined in Annex A.5.2.1
The number of slots between PDSCH and corresponding HARQ-ACK information		2 for FDD. For TDD, specific to each TDD UL-DL pattern and as defined in Annex A.1.2.
Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing.		

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.

5.3.1 1RX requirements

(Void)

5.3.2 2RX requirements

5.3.2.1 FDD

The parameters specified in Table 5.3.2.1-1 are valid for all FDD tests unless otherwise stated.

Table 5.3.2.1-1: Test Parameters

Parameter	Unit	1 Tx Antenna	2 Tx Antenna
CCE to REG mapping type		nonInterleaved	
REG bundle size		6	
Shift index		0	

5.3.2.1.1 2Rx FDD FR1 PDCCH 1 Tx antenna performance for both SA and NSA

5.3.2.1.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.1.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.3.2.1.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.1.1.3-1: Minimum performance for 1 Tx PDCCH with 15 kHz SCS

Test number	Bandwidth	CORESET RB	CORESET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10 MHz	24	2	2	R.PDCCH.1-2.1 FDD	TDLA30-10	1x2 Low	1	8.1
2	10 MHz	24	2	2	R.PDCCH.1-2.3 FDD	TDLC300-100	1x2 Low	1	8.2
3	10 MHz	48	2	4	R.PDCCH.1-2.4 FDD	TDLA30-10	1x2 Low	1	5.5
4	10 MHz	48	1	4	R.PDCCH.1-1.1 FDD	TDLA30-10	1x2 Low	1	4.4
5	10 MHz	48	2	16	R.PDCCH.1-2.6 FDD	TDLA30-10	1x2 Low	1	-2.1

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.

5.3.2.1.1.4 Test description

5.3.2.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A in Figure A.3.1.7.2 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1 and Table 5.3.2.1.1-1 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.1.4.3.

5.3.2.1.1.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.2.1.1.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.2.1-1, Table 5.3.2.1.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.1.1.3-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.1.1.4.4-1, pass the UE. Otherwise fail the UE.
4. Repeat steps from 1 to 3 for each subtest in Table 5.3.2.1.1-1 as appropriate.

5.3.2.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.1.1.4.3.1 Message exceptions for SA

Table 5.3.2.1.1.4.3.1-1: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 000000	CORESET to use the least significant 48 RBs of the BWP Test 3, 4, 5	
	11110000 00000000 00000000 00000000 00000000 000000	CORESET to use the least significant 24 RBs of the BWP Test 1, 2	
Duration	2	SearchSpace duration of 2 symbols Test 1, 2, 3, 5	
	1	SearchSpace duration of 1 symbol Test 4	
}			

Table 5.3.2.1.1.4.3.1-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n1	AL2	Test 1, Test 2
aggregationLevel4	n1	AL4	Test 3, Test 4
aggregationLevel8	n0		
aggregationLevel16	n1	AL16	Test 5
}			
searchSpaceType CHOICE {			
common SEQUENCE {			CSS, SISS
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-1-And-1-1	DCI Format 1_1 for tests 2 and 3	Long_DCI
	formats0-0-And-1-0	DCI Format 1_0 for tests 1, 4, 5	
}			
}			
}			

Table 5.3.2.1.1.4.3.1-3: Void

Table 5.3.2.1.1.4.3.1-3A: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType1		Test 1, Test 4, Test 5
}			

5.3.2.1.1.4.3.2 Message exceptions for NSA

Same as 5.3.2.1.1.4.3.1

5.3.2.1.1.4.4 Test requirement

Table 5.3.2.1.1.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.1.4.4-1.

Table 5.3.2.1.1.4.4-1: Test Requirement for 1Tx PDCCH with 15 kHz SCS

Test number	Bandwidth	CORESET RB	CORESET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10 MHz	24	2	2	R.PDCCH.1-2.1 FDD	TDLA30-10	1x2 Low	1	9.0
2	10 MHz	24	2	2	R.PDCCH.1-2.3 FDD	TDLC300-100	1x2 Low	1	9.1
3	10 MHz	48	2	4	R.PDCCH.1-2.4 FDD	TDLA30-10	1x2 Low	1	6.4
4	10 MHz	48	1	4	R.PDCCH.1-1.1 FDD	TDLA30-10	1x2 Low	1	5.3
5	10MHz	48	2	16	R.PDCCH.1-2.6 FDD	TDLA30-10	1x2 Low	1	-1.2

5.3.2.1.2 2Rx FDD FR1 PDCCH 2 Tx antenna performance for both SA and NSA

5.3.2.1.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.1.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.3.2.1.2.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.1.2.3-1: Minimum performance for 2 Tx PDCCH with 15 kHz SCS

Test number	Bandwidth	CORESET RB	CORESET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10 MHz	24	2	4	R.PDCCH. 1-2.2 FDD	TDLC300-100	2x2 Low	1	2.0
2	10 MHz	48	2	8	R.PDCCH. 1-2.5 FDD	TDLC300-100	2x2 Low	1	-1.3
3	10 MHz	48	1	8	R.PDCCH.1 -1.3 FDD	TDLA30-10	2x2 Low	1	-0.2

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.

5.3.2.1.2.4 Test description

5.3.2.1.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.1-1 and Table 5.3.2.1.2.3-1 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.1.2.4.3.

5.3.2.1.2.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.2.1.2.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.2.1-1, Table 5.3.2.1.2.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.1.2.3-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.1.2.4.4-1, pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 5.3.2.1.2.3-1 as appropriate.

5.3.2.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.1.2.4.3.1 Message exceptions for SA

Table 5.3.2.1.2.4.3.1-1: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE { frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 00000	CORESET to use the least significant 48 RBs of the BWP Test 2, 3	
	11110000 00000000 00000000 00000000 00000000 00000	CORESET to use the least significant 24 RBs of the BWP Test 1	
Duration	2	SearchSpace duration of 2 symbols Test 1, 2	
	1	SearchSpace duration of 1 symbol Test 3	
}			

Table 5.3.2.1.2.4.3.1-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE { nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n0		
aggregationLevel4	n1	AL4	Test 1
aggregationLevel8	n1	AL8	Test 2, 3
aggregationLevel16	n0		
}			
searchSpaceType CHOICE { common SEQUENCE {			CSS, SISS
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-1-And-1-1	DCI Format 1_1 for tests 2 and 3	Long_DCI
	formats0-0-And-1-0	DCI Format 1_0 for test 1	
}			
}			
}			

Table 5.3.2.1.2.4.3.1-3: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType1		Test 1
}			

5.3.2.1.2.4.3.2 Message exceptions for NSA

Same as 5.3.2.1.2.4.3.1

5.3.2.1.2.4.4 Test requirement

Table 5.3.2.1.2.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.2.4.4-1.

Table 5.3.2.1.2.4.4-1: Test Requirements for 2 Tx PDCCH with 15 kHz SCS

Test number	Bandwidth	CORESET RB	CORESET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10 MHz	24	2	4	R.PDCCH. 1-2.2 FDD	TDLC300-100	2x2 Low	1	3.0
2	10 MHz	48	2	8	R.PDCCH. 1-2.5 FDD	TDLC300-100	2x2 Low	1	-0.3
3	10 MHz	48	1	8	R.PDCCH.1 -1.3 FDD	TDLA30-10	2x2 Low	1	0.8

5.3.2.1.3 2Rx FDD FR1 PDCCH 1 Tx antenna performance for power saving

Editor's Note: This test case is incomplete in the following aspects:

- R.PDCCH.1-2.7 FDD is TBD in Annex G.1.5 for minimum test time.

5.3.2.1.3.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.1.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.1.3.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Long DRX and DRX adaptation

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Long DRX and DRX adaptation.

5.3.2.1.3.3 Minimum conformance requirements

The parameters specified in Table 5.3.2.1.3.3-1 are valid for FDD test unless otherwise stated.

Table 5.3.2.1.3.3-1: Test Parameters

Parameter		Unit	1 Tx Antenna
CCE to REG mapping type			nonInterleaved
REG bundle size			6
Shift Index			0
DRX cycle		ms	10
ps-WakeUp-r16			absent
Wake-up indication bit in DCI format 2_6			1
PDCCH DCI format 2_6 configuration	PS-offset		$(T_{\text{minimumTimeGap}} + 1)/2^{\mu}/0.125$
	Number of PDCCH candidates		1
	Frequency domain resource allocation for CORESET		Start from RB = 0 with contiguous RB allocation
	TCI state		TCI state #1
PDCCH configuration	Slots for PDCCH monitoring		Each slot during DRX-on period
Note: $T_{\text{minimumTimeGap}}$ is signalled as a part of <i>drx-Adaptation-r16</i> UE capability.			

For the parameters specified in Table 5.3.2.1.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.1.3.3-2: Minimum performance for PDCCH with 15 kHz SCS

Test number	Bandwidth (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10	48	2	4	R.PDCCH. 1-2.4 FDD	TDLA30-10	1x2 Low	1	5.5
			2	8	R.PDCCH. 1-2.7 FDD				

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.2.1.3.

5.3.2.1.3.4 Test description

5.3.2.1.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.1-1, Table 5.3.2.1.3.3-1 and Table 5.3.2.1.3.3-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.1.3.4.3.

5.3.2.1.3.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.2.1.3.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.2.1-1, Table 5.3.2.1.3.3-1 and Table 5.3.2.1.3.3-2 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC. During the test the UE shall monitor the DCI format 2_6 PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.1.3.3-2 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.1.3.4.4-1, pass the UE. Otherwise fail the UE.
4. Repeat steps from 1 to 3 for each subtest in Table 5.3.2.1.3.3-2 as appropriate.

5.3.2.1.3.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.1.3.4.3.1 Message exceptions for SA

Table 5.3.2.1.3.4.3.1-1: DRX-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-56			
Information Element	Value/remark	Comment	Condition
DRX-Config ::= SEQUENCE {			
drx-onDurationTimer CHOICE {			
milliseconds	ms1		
}			
drx-InactivityTimer	ms1		
drx-HARQ-RTT-TimerDL	0		
drx-HARQ-RTT-TimerUL	0		
drx-RetransmissionTimerDL	sl1		
drx-RetransmissionTimerUL	sl1		
drx-LongCycleStartOffset CHOICE {			
ms10	0		
}			
}			

Table 5.3.2.1.3.4.3.1-2: DCP-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-106			
Information Element	Value/remark	Comment	Condition
dcp-Config-r16 CHOICE {			
setup SEQUENCE {			
ps-Offset-r16	40		
sizeDCI-2-6-r16	2		
ps-PositionDCI-2-6-r16	0		
}			
}			

Table 5.3.2.1.3.4.3.1-3: PDCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-95			
Information Element	Value/remark	Comment	Condition
PDCCH-Config ::= SEQUENCE {			
controlResourceSetToAddModList	2 entry		
SEQUENCE(SIZE (1..3)) OF			
ControlResourceSet ::= SEQUENCE {			
ControlResourceSet[1]	ControlResourceSet1		
ControlResourceSet[2]	ControlResourceSet2		
}			
searchSpacesToAddModList	1 entry		
SEQUENCE(SIZE (1..10)) OF SearchSpace ::=			
SEQUENCE {			
SearchSpace[1]	SearchSpace		
}			
searchSpacesToAddModListExt-r16	1 entry		
SEQUENCE(SIZE (1..10)) OF SearchSpace {			
searchSpaceExt-r16[1]	SearchSpaceExt		
}			
}			

Table 5.3.2.1.3.4.3.1-4: PDCCH-ControlResourceSet1

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	1		
frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 00000	CORESET to use the least significant 48 RBs of the BWP	
Duration	2	SearchSpace duration of 2 symbol	
cce-REG-MappingType CHOICE {			
nonInterleaved SEQUENCE			
}			
}			

Table 5.3.2.1.3.4.3.1-5: PDCCH-ControlResourceSet2

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	2		
frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 00000	CORESET to use the least significant 48 RBs of the BWP	
Duration	2	SearchSpace duration of 2 symbol	
cce-REG-MappingType CHOICE {			
nonInterleaved SEQUENCE			
}			
tci-StatesPDCCH-ToAddList {	1	TCI State #1	
}			
}			

Table 5.3.2.1.3.4.3.1-6: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
searchSpaceId	2	SearchSpaceId with condition USS	
controlResourceSetId	1	ControlResourceSetId	
monitoringSlotPeriodicityAndOffset CHOICE {			
s1	NULL		
}			
nrofCandidates SEQUENCE {			
aggregationLevel4	n1	AL4	
}			
}			

Table 5.3.2.1.3.4.3.1-7: PDCCH Search Space Ext

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a			
Information Element	Value/remark	Comment	Condition
SearchSpaceExt-r16 ::= SEQUENCE {			
controlResourceSetId-r16	2		
searchSpaceType-r16 SEQUENCE {			
common SEQUENCE {			
dci-Format2-6-r16 SEQUENCE {	NULL		
}			
}			
}			

Table 5.3.2.1.3.4.3.1-8: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
TCI-State[1]	TCI-StateId 0		
qcl-type1 {		Type 1 QCL information	
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	Ssb : 0	SSB # 0	
Qcl-Type	Type C		
}			
qcl-type2 {		Type 2 QCL information	
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	Ssb : 0	SSB # 0	
Qcl-Type	Type D		
}			
TCI-State[2]	TCI-StateId 1	Type 1 QCL information	
qcl-type1 {			
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	csi-rs : 0	CSI-RS # 0	
Qcl-Type	Type A		
}			
qcl-type2 {		Type 2 QCL information	
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	csi-rs : 0	SSB # 0	
Qcl-Type	Type D		
}			
}			
}			
}			

5.3.2.1.3.4.3.2 Message exceptions for NSA

Same as 5.3.2.1.3.4.3.1

5.3.2.1.3.4.4 Test requirement

Table 5.3.2.1.3.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.3.4.4-1.

Table 5.3.2.1.3.4.4-1: Test Requirements for PDCCH with 15 kHz SCS

Test number	Bandwidth (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10	48	2	4	R.PDCCH. 1-2.4 FDD	TDLA30-10	1x2 Low	1	6.4
			2	8	R.PDCCH. 1-2.7 FDD				

5.3.2.2 TDD

The parameters specified in Table 5.3.2.2-1 are valid for all TDD tests unless otherwise stated.

Table 5.3.2.2-1: Test Parameters

Parameter	Unit	1 Tx Antenna	2 Tx Antenna
TDD UL-DL pattern		FR1,30-1	
CCE to REG mapping type		Test 3: non-interleaved Other tests: interleaved	interleaved
Interleaver size		3	
REG bundle size		Test 3: 6 Other tests: 2	6
Shift Index		0	

5.3.2.2.1 2Rx TDD FR1 PDCCH 1 Tx antenna performance for both SA and NSA

5.3.2.2.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.2.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.3.2.2.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.2.1.3-1: Minimum performance for PDCCH with 30 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	102	1	2	R.PDCCH. 2-1.1 TDD	TDLA30-10	1x2 Low	1	7.0
2	40	102	1	4	R.PDCCH. 2-1.2 TDD	TDLC300-100	1x2 Low	1	3.0
3	40	48	2	16	R.PDCCH. 2-2.1 TDD	TDLC300-100	1x2 Low	1	-3.8

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.2.2.

5.3.2.2.1.4 Test description

5.3.2.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.1.3-1 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.2.1.4.3.

5.3.2.2.1.4.2 Test procedure

1. SS transmits PDSCH via PDCCH with DCI format as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.2.2.1.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.2.1.3-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.2.1.5-1, pass the UE. Otherwise fail the UE.
4. Repeat steps from 1 to 3 for each subtest in Table 5.3.2.2.1.3-1 as appropriate.

5.3.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.3.2.2.1.4.3.1 Message exceptions for SA

Table 5.3.2.2.1.4.3.1-1: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE { frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 000000	CORESET to use the least significant 48 RBs of the BWP Test 3	
	11111111 11111111 10000000 00000000 00000000 000000	CORESET to use the least significant 102 RBs of the BWP Test 1, 2	

Duration	2	SearchSpace duration of 2 symbols Test 3	
	1	SearchSpace duration of 1 symbol Test 1, 2	
cce-REG-MappingType CHOICE { Interleaved SEQUENCE {	Null		Test 1, Test 2
reg-BundleSize	n2		1 Tx
interleaverSize	n3		TDD
}			
nonInterleaved	null		Test 3
}			
}			

Table 5.3.2.2.1.4.3.1-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel2	n1	AL2	Test 1
aggregationLevel4	n1	AL4	Test 2
aggregationLevel16	n1	AL16	Test 3
}			
searchSpaceType CHOICE {			
common SEQUENCE {			CSS, SISS
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-1-And-1-1	DCI Format 1_1 for test 2	Long_DCI
	formats0-0-And-1-0	DCI Format 1_0 for tests 1 and 3	
}			
}			
}			

Table 5.3.2.2.1.4.3.1-3: Void

Table 5.3.2.2.1.4.3.1-3A: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType1		Test 1, Test 3
}			

5.3.2.2.1.4.3.2 Message exceptions for NSA

Same as 5.3.2.2.1.4.3.1.

5.3.2.2.1.5 Test requirement

Table 5.3.2.2.1.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.1.5-1.

Table 5.3.2.2.1.5-1: Test Requirement for 1Tx PDCCH with 30 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	102	1	2	R.PDCCH. 2-1.1 TDD	TDLA30-10	1x2 Low	1	7.9
2	40	102	1	4	R.PDCCH. 2-1.2 TDD	TDLC300-100	1x2 Low	1	3.9
3	40	48	2	16	R.PDCCH. 2-2.1 TDD	TDLC300-100	1x2 Low	1	-2.9

5.3.2.2.2 2Rx TDD FR1 PDCCH 2 Tx antenna performance for both SA and NSA

5.3.2.2.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.2.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.2.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.3.2.2.2.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.2.2.3-1: Minimum performance for PDCCH with 30 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	90	1	8	R.PDCCH. 2-1.3 TDD	TDLC300-100	2x2 Low	1	-1.2

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.2.2.

5.3.2.2.2.4 Test description

5.3.2.2.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.2.3-1 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer MCG and SCG, *Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.2.2.4.3.

5.3.2.2.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH with DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.3.2.2.2.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.2.3-1 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.2.2.3-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.2.2.5-1, pass the UE. Otherwise fail the UE.

5.3.2.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.2.2.4.3.1 Message exceptions for SA

Table 5.3.2.2.2.4.3.1-1: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
frequencyDomainResources	11111111 11111110 00000000 00000000 00000000 000000	CORESET to use the least significant 90 RBs of the BWP Test 1	
Duration	1	SearchSpace duration of 1 symbols Test 1	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {	Null		
reg-BundleSize	n6		2 Tx
interleaverSize	n3		TDD
}			
}			

}			
---	--	--	--

Table 5.3.2.2.4.3.1-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel8	n1	AL8	Test 1
}			
}			

Table 5.3.2.2.4.3.1-3: Void

5.3.2.2.4.3.2 Message exceptions for NSA

Same as 5.3.2.2.4.3.1.

5.3.2.2.2.5 Test requirement

Table 5.3.2.2.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.5-1.

Table 5.3.2.2.5-1: Test Requirement for 2Tx PDCCH with 30 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	90	1	8	R.PDCCH. 2-1.3 TDD	TDLC300-100	2x2 Low	1	-0.2

5.3.2.2.3 2Rx TDD FR1 PDCCH 1 Tx antenna performance for power saving

Editor's Note: This test case is incomplete in the following aspects:

- R.PDCCH.2-1.4 TDD is TBD in Annex G.1.5 for minimum test time.

5.3.2.2.3.1 Test Purpose

This test verifies the demodulation performance of *DCI format 2_6* PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.2.3.3-2 after receipt wake-up indication in the *DCI format 2_6* PDCCH in DRX off state. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.2.3.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Long DRX Cycle and DRX adaptation.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Long DRX Cycle and DRX adaptation.

5.3.2.2.3.3 Minimum conformance requirements

During the test the UE shall monitor the *DCI format 2_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

The parameters specified in Table 5.3.2.2.3.3-1 are valid for all TDD tests for power saving unless otherwise stated.

Table 5.3.2.2.3.3-1: Test Parameters

Parameter		Unit	1 Tx Antenna
TDD UL-DL pattern			FR1.30-1
CCE to REG mapping type			interleaved
Interleaver size			3
REG bundle size			2
Shift Index			0
DRX cycle		ms	10
ps-WakeUp-r16			absent
Wake-up indication bit in DCI format 2_6			1
PDCCH DCI format 2_6 configuration	PS-offset		$(T_{\text{minimumTimeGap}}+1)/2^{\mu}/0.125$
	Number of PDCCH candidates		1
	Frequency domain resource allocation for CORESET		Start from RB = 0 with contiguous RB allocation
	TCI state		TCI state #1
PDCCH configuration	Slots for PDCCH monitoring		Each slot during DRX-on period
Note: $T_{\text{minimumTimeGap}}$ is signalled as a part of <i>drx-Adaptation-r16</i> UE capability.			

For the parameters specified in Table 5.3.2.2.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.2.2.3.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.2.3.3-2: Minimum performance with 30 kHz SCS

Test number	Bandwidth (MHz)	CORE SET RB	CORESET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	102	1	4	R.PDCCH. 2-1.2 TDD	TDLC300-100	1x2 Low	1	3.0
				8	R.PDCCH. 2-1.4 TDD				

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.2.2.

5.3.2.2.3.4 Test description

5.3.2.2.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of DRX, DCP, PDSCH and PDCCH before measurement are specified in 5.3.2.2.3.4.3.1 and Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.3.3-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.2.3.4.3.

5.3.2.2.3.4.2 Test procedure

1. SS transmits PDCCH with DCI format2_6 as specified in PDCCH Reference Channel for C_RNTI within DRX off state. The Wake-up indication bit in PDCCH is set to 1.
2. SS transmits PDSCH via PDCCH with DCI format1_1 as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.2.2.3.3-2 in DRX on period. The details of PDCCH are specified in Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.3.3-2 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.
3. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.2.3.3-2 as appropriate.
4. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.2.3.5-1, pass the UE. Otherwise fail the UE.
5. Repeat steps from 2 to 4 for each subtest in Table 5.3.2.2.3.3-1 as appropriate.

5.3.2.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.3.2.2.3.4.3.1 Message exceptions for SA

Table 5.3.2.2.3.4.3.1-1: DRX-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-56			
Information Element	Value/remark	Comment	Condition
DRX-Config ::= SEQUENCE {			
drx-onDurationTimer CHOICE {			
milliseconds	ms1		
}			
drx-InactivityTimer	ms1		
drx-HARQ-RTT-TimerDL	0		
drx-HARQ-RTT-TimerUL	0		
drx-RetransmissionTimerDL	sl1		
drx-RetransmissionTimerUL	sl1		
drx-LongCycleStartOffset CHOICE {			
ms10	0		
}			
}			

Table 5.3.2.2.3.4.3.1-2: DCP-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-106			
Information Element	Value/remark	Comment	Condition
dcp-Config-r16 CHOICE {			
setup SEQUENCE {			
ps-Offset-r16	40		
sizeDCI-2-6-r16	2		
ps-PositionDCI-2-6-r16	0		
}			
}			

Table 5.3.2.2.3.4.3.1-3: PDCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-95			
Information Element	Value/remark	Comment	Condition
PDCCH-Config ::= SEQUENCE {			
controlResourceSetToAddModList	2 entry		
SEQUENCE(SIZE (1..3)) OF			
ControlResourceSet ::= SEQUENCE {			
ControlResourceSet[1]	ControlResourceSet1		
ControlResourceSet[2]	ControlResourceSet2		
}			
searchSpacesToAddModList	1 entry		
SEQUENCE(SIZE (1..10)) OF SearchSpace ::=			
SEQUENCE {			
SearchSpace[1]	SearchSpace		
}			
searchSpacesToAddModListExt-r16	1 entry		
SEQUENCE(SIZE (1..10)) OF SearchSpace {			
searchSpaceExt-r16[1]	SearchSpaceExt		
}			
}			

Table 5.3.2.2.3.4.3.1-4: PDCCH-ControlResourceSet1

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	1		
frequencyDomainResources	11111111 11111111 10000000 00000000 00000000 00000	CORESET to use the least significant 102 RBs of the BWP	
Duration	1	SearchSpace duration of 1 symbol	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {			
reg-BundleSize	n2		1 Tx
interleaverSize	n3		TDD
}			
}			
}			

Table 5.3.2.2.3.4.3.1-5: PDCCH-ControlResourceSet2

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	2		
frequencyDomainResources	11111111 11111111 10000000 00000000 00000000 00000	CORESET to use the least significant 102 RBs of the BWP	
Duration	1	SearchSpace duration of 1 symbol	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {			
reg-BundleSize	n2		1 Tx
interleaverSize	n3		TDD
}			
}			
tci-StatesPDCCH-ToAddList {	1	TCI State #1	
}			
}			

Table 5.3.2.2.3.4.3.1-6: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
searchSpaceId	2	SearchSpaceId with condition USS	USS
controlResourceSetId	1	ControlResourceSetId	
monitoringSlotPeriodicityAndOffset CHOICE {			
sl1	NULL		
}			
nrofCandidates SEQUENCE {			
aggregationLevel4	n1	AL4	
}			
}			

Table 5.3.2.2.3.4.3.1-7: PDCCH Search Space Ext

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a			
Information Element	Value/remark	Comment	Condition
SearchSpaceExt-r16 ::= SEQUENCE {			
controlResourceSetId-r16	2		
searchSpaceType-r16 SEQUENCE {			
common SEQUENCE {			
dci-Format2-6-r16 SEQUENCE {	NULL		
}			
}			
}			

Table 5.3.2.2.3.4.3.1-8: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
TCI-State[1]	TCI-StateId 0		
qcl-type1 {		Type 1 QCL information	
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	Ssb : 0	SSB # 0	
Qcl-Type	Type C		
}			
qcl-type2 {		Type 2 QCL information	
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	Ssb : 0	SSB # 0	
Qcl-Type	Type D		
}			
TCI-State[2]	TCI-StateId 1	Type 1 QCL information	
qcl-type1 {			
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	csi-rs : 0	CSI-RS # 0	
Qcl-Type	Type A		
}			
qcl-type2 {		Type 2 QCL information	
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	csi-rs : 0	SSB # 0	
Qcl-Type	Type D		
}			
}			
}			

5.3.2.2.3.4.3.2 Message exceptions for NSA

Same as 5.3.2.2.3.4.3.1.

5.3.2.2.3.5 Test requirement

Table 5.3.2.2.3.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.3.5-1.

Table 5.3.2.2.3.5-1: Minimum performance with 30 kHz SCS

Test number	Bandwidth (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	102	1	4	R.PDCCH. 2-1.2 TDD	TDLC300-100	1x2 Low	1	3.9
				8	R.PDCCH. 2-1.4 TDD				

5.3.3 4RX requirements

5.3.3.1 FDD

The parameters specified in Table 5.3.3.1-1 are valid for all FDD tests unless otherwise stated.

Table 5.3.3.1-1: Test Parameters

Parameter	Unit	1 Tx Antenna	2 Tx Antenna
CCE to REG mapping type		nonInterleaved	
REG bundle size		6	
Shift index		0	

5.3.3.1.1 4Rx FDD FR1 PDCCH 1 Tx antenna performance for both SA and NSA

5.3.3.1.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.1.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.3.3.1.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.3.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.1.1.3-1: Minimum performance for PDCCH with 15 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10	24	2	2	R.PDCCH. 1-2.1 FDD	TDLA30-10	1x4 Low	1	2.2
2	10	24	2	2	R.PDCCH. 1-2.3 FDD	TDLC300-100	1x4 Low	1	2.7
3	10	48	2	4	R.PDCCH. 1-2.4 FDD	TDLA30-10	1x4 Low	1	0.2
4	10	48	1	4	R.PDCCH. 1-1.1 FDD	TDLA30-10	1x4 Low	1	-0.4
5	10	48	2	16	R.PDCCH. 1-2.6 FDD	TDLA30-10	1x4 Medium A	1	-3.2

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.1.

5.3.3.1.1.4 Test description

5.3.3.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.1-1 and Table 5.3.3.1.1.3-1 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.1.1.4.3.

5.3.3.1.1.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.3.1.1.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.1-1 and Table 5.3.3.1.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.1.1.3-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.1.1.5-1, pass the UE. Otherwise fail the UE.
4. Repeat steps from 1 to 3 for each subtest in Table 5.3.3.1.1.3-1 as appropriate.

5.3.3.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.1.1.4.3.1 Message exceptions for SA

Table 5.3.3.1.1.4.3.1-1: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE { frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 000000	CORESET to use the least significant 48 RBs of the BWP Test 3, 4, 5	
	11110000 00000000 00000000 00000000 00000000 000000	CORESET to use the least significant 24 RBs of the BWP Test 1, 2	

Duration	2	SearchSpace duration of 2 symbols Test 1, 2, 3, 5	
	1	SearchSpace duration of 1 symbol Test 4	
}			

Table 5.3.3.1.1.4.3.1-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel2	n1	AL2	Test 1, Test 2
aggregationLevel4	n1	AL4	Test 3, Test 4
aggregationLevel16	n1	AL16	Test 5
}			
searchSpaceType CHOICE {			
common SEQUENCE {			CSS, SISS
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-1-And-1-1	DCI Format 1_1 for tests 2 and 3	Long_DCI
	formats0-0-And-1-0	DCI Format 1_0 for tests 1, 4, 5	
}			
}			
}			

Table 5.3.3.1.1.4.3.1-3: Void

Table 5.3.3.1.1.4.3.1-3A: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType1		Test 1, Test 4, Test 5
}			

5.3.3.1.1.4.3.2 Message exceptions for NSA

Same as 5.3.3.1.1.4.3.1.

5.3.3.1.1.5 Test requirement

Table 5.3.3.1.1.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.1.5-1.

Table 5.3.3.1.1.5-1: Test Requirement for 1Tx PDCCH with 15 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10	24	2	2	R.PDCCH. 1-2.1 FDD	TDLA30-10	1x4 Low	1	3.1
2	10	24	2	2	R.PDCCH. 1-2.3 FDD	TDLC300-100	1x4 Low	1	3.6
3	10	48	2	4	R.PDCCH. 1-2.4 FDD	TDLA30-10	1x4 Low	1	1.1
4	10	48	1	4	R.PDCCH. 1-1.1 FDD	TDLA30-10	1x4 Low	1	0.5
5	10	48	2	16	R.PDCCH. 1-2.6 FDD	TDLA30-10	1x4 Medium A	1	-2.3

5.3.3.1.2 4Rx FDD FR1 PDCCH 2 Tx antenna performance for both SA and NSA

5.3.3.1.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.1.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.3.3.1.2.3 Minimum conformance requirements

For the parameters specified in Table 5.3.3.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.1.2.3-1: Minimum performance for PDCCH with 15 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10	24	2	4	R.PDCCH. 1-2.2 FDD	TDLC300-100	2x4 Low	1	-1.9
2	10	48	2	8	R.PDCCH. 1-2.5 FDD	TDLC300-100	2x4 Low	1	-4.5
3	10	48	1	4	R.PDCCH. 1-1.2 FDD	TDLA30-10	2x4 Low	1	-1.0

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.1.

5.3.3.1.2.4 Test description

5.3.3.1.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.1-1 and Table 5.3.3.1.2.3-1 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On*) for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.1.2.4.3.

5.3.3.1.2.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.3.1.2.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.1-1 and Table 5.3.3.1.2.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.1.2.3-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.1.2.5-1, pass the UE. Otherwise fail the UE.
4. Repeat steps from 1 to 3 for each subtest in Table 5.3.3.1.2.3-1 as appropriate.

5.3.3.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.1.2.4.3.1 Message exceptions for SA

Table 5.3.3.1.2.4.3.1-1: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 000000	CORESET to use the least significant 48 RBs of the BWP Test 2, 3	
	11110000 00000000 00000000 00000000 00000000 000000	CORESET to use the least significant 24 RBs of the BWP Test 1	

Duration	2	SearchSpace duration of 2 symbols Test 1, 2	
	1	SearchSpace duration of 1 symbol Test3	
}			

Table 5.3.3.1.2.4.3.1-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel4	n1	AL4	Test 1, Test 3
aggregationLevel8	n1	AL8	Test 2
}			
}			
searchSpaceType CHOICE {			
common SEQUENCE {			CSS, SISS
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-1-And-1-1	DCI Format 1_1 for tests 2 and 3	Long_DCI
	formats0-0-And-1-0	DCI Format 1_0 for test 1	
}			
}			
}			

Table 5.3.3.1.2.4.3.1-3: Void

Table 5.3.3.1.2.4.3.1-3A: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType1		Test 1
}			

5.3.3.1.2.4.3.2 Message exceptions for NSA

Same as 5.3.3.1.2.4.3.1.

5.3.3.1.2.5 Test requirement

Table 5.3.3.1.2.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.2.5-1.

Table 5.3.3.1.2.5-1: Test Requirement for 2Tx PDCCH with 15 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)

1	10	24	2	4	R.PDCCH. 1-2.2 FDD	TDLC300- 100	2x4 Low	1	-0.9
2	10	48	2	8	R.PDCCH. 1-2.5 FDD	TDLC300- 100	2x4 Low	1	-3.5
3	10	48	1	4	R.PDCCH. 1-1.2 FDD	TDLA30-10	2x4 Low	1	0

5.3.3.1.3 4Rx FDD FR1 PDCCH 1 Tx antenna performance for power saving

Editor's Note: This test case is incomplete in the following aspects:

- R.PDCCH.1-2.7 FDD is TBD in Annex G.1.5 for minimum test time.

5.3.3.1.3.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.1.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.1.3.2 Test applicability

This test applies to all types of NR UE release 16 and forward that supporting 4 Rx antenna ports and DRX adaptation.

This test also applies to all types of EUTRA UE release 16 and forward that supporting EN-DC, 4 Rx antenna ports, Long DRX and DRX adaptation.

5.3.3.1.3.3 Minimum conformance requirements

The parameters specified in Table 5.3.3.1.3.3-1 are valid for FDD test unless otherwise stated.

Table 5.3.3.1.3.3-1: Test Parameters

Parameter		Unit	1 Tx Antenna
CCE to REG mapping type			nonInterleaved
REG bundle size			6
Shift Index			0
DRX cycle		ms	10
ps-WakeUp-r16			absent
Wake-up indication bit in DCI format 2_6			1
PDCCH DCI format 2_6 configuration	PS-offset		$(T_{\text{minimumTimeGap}} + 1)/2^{\mu}/0.125$
	Number of PDCCH candidates		1
	Frequency domain resource allocation for CORESET		Start from RB = 0 with contiguous RB allocation
	TCI state		TCI state #1
Slots for PDCCH monitoring			Each slot during DRX-on period
Note: $T_{\text{minimumTimeGap}}$ is signalled as a part of <i>drx-Adaptation-r16</i> UE capability.			

For the parameters specified in Table 5.3.3.1.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.1.3.3-2: Minimum performance for PDCCH with 15 kHz SCS

Test number	Bandwidth (MHz)	CORESET RB	CORESET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)

1	10	48	2	4	R.PDCCH. 1-2.4 FDD	TDLA30-10	1x4 Low	1	0.2
			2	8	R.PDCCH. 1-2.7 FDD				

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.3.1.3.

5.3.3.1.3.4 Test description

5.3.3.1.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.1-1, Table 5.3.3.1.3.3-1 and Table 5.3.3.1.3.3-2 and as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG*, *Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.1.3.4.3.

5.3.3.1.3.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.3.1.3.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.3.1-1, Table 5.3.3.1.3.3-1 and Table 5.3.3.1.3.3-2 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC. During the test the UE shall monitor the DCI format 2_6 PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.1.3.3-2 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.1.3.4.4-1, pass the UE. Otherwise fail the UE.
4. Repeat steps from 1 to 3 for each subtest in Table 5.3.3.1.3.3-2 as appropriate.

5.3.3.1.3.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.1.3.4.3.1 Message exceptions for SA

Table 5.3.3.1.3.4.3.1-1: DRX-Config

Derivation Path: TS 38.508-1 [4], Table 4.6.3-56			
Information Element	Value/remark	Comment	Condition
DRX-Config ::= SEQUENCE {			
drx-onDurationTimer CHOICE {			
milliseconds	ms1		
}			
drx-InactivityTimer	ms1		
drx-HARQ-RTT-TimerDL	0		
drx-HARQ-RTT-TimerUL	0		
drx-RetransmissionTimerDL	sl1		
drx-RetransmissionTimerUL	sl1		
drx-LongCycleStartOffset CHOICE {			
ms10	0		
}			
}			

Table 5.3.3.1.3.4.3.1-2: DCP-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-106			
Information Element	Value/remark	Comment	Condition
dcp-Config-r16 CHOICE {			
setup SEQUENCE {			
ps-Offset-r16	40		
sizeDCI-2-6-r16	2		
ps-PositionDCI-2-6-r16	0		
}			
}			

Table 5.3.3.1.3.4.3.1-3: PDCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-95			
Information Element	Value/remark	Comment	Condition
PDCCH-Config ::= SEQUENCE {			
controlResourceSetToAddModList	2 entry		
SEQUENCE(SIZE (1..3)) OF			
ControlResourceSet ::= SEQUENCE {			
ControlResourceSet[1]	ControlResourceSet1		
ControlResourceSet[2]	ControlResourceSet2		
}			
searchSpacesToAddModList	1 entry		
SEQUENCE(SIZE (1..10)) OF SearchSpace ::=			
SEQUENCE {			
SearchSpace[1]	SearchSpace		
}			
searchSpacesToAddModListExt-r16	1 entry		
SEQUENCE(SIZE (1..10)) OF SearchSpace {			
searchSpaceExt-r16[1]	SearchSpaceExt		
}			
}			

Table 5.3.2.1.3.4.3.1-4: PDCCH-ControlResourceSet1

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	1		
frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 00000	CORESET to use the least significant 48 RBs of the BWP	
Duration	2	SearchSpace duration of 2 symbol	
cce-REG-MappingType CHOICE {			
nonInterleaved SEQUENCE			
}			
}			

Table 5.3.2.1.3.4.3.1-5: PDCCH-ControlResourceSet2

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	2		
frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 00000	CORESET to use the least significant 48 RBs of the BWP	
Duration	2	SearchSpace duration of 2 symbol	
cce-REG-MappingType CHOICE {			
nonInterleaved SEQUENCE			
}			
tci-StatesPDCCH-ToAddList {	1	TCI State #1	
}			
}			

Table 5.3.3.1.3.4.3.1-6: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
searchSpaceId	2	SearchSpaceId with condition USS	
controlResourceSetId	1	ControlResourceSetId	
monitoringSlotPeriodicityAndOffset CHOICE {			
sl1	NULL		
}			
nrofCandidates SEQUENCE {			
aggregationLevel4	n1	AL4	
}			
searchSpaceType CHOICE {			
common SEQUENCE {			
ue-Specific SEQUENCE {			
dci-Formats	formats0-1-And-1-1	DCI Format 1_1	
}			
}			
}			
}			

Table 5.3.3.1.3.4.3.1-7: PDCCH Search Space Ext

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a			
Information Element	Value/remark	Comment	Condition
SearchSpaceExt-r16 ::= SEQUENCE {			
controlResourceSetId-r16	2		
searchSpaceType-r16 SEQUENCE {			
common SEQUENCE {			
dci-Format2-6-r16 SEQUENCE {	NULL		
}			
}			
}			

5.3.3.2 TDD

The parameters specified in Table 5.3.3.2-1 are valid for all TDD tests unless otherwise stated.

Table 5.3.3.2-1: Common Test Parameters

Parameter	Unit	1 Tx Antenna	2 Tx Antenna
TDD UL-DL pattern		FR1,30-1	
CCE to REG mapping type		Test 3: Non-interleaved Other tests: interleaved	interleaved
Interleaver size		3	
REG bundle size		Test 3: 6 Other tests: 2	6
Shift Index		0	

5.3.3.2.1 4Rx TDD FR1 PDCCH 1 Tx antenna performance for both SA and NSA

5.3.3.2.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.2.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.3.3.2.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.3.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.2.1.3-1: Minimum performance for PDCCH with 30 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	102	1	2	R.PDCCH. 2-1.1 TDD	TDLA30-10	1x4 Low	1	2.1
2	40	102	1	4	R.PDCCH. 2-1.2 TDD	TDLC300-100	1x4 Low	1	-0.9
3	40	48	2	16	R.PDCCH. 2-2.1 TDD	TDLA30-10	1x4 Medium A	1	-3.6

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.2.

5.3.3.2.1.4 Test description

5.3.3.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.1.3-1 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On*) for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.2.1.4.3.

5.3.3.2.1.4.2 Test procedure

1. SS transmits PDSCH via PDCCH with DCI format as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.3.2.1.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.2.1.3-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.2.1.5-1, pass the UE. Otherwise fail the UE.
4. Repeat steps from 1 to 3 for each subtest in Table 5.3.3.2.1.3-1 as appropriate.

5.3.3.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.2.1.4.3.1 Message exceptions for SA

Table 5.3.3.2.1.4.3.1-1: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
frequencyDomainResources	11111111 00000000 00000000 00000000 00000000 000000	CORESET to use the least significant 48 RBs of the BWP Test 3	
	11111111 11111111 10000000 00000000 00000000 000000	CORESET to use the least significant 102 RBs of the BWP Test 1, 2	
Duration	2	SearchSpace duration of 2 symbols Test 3	
	1	SearchSpace duration of 1 symbol Test 1, 2	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {	Null		Test 1, Test 2
reg-BundleSize	n2		1 Tx
interleaverSize	n3		TDD
}			
nonInterleaved	null		Test 3
}			
}			

Table 5.3.3.2.1.4.3.1-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel2	n1	AL2	Test 1
aggregationLevel4	n1	AL4	Test 2
aggregationLevel16	n1	AL16	Test 3
}			
searchSpaceType CHOICE {			
common SEQUENCE {			CSS, SISS
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-1-And-1-1	DCI Format 1_1 for test 2	Long_DCI
	formats0-0-And-1-0	DCI Format 1_0 for test 1 and 3	
}			
}			
}			

Table 5.3.3.2.1.4.3.1-3: Void

Table 5.3.3.2.1.4.3.1-3A: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType1		Test 1, Test 3
}			

5.3.3.2.1.4.3.2 Message exceptions for NSA

Same as 5.3.3.2.1.4.3.1.

5.3.3.2.1.5 Test requirement

Table 5.3.3.2.1.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.1.5-1.

Table 5.3.3.2.1.5-1: Test Requirement for 1Tx PDCCH with 30 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	102	1	2	R.PDCCH. 2-1.1 TDD	TDLA30-10	1x4 Low	1	3
2	40	102	1	4	R.PDCCH. 2-1.2 TDD	TDLC300-100	1x4 Low	1	0
3	40	48	2	16	R.PDCCH. 2-2.1 TDD	TDLA30-10	1x4 Medium A	1	-2.7

5.3.3.2.2 4Rx TDD FR1 PDCCH 2 Tx antenna performance for both SA and NSA

5.3.3.2.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.2.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.2.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.3.3.2.2.3 Minimum conformance requirements

For the parameters specified in Table 5.3.3.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.2.2.3-1: Minimum performance for PDCCH with 30 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	90	1	8	R.PDCCH. 2-1.3	TDLC300-100	2x4 Low	1	-4.3

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.2.

5.3.3.2.2.4 Test description

5.3.3.2.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.2.3-1 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer MCG and SCG, *Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.2.2.4.3.

5.3.3.2.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH with DCI format as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.3.2.2.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.2.3-1. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.2.2.3-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.2.2.5-1, pass the UE. Otherwise fail the UE.
4. Repeat steps from 1 to 3 for each subtest in Table 5.3.3.2.2.3-1 as appropriate.

5.3.3.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.3.3.2.2.4.3.1 Message exceptions for SA

Table 5.3.3.2.2.4.3.1-1: PDCCH-ControlResourceSet

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
frequencyDomainResources	11111111 11111110 00000000 00000000 00000000 000000	CORESET to use the least significant 90 RBs of the BWP Test 1	
Duration	1	SearchSpace duration of 1 symbols Test 1	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {	Null		
reg-BundleSize	n6		2 Tx
interleaverSize	n3		TDD
}			
}			

Table 5.3.3.2.2.4.3.1-2: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel8	n1	AL8	Test 1
}			
}			

Table 5.3.3.2.2.4.3.1-3: Void

5.3.3.2.2.4.3.2 Message exceptions for NSA

FFS

5.3.3.2.2.5 Test requirement

Table 5.3.3.2.2.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.2.5-1.

Table 5.3.3.2.2.5-1: Test Requirement for 2Tx PDCCH with 30 kHz SCS

Test number	Band width (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	90	1	8	R.PDCCH. 2-1.3	TDLC300-100	2x4 Low	1	-3.3

5.3.3.2.3 4Rx TDD FR1 PDCCH 1 Tx antenna performance for power saving

Editor's Note: This test case is incomplete in the following aspects:

- R.PDCCH.2-1.4 TDD is TBD in Annex G.1.5 for minimum test time.

5.3.3.2.3.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.2.3.3-2 after receipt wake-up indication in the *DCI format 2_6* PDCCH in DRX off state. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.2.3.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting 4 Rx antenna ports and Long DRX Cycle and DRX adaptation.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and 4 Rx antenna ports and Long DRX Cycle and DRX adaptation.

5.3.3.2.3.3 Minimum conformance requirements

During the test the UE shall monitor the *DCI format 2_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

For the parameters specified in Table 5.3.3.2.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX shall be below the specified value in Table 5.3.3.2.3.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.2.3.3-1: Test Parameters

Parameter		Unit	1 Tx Antenna
TDD UL-DL pattern			FR1.30-1
CCE to REG mapping type			interleaved
Interleaver size			3
REG bundle size			2
Shift Index			0
DRX cycle		ms	10
ps-WakeUp-r16			absent
Wake-up indication bit in DCI format 2_6			1
PDCCH DCI format 2_6 configuration	PS-offset		$(T_{\text{minimumTimeGap}}+1)/2^{\mu}/0.125$
	Number of PDCCH candidates		1
	Frequency domain resource allocation for CORESET		Start from RB = 0 with contiguous RB allocation
	TCI state		TCI state #1
Slots for PDCCH monitoring			Each slot during DRX-on period
Note: $T_{\text{minimumTimeGap}}$ is signalled as a part of <i>drx-Adaptation-r16</i> UE capability.			

Table 5.3.3.2.3.3-2: Minimum performance with 30 kHz SCS

Test number	Bandwidth (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	102	1	4	R.PDCCH.2-1.2 TDD	TDLC300-100	1x4 Low	1	-0.9
				8	R.PDCCH.2-1.4 TDD				

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.2.

5.3.3.2.3.4 Test description

5.3.3.2.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of DRX, DCP, PDSCH and PDCCH before measurement are specified in 5.3.3.2.3.4.3.1 and Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2.5 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.1.3-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On*) for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.2.1.4.3.

5.3.3.2.3.4.2 Test procedure

1. SS transmits PDCCH with DCI format2_6 as specified in PDCCH Reference Channel for C_RNTI within DRX off state. The Wake-up indication bit in PDCCH is set to 1.
2. SS transmits PDSCH via PDCCH with DCI format1_1 as specified in PDCCH Reference Channel for C_RNTI to transmit the DL RMC according to Table 5.3.3.2.3.3-2 in DRX on period. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.3.3-2 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.
3. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.2.3.3-2 as appropriate.
4. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.2.3.5-1, pass the UE. Otherwise fail the UE.
5. Repeat steps from 2 to 4 for each subtest in Table 5.3.3.2.3.3-2 as appropriate.

5.3.3.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.3.3.2.3.4.3.1 Message exceptions for SA

Table 5.3.3.2.3.4.3.1-1: DRX-Config

Derivation Path: TS 38.508-1 [4], Table 4.6.3-56			
Information Element	Value/remark	Comment	Condition
DRX-Config ::= SEQUENCE {			
drx-onDurationTimer CHOICE {			
milliseconds	ms1		
}			
drx-InactivityTimer	ms1		
drx-HARQ-RTT-TimerDL	0		
drx-HARQ-RTT-TimerUL	0		
drx-RetransmissionTimerDL	sl1		
drx-RetransmissionTimerUL	sl1		
drx-LongCycleStartOffset CHOICE {			
ms10	0		
}			
}			

Table 5.3.3.2.3.4.3.1-2: DCP-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-106			
Information Element	Value/remark	Comment	Condition
dcp-Config-r16 CHOICE {			
setup SEQUENCE {			
ps-Offset-r16	40		
sizeDCI-2-6-r16	2		
ps-PositionDCI-2-6-r16	0		
}			
}			

Table 5.3.3.2.3.4.3.1-3: PDCCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-95			
Information Element	Value/remark	Comment	Condition
PDCCH-Config ::= SEQUENCE {			
controlResourceSetToAddModList	2 entry		
SEQUENCE(SIZE (1..3)) OF			
ControlResourceSet ::= SEQUENCE {			
ControlResourceSet[1]	ControlResourceSet1		
ControlResourceSet[2]	ControlResourceSet2		
}			
searchSpacesToAddModList	1 entry		
SEQUENCE(SIZE (1..10)) OF SearchSpace ::=			
SEQUENCE {			
SearchSpace[1]	SearchSpace		
}			
searchSpacesToAddModListExt-r16	1 entry		
SEQUENCE(SIZE (1..10)) OF SearchSpace {			
searchSpaceExt-r16[1]	SearchSpaceExt		
}			
}			

Table 5.3.3.2.3.4.3.1-4: PDCCH-ControlResourceSet1

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	1		
frequencyDomainResources	11111111 11111111 10000000 00000000 00000000 00000	CORESET to use the least significant 102 RBs of the BWP	
Duration	1	SearchSpace duration of 1 symbol	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {	Null		
reg-BundleSize	n2		1 Tx
interleaverSize	n3		TDD
}			
}			
}			

Table 5.3.3.2.3.4.3.1-5: PDCCH-ControlResourceSet2

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	2		
frequencyDomainResources	11111111 11111111 10000000 00000000 00000000 00000	CORESET to use the least significant 102 RBs of the BWP	
Duration	1	SearchSpace duration of 1 symbol	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {			
reg-BundleSize	n2		1 Tx
interleaverSize	n3		TDD
}			
}			
tci-StatesPDCCH-ToAddList {	1	TCI State #1	
}			
}			

Table 5.3.3.2.3.4.3.1-6: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
searchSpaceId	2	SearchSpaceId with condition USS	USS
controlResourceSetId	1	ControlResourceSetId	
monitoringSlotPeriodicityAndOffset CHOICE {			
sl1	NULL		
}			
nrofCandidates SEQUENCE {			
aggregationLevel4	n1	AL4	
}			
searchSpaceType CHOICE {			
common SEQUENCE {			CSS, SISS
ue-Specific SEQUENCE {			USS
dci-Formats	formats0-1-And-1-1	DCI Format 1_1	Long_DCI
}			
}			
}			

Table 5.3.3.2.3.4.3.1-7: PDCCH Search Space Ext

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a			
Information Element	Value/remark	Comment	Condition
SearchSpaceExt-r16 ::= SEQUENCE {			
controlResourceSetId-r16	2		
searchSpaceType-r16 SEQUENCE {			
common SEQUENCE {			
dci-Format2-6-r16 SEQUENCE {	NULL		
}			
}			
}			

Table 5.3.3.2.3.4.3.1-8: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
TCI-State[1]	TCI-StateId 0		
qcl-type1 {		Type 1 QCL information	
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	Ssb : 0	SSB # 0	
Qcl-Type	Type C		
}			
qcl-type2 {		Type 2 QCL information	
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	Ssb : 0	SSB # 0	
Qcl-Type	Type D		
}			
TCI-State[2]	TCI-StateId 1	Type 1 QCL information	
qcl-type1 {			
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	csi-rs : 0	CSI-RS # 0	
Qcl-Type	Type A		
}			
qcl-type2 {		Type 2 QCL information	
Cell	ServCellIndex		
Bwp-id	1	BWP ID	
referenceSignal	csi-rs : 0	SSB # 0	
Qcl-Type	Type D		
}			
}			
}			

5.3.3.2.3.4.3.2 Message exceptions for NSA

Same as 5.3.3.2.3.4.3.1.

5.3.3.2.3.5 Test requirement

Table 5.3.3.2.3.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.3.5-1.

Table 5.3.3.2.3.5-1: Minimum performance with 30 kHz SCS

Test number	Bandwidth (MHz)	CORE SET RB	CORE SET duration	Aggregation level	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	40	102	1	4	R.PDCCH. 2-1.2 TDD	TDLC300-100	1x4 Low	1	0
				8	R.PDCCH. 2-1.4 TDD				

5.4 PBCH demodulation requirements

TS 38.101-4 shall specify the PBCH performance requirements and has recommended that these requirements do not need to be tested.

5.5 Sustained downlink data rate provided by lower layers

5.5.1 FR1 Sustained downlink data rate performance for single carrier

5.5.1.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE capabilities. The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement

5.5.1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward.

5.5.1.3 Minimum conformance requirements

The requirements in this clause are applicable to the FR1 single carrier case.

The TB success rate shall be higher than 85% when PDSCH is scheduled with MCS defined for the channel bandwidth with the downlink physical channel setup according to Annex C.3.1.

The TB success rate is defined as $100\% * \text{N}_{\text{DL_correct_rx}} / (\text{N}_{\text{DL_newtx}} + \text{N}_{\text{DL_retx}})$, where $\text{N}_{\text{DL_newtx}}$ is the number of newly transmitted DL transport blocks, $\text{N}_{\text{DL_retx}}$ is the number of retransmitted DL transport blocks, and $\text{N}_{\text{DL_correct_rx}}$ is the number of correctly received DL transport blocks.

The common test parameters are specified in Table 5.5.1.3-1. The parameters specified in Table 5.5.1.3-2 are applicable for tests on FDD bands and parameters specified in Table 5.5.1.3-3 are applicable for tests on TDD bands.

Unless otherwise stated, no user data is scheduled on slot #0, 10 and 11 within 20 ms for SCS 15 kHz.

Unless otherwise stated, no user data is scheduled on slot #0, 20 and 21 within 20 ms for SCS 30 kHz.

Table 5.5.1.3-1: Common test parameters for FDD and TDD bands

Parameter		Unit	Value
PDSCH transmission scheme			Transmission scheme 1
EPRE ratio of PTRS to PDSCH		dB	N/A
Channel bandwidth		MHz	Channel bandwidth from selected CA bandwidth combination
Common serving cell parameters	Physical Cell ID		0
	SSB position in burst		First SSB in Slot #0
	SSB periodicity	ms	20
	First DMRS position for Type A PDSCH mapping		2
Cross carrier scheduling			Not configured
Active DL BWP index			1
Actual carrier configuration	Offset between Point A and the lowest usable subcarrier on this carrier (Note 2)	RBs	0
	Subcarrier spacing	kHz	15 or 30
DL BWP configuration #1	RB offset	RBs	0
	Number of contiguous PRB		Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing
	Subcarrier spacing	kHz	15 or 30

	Cyclic prefix		Normal
PDCCH configuration	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH		Symbols #0
	Number of PRBs in CORESET		Table 5.5.1.3-4
	Number of PDCCH candidates and aggregation levels		2/AL2 for 15 kHz / 5 MHz and 30 kHz / 15 MHz 2/AL4 for 15 kHz / 10 MHz, 30 kHz / 10 MHz and 30 kHz / 20 MHz 2/AL8 for other greater combinations
	CCE-to-REG mapping type		Non-interleaved
	DCI format		1_1
	TCI State		TCI state #1
	PDCCH & PDCCH DMRS Precoding configuration		For 2Tx: Single Panel Type I, Random precoder chosen from precoder index 0 and 2, selection updated per slot For 4Tx: Single Panel Type I, Random precoder chosen from precoders with $i_{-1,1}$ in {1,2,3,5,6,7} and i_{-2} in {0,2}, selection updated per slot
PDSCH configuration	Mapping type		Type A
	k_0		0
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		WB
	Resource allocation type		Type 0
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Length		1
	Antenna ports indexes		{1000} for 1 Layer CCs {1000, 1001} for 2 Layers CCs {1000 – 1003} for 4 Layers CCs
	Number of PDSCH DMRS CDM group(s) without data		1 for 1 layer and 2 layers CCs 2 for 4 Layers CCs
PTRS configuration			PTRS is not configured
CSI-RS for tracking	Subcarrier indexes in the PRB used for CSI-RS		$k_0 = 3$ for CSI-RS resource 1,2,3,4
	OFDM symbols in the PRB used for CSI-RS		$l_0 = 6$ for CSI-RS resource 1 and 3 $l_0 = 10$ for CSI-RS resource 2 and 4
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
	Density (ρ)		3 for CSI-RS resource 1,2,3,4
	CSI-RS periodicity	Slots	15 kHz SCS: 20 for CSI-RS resource 1,2,3,4 30 kHz SCS: 40 for CSI-RS resource 1,2,3,4
	CSI-RS offset	Slots	15 kHz SCS: 10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4 30 kHz SCS: 20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
	Frequency Occupation		Start PRB 0 Number of PRB = BWP size
	QCL info		TCI state #0
	NZP CSI-RS for CSI acquisition	Subcarrier indexes in the PRB used for CSI-RS	
OFDM symbols in the PRB used for CSI-RS			$l_0 = 12$
Number of CSI-RS ports (X)			Same as number of transmit antenna
CDM Type			'FD-CDM2'

	Density (ρ)		1
	CSI-RS periodicity		15 kHz SCS: 20 30 kHz SCS: 40
	CSI-RS offset		0
	Frequency Occupation		Start PRB 0 Number of PRB = BWP size
	QCL info		TCI state #1
ZP CSI-RS for CSI acquisition	Subcarrier indexes in the PRB used for CSI-RS		$k_0 = 0$
	OFDM symbols in the PRB used for CSI-RS		$l_0 = 12$
	Number of CSI-RS ports (X)		4
	CDM Type		'FD-CDM2'
	Density (ρ)		1
	CSI-RS periodicity		15 kHz SCS: 20 30 kHz SCS: 40
	CSI-RS offset		0
TCI state #0	Type 1 QCL information	SSB index	SSB #0
		QCL Type	Type C
	Type 2 QCL information	SSB index	N/A
		QCL Type	N/A
TCI state #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration
		QCL Type	Type A
	Type 2 QCL information	CSI-RS resource	N/A
		QCL Type	N/A
Maximum number of code block groups for ACK/NACK feedback			1
Maximum number of HARQ transmission			4
HARQ ACK/NACK bundling			Multiplexed
Redundancy version coding sequence			{0,2,3,1}
PDSCH & PDSCH DMRS Precoding configuration			Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i_1, i_2 combination with PRB bundling granularity
Symbols for all unused REs			OCNG Annex A.5
Propagation condition			Static propagation condition No external noise sources are applied
Antenna configuration	1 layer CCs		1x2 or 1x4
	2 layers CCs		2x2 or 2x4
	4 layers CCs		4x4
Physical signals, channels mapping and precoding			As specified in Annex B.4.1
Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission			
Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing			

Table 5.5.1.3-2: Additional test parameters for FDD band

Parameter		Unit	Value
Duplex mode			FDD
PDSCH configuration	Starting symbol (S)		1
	Length (L)		13
Number of HARQ Processes			4
K1 value			2

Table 5.5.1.3-3: Additional test parameters for TDD band

Parameter		Unit	Value
Duplex mode			TDD
PDSCH configuration	Starting symbol (S)		1
	Length (L)		13

Number of HARQ Processes		8
K1 value		Specific to each UL-DL pattern
TDD UL-DL pattern		15 kHz SCS: FR1.15-1 30 kHz SCS: FR1.30-1
Note 1: PDSCH is scheduled only on full DL slots		

Table 5.5.1.3-4: Number of PRBs in CORESET

SCS (kHz)	5MHz	10MHz	15MHz	20 MHz	25 MHz	30 MHz	40 MHz	50MHz	60 MHz	80 MHz	100 MHz
15	24	48	78	102	132	156	216	270	N/A	N/A	N/A
30	6	24	36	48	60	78	102	132	162	216	270

Table 5.5.1.3-5: MCS indexes for indicated UE capabilities

Maximum number of PDSCH MIMO layers	Maximum modulation format	Scaling factor	MCS
1	8	1	26
1	8	0.8	21
1	8	0.75	20
1	8	0.4	11
1	6	1	27
1	6	0.8	23
1	6	0.75	22
1	6	0.4	14
1	4	1	16
1	4	0.8	16
1	4	0.75	16
1	4	0.4	10
1	2	1	9
1	2	0.8	9
1	2	0.75	9
1	2	0.4	4
2	8	1	26
2	8	0.8	21
2	8	0.75	20
2	8	0.4	11
2	6	1	27
2	6	0.8	23
2	6	0.75	22
2	6	0.4	14
2	4	1	16
2	4	0.8	16
2	4	0.75	16
2	4	0.4	10
2	2	1	9
2	2	0.8	9
2	2	0.75	9
2	2	0.4	4
4	8	1	26
4	8	0.8	23
4	8	0.75	22
4	8	0.4	12
4	6	1	27
4	6	0.8	24
4	6	0.75	23
4	6	0.4	14
4	4	1	16
4	4	0.8	16
4	4	0.75	16
4	4	0.4	11
4	2	1	9
4	2	0.8	9
4	2	0.75	9
4	2	0.4	5
Note 1:	MCS Index for maximum modulation format 2,4 and 6 is based on MCS index table 1 defined in clause 5.1.3.1 of TS 38.214 [12]		
Note 2:	MCS Index for maximum modulation format 8 is based on MCS index table 2 defined in clause 5.1.3.1 of TS 38.214 [12]		

5.5.1.3.1 Procedure for test parameter selection

Below test parameter selection procedure is from 38.101-4 [5] by replacing CA configuration with operating band, and bandwidth instead of bandwidth combination.

The test parameters are determined by the following procedure:

- Select one operating band among all supported operating bands and set of per band UE capabilities among all supported UE capabilities that provides the largest data rate [TS 38.306 [14, Section 4.1.2]].
- Set of per band UE capabilities includes channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor [TS 38.306 [14, Section 4.1.2]].
- When there are multiple sets of bandwidths and UE capabilities (channel bandwidth, subcarrier spacing, number of MIMO layer, modulation format, scaling factor) with same largest data rate, select one among sets with the smallest channel bandwidth.
- For each operating band, use Table 5.5.1.3-5 to determine MCS based on test parameters and indicated UE capabilities

Pasting relevant portion of max data rate equation from TS 38.306 [14] section 4.1

For NR, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.

$$\text{data rate (in Mbps)} = 10^{-6} \cdot \sum_{j=1}^J \left(v_{\text{Layers}}^{(j)} \cdot Q_m^{(j)} \cdot f^{(j)} \cdot R_{\text{max}} \cdot \frac{N_{\text{PRB}}^{BW^{(j)},\mu} \cdot 12}{T_s^\mu} \cdot (1 - OH^{(j)}) \right)$$

wherein

J is the number of aggregated component carriers in a band or band combination

$$R_{\text{max}} = 948/1024$$

For the j-th CC,

$v_{\text{Layers}}^{(j)}$ is the maximum number of supported layers given by higher layer parameter *maxNumberMIMO-LayersPDSCH* for downlink and maximum of higher layer parameters *maxNumberMIMO-LayersCB-PUSCH* and *maxNumberMIMO-LayersNonCB-PUSCH* for uplink.

$Q_m^{(j)}$ is the maximum supported modulation order given by higher layer parameter *supportedModulationOrderDL* for downlink and higher layer parameter *supportedModulationOrderUL* for uplink.

$f^{(j)}$ is the scaling factor given by higher layer parameter *scalingFactor* and can take the values 1, 0.8, 0.75, and 0.4.

μ is the numerology (as defined in TS 38.211 [6])

T_s^μ is the average OFDM symbol duration in a subframe for numerology μ , i.e. $T_s^\mu = \frac{10^{-3}}{14 \cdot 2^\mu}$. Note that normal cyclic prefix is assumed.

$N_{\text{PRB}}^{BW^{(j)},\mu}$ is the maximum RB allocation in bandwidth $BW^{(j)}$ with numerology μ , as defined in 5.3 TS 38.101-1 [2] and 5.3 TS 38.101-2 [3], where $BW^{(j)}$ is the UE supported maximum bandwidth in the given band or band combination.

$OH^{(j)}$ is the overhead and takes the following values

0.14, for frequency range FR1 for DL

0.18, for frequency range FR2 for DL

0.08, for frequency range FR1 for UL

0.10, for frequency range FR2 for UL

NOTE: Only one of the UL or SUL carriers (the one with the higher data rate) is counted for a cell operating SUL.

The approximate maximum data rate can be computed as the maximum of the approximate data rates computed using the above formula for each of the supported band or band combinations.

The normative reference for this requirement is TS 38.101-4 [5], clause 5.5.1.

5.5.1.4 Test description

5.5.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of TS 38.521-1.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram (without fader and AWGN) and clause A.3.2.2 for UE diagram.
2. The parameter settings for the NR cell are initially set up according to Table 5.5.1.3-1 as appropriate.
3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions for the NR cell are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR with *Connected without release On, Test Loop Function On with UE Test Loop Mode A with UL_PDCP_SDU_SIZE = 0* according to TS 38.508-1 [6] clause 4.5.4. Message content are defined in clause 5.5.1.4.3.
6. SS shall transmit UECapabilityEnquiry message.
7. The UE shall transmit UECapabilityInformation message.
8. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-NR-Capability*, and the procedure outlined in 5.5.1.3.1 determine one set of parameters that would provide the largest data rate.
9. Setup up the NR cell using these parameters for the test.
10. Configure the TBsize, DL RMC, UL RMC, PDCP size from Annex A.3.2_1 and Annex A.2.2 for UL as appropriate.

5.5.1.4.2 Test procedure

1. SS configures T-reordering timer to be infinity.
2. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.
3. SS sets the counters N_{DL_newtx} N_{DL_retx} to 0.
4. For each new DL HARQ transmission the SS generates sufficient PDCP SDUs (max PDCP SDU size and minimum number of consecutive PDCP SDUs) to fill up the TB in accordance with Annex A.3.2_1. The SS ciphers the PDCP SDUs, concatenates the resultant PDCP PDUs to form an RLC PDU and then a MAC PDU. The SS transmits the MAC PDU. The SS increments then N_{DL_newtx} by one
5. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments N_{DL_retx} by one.

6. Steps 5 to 6 are repeated at every TTI for at least 300 frames and the SS waits for 300ms to let any HARQ retransmissions and RLC retransmissions to finish.
7. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.
8. The SS calculates the TB success rate as $A = 100\% * N_{DL_correct_rx} / (N_{DL_newtx} + N_{DL_retx})$.
10. SS computes the PDCP SDU loss by looking into the FMC and Bitmap field in the PDCP Status Report. PDCP SDU loss $B = COUNT$ reported in the Bitmap field of PDCP Stata Report.
11. The UE passes the test if $A \geq 85\%$ TB success rates and $B = 0$.

Note 1: In case of RLC PDU retransmission, the number of new required PDCP SDUs is as many as to fill the rest of TB.

5.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

Table 5.5.1.4.3-0: CLOSE UE TEST LOOP (in the preamble)

Derivation Path: 38.509 clause 6.3.1			
Information Element	Value/remark	Comment	Condition
Protocol discriminator	1 1 1 1		
Skip indicator	0 0 0 0		
Message type	1 0 0 0 0 0 0 0		
UE test loop mode	0 0 0 0 0 0 0 0	UE test loop mode A	
UE test loop mode A LB setup			
Length of UE test loop mode A LB setup list in bytes	0 0 0 0 0 0 1 1	Length of one LB setup DRB (3 bytes)	
LB setup DRB	0 0 0 0 0 0 0 0, 0 0 0 0 0 0 0 0, 0 0 Q5 Q4 Q3 Q2 Q1 Q0	UL PDCP SDU size = 0 Q5 = 1 (for NR Data Radio Bearers) Q4..Q0 = Data Radio Bearer identity number -1 for the radio bearer. See 38.509 clause 6.3.1	
UE test loop mode B LB setup	Not present		

Table 5.5.1.4.3-1 to -6: Void

Table 5.5.1.4.3-7: RadioBearerConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3-132			
Information Element	Value/remark	Comment	Condition
RadioBearerConfig ::= SEQUENCE {			
drb-ToAddModList SEQUENCE (SIZE (1..maxDRB))	1 entry		DRB1
OF SEQUENCE {			
cnAssociation CHOICE {			
sdap-Config	SDAP-Config		
}			
drb-Identity	DRB-Identity using condition DRB1		
reestablishPDCP	true		DRB1 AND Re-establish_PDCP
pdcp-Config	PDCP-Config		
}			

Table 5.5.1.4.3-8: PDCP-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-99			
Information Element	Value/remark	Comment	Condition
PDCP-Config ::= SEQUENCE {			
drb SEQUENCE {			
discardTimer	infinity		
pdcp-SN-Size-UL	len18bits		
pdcp-SN-Size-DL	len18bits		
headerCompression CHOICE {			
notUsed	Null		
}			
integrityProtection	Not present		
statusReportRequired	true		
outOfOrderDelivery	Not present		
}			
t-Reordering	Not present		
}			

5.5.1.5 Test requirement

The PDCP SDU success rate of greater than 85% shall be sustained during at least 300 frames.

5.5A.1 FR1 Sustained downlink data rate performance for carrier aggregation

5.5A.1.1 FR1 SDR performance for CA (2DLCA)

5.5A.1.1.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE capabilities. The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

5.5A.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL CA

5.5A.1.1.3 Minimum conformance requirements

The Sustained Data Rate (SDR) requirements in this clause are applicable to the FR1 CA.

The TB success rate shall be higher than 85% when PDSCH is scheduled with MCS defined for the selected CA bandwidth combination and with the downlink physical channel setup according to Annex C.2.1.

The TB success rate is defined as $100\% \cdot N_{DL_correct_rx} / (N_{DL_newtx} + N_{DL_retx})$, where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport blocks, and $N_{DL_correct_rx}$ is the number of correctly received DL transport blocks.

The common test parameters are specified in Table 5.5A.1.1.3-1. The parameters specified in Table 5.5A.1.1.3-2 are applicable for tests on FDD CCs and parameters specified in Table 5.5A.1.1.3-3 are applicable for tests on TDD CCs.

Unless otherwise stated, no user data is scheduled on slot #0, 10 and 11 within 20 ms for SCS 15 kHz.

Unless otherwise stated, no user data is scheduled on slot #0, 20 and 21 within 20 ms for SCS 30 kHz.

Table 5.5A.1.1.3-1: Common test parameters for FDD and TDD component carriers

Parameter		Unit	Value
PDSCH transmission scheme			Transmission scheme 1
EPRE ratio of PTRS to PDSCH		dB	N/A
Channel bandwidth		MHz	Channel bandwidth from selected CA bandwidth combination
Common serving cell parameters	Physical Cell ID		0
	SSB position in burst		First SSB in Slot #0
	SSB periodicity	ms	20
	First DMRS position for Type A PDSCH mapping		2
Cross carrier scheduling			Not configured
Active DL BWP index			1
Actual carrier configuration	Offset between Point A and the lowest usable subcarrier on this carrier (Note 2)	RBs	0
	Subcarrier spacing	kHz	15 or 30
DL BWP configuration #1	RB offset	RBs	0
	Number of contiguous PRB		Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing
	Subcarrier spacing	kHz	15 or 30
	Cyclic prefix		Normal
PDCCH configuration	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH		Symbols #0
	Number of PRBs in CORESET		Table 5.5A-4
	Number of PDCCH candidates and aggregation levels		1/AL 1 for 30 kHz / 5 MHz 1/AL4 for 15 kHz / 5 MHz, 30 kHz / 10 MHz and 30 kHz / 15 MHz 1/AL 8 for other combinations
	CCE-to-REG mapping type		Non-interleaved
	DCI format		1_1
	TCI State		TCI state #1
	PDCCH & PDCCH DMRS Precoding configuration		For 2Tx: Single Panel Type I, Random precoder chosen from precoder index 0 and 2, selection updated per slot For 4Tx: Single Panel Type I, Random precoder chosen from precoders with $i_{1,1}$ in

			{1,2,3,5,6,7} and i_2 in {0,2}, selection updated per slot
PDSCH configuration	Mapping type		Type A
	k ₀		0
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		wideband
	Resource allocation type		Type 0
	VRB-to-PRB mapping type		Non-interleaved
VRB-to-PRB mapping interleaver bundle size		N/A	
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Length		1
	Antenna ports indexes		{1000} for 1 Layer CCs {1000, 1001} for 2 Layers CCs {1000 – 1003} for 4 Layers CCs
	Number of PDSCH DMRS CDM group(s) without data		1 for 1 layer and 2 layers CCs 2 for 4 Layers CCs
PTRS configuration			PTRS is not configured
CSI-RS for tracking	Subcarrier indexes in the PRB used for CSI-RS		k ₀ = 3 for CSI-RS resource 1,2,3,4
	OFDM symbols in the PRB used for CSI-RS		l ₀ = 6 for CSI-RS resource 1 and 3 l ₀ = 10 for CSI-RS resource 2 and 4
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
	Density (ρ)		3 for CSI-RS resource 1,2,3,4
	CSI-RS periodicity	Slots	15 kHz SCS: 20 for CSI-RS resource 1,2,3,4 30 kHz SCS: 40 for CSI-RS resource 1,2,3,4
	CSI-RS offset	Slots	15 kHz SCS: 10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4 30 kHz SCS: 20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
	Frequency Occupation		Start PRB 0 Number of PRB = ceil(BWP size /4)*4
	QCL info		TCI state #0
NZP CSI-RS for CSI acquisition	Subcarrier indexes in the PRB used for CSI-RS		k ₀ = 4
	OFDM symbols in the PRB used for CSI-RS		l ₀ = 12
	Number of CSI-RS ports (X)		Same as number of transmit antenna
	CDM Type		'FD-CDM2'
	Density (ρ)		1
	CSI-RS periodicity		15 kHz SCS: 20 30 kHz SCS: 40
	CSI-RS offset		0
	Frequency Occupation		Start PRB 0 Number of PRB = ceil(BWP size /4)*4
	QCL info		TCI state #1
ZP CSI-RS for CSI acquisition	Subcarrier indexes in the PRB used for CSI-RS		k ₀ = 0
	OFDM symbols in the PRB used for CSI-RS		l ₀ = 12
	Number of CSI-RS ports (X)		4
	CDM Type		'FD-CDM2'
	Density (ρ)		1
	CSI-RS periodicity		15 kHz SCS: 20 30 kHz SCS: 40
	CSI-RS offset		0

	Frequency Occupation		Start PRB 0
			Number of PRB = ceil(BWP size/4)*4
TCI state #0	Type 1 QCL information	SSB index	SSB #0
		QCL Type	Type C
	Type 2 QCL information	SSB index	N/A
		QCL Type	N/A
TCI state #1	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration
		QCL Type	Type A
	Type 2 QCL information	CSI-RS resource	N/A
		QCL Type	N/A
Maximum number of code block groups for ACK/NACK feedback			1
Maximum number of HARQ transmission			4
HARQ ACK/NACK bundling			Multiplexed
Redundancy version coding sequence			{0,2,3,1}
PDSCH & PDSCH DMRS Precoding configuration			Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i_1, i_2 combination with PRB bundling granularity
Symbols for all unused REs			OP.1 FDD as defined in Annex A.5.1.1 OP.1 TDD as defined in Annex A.5.2.1
Propagation condition			Static propagation condition No external noise sources are applied
Antenna configuration	1 layer CCs		1x2 or 1x4
	2 layers CCs		2x2 or 2x4
	4 layers CCs		4x4
Physical signals, channels mapping and precoding			As specified in Annex B.4.1
Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission			
Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing			

Table 5.5A.1.1.3-2: Additional test parameters for FDD CC

Parameter		Unit	Value
Duplex mode			FDD
PDSCH configuration	Starting symbol (S)		1
	Length (L)		13
Number of HARQ Processes			4
K1 value			2

Table 5.5A.1.1.3-3: Additional test parameters for TDD CC

Parameter		Unit	Value
Duplex mode			TDD
PDSCH configuration	Starting symbol (S)		1
	Length (L)		13
Number of HARQ Processes			8
K1 value			Specific to each UL-DL pattern
TDD UL-DL pattern			15 kHz SCS: FR1.15-1 30 kHz SCS: FR1.30-1
Note 1: PDSCH is scheduled only on full DL slots			

Table 5.5A.1.1.3-4: Number of PRBs in CORESET

SCS (kHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	35 MHz	40 MHz	45 MHz	50 MHz	60 MHz	80 MHz	1 M
15	24	48	78	102	132	156	186	216	240	270	N/A	N/A	N
30	6	24	36	48	60	78	90	102	114	132	162	216	2

Table 5.5A.1.1.3-5: MCS indexes for indicated UE capabilities

Maximum number of PDSCH MIMO layers	Maximum modulation format	Scaling factor	MCS
1	8	1	26
1	8	0.8	21
1	8	0.75	20
1	8	0.4	11
1	6	1	27
1	6	0.8	23
1	6	0.75	22
1	6	0.4	14
1	4	1	16
1	4	0.8	16
1	4	0.75	16
1	4	0.4	10
1	2	1	9
1	2	0.8	9
1	2	0.75	9
1	2	0.4	4
2	8	1	26
2	8	0.8	21
2	8	0.75	20
2	8	0.4	11
2	6	1	27
2	6	0.8	23
2	6	0.75	22
2	6	0.4	14
2	4	1	16
2	4	0.8	16
2	4	0.75	16
2	4	0.4	10
2	2	1	9
2	2	0.8	9
2	2	0.75	9
2	2	0.4	4
4	8	1	26
4	8	0.8	23
4	8	0.75	22
4	8	0.4	12
4	6	1	27
4	6	0.8	24
4	6	0.75	23
4	6	0.4	14
4	4	1	16
4	4	0.8	16
4	4	0.75	16
4	4	0.4	11
4	2	1	9
4	2	0.8	9
4	2	0.75	9
4	2	0.4	5

Note 1: MCS Index for maximum modulation format 2,4 and 6 is based on MCS index Table 1 defined in clause 5.1.3.1 of TS 38.214 [12]

Note 2: MCS Index for maximum modulation format 8 is based on MCS index Table 2 defined in clause 5.1.3.1 of TS 38.214 [12]

5.5A.1.1.3.1 Procedure for test parameter selection

The test parameters are determined by the following procedure:

- Select one CA bandwidth combination among all supported CA configurations and set of per component carrier (CC) UE capabilities among all supported UE capabilities that provides the largest data rate in accordance with clause 4.1.2 of TS 38.306 [14].
- Set of per CC UE capabilities includes channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor in accordance with clause 4.1.2 of TS 38.306 [14].
- When there are multiple sets of CA bandwidth combinations and UE capabilities (channel bandwidth, subcarrier spacing, number of MIMO layer, modulation format, scaling factor) with same largest data rate, select one among sets with the smallest aggregated channel bandwidth.
- For each CC in CA bandwidth combination, use Table 5.5A.1.1.3-5 to determine MCS based on test parameters and indicated UE capabilities.

The normative reference for this requirement is TS 38.101-4 [5], clause 5.5A.1.

5.5A.1.1.4 Test description

5.5A.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of TS 38.521-1.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 5.2.2.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 4.3.1.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2A, A.3.1.7.6, and A.3.1.7.7 for TE diagram (without fader and AWGN) for 2Rx and 4Rx CC respectively and clause A.3.2.6 for UE diagram.
2. The parameter settings for the NR cell are initially set up according to Table 5.5.1.3-1 as appropriate.
3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].
4. Propagation conditions for the NR cell are set according to Annex B.1.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR with *Connected without release On, Test Loop Function On with UE Test Loop Mode A with UL_PDCP_SDU_SIZE = 0* according to TS 38.508-1 [6] clause 4.5.4. Message content are defined in clause 5.5 A.1.1.4.3.
6. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.
7. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1.
8. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause 9.3).
9. SS shall transmit UECapabilityEnquiry message.
10. The UE shall transmit UECapabilityInformation message.
11. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-NR-Capability*, and the procedure outlined in 5.5A.1.1.3.1 determine one set of parameters that would provide the largest data rate.
12. Setup up the NR cells using these parameters for the test.
13. Configure the TBsize, DL RMC, UL RMC, PDCP size from Annex A.3.2_1 and Annex A.2.2 for UL as appropriate.

5.5A.1.1.4.2 Test procedure

1. SS configures T-reordering timer to be infinity.
2. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.
3. SS sets the counters N_{DL_newtx} N_{DL_retx} to 0.
4. For each new DL HARQ transmission the SS generates sufficient PDCP SDUs (max PDCP SDU size and minimum number of consecutive PDCP SDUs) to fill up the TB on both PCC and SCC in accordance with Annex A.3.2_1. The SS ciphers the PDCP SDUs, concatenates the resultant PDCP PDUs to form an RLC PDU and then a MAC PDU. The SS transmits the MAC PDU. The SS increments then N_{DL_newtx} by one
5. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments N_{DL_retx} by one.
6. Steps 5 to 6 are repeated at every TTI for at least 300 frames and the SS waits for 300ms to let any HARQ retransmissions and RLC retransmissions to finish.
7. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.
8. The SS calculates the TB success rate as $A = 100\% * N_{DL_correct_rx} / (N_{DL_newtx} + N_{DL_retx})$.
9. SS computes the PDCP SDU loss by looking into the FMC and Bitmap field in the PDCP Status Report. PDCP SDU loss $B = COUNT$ reported in the Bitmap field of PDCP Stata Report.
10. The UE passes the test if $A \geq 85\%$ TB success rate on both PCC and SCC and $B = 0$.

Note 1: In case of RLC PDU retransmission, the number of new required PDCP SDUs is as many as to fill the rest of TB.

5.5A.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

Table 5.5A.1.1.4.3-1: CLOSE UE TEST LOOP (in the preamble)

Derivation Path: TS 38.509 [9] clause 6.3.1			
Information Element	Value/remark	Comment	Condition
Protocol discriminator	1 1 1 1		
Skip indicator	0 0 0 0		
Message type	1 0 0 0 0 0 0 0		
UE test loop mode	0 0 0 0 0 0 0 0	UE test loop mode A	
UE test loop mode A LB setup			
Length of UE test loop mode A LB setup list in bytes	0 0 0 0 0 0 1 1	Length of one LB setup DRB (3 bytes)	
LB setup DRB	0 0 0 0 0 0 0 0, 0 0 0 0 0 0 0 0, 0 0 Q5 Q4 Q3 Q2 Q1 Q0	UL PDCP SDU size = 0 Q5 = 1 (for NR Data Radio Bearers) Q4..Q0 = Data Radio Bearer identity number -1 for the radio bearer. See 38.509 clause 6.3.1	
UE test loop mode B LB setup	Not present		

Table 5.5A.1.1.4.3-2: RadioBearerConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3-132			
Information Element	Value/remark	Comment	Condition
RadioBearerConfig ::= SEQUENCE {			
drb-ToAddModList SEQUENCE (SIZE (1..maxDRB))	1 entry		DRB1
OF SEQUENCE {			
cnAssociation CHOICE {			
sdap-Config	SDAP-Config		
}			
drb-Identity	DRB-Identity using condition DRB1		
reestablishPDCP	true		DRB1 AND Re-establish_PDCP
pdcp-Config	PDCP-Config		
}			

Table 5.5A.1.1.4.3-3: PDCP-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-99			
Information Element	Value/remark	Comment	Condition
PDCP-Config ::= SEQUENCE {			
drb SEQUENCE {			
discardTimer	infinity		
pdcp-SN-Size-UL	len18bits		
pdcp-SN-Size-DL	len18bits		
headerCompression CHOICE {			
notUsed	Null		
}			
integrityProtection	Not present		
statusReportRequired	true		
outOfOrderDelivery	Not present		
}			
t-Reordering	Not present		
}			

5.5A.1.1.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.