# 6 CSI reporting requirements (Conducted requirements)

### 6.1 General

This Clause includes conducted requirements for the reporting of channel state information (CSI).

### 6.1.1 Applicability of requirements

### 6.1.1.1 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 6 are mandatory for UE supporting NR operation, except test cases listed in Clause 6.1.1.3, 6.1.1.4, 6.1.1.5.

If same test is listed for different UE features/capabilities in Clauses 6.1.1.3 and 6.1.1.4, then this test shall apply for UEs which support all corresponding UE features/capabilities.

### 6.1.1.2 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 [2]. The UE requirements applicability for UEs with different number of RX antenna ports is defined in Table 6.1.1.2-1.

Supported RX antenna ports	Test type	Test list
UE supports only	CQI	All tests in Clause 6.2.2
2RX	PMI	All tests in Clause 6.3.2
	RI	All tests in Clause 6.4.2
UE supports only	CQI	All tests in Clause 6.2.3
4RX or both 2RX	PMI	All tests in Clause 6.3.3
and 4RX	RI	All tests in Clause 6.4.3

Table 6.1.1.2-1: Requirements applicability

### 6.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 6.1.1.3-1 shall apply for UEs which support optional UE features with capability signalling only.

UE feature/capability [14]	Test	type	Test list	Applicability notes
CQI table with target BLER of	FR1 FDD	CQI	Clause 6.2.2.1.1.2 Clause 6.2.3.1.1.2	
10^-5New CQI table (cqi- TableAlt)	FR1 TDD	CQI	Clause 6.2.2.2.1.2 Clause 6.2.3.2.1.2	
Alternative 64QAM MCS table for PDSCH New 64QAM MCS	FR1 FDD	CQI	Clause 6.2.2.1.1.2 Clause 6.2.3.1.1.2	
table for PDSCH ( <i>dl-64QAM-MCS-TableAlt</i> )	FR1 TDD	CQI	Clause 6.2.2.2.1.2 Clause 6.2.3.2.1.2	

### Table 6.1.1.3-1: Requirements applicability for optional features with UE capability signalling

The performance requirements in Table 6.1.1.3-2 shall apply for UEs which support optional UE features only.

UE feature/capability [14]	Test type		Test list	Applicability notes
Support of Type II codebook	FR1 FDD	PMI	Clause 6.3.2.1.5	
(CodebookParameters contains type2,			Clause 6.3.3.1.5	
supportedCSI-RS-ResourceList,	FR1 TDD	PMI	Clause 6.3.2.2.5	
parameterLx, amplitudeScalingType,			Clause 6.3.3.2.5	
amplitudeSubsetRestriction)				
Support of Enhanced Type II codebook	FR1 FDD	PMI	Clause 6.3.2.1.6	
with at least 16 ports per CSI-RS			Clause 6.3.3.1.6	
resource(codebookParametersAddition-	FR1 TDD	PMI	Clause 6.3.2.2.6	
r16 contains etype2R1-r16, supportedCSI-			Clause 6.3.3.2.6	
RS-ResourceListAdd-r16,				
maxNumberTxPortsPerResource)				

## 6.1.1.4 Applicability of requirements for mandatory UE features with capability signalling

The performance requirements in Table 6.1.1.4-1 shall apply for UEs which support mandatory UE features with capability signalling only.

UE feature/capability [14] Test type		type	Test list	Applicability notes
	FR1 FDD	CQI	Clause 6.2.3.1.1.1	The requirements
		PMI	Clause 6.3.3.1.2	apply only in case the
		RI	Clause 6.4.2.1	PDSCH MIMO rank in
			Clause 6.4.3.1	the test case does not
	FR1 TDD	CQI	Clause 6.2.3.2.1.1	exceed UE PDSCH
PDSCH MIMO layers				MIMO layers
(maxNumberMIMO-				capability
LayersPDSCH)		PMI	Clause 6.3.3.2.2	
		RI	Clause 6.4.2.2	
			Clause 6.4.3.2	
	FR1 FDD	PMI	Clause 6.3.2.1.1	The requirements
			Clause 6.3.2.1.2	apply only in case the
Supported maximum number of			Clause 6.3.3.1.1	number of NZP-CSI-
ports across all configured NZP-			Clause 6.3.3.1.2	RS ports in the test
CSI-RS resources per CC		RI	Clause 6.4.3.1 (Test 4)	case satisfies UE
(maxConfigNumberPortsAcross NZP-CSI-RS-PerCC)	FR1 TDD	PMI	Clause 6.3.2.2.1	capability on
			Clause 6.3.2.2.2	maximum number of
			Clause 6.3.3.2.1	NZP-CSI-RS ports
			Clause 6.3.3.2.2	4
		RI	Clause 6.4.3.2 (Test 4)	

### Table 6.1.1.4-1: Requirements applicability for mandatory features with UE capability signalling

### 6.1.1.5 Applicability of Channel Quality Indicator (CQI) reporting requirements for CA

6.1.1.5.1 Applicability and test rules for different duplex modes and SCS combinations

The applicability and test rules for different duplex modes and SCS combinations are defined in Table 6.1.1.5.1-1.

Tests	PCell CC configuration			
Test 1 in Clause	TDD CC if supported, otherwise FDD CC			
6.2A.3.1.1	TED 60 Il supported; otherwise i EE 60			
Test 2 in Clause				
6.2A.3.1.1	Any of CCs			
(NOTE 2)				
Test 3 in Clause	Any of CCo			
6.2A.3.1.1	Any of CCs			
NOTE 1: The tes	st coverage can be considered fulfilled if UE passes one of			
the CC as PCell in Test 1.				
NOTE 2: These	scenarios are only tested for UEs which are not verified with			
Test 1 in Clause 6.2A.3.1.1.				

## 6.1.1.5.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in clause 6.2A are defined independent of CA configurations and bandwidth combination sets specified in clause 5.5A in TS 38.101-1 [2].

For UEs supporting multiple CA capabilities, test any one of the supported CA capabilities with largest aggregated CA bandwidth combination. The categorization of CA capability is specified in clause 5.1.1.5.1.

For UEs supporting multiple CA configurations from the selected CA capability, test any one of the supported CA configurations with largest aggregated CA bandwidth combination. For simplicity, the CA configuration refers to combination of CA configuration and bandwidth combination set.

A single uplink CC is configured for all tests.

### 6.1.1.5.3 Test coverage for different number of component carriers

For CA CQI tests specified in clause 6.2A, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

### 6.1.1.5.4 Applicability rule and antenna connection for CA tests with 4 RX

All the requirements specified in clause 6.2A for CA with 2 RX are applied for 4 RX capable UEs by connecting all 4 RX with data source from system simulator and reducing the signal power density by 3 dB compared to the signal power density for 2 RX in the test configurations.

### 6.1.2 Common test parameters

Parameters specified in Table 6.1.2-1 are applied for all test cases in this section unless otherwise stated.

	Parameter	Unit	Value
PDSCH transmi	PDSCH transmission scheme		Transmission scheme 1
Actual carrier configuration	Offset between Point A and the lowest usable subcarrier on this carrier (Note 3)	RBs	0
	Subcarrier spacing	kHz	15 or 30
	Cyclic prefix		Normal
DL BWP configuration #1	RB offset Number of contiguous PRB	RBs PRBs	0 Maximum transmission bandwidth configuration as specified in clause 5.3.2 of
			TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH Number of PDCCH candidates and aggregation levels		0,1 1/AL8
Additional	DCI format		0_1
PDCCH	TCI state		TCI state #1
Configuration for Aperiodic Reporting (Note 4)	PDCCH & PDCCH DMRS Precoding configuration		Multi-path fading propagation conditions: Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1
Active DL BWP			1
Common	Physical Cell ID		0
serving cell	SSB position in burst		First SSB in Slot #0
parameters	SSB periodicity	ms	20
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH		0,1
PDCCH configuration	Number of PDCCH candidates and aggregation levels		1/AL8
	DCI format		1_1
	TCI state		TCI state #1
Cross carrier sc			Not configured
	Mapping type		Туре А
	kO		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
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH configuration	PDCCH & PDCCH DMRS Precoding configuration		Multi-path fading propagation conditions: Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1 Static propagation conditions: Single Panel Type I, Random
			precoder chosen from precoder index 0 and 2, selection updated per slot

Table 6.1.2-1: Test parameters for CSI test cases
---

				Turne 4
	DMRS Type	itional DMPS		Type 1 1
	Number of additional DMRS Maximum number of OFDM			
		front loaded DMRS		1
PDSCH DMRS configuration	DMRS ports in			{1000} for Rank1 {1000,1001} for Rank2 {1000,1001,1002} for Rank3 {1000,1001,1002,1003} for Rank4
	Number of PDS group(s) without	SCH DMRS CDM		2
PTRS	Frequency den			N/A
configuration	Time density ( <i>L</i>			N/A
		index in the PRB		0 for CSI-RS resource 1,2,3,4
		mbol in the PRB used		4 for CSI-RS resource 1 and 3 8 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 (p)			3 for CSI-RS resource 1,2,3,4
	Density (p)			15 kHz SCS: 20 for CSI-RS
CSI-RS for tracking	CSI-RS periodi	city	slot	resource 1,2,3,4 30 kHz SCS: 40 for CSI-RS
TACKING	CSI-RS offset		slot	resource 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 Occ	cupation		Start PRB 0 Number of PRB = BWP size
	QCL info			TCI state #0
NZP CSI-RS	Eroqueney Oo	unation		Start PRB 0
for CSI	Frequency Occ	supation		Number of PRB = BWP size
acquisition	QCL info			TCI state #1
ZP CSI-RS for	Frequency Occ	cupation		Start PRB 0
CSI acquisition				Number of PRB = BWP size
	Type 1 QCL	SSB index		SSB #0
TCI state #0	information	QCL Type		Туре С
	Type 2 QCL	SSB index		N/A
	information	QCL Type		N/A
	Type 1 QCL	CSI-RS resource		CSI-RS resource 1 from 'CSI-
TOI state #1	information			RS for tracking' configuration
TCI state #1	T	QCL Type		
	Type 2 QCL information			N/A
	Information	QCL Type		N/A 4 For FDD
Number of HARC	Q Processes			8 for TDD
HARQ ACK/NAC	K bundling			Multiplexed
Redundancy ver		ionco		{0,2,3,1}
Redundancy ver	sion couling sequ	lence		2 for FDD
K1 value (PDSCH-to-HARQ-timing-indicator)			For FR1.30-1: 8 if mod(i,10) = 0 6 if mod(i,10) = 2 5 if mod(i,10) = 3 5 if mod(i,10) = 4 4 if mod(i,10) = 5 3 if mod(i,10) = 6 Where i is slot index per radio frame with $0\sim19$ For FR1.30-7:	
				8  if mod(i,10) = 0 7  if mod(i,10) = 1 6  if mod(i,10) = 2

			5 if mod(i,10) = 3 4 if mod(i,10) = 4 3 if mod(i,10) = 5	
			2 if $mod(i, 10) = 6$	
			Where i is the slot index of all	
			slots in every 5ms i = {0,,9}	
Symbols for unused REs			OP.1 FDD as defined in Annex A.5.1.1	
			OP.1 TDD as defined in Annex A.5.2.1	
Physical signals, channels mapping and precoding			As specified in Annex B.4.1	
Note 1: PDSCH is not scheduled on slots containing CSI-			ots which are not full DL.	
Note 2:	UE assumes that the TCI state for the PDSCI	I is identical	to the TCI state applied for the	
PDCCH transmission.				
Note 3: Point A coincides with minimum guard band as specified		is specified i	n Table 5.3.3-1 from TS 38.101-1	
	[2] for tested channel bandwidth and subcarrier spacing.			
Note 4:	•••			
	CSI reporting configured.			

### 6.2 Reporting of Channel Quality Indicator (CQI)

- 6.2.1 1RX requirements (Void)
- 6.2.2 2RX requirements
- 6.2.2.1 FDD

### 6.2.2.1.1 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB

6.2.2.1.1.1 2Rx FDD FR1 periodic CQI reporting under AWGN conditions for both SA and NSA

### 6.2.2.1.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

### 6.2.2.1.1.1.2 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.

### 6.2.2.1.1.1.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.2.1.1.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) The reported CQI value according to the reference channel shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.

b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by the less than or equal to 0.1.

Parameter		Unit	Te	est 1	Те	st 2
Bandwidth	MHz		1	0		
Duplex Mode		FDD				
	Subcarrier spacing kHz 15					
SNR	5	dB	8	8 9 14 15		
Propagation chan	nel			AW	GN	
Antenna configura			2×2 wit	th static ch Anne		cified in
Beamforming Model			As s	As specified in Section Annex B.4.1		
-	CSI-RS resource Type		-			
	Number of CSI-RS ports (X)		Periodic 4			
	CDM Type		-	FD-C		
	Density (p)		-			
ZP CSI-RS	First subcarrier index in the PRB			1		
configuration	used for CSI-RS (k <sub>0</sub> )			Row	5,4	
	First OFDM symbol in the PRB used			ç	2	
1	for CSI-RS (I <sub>0</sub> )			````	,	
	CSI-RS	slot		5/	/1	
	periodicity and offset	5101		5/	1	
	CSI-RS resource Type			Peri	odic	
	Number of CSI-RS ports (X)				2	
	CDM Type			FD-C	DM2	
	Density (ρ)					
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS ( $k_0$ , $k_1$ )			Row 3	3,(6,-)	
	First OFDM symbol in the PRB used			1	3	
	for CSI-RS (I <sub>0</sub> ) NZP CSI-RS-timeConfig	slot		5/	/1	
	periodicity and offset	0.01				
CSI-IM	CSI-IM resource Type			Peri		
configuration	CSI-IM RE pattern			(	)	
	CSI-IM Resource Mapping (kcsi-im,lcsi-im)			(4,	9)	
	CSI-IM timeConfig periodicity and offset	slot		5/	/1	
ReportConfigType				Peri	odic	
CQI-table	,			Tab		
reportQuantity				cri-RI-P		
	rChannelMeasurements			Not cor		
	rInterferenceMeasurements			Not cor		
cqi-FormatIndicate				Wide	<u> </u>	
pmi-FormatIndicat				Wide		
		חם				
Sub-band Size	4	RB		3		
CSI-reportingBan				1111		
CSI-Report period		slot		5/		
aperiodicTriggeringOffset				Not cor		
		typeI-Sin	glePanel			
configuration	Codebook Mode					
	(CodebookConfig- N1,CodebookConfig-N2)			Not cor	figured	
	CodebookSubsetRestriction			010	000	
	RI Restriction		1		/A	
Physical channel						
	CQI/RI/PMI delay	ms	PUCCH           ms         8			
CQI/RI/PMI delay Maximum number of HARQ transmission		1115	1		,	
			Ac	oified in T-		TDC 0
Measurement cha	nnel		As specified in Table A.4-2, TBS. 2		, 185.2-	

### Table 6.2.2.1.1.1.3-1: CQI reporting definition test

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The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.1.1.

6.2.2.1.1.1.4 Test Description

6.2.2.1.1.1.4.1 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 subcarrier 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 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 for TE diagram and section A.3.2.3 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.1.1.1.3-1 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.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* 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 6.2.2.1.1.1.4.3.

### 6.2.2.1.1.1.4.2 Test Procedure

- 1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.1.3-1.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.
- 5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio  $(NACK / ACK + NACK) \le 0.1$  then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE's wideband CQI reports. The SS sends

downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK / ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK / ACK + NACK)  $\leq 0.1$ 

then pass the UE for this test and go to step 9, otherwise go to step 8.

- 8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.
- 9. Repeat step 1 to 8 for Test2.

6.2.2.1.1.1.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.2.1.1.1.4.3\_1 Message exceptions for SA

### Table 6.2.2.1.1.1.4.3\_1-1: Void

### Table 6.2.2.1.1.1.4.3\_1-2: Void

#### 6.2.2.1.1.1.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.2.1.1.1.4.3\_1.

#### 6.2.2.1.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.1.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

## 6.2.2.1.1.2 2Rx FDD FR1 periodic CQI reporting with Table 3 under AWGN conditions for both SA and NSA

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

Whether to adopt minimum sample for pass/fail verdict needs further study.

### 6.2.2.1.1.2.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of  $10^{-5}$  falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

### 6.2.2.1.1.2.2 Test Applicability

This test applies to all types of NR UE release 16 supporting *cqi-TableAlt*.

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This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and cqi-TableAlt.

### 6.2.2.1.1.2.3 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.2.1.1.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10<sup>-5</sup>, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10<sup>-5</sup>. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10<sup>-5</sup>, then the BLER using transport format indicated by the less than or equal to 10<sup>-5</sup>.
- c) The reported CQI value according to the reference channel shall be  $\geq 1$ .

Parameter		Unit	Test 1	
Bandwidth	Bandwidth		10	
Duplex Mode			FDD	
Subcarrier spacing		kHz	15	
SNR	×	dB	1 2	
Propagation chan	nel		AWGN	
Antenna configura			1x2 with static channel specified in Annex B.1	
Beamforming Mod	del		As specified in Annex B.4.1	
¥	CSI-RS resource Type		Periodic	
	Number of CSI-RS ports (X)		4	
	CDM Type		FD-CDM2	
	Density (ρ)		1	
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> )		Row 5,4	
-	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		9	
	CSI-RS periodicity and offset	slot	5/1	
	CSI-RS resource Type		Periodic	
	Number of CSI-RS ports (X)		1	
	CDM Type		No CDM	
	Density (ρ)		3	
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 1,(0,-)	
	First OFDM symbol in the PRB used for CSI-RS ( $I_0$ )		13	
	NZP CSI-RS-timeConfig periodicity and offset	slot	5/1	
	CSI-IM resource Type		Periodic	
	CSI-IM RE pattern		0	
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)	
	CSI-IM timeConfig periodicity and offset	slot	5/1	

Table 6.2.2.1.1.2.3-1: CQI reporting test parameters

ReportConfigType			Periodic
CQI-table			Table 3
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFo	rChannelMeasurements		Not configured
timeRestrictionFo	rInterferenceMeasurements		Not configured
cqi-FormatIndicate	or		Wideband
pmi-FormatIndica	tor		Wideband
Sub-band Size		RB	8
Csi-ReportingBan	d		1111111
CSI-Report period	licity and offset	slot	5/0
aperiodicTriggerin	gOffset		Not configured
	Codebook Type		typeI-SinglePanel
	Codebook Mode		1
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel	for CSI report		PUCCH
CQI/RI/PMI delay	CQI/RI/PMI delay		8
Maximum number of HARQ transmission			1
Measurement channel			As specified in Table A.4-4, TBS.4-1

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.1.2.

### 6.2.2.1.1.2.4 Test Description

### 6.2.2.1.1.2.4.1 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 subcarrier 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 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 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.1.1.2.3-1 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.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* 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 6.2.2.1.1.2.4.3.

### 6.2.2.1.1.2.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.1.2.3-1.

- 2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 5000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- If Median CQI is not equal to 1 or 15 and 4500 or more of the wideband CQI values are in the range (Median CQI 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.
- 5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

For the filtered ACK and NACK responses if the ratio  $(NACK / (ACK + NACK)) \le 10^{-5}$  then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio (NACK /(ACK + NACK)) >  $10^{-5}$ 

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio (NACK /ACK + NACK)  $\leq 10^{-5}$ 

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

### 6.2.2.1.1.2.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

### 6.2.2.1.1.2.4.3\_1 Message exceptions for SA

### Table 6.2.2.1.1.2.4.3\_1-1: NZP CSI-RS-ResourceMapping

Derivation Path: TS 38.508-1 [6], Table 4.6.3-45			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	K0=0, row 1,	1Tx test
			cases
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	13		
СDМ Туре	noCDM		
density CHOICE {			
three	NULL		
}			
}			

### Table 6.2.2.1.1.2.4.4\_1-3: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-6					
Information Element	Value/remark	Comment	Condition		
CSI-IM-Resource ::= SEQUENCE {					
periodicityAndOffset SEQUENCE {					
slot5	0				
}					
}					

### Table 6.2.2.1.1.2.4.3\_1-2: NZP-CSI-RS-Resource

Value/remark	Comment	Condition
1		
	Value/remark	Value/remark Comment  1  1

### Table 6.2.2.1.1.2.4.4\_1-3: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-12					
Information Element	Value/remark	Comment	Condition		
CSI-ReportConfig ::= SEQUENCE {					
cqi-Table	table3				
}					

Derivation Path: TS38.508-1 [6], Table 5.4.2.4-15					
Information Element	Value/remark	Comment	Condition		
CodebookConfig ::= SEQUENCE {					
codebookType CHOICE {					
type1 SEQUENCE {					
subType CHOICE {					
typeI-SinglePanel SEQUENCE {					
nrOfAntennaPorts CHOICE {					
Two SEQUENCE {					
twoTX-codebookSubsetRestriction	000001				
}					
}					
}					
}					
}					
}					
}					

### Table 6.2.2.1.1.2.4.4\_1-4: CodebookConfig

### Table 6.2.2.1.1.2.4.4\_1-5: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-100					
Information Element	Value/remark	Comment	Condition		
PDSCH-Config ::= SEQUENCE {					
mcs-Table	qam64LowSE				
}					

### 6.2.2.1.1.2.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.2.1.1.2.4.3\_1.

### 6.2.2.1.1.2.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.1.1.2.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

### 6.2.2.1.2 CQI reporting under fading conditions

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of [1] dB.

## 6.2.2.1.2.1 2Rx FDD FR1 periodic wideband CQI reporting under fading conditions for both SA and NSA

### 6.2.2.1.2.1.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

#### 6.2.2.1.2.1.2 Test applicability

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

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

### 6.2.2.1.2.1.3 Minimum conformance requirements

For the parameters specified in Table 6.2.2.1.2.1.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time where  $\alpha$ % is specified in Table 6.2.2.1.2.1-2;
- b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ , where  $\gamma$  is specified in Table 6.2.2.1.2.1.3-2;
- c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

	Parameter	Unit	Те	est 1	Te	st 2
Bandwidth		MHz		10		
Subcarrier spacin	g	kHz	15			
Duplex Mode	5			FD	D	
SNR		dB	6	7	12	13
Propagation chan	nel	üÐ	Ŭ	TDLA		10
Antenna configura				2x		
Correlation configuration				ULA I		
Beamforming Model			10.			
beamorning woo			ASS	specified in		5.4.1
	CSI-RS resource Type			Perio		
	Number of CSI-RS ports (X)			4		
	СDМ Туре			FD-CI	JM2	
	Density (ρ)			1		
ZP CSI-RS	First subcarrier index in the PRB			Row	54	
configuration	used for CSI-RS (k <sub>0</sub> )			Row	5,7	
	First OFDM symbol in the PRB used			9		
	for CSI-RS (I <sub>0</sub> )			9		
	CSI-RS	01-1		<b>-</b> /-	1	-
	periodicity and offset	slot		5/*	I	
	CSI-RS resource Type		1	Perio	dic	
	Number of CSI-RS ports ( <i>X</i> )		1	2	-	
	CDM Type			FD-CI	DM2	
	Density ( $\rho$ )			1		
NZP CSI-RS for	First subcarrier index in the PRB			1		
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )			Row 3	3,(6)	
	First OFDM symbol in the PRB used		13			
	for CSI-RS (I <sub>0</sub> )					
	NZP CSI-RS-timeConfig	slot		5/*	1	
	periodicity and offset					
	CSI-IM resource Type		Periodic			
	CSI-IM RE pattern			0		
CSI-IM	CSI-IM Resource Mapping			(4,	9)	
configuration	(kcsi-iм,lcsi-iм)			(1,	0)	
	CSI-IM timeConfig	slot		5/*	1	
	periodicity and offset	3101		5/	I	
ReportConfigType	9			Perio	odic	
CQI-table				Tabl	e 2	
reportQuantity				cri-RI-PI	AI-CQI	
	rChannelMeasurements			Not con		
	rInterferenceMeasurements			Not con		
cgi-FormatIndicate				Widek	<u> </u>	
pmi-FormatIndica	-			Widek		
Sub-band Size		RB		8		
Csi-ReportingBan	d	ND	+	ہ 1111	111	
		01-1	-			
CSI-Report period		slot	+	5/0		
aperiodicTriggerin				Not cont		
	Codebook Type			typel-Sing	jiePanel	
	Codebook Mode			1		
Codebook	(CodebookConfig-			Not cont	igured	
configuration	N1,CodebookConfig-N2)				-	
	CodebookSubsetRestriction			0000		
	RI Restriction			N//	4	
Physical channel for CSI report				PUC		
CQI/RI/PMI delay		ms		8		
	r of HARQ transmission			1		
			As show	cified in Tal		TBS 2
Measurement cha	nnal		L V2 sher	incu in rai	л <del>о Л.4-</del> 2	, 100.2-

### Table 6.2.2.1.2.1.3-1: Wideband CQI reporting test under frequency non-selective fading conditions

Table 6.2.2.1.2.1.3-2:	Minimum rec	uirements
------------------------	-------------	-----------

Parameters	Test 1	Test 2
α [%]	20	20
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.2.1.

6.2.2.1.2.1.4 Test description

### 6.2.2.1.2.1.4.1 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 subcarrier 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 Figure A.3.2.3 for UE diagram.
- 2. The parameter settings for the cell are set up according to Table 6.2.2.1.2.1.3-1 as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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 6.2.2.1.2.1.4.3.

### 6.2.2.1.2.1.4.2 Test procedure

- 1. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.2.1.5-1.
- 2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 6000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as Median CQI value.
- 4. If Median CQI value is not equal to 1 or 15 and 1200 ( $\alpha$ %) or more of the wideband CQI values are outside the range (Median CQI 1)  $\leq$  Median CQI  $\leq$  (Median CQI + 1) then continue with step 5, otherwise go to step 7.
- 5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the Median CQI value from step 3 and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. Measure the average throughput according to Annex G.3.3 and G.3.4.

Declare the throughput as  $t_{median}$ .

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE's reported wideband CQI value. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as t.

If the recorded BLER  $\ge 0.02$  and t /  $t_{median} \ge \gamma$  then pass the UE for this test and go to step 8.

- 7. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 6) for the other SNR point as appropriate. Otherwise fail the UE.
- 8. Repeat step 1 to 7, with test conditions according to the table 6.2.2.1.2.1.5 -1, for Test2 as appropriate.

### 6.2.2.1.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

6.2.2.1.2.1.4.3\_1 Message exceptions for SA

### Table 6.2.2.1.2.1.4.3\_1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45					
Information Element	Value/remark	Comment	Condition		
CSI-RS-ResourceMapping ::= SEQUENCE {					
frequencyDomainAllocation CHOICE {					
other	001000				
}					
nrofPorts	p2				
firstOFDMSymbolInTimeDomain	13				
}					

### Table 6.2.2.1.2.1.4.3\_1-2: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

### Table 6.2.2.1.2.1.4.3\_1-3: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34			
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			
periodicityAndOffset	CSI-		
	ResourcePeriodicityAnd		
	Offset		

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Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-43			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset CHOICE {			
slots5	1		
}			

### Table 6.2.2.1.2.1.4.3\_1-4: CSI-ResourcePeriodicityAndOffset

### Table 6.2.2.1.2.1.4.3\_1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25			
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
Two SEQUENCE {			
twoTX-CodebookSubsetRestriction	000001		
}			
}			
typel-SinglePanel-ri-Restriction	11111111		

### Table 6.2.2.1.2.1.4.3\_1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
periodic SEQUENCE {			
reportSlotConfig	CSI- ReportPeriodicityAndOffs et		
pucch-CSI-ResourceList	PUCCH-CSI-Resource		
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands7	1111111		
}			
}			
subbandSize	value2		
}			

6.2.2.1.2.1.4.3\_2 Message exceptions for NSA

Same as in 6.2.2.1.2.1.4.3\_1.

6.2.2.1.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.2.1.2.1.4.2.

	Parameter	Unit	Test 1	Test 2
Bandwidth	MHz 10			
Subcarrier spacing		kHz	1:	
Duplex Mode	9	KI IZ	FD	
		dB	6 7	12 13
Propagation chan	nol	uВ	TDLA	
Antenna configura			10LA 2×	
Correlation config Beamforming Mod			ULA	
Beamforming Woo				
	CSI-RS resource Type			
	Number of CSI-RS ports (X)		4	
	CDM Type		FD-C	
	Density (ρ)		1	
ZP CSI-RS	First subcarrier index in the PRB		Row	5.4
configuration	used for CSI-RS (k <sub>0</sub> )		_	-,
	First OFDM symbol in the PRB used		g	1
	for CSI-RS (I <sub>0</sub> )		ļ	
	CSI-RS	slot	5/	1
	periodicity and offset	0.01		
	CSI-RS resource Type		Perio	
	Number of CSI-RS ports (X)		2	
	СDМ Туре		FD-C	DM2
	Density (ρ)		1	
NZP CSI-RS for	First subcarrier index in the PRB		Row	3 (6)
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		NOW	3,(0)
	First OFDM symbol in the PRB used		1;	2
	for CSI-RS (I <sub>0</sub> )		1.	5
	NZP CSI-RS-timeConfig	alat	5/	4
	periodicity and offset	slot	5/	1
	CSI-IM resource Type		Perio	odic
	CSI-IM RE pattern		0	
CSI-IM	CSI-IM Resource Mapping		( )	0)
configuration	(kcsi-im,lcsi-im)		(4,	9)
	CSI-IM timeConfig	alat		4
	periodicity and offset	slot	5/	1
ReportConfigType			Perio	odic
CQI-table			Tab	
reportQuantity			cri-RI-P	
	rChannelMeasurements		Not con	
	rInterferenceMeasurements		Not con	
cqi-FormatIndicate			Wide	
pmi-FormatIndica			Wide	
Sub-band Size		RB	8	
Csi-ReportingBan	d		1111	
CSI-Report period		slot	5/	
aperiodicTriggerin		5101	Not con	•
apenouic mggenn				
	Codebook Type		typeI-Sin	gieranei
Cadaback	Codebook Mode		1	
Codebook	(CodebookConfig-		Not con	figured
configuration	N1,CodebookConfig-N2)			5
	CodebookSubsetRestriction		000	
	RI Restriction		N/	
Physical channel for CSI report			PUC	
	CQI/RI/PMI delay		8	
Maximum number	of HARQ transmission		1	
Measurement cha	uppel		As specified in Ta	ble A.4-2, TBS.2-
measurement cha			1	

### Table 6.2.2.1.2.1.5-1: Wideband CQI reporting test under frequency non-selective fading conditions

Parameters	Test 1	Test 2
α[%]	20	20
γ	1.05 -TT	1.05 -TT
Note1 : TT = 0.01		

Table 6.2.2.1.2.1.5-2: Test requirements

## 6.2.2.1.2.2 2Rx FDD FR1 aperiodic subband CQI reporting under fading conditions for both SA and NSA

### 6.2.2.1.2.2.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

### 6.2.2.1.2.2.2 Test applicability

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

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

### 6.2.2.1.2.2.3 Minimum conformance requirements

The accuracy of sub-band channel CQI reporting under the frequency-selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting the transport format indicated by the corresponding reported sub-band CQI on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level compared to the throughput when transmitting a fixed transport format according to the wideband CQI median on a randomly selected sub-band among all the sub-bands.

For the parameters specified in Table 6.2.2.1.2.2.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % of the time for each sub-band, where  $\alpha$  and  $\beta$  are specified in Table 6.2.2.1.2.3-2.
- b) The ratio of the throughput obtained when transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level and that obtained when transmitting the transport format indicated by the reported wideband CQI median on a randomly selected sub-band among all the sub-bands shall be  $\geq \gamma$ , where  $\gamma$  is specified in Table 6.2.2.1.2.3-2.
- c) When transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level, the average BLER for the indicated transport format shall be greater than or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD.

	Parameter	Unit	Test 1 Test 2
Bandwidth		MHz	10
Subcarrier spacin	g	kHz	15
Duplex Mode			FDD
SNR		dB	8 9 14 15
			Two tap model specified in Annex
Propagation chan	nel		B.2.4 with $a=1$ , $f_D = 5Hz$ , and
			т <sub>d</sub> =0.45µs
Antenna configura			2x2
Correlation config			As per Annex B.1
Beamforming Mod			As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	СDМ Туре		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the PRB		Row 5,4
configuration	used for CSI-RS (k <sub>0</sub> )		100 0,4
	First OFDM symbol in the PRB used		9
	for CSI-RS (I <sub>0</sub> )		<u> </u>
	CSI-RS	slot	5/1
	periodicity and offset	0101	
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	СDМ Туре		FD-CDM2
	Density (ρ)		1
NZP CSI-RS for	First subcarrier index in the PRB		Row 3,(6,-)
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		100W 3,(0,-)
	First OFDM symbol in the PRB used		13
	for CSI-RS (I <sub>0</sub> )		13
	NZP CSI-RS-timeConfig	slot	5/1
	periodicity and offset	5101	5/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM	CSI-IM Resource Mapping		(4, 9)
configuration	(ксы-ім,Ісы-ім)		(4, 5)
	CSI-IM timeConfig	slot	5/1
	periodicity and offset	0101	
ReportConfigType	9		Aperiodic
CQI-table			Table 2
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		Not configured
	rInterferenceMeasurements		Not configured
cqi-FormatIndicat			Subband
pmi-FormatIndica	tor		Wideband
Sub-band Size		RB	8
csi-ReportingBan			1111111
CSI-Report interv		slot	Not configured
Aperiodic Report	Slot Offset		5
CSI request			1 in slots i, where $mod(i, 5) = 1$ ,
•			otherwise it is equal to 0
reportTriggerSize			1
			One State with one Associated
	<b>-</b>		Report Configuration
CSI-AperiodicTrig	gerStateList		Associated Report Configuration
			contains pointers to NZP CSI-RS
<u> </u>	<b>~</b> <i>"</i>		and CSI-IM
aperiodicTriggerin			Not configured
	Codebook Type		typeI-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig-		Not configured
configuration	N1,CodebookConfig-N2)		
	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel	for CSI report		PUSCH

### Table 6.2.2.1.2.2.3-1: Sub-band CQI reporting test under frequency-selective fading conditions

CQI/RI/PMI delay	ms	8
Maximum number of HARQ transmission		1
Measurement channel		As specified in Table A.4-2, TBS.2- 5

#### Table 6.2.2.1.2.2.3-2: Minimum requirements

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.2.2.

### 6.2.2.1.2.2.4 Test description

#### 6.2.2.1.2.2.4.1 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 subcarrier 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.3.1.6.1 for TE diagram and Figure A.3.2.3.1 for UE diagram.
- 2. The parameter settings for the cell are set up according to Table 6.2.2.1.2.2.3-1 as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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 6.2.2.1.2.2.4.3.

### 6.2.2.1.2.2.4.2 Test procedure

- 1. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.2.2.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband and subband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs at RB<sub>Start</sub>=0 allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Continue transmission of the PDSCH until 2000 wideband CQI reports and full-size subband CQI reports for each full-size subband have been gathered. In this process the SS collects sub-band CQI reports of ms and also cases where UE transmits nothing in its CQI timing are also counted as subband CQI reports.

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- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- 4. For each subband, if subband differential CQI offset level of 0 is reported, at least  $\alpha$  % but less than  $\beta$  % of 6000 full-size subband CQI report, then continue to step 5, otherwise, go to step 7.
- 5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC in an each available downlink transmission instance randomly selected full-size subband using the transport format according to the wideband median CQI value regardless of UE wideband or subband CQI report. Note that each full-size subband shall be selected in the equal probability. The SS sends downlink MAC padding bits on the DL

RMC. Measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as  $t_{median}$ .

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the highest UE reported full-size subband CQI value in one full-size subband selected among the sub-bands in which UE report the highest full-size subband CQI. Subband differential CQI offset level is selected from {0, 1, 2, -1}. Note that the SS shall send PDSCH in the same full-size subband until next UE report is available. In case when same full-size subbands are reported subsequently as subbands with highest full-size subband CQI, the SS shall select for transmission a different subband with respect to the last selection. The SS sends downlink MAC padding bits on the DL RMC Measure the average throughput and (NACK /(ACK + NACK)) according to

Annex G.3.3 and G.3.4. Declare the throughput as  $t_{subband}$ . If the ratio  $(t_{subband} / t_{median}) \ge \gamma$  and (NACK /(ACK + NACK))  $\ge 0.02$ , pass the UE and go to step 8. Otherwise, go to step 7.

- 7. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 6) for the other SNR point as appropriate. Otherwise fail the UE.
- 8. If both tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the table 6.2.2.1.2.2.3-1 for the other test as appropriate.

### 6.2.2.1.2.2.4.3 Message contents

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

### 6.2.2.1.2.2.4.3\_1 Message exceptions for SA

### Table 6.2.2.1.2.2.4.3\_1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	001000		
}			
nrofPorts	p2		
firstOFDMSymbolInTimeDomain	13		
}			

### Table 6.2.2.1.2.2.4.3\_1-2: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

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Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34				
Information Element	Value/remark	Comment	Condition	
csi-IM-ResourceElementPattern				
pattern0 SEQUENCE {				
subcarrierLocation-p0	s4			
symbolLocation-p0	9			
}				
periodicityAndOffset	CSI-			
	ResourcePeriodicityAnd Offset			

### Table 6.2.2.1.2.2.4.3\_1-3: CSI-IM-Resource

### Table 6.2.2.1.2.2.4.3\_1-4: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43				
Information Element Value/remark Comment Conditi				
CSI-ResourcePeriodicityAndOffset CHOICE {				
slots5	1			
}				

### Table 6.2.2.1.2.2.4.3\_1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
Two SEQUENCE {				
twoTX-CodebookSubsetRestriction	000001			
}				
}				
typeI-SinglePaneI-ri-Restriction	11111111			

### Table 6.2.2.1.2.2.4.3\_1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39			
Information Element	Value/remark	Comment	Condition
reportFreqConfiguration SEQUENCE {			
cqi-FormatIndicator	subbandCQI		
csi-ReportingBand CHOICE {			
subbands7	1111111		
}			
}			

### 6.2.2.1.2.2.4.3\_2 Message exceptions for NSA

Same as in 6.2.2.1.2.2.4.3\_1.

### 6.2.2.1.2.2.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.2.1.2.2.4.2.

### Table: 6.2.2.1.2.2.5-1: Test requirements

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.04	1.04

6.2.2.2	TDD
6.2.2.2.1	CQI Reporting definition under AWGN conditions
6.2.2.2.1.1	2Rx TDD FR1 periodic CQI reporting under AWGN conditions for both SA and NSA
6.2.2.2.1.1.1	Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

### 6.2.2.2.1.1.2 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.

### 6.2.2.2.1.1.3 Minimum requirement for periodic CQI reporting

The purpose of the requirements is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. The reporting accuracy of CQI under AWGN condition is determined by the reporting variance and BLER performance using the transport format indicated by the reported CQI median.

For the parameters specified in Table 6.2.2.2.1.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by the less than or equal to 0.1.

	Parameter	Unit	Test 1 Test 2
Bandwidth		MHz	40
Subcarrier spacir	ng	kHz	30
Duplex Mode			TDD
TDD UL-DL patte	ern		FR1.30-1
SNR		dB	8 9 14 15
Propagation char	nnel		AWGN
			2x2 with static channel specified in
Antenna configur	ation		Annex B.1
Beamforming Mo	del		As specified in Section Annex
beamorning wo			B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the PRB		Daw 5.4
configuration	used for CSI-RS (k <sub>0</sub> )		Row 5,4
0	First OFDM symbol in the PRB used		9
	for CSI-RS (I <sub>0</sub> )		9
	CSI-RS	-1-4	40/4
	periodicity and offset	slot	10/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports ( <i>X</i> )		2
	CDM Type		FD-CDM2
	Density (ρ)		1
NZP CSI-RS for	First subcarrier index in the PRB		1
			Row 3,(6,-)
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		13
	NZP CSI-RS-timeConfig	slot	10/1
001.04	periodicity and offset		
CSI-IM	CSI-IM resource Type		Periodic
configuration	CSI-IM RE pattern		0
	CSI-IM Resource Mapping		(4, 9)
	(ксы-ім,Ісы-ім)		(1, 3)
	CSI-IM timeConfig	slot	10/1
	periodicity and offset	5101	10/1
ReportConfigTyp	e		Periodic
CQI-table			Table 2
reportQuantity			cri-RI-PMI-CQI
	orChannelMeasurements		Not configured
	orInterferenceMeasurements		Not configured
cgi-FormatIndicat			Wideband
pmi-FormatIndica			Wideband
		DD	
Sub-band Size		RB	16
CSI-reportingBan			1111111
CSI-Report perio		slot	10/9
aperiodicTriggeri			Not configured
Codebook	Codebook Type		typeI-SinglePanel
configuration	Codebook Mode		1
	(CodebookConfig-		Not configured
	N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		010000
	RI Restriction		N/A
Physical channel			PUCCH
	CQI/RI/PMI delay	ms	9.5
Maximum numbo	r of HARO transmission	1110	1
Maximum number of HARQ transmission			1
			As specified in Table A.4-2, TBS.2

Table 6.2.2.2.1.1.3-1: CQ	I reporting definition	on test
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The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.1.1.

6.2.2.2.1.1.4 Test Description

6.2.2.2.1.1.4.1 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 subcarrier 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 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 for TE diagram and section A.3.2.3 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.2.1.1.3-1 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.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* 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 6.2.2.2.1.1.4.3.

### 6.2.2.2.1.1.4.2 Test Procedure

- 1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.1.3-1.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.
- 5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio  $(NACK / ACK + NACK) \le 0.1$  then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE's wideband CQI reports. The SS sends

downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK / ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK / ACK + NACK)  $\leq 0.1$ 

then pass the UE for this test and go to step 9, otherwise go to step 8.

- 8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.
- 9. Repeat step 1 to 8 for Test2.

6.2.2.2.1.1.4.4 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.2.2.1.1.4.4\_1 Message exceptions for SA

### Table 6.2.2.2.1.1.4.4\_1-1: Void

### Table 6.2.2.2.1.1.4.4\_1-2: Void

### 6.2.2.2.1.1.4.4\_2 Message exceptions for NSA

Same as specified in 6.2.2.2.1.1.4.4\_1.

### 6.2.2.2.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.2.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

### 6.2.2.2.1.2 2Rx TDD FR1 periodic CQI reporting with Table 3 under AWGN conditions for both SA and NSA

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

Whether to adopt minimum sample for pass/fail verdict needs further study.

#### 6.2.2.2.1.2.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of  $10^{-5}$  falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

### 6.2.2.2.1.2.2 Test Applicability

This test applies to all types of NR UE release 16 supporting *cqi-TableAlt*.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and *cqi-TableAlt*.

### 6.2.2.2.1.2.3 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.2.2.1.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10<sup>-5</sup>, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10<sup>-5</sup>. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10<sup>-5</sup>, then the BLER using transport format indicated by the less than or equal to 10<sup>-5</sup>.
- c) The reported CQI value according to the reference channel shall be  $\geq 1$ .

	Parameter	Unit	Test 1
Bandwidth		MHz	40
Subcarrier spacin	g	kHz	30
Duplex Mode	·		TDD
TDD UL-DL patte	rn		FR1.30-1
SNR		dB	1 2
Propagation chan	nel		AWGN
Antenna configura	ation		1x2 with static channel specified in Annex B.1
Beamforming Mod	del		As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the PRB		Row 5,4
configuration	used for CSI-RS (k <sub>0</sub> )		K0W 5,4
	First OFDM symbol in the PRB used for CSI-RS ( $I_0$ )		9
	CSI-RS periodicity and offset	slot	10/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		1
	CDM Type		No CDM
	Density (ρ)		3
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 1,(0,-)
	First OFDM symbol in the PRB used for CSI-RS ( $I_0$ )		1
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)
comguration	CSI-IM,ICSI-IM) CSI-IM timeConfig periodicity and offset	slot	10/1

### Table 6.2.2.2.1.2.3-1: CQI reporting test parameters

ReportConfigType			Periodic
CQI-table			Table 3
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFo	rChannelMeasurements		Not configured
timeRestrictionFo	rInterferenceMeasurements		Not configured
cqi-FormatIndicate	or		Wideband
pmi-FormatIndica	tor		Wideband
Sub-band Size		RB	16
Csi-ReportingBan	d		1111111
CSI-Report period	licity and offset	slot	10/9
aperiodicTriggerin	aperiodicTriggeringOffset		Not configured
	Codebook Type		typeI-SinglePanel
	Codebook Mode		1
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel	for CSI report		PUCCH
CQI/RI/PMI delay	CQI/RI/PMI delay		9.5
Maximum number of HARQ transmission			1
Measurement channel			As specified in Table A.4-4, TBS.4-2

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.1.2.

### 6.2.2.2.1.2.4 Test Description

### 6.2.2.2.1.2.4.1 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 subcarrier 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 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 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.2.1.2.3-1 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.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* 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 6.2.2.2.1.2.4.3.

### 6.2.2.2.1.2.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.2.3-1.

- 2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 5000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 10 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- If Median CQI is not equal to 1 or 15 and 4500 or more of the wideband CQI values are in the range (Median CQI 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.
- 5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

For the filtered ACK and NACK responses if the ratio  $(NACK / (ACK + NACK)) \le 10^{-5}$  then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio (NACK / (ACK + NACK)) >  $10^{-5}$ 

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio (NACK / ACK + NACK)  $\leq 10^{-5}$ 

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

### 6.2.2.2.1.2.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

### 6.2.2.2.1.2.4.3\_1 Message exceptions for SA

### Table 6.2.2.2.1.2.4.3\_1-1: NZP CSI-RS-ResourceMapping

Derivation Path: TS 38.508-1 [6], Table 4.6.3-45			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0000	K0=0, row 1,	1Tx test
			cases
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	1		
СDМ Туре	noCDM		
density CHOICE {			
three	NULL		
}			
}			

### Table 6.2.2.2.1.2.4.3\_1-2: NZP-CSI-RS-Resource

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14			
Information Element	Value/remark	Comment	Condition
NZP-CSI-RS-Resource ::= SEQUENCE {			
periodicityAndOffset CHOICE {			
slot10	1		
}			
}			

### Table 6.2.2.2.1.2.4.4\_1-3: CSI-IM-Resource

Value/remark	Comment	Condition
1		
	Value/remark	Value/remark     Comment       1     1       1     1

### Table 6.2.2.2.1.2.4.4\_1-4: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-12			
Information Element	Value/remark	Comment	Condition
CSI-ReportConfig ::= SEQUENCE {			
cqi-Table	table3		
}			

### Table 6.2.2.2.1.2.4.4\_1-5: CodebookConfig

Derivation Path: TS38.508-1 [6], Table 5.4.2.4-15			
Information Element	Value/remark	Comment	Condition
CodebookConfig ::= SEQUENCE {			
codebookType CHOICE {			
type1 SEQUENCE {			
subType CHOICE {			
typeI-SinglePanel SEQUENCE {			
nrOfAntennaPorts CHOICE {			
Two SEQUENCE {			
twoTX-codebookSubsetRestriction	000001		
}			
}			
}			
}			
}			
}			
}			

### Table 6.2.2.2.1.2.4.4\_1-6: PDSCH-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-100			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
mcs-Table	qam64LowSE		
}			

### 6.2.2.2.1.2.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.2.2.1.2.4.3\_1.

### 6.2.2.2.1.2.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.2.1.2.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

- 6.2.2.2.2 CQI reporting under fading conditions
- 6.2.2.2.2.1 2Rx TDD FR1 periodic wideband CQI reporting under fading conditions for both SA and NSA
- 6.2.2.2.2.1.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

### 6.2.2.2.2.1.2 Test applicability

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

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

### 6.2.2.2.2.1.3 Minimum conformance requirements

For the parameters specified in Table 6.2.2.2.1.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time where  $\alpha$ % is specified in Table 6.2.2.2.1.3-2;
- b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ , where  $\gamma$  is specified in Table 6.2.2.2.1.3-2;
- c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

	Parameter	Unit	Test 1	Test 2	
Bandwidth		MHz	40		
Subcarrier spacing	arrier spacing kHz 30		)		
Duplex Mode			TD	D	
TDD UL-DL patter	m		FR1.	30-1	
SNR		dB	6 7	12 13	
Propagation chan	nel		TDLA	30-5	
Antenna configura	ation		2×	2	
Correlation config	uration		ULA	high	
Beamforming Mod			As specified in		
	CSI-RS resource Type		Perio		
	Number of CSI-RS ports (X)		4		
	CDM Type		FD-C	DM2	
	Density (p)		1		
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> )		Row	5,4	
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		9		
	CSI-RS periodicity and offset	slot	10	(1	
	CSI-RS resource Type		Perio	odic	
	Number of CSI-RS ports (X)		2		
	CDM Type		FD-C		
	Density (p)		1	BIIIL	
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 3,(6,-)		
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		1;	3	
	NZP CSI-RS-timeConfig periodicity and offset	slot	10.	/1	
CSI-IM	CSI-RS resource Type		Perio	odic	
configuration	CSI-IM RE pattern		0		
eegui uuei	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,		
	CSI-IM timeConfig periodicity and offset	slot	10	(1	
ReportConfigType			Perio	odic	
CQI-table			Tabl		
reportQuantity			cri-RI-P		
timeRestrictionFo	rChannelMeasurements		Not con		
	rInterferenceMeasurements		Not con		
cqi-FormatIndicate			Widel	0	
pmi-FormatIndica			Widel		
Sub-band Size		RB	10		
Csi-ReportingBan	d	-	1111		
CSI-Report period		slot	10		
aperiodicTriggerin			Not con		
		typeI-Sing			
configuration	Codebook Mode		1		
	(CodebookConfig- N1,CodebookConfig-N2)		Not con	figured	
	CodebookSubsetRestriction		0000	001	
	RI Restriction		N/		
Physical channel for CSI report			PUC		
CQI/RI/PMI delay		ms	9.		
	r of HARQ transmission		1	-	
			As specified in Ta	ole A.4-1. TBS.2-	
Measurement channel			3		

# Table 6.2.2.2.2.1.3-1: Wideband CQI reporting test under frequency non-selective fading conditions

Parameters	Test 1	Test 2
α [%]	20	20
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.1.

6.2.2.2.1.4 Test description

### 6.2.2.2.2.1.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.1.4.1 with the following exceptions:

Instead of Table 6.2.2.1.2.1.3-1  $\rightarrow$  use Table 6.2.2.2.2.1.3-1.

6.2.2.2.2.1.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.1.4.2 with the following exceptions:

Instead of Table 6.2.2.1.2.1.5-1  $\rightarrow$  use Table 6.2.2.2.2.1.3-1.

## 6.2.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

6.2.2.2.2.1.4.3\_1 Message exceptions for SA

Same as 6.2.2.1.2.1.4.3\_1 with following exceptions:

# Table 6.2.2.2.2.1.4.3\_1-1: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43				
Information Element	Value/remark	Comment	Condition	
CSI-ResourcePeriodicityAndOffset CHOICE {				
slots10	1			
}				

6.2.2.2.1.4.3\_2 Message exceptions for NSA

Same as 6.2.2.2.1.4.3\_1.

#### 6.2.2.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.2.2.1.4.2.

## Table 6.2.2.2.2.1.5-1: Test requirements

Parameters	Test 1	Test 2	
α[%]	20	20	
γ	1.04	1.04	

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# 6.2.2.2.2.2 2Rx TDD FR1 aperiodic subband CQI reporting under fading conditions for both SA and NSA

# 6.2.2.2.2.2.1 Test purpose

To verify the variance of the subband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2 % for the indicated transport format.

# 6.2.2.2.2.2.2 Test applicability

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

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

# 6.2.2.2.2.2.3 Minimum conformance requirements

The purpose of the requirements is to verify that the preferred sub-bands can be used for frequency-selective scheduling under the frequency-selective fading conditions.

The accuracy of sub-band channel CQI reporting under the frequency-selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting the transport format indicated by the corresponding reported sub-band CQI on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level compared to the throughput when transmitting a fixed transport format according to the wideband CQI median on a randomly selected sub-band among all the sub-bands.

For the parameters specified in Table 6.2.2.2.2.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % of the time for each sub-band, where  $\alpha$  and  $\beta$  are specified in Table 6.2.2.2.2.3-2;
- b) The ratio of the throughput obtained when transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level and that obtained when transmitting the transport format indicated by the reported wideband CQI median on a randomly selected sub-band among all the sub-bands shall be  $\geq \gamma$ , where  $\gamma$  is specified in Table 6.2.2.2.3-2;
- c) When transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level, the average BLER for the indicated transport format shall be greater than or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance for TDD.

Dondwidth	Parameter		Test 1 Test 2
Bandwidth	a	MHz kHz	40 30
Subcarrier spacin Duplex Mode	g	KHZ	TDD
TDD UL-DL patte	r0		FR1.30-1
	m	٩D	
SNR		dB	8 9 14 15
Dranagation shap	nal		Two tap model specified in Annex
Propagation chan	nei		B.2.4 with $a=1$ , $f_D = 5Hz$ , and
A	- (		т <sub>d</sub> =0.1125µs
Antenna configura			2x2
Correlation config			As per Annex B.1
Beamforming Mod			As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	СDМ Туре		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the PRB		Row 5,4
configuration	used for CSI-RS (k <sub>0</sub> )		100 0,4
	First OFDM symbol in the PRB used		9
	for CSI-RS (I <sub>0</sub> )		5
	CSI-RS	slot	10/1
	periodicity and offset	5101	10/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	CDM Type		FD-CDM2
	Density (ρ)		1
NZP CSI-RS for	First subcarrier index in the PRB		
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 3,(6,-)
·	First OFDM symbol in the PRB used		
	for CSI-RS (I <sub>0</sub> )		13
	NZP CSI-RS-timeConfig		
	periodicity and offset	slot	10/1
CSI-IM	CSI-IM resource Type		Periodic
configuration	CSI-IM RE pattern		0
<b>J</b>	CSI-IM Resource Mapping		
	(k <sub>CSI-IM</sub> ,I <sub>CSI-IM</sub> )		(4, 9)
	CSI-IM timeConfig		
	periodicity and offset	slot	10/1
ReportConfigType			Aperiodic
CQI-table	5		Table 2
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		Not configured
			Not configured
cqi-FormatIndicat	rInterferenceMeasurements		Subband
pmi-FormatIndica	ເບເ		Wideband
Sub-band Size		RB	16
csi-ReportingBan			1111111
CSI-Report interv		slot	Not configured
Aperiodic Report	Slot Offset		8
CSI request			1 in slots i, where $mod(i, 10) = 1$ ,
•			otherwise it is equal to 0
reportTriggerSize			1
			One State with one Associated
			Report Configuration
CSI-AperiodicTrig	gerStateList		Associated Report Configuration
			contains pointers to NZP CSI-RS
			and CSI-IM
aperiodicTriggerir	ngOffset		Not configured
	Codebook Type		typeI-SinglePanel
Codebook	Codebook Mode		1
Codebook configuration	(CodebookConfig-		Not configured
			Not configured 000001

# Table 6.2.2.2.2.3-1: Sub-band CQI reporting test under frequency-selective fading conditions

Physical channel for CSI report		PUSCH
CQI/RI/PMI delay	ms	9.5
Maximum number of HARQ transmission		1
Measurement channel		As specified in Table A.4-2, TBS.2- 6

# Table 6.2.2.2.2.2.3-2: Minimum requirements

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.2.2.

6.2.2.2.2.2.4 Test description

6.2.2.2.2.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.2.4.1 with the following exceptions:

Instead of Table 6.2.2.1.2.2.3-1  $\rightarrow$  use Table 6.2.2.2.2.3 -1.

Instead of clause 6.2.2.1.2.2.4.3  $\rightarrow$  use clause 6.2.2.2.2.4.3.

# 6.2.2.2.2.2.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.2.4.2 with the following exceptions:

Instead of Table 6.2.2.1.2.2.3-1  $\rightarrow$  use Table 6.2.2.2.2.3-1.

6.2.2.2.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

#### 6.2.2.2.2.4.3\_1 Message exceptions for SA

# Table 6.2.2.2.2.4.3\_1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	001000			
}				
nrofPorts	p2			
firstOFDMSymbolInTimeDomain	13			
}				

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	000100			
}				
nrofPorts	p4			
firstOFDMSymbolInTimeDomain	9			
}				

# Table 6.2.2.2.2.4.3\_1-2: CSI-RS-ResourceMapping for ZP-CSI-RS

# Table 6.2.2.2.2.2.4.3\_1-3: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34				
Information Element	Value/remark	Comment	Condition	
csi-IM-ResourceElementPattern				
pattern0 SEQUENCE {				
subcarrierLocation-p0	s4			
symbolLocation-p0	9			
}				
periodicityAndOffset	CSI-			
	ResourcePeriodicityAnd			
	Offset			

# Table 6.2.2.2.2.2.4.3\_1-4: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43				
Information Element Value/remark Comment Condition				
CSI-ResourcePeriodicityAndOffset CHOICE {				
slots10	1			
}				

# Table 6.2.2.2.2.2.4.3\_1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
Two SEQUENCE {				
twoTX-CodebookSubsetRestriction	000001			
}				
}				
typel-SinglePanel-ri-Restriction	11111111			

# Table 6.2.2.2.2.2.4.3\_1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39				
Information Element	Value/remark	Comment	Condition	
reportFreqConfiguration SEQUENCE {				
cqi-FormatIndicator	subbandCQI			
csi-ReportingBand CHOICE {				
subbands7	1111111			
}				
}				

# 6.2.2.2.2.4.3\_2 Message exceptions for NSA

Same as in 6.2.2.2.2.4.3\_1.

### 6.2.2.2.2.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.2.2.2.4.2.

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.04	1.04

Table 6.2.2.2.2.2.5-1: Test requirements

# 6.2.3 4RX requirements

# 6.2.3.1 FDD

# 6.2.3.1.1 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB

# 6.2.3.1.1.1 4Rx FDD FR1 periodic CQI reporting under AWGN conditions for both SA and NSA

### 6.2.3.1.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

#### 6.2.3.1.1.1.2 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.

#### 6.2.3.1.1.1.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.3.1.1.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by the less than or equal to 0.1.

	Parameter	Unit	Test 1		st 2
Bandwidth		MHz	-		
Subcarrier spacin	g	kHz		15	
Duplex Mode				FDD	
SNR		dB	5 6	11	12
Propagation char	inel			AWGN	
Antenna configura	ation		2x4 with static channel specifi Annex B.1		ecified ir
Beamforming Mo	del			ed in Annex I	3.4.1
	CSI-RS resource Type			Periodic	
	Number of CSI-RS ports (X)			4	
	CDM Type		F	D-CDM2	
	Density (ρ)			1	
ZP CSI-RS	First subcarrier index in the PRB				
configuration	used for CSI-RS (k <sub>0</sub> )		F	Row 5,4	
configuration	First OFDM symbol in the PRB used				
				9	
	for CSI-RS (I <sub>0</sub> )				
	CSI-RS	slot		5/1	
	periodicity and offset				
	CSI-RS resource Type		F	Periodic	
	Number of CSI-RS ports (X)			2	
	CDM Type		F	D-CDM2	
	Density (ρ)			1	
NZP CSI-RS for	First subcarrier index in the PRB		_	a (a )	
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		R	ow 3,(6,-)	
	First OFDM symbol in the PRB used				
	for CSI-RS (I <sub>0</sub> )			13	
	NZP CSI-RS-timeConfig				
		slot		5/1	
	periodicity and offset		r	) a mi a ali a	
	CSI-IM resource Type		1	Periodic	
	CSI-IM RE pattern			0	
CSI-IM	CSI-IM Resource Mapping			(4, 9)	
configuration	(ксы-ім,Ісы-ім)			( !, 0)	
	CSI-IM timeConfig	slot		5/1	
	periodicity and offset	3101			
ReportConfigType	9		F	Periodic	
CQI-table			-	Table 2	
reportQuantity			cri-F	RI-PMI-CQI	
timeRestrictionFo	rChannelMeasurements		Not	configured	
	rInterferenceMeasurements			configured	
cgi-FormatIndicat				/ideband	
pmi-FormatIndica				/ideband	
Sub-band Size		RB	V	8	
	d	ΝŬ		-	
csi-ReportingBan		al - 4	1	111111	
CSI-Report period		slot		5/0	
aperiodicTriggerin				configured	
	Codebook Type		typel-	SinglePanel	
	Codebook Mode			1	
Codebook	(CodebookConfig-		Not	configured	
configuration	N1,CodebookConfig-N2)				
	CodebookSubsetRestriction			010000	
	RI Restriction			N/A	
Physical channel			F	PUCCH	
CQI/RI/PMI delay		ms	· · ·	8	
Maximum number of HARQ transmission		110		1	
Mayimi m numbo			1	1	
Maximum numbe			As specified in		TPO

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.1.1.

# 6.2.3.1.1.1.4 Test Description

## 6.2.3.1.1.1.4.1 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 subcarrier 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 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 section A.3.2.5 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.1.1.1.3-1 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.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* 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 6.2.3.1.1.1.4.3.

# 6.2.3.1.1.1.4.2 Test Procedure

- 1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.1.3-1.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- 4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI 1)  $\leq$  Median CQI  $\leq$  (Median CQI + 1) then continue with step 5, otherwise go to step 8.
- 5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK)  $\leq$  0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK / ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK)  $\leq 0.1$ 

then pass the UE for this test and go to step 9, otherwise go to step 8.

- 8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.
- 9. Repeat step 1 to 8 for Test2.

### 6.2.3.1.1.1.4.4 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

### 6.2.3.1.1.1.4.4\_1 Message exceptions for SA

Same as specified in clause 6.2.2.1.1.1.4.4\_1

# 6.2.3.1.1.1.4.4\_2 Message exceptions for NSA

Same as specified in clause 6.2.3.1.1.1.4.4\_1.

### 6.2.3.1.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.1.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

# 6.2.3.1.1.2 4Rx FDD FR1 periodic CQI reporting with Table 3 under AWGN conditions for both SA and NSA

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Whether to adopt minimum sample for pass/fail verdict needs further study.

#### 6.2.3.1.1.2.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of  $10^{-5}$  falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

# 6.2.3.1.1.2.2 Test Applicability

This test applies to all types of NR UE release 16 supporting *cqi-TableAlt*.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and cqi-TableAlt.

#### 6.2.3.1.1.2.3 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.3.1.1.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) The reported CQI value according to the reference channel shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.

- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10<sup>-5</sup>, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10<sup>-5</sup>. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10<sup>-5</sup>, then the BLER using transport format indicated by the less than or equal to 10<sup>-5</sup>.
- c) The reported CQI value according to the reference channel shall be  $\geq 1$ .

	Parameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier spacin	a	kHz	15
Duplex Mode	5		FDD
SNR		dB	-2 -1
Propagation chan	nel		AWGN
Antenna configura			1x4 with static channel specified in Annex B.1
Beamforming Mod	del		As specified in Annex B.4.1
g	CSI-RS resource Type		Periodic
	Number of CSI-RS ports ( <i>X</i> )		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the PRB		
configuration	used for CSI-RS ( $k_0$ )		Row 5,4
garation	First OFDM symbol in the PRB used		
	for CSI-RS (I <sub>0</sub> )		9
	CSI-RS		
	periodicity and offset	slot	5/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports ( <i>X</i> )		1
	CDM Type		No CDM
	Density (ρ)		3
NZP CSI-RS for	First subcarrier index in the PRB		-
CSI acquisition	used for CSI-RS ( $k_0$ , $k_1$ )		Row 1,(0,-)
	First OFDM symbol in the PRB used		
	for CSI-RS (I <sub>0</sub> )		1
	NZP CSI-RS-timeConfig		
	periodicity and offset	slot	5/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM	CSI-IM Resource Mapping		
configuration	(kcsi-im,lcsi-im)		(4, 9)
	CSI-IM timeConfig	-1-4	E /4
	periodicity and offset	slot	5/1
ReportConfigType			Periodic
CQI-table			Table 3
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFo	rChannelMeasurements		Not configured
timeRestrictionFo	rInterferenceMeasurements		Not configured
cqi-FormatIndicat	or		Wideband
pmi-FormatIndica	tor		Wideband
Sub-band Size		RB	8
Csi-ReportingBan	d		1111111
CSI-Report period		slot	5/0
aperiodicTriggerir			Not configured
	Codebook Type		typeI-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig-		Not configured
configuration	N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel	for CSI report		PUCCH
CQI/RI/PMI delay		ms	8
	of HARQ transmission		1
			As specified in Table A.4-4,
Measurement cha	Innei		TBS.4-1

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.1.2.

# 6.2.3.1.1.2.4 Test Description

## 6.2.3.1.1.2.4.1 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 subcarrier 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 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 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.1.1.2.3-1 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.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* 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 6.2.3.1.1.2.4.3.

# 6.2.3.1.1.2.4.2 Test Procedure

- 1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.3.1.1.2.3-1.
- 2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 5000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- 4. If Median CQI is not equal to 1 or 15 and 4500 or more of the wideband CQI values are in the range (Median CQI 1)  $\leq$  Median CQI + 1) then continue with step 5, otherwise go to step 8.
- 5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

For the filtered ACK and NACK responses if the ratio  $(NACK / (ACK + NACK)) \le 10^{-5}$  then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the

ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio (NACK /(ACK + NACK)) >  $10^{-5}$ 

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio (NACK /ACK + NACK)  $\leq 10^{-5}$ 

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

#### 6.2.3.1.1.2.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

#### 6.2.3.1.1.2.4.3\_1 Message exceptions for SA

Same as specified in clause 6.2.2.1.1.2.4.3\_1.

#### 6.2.3.1.1.2.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.3.1.1.2.4.3\_1.

#### 6.2.3.1.1.2.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.1.1.2.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

## 6.2.3.1.2 CQI reporting definition under fading conditions

6.2.3.1.2.1 4Rx FDD FR1 periodic wideband CQI reporting under fading conditions for both SA and NSA

#### 6.2.3.1.2.1.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

#### 6.2.3.1.2.1.2 Test applicability

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

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

#### 6.2.3.1.2.1.3 Minimum conformance requirements

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to

the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI.

For the parameters specified in Table 6.2.3.1.2.1.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time where  $\alpha$ % is specified in Table 6.2.3.1.2.1.3-2;
- b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ , where  $\gamma$  is specified in Table 6.2.3.1.2.1.3-2;
- c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

	Parameter	Unit	Te	est 1	Те	st 2
Bandwidth		MHz	10			
Subcarrier spacin	q	kHz				
Duplex Mode				FD	D	
SNR		dB	3	4	9	10
Propagation chan	nel			TDLA	30-5	
Antenna configura	ation			2×		
Correlation config				XP H		
Beamforming Mod			As	specified in		3 4 1
Doamoning	CSI-RS resource Type		7.0	Peric		
	Number of CSI-RS ports ( <i>X</i> )			4	alo	
	CDM Type			FD-CI	M2	
	Density (p)			1		
ZP CSI-RS	First subcarrier index in the PRB			1		
				Row	5,4	
configuration	used for CSI-RS (k <sub>0</sub> )					
	First OFDM symbol in the PRB used			9		
	for CSI-RS (I <sub>0</sub> )					
	CSI-RS	slot		5/*		
	periodicity and offset					
	CSI-RS resource Type			Peric	aic	
	Number of CSI-RS ports (X)		-	2		
	CDM Type			FD-CI	JM2	
	Density (ρ)			1		
NZP CSI-RS for	First subcarrier index in the PRB			Row 3	(6 -)	
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )			Row 3	,(0,-)	
	First OFDM symbol in the PRB used			13		
	for CSI-RS (I <sub>0</sub> )			10		
	NZP CSI-RS-timeConfig	slot		5/*	1	
	periodicity and offset	5101		5/		
	CSI-IM resource Type			Peric	dic	
	CSI-IM RE pattern			0		
CSI-IM	CSI-IM Resource Mapping			(4)	n)	
configuration	(kcsi-im,lcsi-im)			(4, 9	9)	
	CSI-IM timeConfig	alat		<b>F</b> //	1	
	periodicity and offset	slot		5/*		
ReportConfigType				Peric	dic	
CQI-table				Tabl	e 2	
reportQuantity				cri-RI-PI		
	rChannelMeasurements			Not conf		
	rInterferenceMeasurements			Not conf		
cqi-FormatIndicat			1	Widek	0	
pmi-FormatIndica				Widek		
Sub-band Size		RB		8	anu	
	d	КD		-	111	
csi-ReportingBan		al - 4	111111			
CSI-Report period		slot	-	5/0		
aperiodicTriggerin				Not conf		
	Codebook Type		-	typel-Sing	llePanel	
	Codebook Mode		1	1		
Codebook	(CodebookConfig-			Not conf	iaured	
configuration	N1,CodebookConfig-N2)				5	
	CodebookSubsetRestriction			0000		
	RI Restriction			N//		
Physical channel	for CSI report			PUC		
CQI/RI/PMI delay		ms		8		
	r of HARQ transmission	-		1		
			As spe	cified in Tab	le A.4-2	TBS.2
Measurement cha	annel					,

# Table 6.2.3.1.2.1.3-1: Wideband CQI reporting test under frequency non-selective fading conditions

Table 6.2.3.1.2.1.3-2	: Minimum re	quirements
-----------------------	--------------	------------

Parameters	Test 1	Test 2
α [%]	5	5
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.2.1.

6.2.3.1.2.1.4 Test description

6.2.3.1.2.1.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.1.4.1 with the following exceptions:

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.

Instead of Table 6.2.2.1.2.1.3-1  $\rightarrow$  use Table 6.2.3.1.2.1.3-1.

# 6.2.3.1.2.1.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.1.4.2 with the following exceptions:

4. If Median CQI value is not equal to 1 or 15 and 300 ( $\alpha$ %) or more of the wideband CQI values are outside the range (Median CQI - 1)  $\leq$  Median CQI  $\leq$  (Median CQI + 1) then continue with step 5, otherwise go to step 7.

Instead of Table 6.2.2.1.2.1.5-1  $\rightarrow$  use Table 6.2.3.1.2.1.3-1.

6.2.3.1.2.1.4.3 Message contents

Same message contests as specified in clause 6.2.2.1.2.1.4.3 with the following exceptions:

6.2.3.1.2.1.4.3\_1 Message exceptions for SA

#### Table 6.2.3.1.2.1.4.3\_1-1: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43					
Information Element	Value/remark	Comment	Condition		
CSI-ResourcePeriodicityAndOffset CHOICE {					
slots5	1				
}					

#### 6.2.3.1.2.1.4.3\_2 Message exceptions for NSA

Same as in 6.2.3.1.2.1.4.3\_1.

# 6.2.3.1.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.3.1.2.1.4.2.

## Table 6.2.3.1.2.1.3-1: Test requirements

Parameters	Test 1	Test 2
α[%]	5	5
γ	1.04	1.04

# 6.2.3.1.2.2 4Rx FDD FR1 aperiodic subband CQI reporting under fading conditions for both SA and NSA

## 6.2.3.1.2.2.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

#### 6.2.3.1.2.2.2 Test applicability

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

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

#### 6.2.3.1.2.2.3 Minimum conformance requirements

The purpose of the requirements is to verify that the preferred sub-bands can be used for frequency-selective scheduling under the frequency-selective fading conditions.

The accuracy of sub-band channel CQI reporting under the frequency-selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting the transport format indicated by the corresponding reported sub-band CQI on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level compared to the throughput when transmitting a fixed transport format according to the wideband CQI median on a randomly selected sub-band among all the sub-bands.

For the parameters specified in Table 6.2.3.1.2.2.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % of the time for each sub-band, where  $\alpha$  and  $\beta$  are specified in Table 6.2.3.1.2.2.3-2;
- b) The ratio of the throughput obtained when transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level and that obtained when transmitting the transport format indicated by the reported wideband CQI median on a randomly selected sub-band among all the sub-bands shall be  $\geq \gamma$ , where  $\gamma$  is specified in Table 6.2.3.1.2.2.3-2;
- c) When transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level, the average BLER for the indicated transport format shall be greater than or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD.

	Parameter	Unit	Test 1 Test 2
Bandwidth		MHz	10
Subcarrier spacing	g	kHz	15
Duplex Mode			FDD
SNR		dB	5 6 11 12
			Two tap model specified in Annex
Propagation chan	nel		B.2.4 with $a=1$ , $f_D = 5Hz$ , and
A (			т <sub>d</sub> =0.45µs
Antenna configura Correlation config			2×4
Beamforming Mod			As per Annex B.1 As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the PRB		
configuration	used for CSI-RS ( $k_0$ )		Row 5,4
g	First OFDM symbol in the PRB used		_
	for CSI-RS (l <sub>0</sub> )		9
	CSI-RS	-1-4	E /4
	periodicity and offset	slot	5/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	СDМ Туре		FD-CDM2
	Density (ρ)		1
NZP CSI-RS for	First subcarrier index in the PRB		Row 3,(6,-)
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		1000 0,(0, )
	First OFDM symbol in the PRB used		13
	for CSI-RS (I <sub>0</sub> )		10
	NZP CSI-RS-timeConfig	slot	5/1
	periodicity and offset		Devie die
	CSI-IM resource Type		Periodic 0
CSI-IM	CSI-IM RE pattern CSI-IM Resource Mapping		0
configuration	(kcsi-im,lcsi-im)		(4, 9)
comgaration	CSI-IM timeConfig		
	periodicity and offset	slot	5/1
ReportConfigType			Aperiodic
CQI-table	-		Table 2
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		Not configured
timeRestrictionFo	rInterferenceMeasurements		Not configured
cqi-FormatIndicate	or		Subband
pmi-FormatIndica	tor		Wideband
Sub-band Size		RB	8
csi-ReportingBan			1111111
CSI-Report interva		slot	Not configured
Aperiodic Report	Slot Offset		5
CSI request			1 in slots i, where $mod(i, 5) = 1$ ,
•			otherwise it is equal to 0
reportTriggerSize			1
			One State with one Associated
	unar Statal ist		Report Configuration
CSI-AperiodicTrig	iyei อเลเย่ารเ		Associated Report Configuration
			contains pointers to NZP CSI-RS and CSI-IM
aperiodicTriggerin	αOffset		Not configured
apendule myyelli	Codebook Type		typeI-SinglePanel
	Codebook Type Codebook Mode		
	(CodebookConfig-		1
Codebook			Not configured
Codebook configuration			i tot conligaroa
Codebook configuration	N1,CodebookConfig-N2)		-
			000001 N/A

# Table 6.2.3.1.2.2.3-1: Sub-band CQI reporting test under frequency-selective fading conditions

CQI/RI/PMI delay	ms	8
Maximum number of HARQ transmission		1
Measurement channel		As specified in Table A.4-2, TBS.2- 5

#### Table 6.2.3.1.2.2.3-2: Minimum requirements

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.2.2.

6.2.3.1.2.2.4 Test description

6.2.3.1.2.2.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.2.4.1 with the following exceptions:

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.

Instead of Table 6.2.2.1.2.2.3-1  $\rightarrow$  use Table 6.2.3.1.2.2.3-1.

6.2.3.1.2.2.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.2.4.2 with the following exceptions:

Instead of Table 6.2.2.1.2.2.5-1  $\rightarrow$  use Table 6.2.3.1.2.2.3-1.

6.2.3.1.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

6.2.3.1.2.2.4.3\_1 Message exceptions for SA

Same message exceptions as in 6.2.2.1.2.2.4.3\_1.

# 6.2.3.1.2.2.4.3\_2 Message exceptions for NSA

Same as in 6.2.3.1.2.2.4.3\_1.

6.2.3.1.2.2.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.3.1.2.2.4.2.

# Table 6.2.3.1.2.2.5-1: Test requirements

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.04	1.04

# 6.2.3.2 TDD

# 6.2.3.2.1 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB

# 6.2.3.2.1.1 4Rx TDD FR1 periodic CQI reporting under AWGN conditions for both SA and NSA

# 6.2.3.2.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

# 6.2.3.2.1.1.2 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.

# 6.2.3.2.1.1.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.3.2.1.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by the less than or equal to 0.1.

Parameter		Unit	Te	est 1	Te	st 2
Bandwidth		MHz	40			
Subcarrier spacing	g	kHz		3	0	
Duplex Mode				TC	D	
TDD UL-DL patter	rn			FR1.	30-1	
SNR		dB	5	6	11	12
Propagation chan	nel			AW	GN	
Antenna configura	ation		2×4 wit	h static cha Anne		ecified in
Beamforming Mod	del		As	specified ir	n Annex E	3.4.1
	CSI-RS resource Type		Periodic			
	Number of CSI-RS ports (X)		4			
	СDМ Туре		FD-CDM2			
	Density (ρ)			1		
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> )		Row 5,4			
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )			ç	)	
	CSI-RS periodicity and offset	slot	10/1			
	CSI-RS resource Type			Peri	odic	
NZP CSI-RS for	Number of CSI-RS ports (X)			2	2	
CSI acquisition	CDM Type			FD-C	DM2	
	Density (ρ)			1		

Table 6.2.3.2.1.1.3-1: CQI reporting definition test

	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 3,(6,-)	
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		13	
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1	
	CSI-IM resource Type		Periodic	
	CSI-IM RE pattern		0	
CSI-IM configuration	CSI-IM Resource Mapping		(4, 9)	
configuration	(kcsi-im,lcsi-im) CSI-IM timeConfig periodicity and offset	slot	10/1	
ReportConfigTyp			Periodic	
CQI-table	-		Table 2	
reportQuantity			cri-RI-PMI-CQI	
	orChannelMeasurements		Not configured	
timeRestrictionFo	orInterferenceMeasurements		Not configured	
cqi-FormatIndicat	tor		Wideband	
pmi-FormatIndica	ator		Wideband	
Sub-band Size		RB	16	
csi-ReportingBan	d		1111111	
CSI-Report perio	dicity and offset	slot	10/9	
aperiodicTriggeri			Not configured	
	Codebook Type		typeI-SinglePanel	
	Codebook Mode		1	
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		Not configured	
5	CodebookSubsetRestriction		010000	
	RI Restriction		N/A	
Physical channel for CSI report			PUCCH	
CQI/RI/PMI delay		ms	9.5	
Maximum numbe	r of HARQ transmission		1	
Measurement channel			As specified in Table A.4-2, TBS.2- 4	

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.1.1.

# 6.2.3.2.1.1.4 Test Description

# 6.2.3.2.1.1.4.1 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 subcarrier 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 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 section A.3.2.5 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.2.1.1.3-1 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.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* 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 6.2.3.2.1.1.4.3.

# 6.2.3.2.1.1.4.2 Test Procedure

- 1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.1.3-1.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- 4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.
- 5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio  $(NACK / ACK + NACK) \le 0.1$  then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK / ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK)  $\leq 0.1$ 

then pass the UE for this test and go to step 9, otherwise go to step 8.

- 8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.
- 9. Repeat step 1 to 8 for Test2.

#### 6.2.3.2.1.1.4.4 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

#### 6.2.3.2.1.1.4.4\_1 Message exceptions for SA

Same as specified in 6.2.2.2.1.1.4.4\_1.

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## 6.2.3.2.1.1.4.4\_2 Message exceptions for NSA

Same as specified in 6.2.3.2.1.1.4.4\_1.

### 6.2.3.2.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.2.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

# 6.2.3.2.1.2 4Rx TDD FR1 periodic CQI reporting with Table 3 under AWGN conditions for both SA and NSA

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

Whether to adopt minimum sample for pass/fail verdict needs further study.

# 6.2.3.2.1.2.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of  $10^{-5}$  falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

### 6.2.3.2.1.2.2 Test Applicability

This test applies to all types of NR UE release 16 supporting cqi-TableAlt.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and cqi-TableAlt.

### 6.2.3.2.1.2.3 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.3.2.1.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10<sup>-5</sup>, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10<sup>-5</sup>. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10<sup>-5</sup>, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 10<sup>-5</sup>.
- c) The reported CQI value according to the reference channel shall be  $\geq 1$ .

# Table 6.2.3.2.1.2.3-1: CQI reporting test parameters

Parameter		Unit	Test 1	
Bandwidth		MHz	40	
Subcarrier spacin	g	kHz	30	)
Duplex Mode			TD	D
TDD UL-DL patte	rn		FR1.3	30-1
SNR		dB	-2	-1
Propagation char	Propagation channel		AWO	GN
Antenna configuration			1×4 with static channel specified i Annex B.1	
Beamforming Mo	del		As specified in	Annex B.4.1
	CSI-RS resource Type		Periodic	
	Number of CSI-RS ports (X)		4	
ZP CSI-RS	CDM Type		FD-CDM2	
configuration	Density (ρ)		1	
comguration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> )		Row 5,4	
	First OFDM symbol in the PRB used		9	

	for CSI-RS (I <sub>0</sub> )			
	CSI-RS			
	periodicity and offset	slot	10/1	
	CSI-RS resource Type		Periodic	
	Number of CSI-RS ports (X)		1	
	CDM Type		No CDM	
	Density (p)		3	
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB		Row 1,(0,-)	
	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		· · ·	
	First OFDM symbol in the PRB used		1	
	for CSI-RS (I <sub>0</sub> )			
	NZP CSI-RS-timeConfig	slot	10/1	
	periodicity and offset		<b></b>	
	CSI-IM resource Type		Periodic	
	CSI-IM RE pattern		0	
CSI-IM	CSI-IM Resource Mapping		(4, 9)	
configuration	(ксзі-ім,Ісзі-ім)		(1, 0)	
	CSI-IM timeConfig	slot	10/1	
	periodicity and offset	0101		
ReportConfigType	9		Periodic	
CQI-table			Table 3	
reportQuantity			cri-RI-PMI-CQI	
	rChannelMeasurements		Not configured	
timeRestrictionFor	rInterferenceMeasurements		Not configured	
cqi-FormatIndicate	or		Wideband	
pmi-FormatIndicat	tor		Wideband	
Sub-band Size		RB	16	
Csi-ReportingBan	d		111111	
CSI-Report period		slot	10/9	
aperiodicTriggerin			Not configured	
	Codebook Type		typel-SinglePanel	
	Codebook Mode		1	
Codebook	(CodebookConfig-		· · · ·	
configuration	N1,CodebookConfig-N2)		Not configured	
J	CodebookSubsetRestriction		000001	
	RI Restriction		N/A	
Physical channel for CSI report			PUCCH	
CQI/RI/PMI delay			9.5	
	of HARQ transmission	ms	1	
Measurement channel			As specified in Table A.4-4, TBS.4-2	

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.1.2.

## 6.2.3.2.1.2.4 Test Description

### 6.2.3.2.1.2.4.1 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 subcarrier 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 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 for UE diagram.

- 2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.2.1.2.3-1 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.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* 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 6.2.3.2.1.2.4.3.

#### 6.2.3.2.1.2.4.2 Test Procedure

- 1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.3.2.1.2.3-1.
- 2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 5000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 10 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- If Median CQI is not equal to 1 or 15 and 4500 or more of the wideband CQI values are in the range (Median CQI 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.
- 5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

For the filtered ACK and NACK responses if the ratio  $(NACK / (ACK + NACK)) \le 10^{-5}$  then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio  $(NACK / (ACK + NACK)) > 10^{-5}$ 

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio (NACK / ACK + NACK)  $\leq 10^{-5}$ 

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

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### 6.2.3.2.1.2.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

### 6.2.3.2.1.2.4.3\_1 Message exceptions for SA

Same as specified in clause 6.2.2.2.1.2.4.3\_1.

### 6.2.3.2.1.2.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.3.2.1.2.4.3\_1.

#### 6.2.3.2.1.2.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.2.1.2.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

### 6.2.3.2.2 CQI reporting under fading conditions

6.2.3.2.2.1 4Rx TDD FR1 periodic wideband CQI reporting under fading conditions for both SA and NSA

### 6.2.3.2.2.1.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

#### 6.2.3.2.2.1.2 Test applicability

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

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

#### 6.2.3.2.2.1.3 Minimum conformance requirements

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI.

For the parameters specified in Table 6.2.3.2.2.1.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time where  $\alpha$ % is specified in Table 6.2.3.2.2.1.3-2;
- b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\ge \gamma$ , where  $\gamma$  is specified in Table 6.2.3.2.2.1.3-2;
- c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

	Parameter	Unit	Test 1	Test 2
Bandwidth		MHz	-	0
Subcarrier spacing		kHz	30	
Duplex Mode	9	KI IZ		
TDD UL-DL patter	ro		FR1	
	111	15		
SNR		dB	3 4	9 10
Propagation chan				30-5
Antenna configura				<b>&lt;</b> 4
Correlation config	uration		XPI	
Beamforming Mod			As specified in	
	CSI-RS resource Type		Peri	odic
	Number of CSI-RS ports (X)			1
	CDM Type		FD-C	DM2
	Density (ρ)			
ZP CSI-RS	First subcarrier index in the PRB		Day	
configuration	used for CSI-RS (k <sub>0</sub> )		Row	5,4
	First OFDM symbol in the PRB used			N
	for CSI-RS (I <sub>0</sub> )			9
	CSI-RS		4.0	
	periodicity and offset	slot	10	//1
	CSI-RS resource Type		Peri	odic
	Number of CSI-RS ports ( <i>X</i> )			2
	CDM Type		FD-C	
	Density (ρ)		100	
NZP CSI-RS for	First subcarrier index in the PRB			
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row	3,(6,-)
	First OFDM symbol in the PRB used			
	for CSI-RS (l <sub>0</sub> )		1	3
	NZP CSI-RS-timeConfig			
	periodicity and offset	slot	10	)/1
	CSI-IM resource Type		Pori	odic
	CSI-IM RE pattern			)
CSI-IM	CSI-IM Resource Mapping			)
configuration	(kcsi-im,lcsi-im)		(4,	9)
configuration	CSI-IM, ICSI-IM)			
	periodicity and offset	slot	10	)/1
ReportConfigType			Peri	odio
CQI-table	5		Tab	
reportQuantity			cri-RI-F	
	rChannelMeasurements		Not cor	
	rInterferenceMeasurements		Not cor	
cqi-FormatIndicat			Wide	
pmi-FormatIndica	tor		Wide	
Sub-band Size		RB		6
csi-ReportingBan			111	
CSI-Report period	licity and offset	slot		/9
aperiodicTriggerin			Not cor	
	Codebook Type		typeI-Sin	glePanel
	Codebook Mode			
Codebook	(CodebookConfig-		Not cor	figured
configuration	N1,CodebookConfig-N2)			
	CodebookSubsetRestriction		000	001
	RI Restriction		N	/A
Physical channel	for CSI report		PUC	CH
CQI/RI/PMI delay		ms	9	
	r of HARQ transmission			
Measurement cha	ununal .		As specified in Ta	ble A.4-2, TBS.2-

# Table 6.2.3.2.2.1.3-1: Wideband CQI reporting test under frequency non-selective fading conditions

Table 6.2.3.2.2.1.3-2:	Minimum ree	quirements
------------------------	-------------	------------

Parameters	Test 1	Test 2
α [%]	5	5
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.2.1.

6.2.3.2.2.1.4 Test description

6.2.3.2.2.1.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.1.4.1 with the following exceptions:

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.

Instead of Table 6.2.2.1.2.1.3-1  $\rightarrow$  use Table 6.2.3.2.2.1.3-1.

#### 6.2.3.2.2.1.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.1.4.2 with the following exceptions:

4. If Median CQI value is not equal to 1 or 15 and 300 ( $\alpha$ %) or more of the wideband CQI values are outside the range (Median CQI - 1)  $\leq$  Median CQI  $\leq$  (Median CQI + 1) then continue with step 5, otherwise go to step 7.

Instead of Table 6.2.2.1.2.1.5-1  $\rightarrow$  use Table 6.2.3.2.2.1.3-1.

## 6.2.3.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

## 6.2.3.2.2.1.4.3\_1 Message exceptions for SA

Same as 6.2.2.1.2.1.4.3\_1 with following exceptions:

#### Table 6.2.3.2.2.1.4.3\_1-1: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-43					
Information Element Value/remark Comment Condition					
CSI-ResourcePeriodicityAndOffset CHOICE {					
slots10	1				
}					

#### 6.2.3.2.2.1.4.3\_2 Message exceptions for NSA

Same as 6.2.3.2.2.1.4.3\_1.

## 6.2.3.2.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.3.2.2.1.4.2.

## Table 6.2.3.2.2.1.5-1: Test requirements

Parameters	Test 1	Test 2
α[%]	5	5
γ	1.04	1.04

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# 6.2.3.2.2.2 4Rx TDD FR1 aperiodic subband CQI reporting under fading conditions for both SA and NSA

# 6.2.3.2.2.2.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

# 6.2.3.2.2.2.2 Test applicability

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

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

# 6.2.3.2.2.2.3 Minimum conformance requirements

The purpose of the requirements is to verify that the preferred sub-bands can be used for frequency-selective scheduling under the frequency-selective fading conditions.

The accuracy of sub-band channel CQI reporting under the frequency-selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting the transport format indicated by the corresponding reported sub-band CQI on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level compared to the throughput when transmitting a fixed transport format according to the wideband CQI median on a randomly selected sub-band among all the sub-bands.

For the parameters specified in Table 6.2.3.2.2.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % of the time for each sub-band, where  $\alpha$  and  $\beta$  are specified in Table 6.2.3.2.2.3-2;
- b) The ratio of the throughput obtained when transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level and that obtained when transmitting the transport format indicated by the reported wideband CQI median on a randomly selected sub-band among all the sub-bands shall be  $\geq \gamma$ , where  $\gamma$  is specified in Table 6.2.3.2.2.3-2;
- c) When transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level, the average BLER for the indicated transport format shall be greater than or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance for TDD.

	Parameter	Unit	Test 1 Test 2
Bandwidth		MHz	40
Subcarrier spacing		kHz	30
Duplex Mode			TDD
TDD UL-DL pattern			FR1.30-1
SNR		dB	5 6 11 12
-			Two tap model specified in Annex
Propagation chan	nel		B.2.4 with $a=1$ , $f_D = 5Hz$ , and
. repagaien enan			Td=0.1125µs
Antenna configura	ation		2×4
Correlation config			As per Annex B.1
Beamforming Mod			As specified in Annex B.4.1
Doarnionning woo	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (p)		1
ZP CSI-RS	First subcarrier index in the PRB		 
			Row 5,4
configuration	used for CSI-RS (k <sub>0</sub> )		
	First OFDM symbol in the PRB used		9
	for CSI-RS (I <sub>0</sub> )		
	CSI-RS	slot	10/1
	periodicity and offset		
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	CDM Type		FD-CDM2
	Density (ρ)		1
NZP CSI-RS for	First subcarrier index in the PRB		Bow 2 (6 )
CSI acquisition	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 3,(6,-)
	First OFDM symbol in the PRB used		10
	for CSI-RS (I <sub>0</sub> )		13
	NZP CSI-RS-timeConfig		10/4
	periodicity and offset	slot	10/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM	CSI-IM Resource Mapping		-
configuration	(kcsi-im,lcsi-im)		(4, 9)
g	CSI-IM timeConfig		
	periodicity and offset	slot	10/1
ReportConfigType			Aperiodic
CQI-table	, 		Table 2
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		Not configured
	rInterferenceMeasurements		Not configured
cqi-FormatIndicate			Subband
pmi-FormatIndica	lUI		Wideband
Sub-band Size		RB	16
csi-ReportingBand		-1-1	1111111
CSI-Report interval and offset		slot	Not configured
Aperiodic Report	SIDT UTISET		8
CSI request			1 in slots i, where $mod(i, 10) = 1$ ,
			otherwise it is equal to 0
reportTriggerSize			1
			One State with one Associated
CSI-AperiodicTriggerStateList			Report Configuration
			Associated Report Configuration
			contains pointers to NZP CSI-RS
			and CSI-IM
aperiodicTriggerin	gOffset		Not Configured
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig-		
configuration	N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A
RI Restriction		I	I IV/A

# Table 6.2.3.2.2.3-1: Sub-band CQI reporting test under frequency-selective fading conditions

Physical channel for CSI report		PUSCH
CQI/RI/PMI delay	ms	9.5
Maximum number of HARQ transmission		1
Measurement channel		As specified in Table A.4-2, TBS.2- 6

#### Table 6.2.3.2.2.2.3-2: Minimum requirements

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.2.2.

6.2.3.2.2.2.4 Test description

#### 6.2.3.2.2.2.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.2.4.1 with the following exceptions:

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.

Instead of Table 6.2.2.1.2.2.3-1  $\rightarrow$  use Table 6.2.3.2.2.3-1.

Instead of clause 6.2.2.1.2.2.4.3  $\rightarrow$  use clause 6.2.3.2.2.4.3.

### 6.2.3.2.2.2.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.2.4.2 with the following exceptions:

Instead of Table 6.2.2.1.2.2.3-1  $\rightarrow$  use Table 6.2.3.2.2.3-1.

## 6.2.3.2.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

6.2.3.2.2.4.3\_1 Message exceptions for SA

Same as 6.2.2.1.2.2.4.3\_1 with following exceptions:

#### Table 6.2.3.2.2.2.4.3\_1-1: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43				
Information Element	Value/remark	Comment	Condition	
CSI-ResourcePeriodicityAndOffset CHOICE {				
Slots10	1			
}				

6.2.3.2.2.4.3\_2 Message exceptions for NSA

Same as 6.2.3.2.2.4.3\_1.

# 6.2.3.2.2.2.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.3.2.2.4.2.

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.04	1.04
Note 1: TT = 0.01		

# 6.2A Reporting of Channel Quality Indicator (CQI) for CA

# 6.2A.1 General

This clause includes the requirements for the reporting of channel quality indicator (CQI) with the UE configured for CA. The purpose is to verify that the CQI is correctly reported in accordance with the CQI definition given in TS 38.214 [12] for each CC with multiple cells configured for periodic reporting.

# 6.2A.2 1RX requirements

(Void)

# 6.2A.3 2RX requirements

# 6.2A.3.1 CQI reporting definition under AWGN conditions

# 6.2A.3.1.0 Minimum requirement for periodic CQI reporting

For each CA CQI reporting test defined in Table 6.2A.3.1.0-6, the test requirements and the test parameters are defined as below.

For each CC, the test parameters are specified in Table 6.2A.3.1.0-1. The additional parameters specified in Table 6.2A.3.1.0-2 are applicable for tests on FDD CC. The additional parameters specified in Table 6.2A.3.1.0-3 are applicable for tests on TDD CC.

For CA with 2 DL CC, for the SNR configuration specified in Table 6.2A.3.1.0-4, and using the downlink physical channels specified in Annex C.3.1 on each CC, the difference between the wideband CQI indices of PCell and SCell reported shall be such that

wideband  $CQI_{PCell}$  – wideband  $CQI_{SCell} \ge 2$ 

for more than 90% of the time.

For CA with 3 or more DL CC, for the SNR configuration specified in Table 6.2A.3.1.0-5, and using the downlink physical channels specified in Annex C.3.1 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, 3... reported shall be such that

wideband  $CQI_{PCell}-wideband\ CQI_{SCell1} \geq 2$ 

wideband CQI<sub>SCell1</sub> – wideband CQI<sub>SCell2</sub>,  $3... \ge 2$ 

for more than 90% of the time.

	Parameter	Unit	Value
Propagation channel			AWGN
Antenna configura	ation		1x2 with static channel specified in Annex B.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
ZP CSI-RS	Density (ρ)		1
configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> )		Row 5, 4
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		9
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		1
	CDM Type		No CDM
NZP CSI-RS for	Density (ρ)		1
CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> )		Row 2, 6
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		13
	CSI-IM resource Type		Periodic
CSI-IM	CSI-IM RE pattern		0
configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)
ReportConfigType			Periodic
CQI-table			Table 2
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFo	rChannelMeasurements		Not configured
timeRestrictionForInterferenceMeasurements			Not configured
cgi-FormatIndicator			Wideband
pmi-FormatIndicator			Wideband
Csi-ReportingBand			1111111
aperiodicTriggeringOffset			Not configured
Physical channel for CSI report			PUCCH
Maximum number of HARQ transmission			1
Measurement cha	nnel		Derived as per section 5.1.3.2 of TS 38.214 [12]

Table 6 2A 3 1 0-1: CA CQI reporting	g test parameters for FDD and TDD CC
Table 0.2A.3. 1.0-1. CA Callepoliting	g test parameters for i DD and i DD CC

	Parameter	Unit	Value
Duplex Mode			FDD
Subcarrier spacin	g	kHz	15
ZP CSI-RS configuration	CSI-RS periodicity and offset	slot	5/1
NZP CSI-RS for CSI acquisition	NZP CSI-RS-timeConfig periodicity and offset	slot	5/1 10/1 if configured as SCell with TDD PCell (Test1)
CSI-IM configuration	CSI-IM timeConfig periodicity and offset	slot	5/1
CSI-Report period	licity and offset	slot	5/0 if configured as PCell 5/1 if configured as SCell with FDD PCell (Test2) 20/18 if configured as SCell with TDD PCell (Test1)
CQI/RI/PMI delay		ms	8 if configured as PCell 12 if configured as SCell
Sub-band Size		RB	8 for 5MHz and 10MHz, 16 for 15MHz, 20MHz and 25MHz, 32 for 30MHz, 35MHz, 40MHz, 45MHz and 50MHz
Note 1: NZP CSI-RS periodicity/offset slots are based on the carrier SCS and CSI reporting periodicity/offset slots are based on the PCell SCS.			

Table 6.2A.3.1.0-2: Additional t	test parameters for FDD CC
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# Table 6.2A.3.1.0-3: Additional test parameters for TDD CC

	Parameter	Unit	Value
Duplex Mode			TDD
Subcarrier spacin		kHz	30
TDD UL-DL patte	rn		FR1.30-1
ZP CSI-RS configuration	CSI-RS periodicity and offset	slot	10/1
NZP CSI-RS for CSI acquisition	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1 if configured as SCell with FDD PCell (Test1)
			20/1
CSI-IM configuration	CSI-IM timeConfig periodicity and offset	slot	10/1
CSI-Report period	licity and offset	slot	20/19 if configured as PCell 20/18 if configured as SCell with TDD PCell (Test3) 5/1 if configured as SCell with FDD PCell (Test1)
CQI/RI/PMI delay		ms	14.5 if configured as PCell         12.5 if configured as SCell with         TDD PCell (Test3)         9.5 if configured as SCell with FDD         PCell (Test1)
Sub-band SizeRB25MSub-band SizeRB16 for 30MHz, 4032 for 60MHz, 80		8 for 10MHz, 15MHz, 20MHz and 25MHz, 16 for 30MHz, 40MHz and 50MHz, 32 for 60MHz, 80MHz, 90MHz and 100MHz	
Note 1: NZP CSI-RS periodicity/offset slots are based on the carrier SCS and CSI reporting periodicity/offset slots are based on the PCell SCS.			

# Table 6.2A.3.1.0-4: SNR configurations for 2 DL CA

Parameter	PCell	SCell
SNR (dB)	10.0	4.0

Table 6.2A.3.1.0-5: SNR configurations for 3 or more DL CA	

Parameter	PCell	SCell1	SCell2, 3
SNR (dB)	12.0	6.0	0.0

# Table 6.2A.3.1.0-6: List of CA CQI reporting test

Test nu	number CA duplex mode and SCS combination	
1	1 FDD 15 kHz + TDD 30 kHz	
2		FDD 15 kHz + FDD 15 kHz
3	3 TDD 30 kHz + TDD 30 kHz	
Note 1:	Note 1: The applicability of requirements for different CA duplex modes, SCSs, is defined in 6.1.1.5.1.	
Note 2:	lote 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 6.1.1.5.2.	

The normative reference for this requirement is TS 38.101-4 [5], clause 6.2A.3.1.1.

# 6.2A.3.1.1 2Rx CQI reporting accuracy under AWGN conditions for CA (2DL CA)

Editor's note: EN-DC applicability of this test case is FFS in TS 38.522.

# 6.2A.3.1.1.1 Test Purpose

To verify that the CQI is correctly reported in accordance with the CQI definition given in TS 38.214 [12] for each CC with multiple cells configured for periodic reporting.

### 6.2A.3.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL CA.

- 6.2A.3.1.1.3 Test description
- 6.2A.3.1.1.3.1 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 subcarrier 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

CA capability to be tested: test any one of the supported CA capabilities with largest aggregated CA bandwidth combination, as specified in 6.1.1.5.2.

CA configuration to be tested: For the selected CA capability, test any one of the supported CA configurations with largest aggregated CA bandwidth combination, as specified in 6.1.1.5.2.

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Test number	CA duplex mode	Configuration	PCell CC configuration	
1	FDD 15 kHz + TDD 30 kHz	As defined in Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3	TDD CC if supported, otherwise FDD CC	
2 (Note 2)	FDD 15 kHz + FDD 15 kHz	As defined in Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-2	Any of CCs	
3	TDD 30 kHz + TDD 30 kHz	As defined in Table 6.2A.3.1.0-1 and Table 6.2A.3.1.0-3	Any of CCs	
NOTE 1: The test coverage can be considered fulfilled if UE passes one of the CC as PCell in Test 1. NOTE 2: These scenarios are only tested for UEs which are not verified with Test 1.				

#### Table 6.2A.3.1.1.3.1-1: Test point selection table

- 1. Connect the SS and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A Figure A.3.1.7.2A for TE diagram, Figure A.3.2.3 for UE supporting only 2Rx RF bands on all CC. Annex A, Figure A.3.2.5 for UE supporting 4Rx on some or all the CCs.
- 2. The parameter settings for the cell are set up according to Table 6.1.2-1, and Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3 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.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* 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 6.2A.3.1.1.3.3.

#### 6.2A.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 SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 6.2A.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], clause9.3).
- 4. Set the parameters of bandwidth, reference channel, propagation condition and antenna configuration according to Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3 as appropriate. Set the SNR according to Table 6.2A.3.1.0-4 as appropriate for PCC and SCC (For UE supporting 4Rx antenna ports on a given CC, the SNR is reduced by 3dB for that CC).
- 5. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.
- 6. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCC. For each CSI report calculate the respective difference  $CQI_{P-S}$  = wideband  $CQI_{PCell}$  wideband  $CQI_{SCell}$ .
- 7. If more than 1800 values of CQI<sub>P-S</sub> are  $\geq 2$  pass the UE. Otherwise fail the UE.
- 8. Repeat steps from 1 to 7 for each test point in Table 6.2A.3.1.1.3.1-1 as appropriate.

#### 6.2A.3.1.1.3.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

# 6.2A.3.1.1.3.3\_1 Message exceptions for SA

# Table 6.2A.3.1.1.3.3\_1-1: CSI-RS-ResourceMapping

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-2			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row2	0000 1000 0000	k0= 4, row2	
}			
density CHOICE {			
one	NULL		
}			
}			

# Table 6.2A.3.1.1.3.3\_1-2: NZP CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-2a			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots5	1		For FDD CC
slot10	1		(For TDD CC if configured as SCell with FDD PCell (Test1)) OR (For FDD CC if configured as SCell with TDD PCell (Test1))
Slot20	1		For TDD CC
}			

# Table 6.2A.3.1.1.3.3\_1-3: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-6			
Information Element	Value/remark	Comment	Condition
CSI-IM-Resource ::= SEQUENCE {			
periodicityAndOffset SEQUENCE {			
slots5	1		For FDD CC
slots10	1		For TDD CC
}			
}			

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-	12	
Information Element	Value/remark	Condition
CSI-ReportConfig ::= SEQUENCE {		
subbandSize	8	For the CC with FDD 15kHz SCS 5MHz and 10MHz CHBW; For the CC with TDD 30kHz SCS 10MHz, 15MHz, 20MHz and 25MHz CHBW.
	16	For the CC with FDD 15kHz SCS 15MHz, 20MHz and 25MHz CHBW; For the CC with TDD 30kHz SCS 30MHz, 40MHz and 50MHz CHBW.
	32	For the CC with FDD 15kHz SCS 30MHz, 35MHz, 40MHz, 45MHz and 50MHz CHBW; For the CC with TDD 30kHz SCS 60MHz, 80MHz, 90MHz and 100MHz CHBW.
}		

## Table 6.2A.3.1.1.3.3\_1-4: CSI-ReportConfig

#### 6.2A.3.1.1.3.3\_2 Message exceptions for NSA

Same as specified in 6.2A.3.1.1.3.3\_2.

#### 6.2A.3.1.1.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2A.3.1.1.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

#### 6.2A.3.1.2 2Rx CQI reporting accuracy under AWGN conditions for CA (3DL CA)

Editor's note: EN-DC applicability of this test case is FFS in TS 38.522.

6.2A.3.1.2.1 Test Purpose

Same with 6.2A.3.1.1.1.

6.2A.3.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 3DL CA.

6.2A.3.1.2.3 Test description

6.2A.3.1.2.3.1 Initial conditions

Same with 6.2A.3.1.1.3.1.

6.2A.3.1.2.3.2 Test Procedure

- 1. Configure SCCs 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 6.2A.3.1.2.3.3.
- 3. SS activates SCCs 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. Set the parameters of bandwidth, reference channel, propagation condition and antenna configuration according to Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3 as appropriate. Set the SNR according to Table 6.2A.3.1.0-5 as appropriate for PCC and SCCs (For a UE supporting 4Rx antenna ports on a given CC, the SNR is reduced by 3dB for that CC).
- 5. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.
- 6. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCCs. For each CSI report calculate the respective difference  $CQI_{P-S1}$  = wideband  $CQI_{PCell}$  wideband  $CQI_{SCell1}$  and the respective difference  $CQI_{S1-S2}$  = wideband  $CQI_{SCell1}$  wideband  $CQI_{SCell1}$  wideband  $CQI_{SCell2}$ .
- 7. If more than 1800 values of CQI<sub>P-S1</sub> are  $\geq$  2 and more than 1800 values of CQI<sub>S1-S2</sub> are  $\geq$  2, pass the UE. Otherwise fail the UE.
- 8. Repeat steps from 1 to 7 for each test point in Table 6.2A.3.1.0-6 as appropriate.

#### 6.2A.3.1.2.3.3 Message contents

Same with 6.2A.3.1.1.3.3.

#### 6.2A.3.1.2.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2A.3.1.2.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

#### 6.2A.3.1.3 2Rx CQI reporting accuracy under AWGN conditions for CA (4DL CA)

Editor's note: EN-DC applicability of this test case is FFS in TS 38.522.

6.2A.3.1.3.1 Test Purpose

Same with 6.2A.3.1.1.1.

6.2A.3.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 4DL CA.

- 6.2A.3.1.3.3 Test description
- 6.2A.3.1.3.3.1 Initial conditions

Same with 6.2A.3.1.1.3.1.

# 6.2A.3.1.3.3.2 Test Procedure

- 1. Configure SCCs 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 6.2A.3.1.3.3.3.
- 3. SS activates SCCs 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. Set the parameters of bandwidth, reference channel, propagation condition and antenna configuration according to Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3 as appropriate. Set the SNR according to Table 6.2A.3.1.0-5 as appropriate for PCC and SCCs (For a UE supporting 4Rx antenna ports on a given CC, the SNR is reduced by 3dB for that CC).

- 5. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.
- 6. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCCs. For each CSI report calculate the respective difference  $CQI_{P-S1}$  = wideband  $CQI_{PCell}$  wideband  $CQI_{SCell1}$ , the respective difference  $CQI_{S1-S2}$  = wideband  $CQI_{SCell1}$  wideband  $CQI_{SCell2}$  and the respective difference  $CQI_{S1-S3}$  = wideband  $CQI_{SCell2}$ .
- 7. If more than 1800 values of CQI<sub>P-S1</sub> are  $\geq 2$ , more than 1800 values of CQI<sub>S1-S2</sub> are  $\geq 2$  and more than 1800 values of CQI<sub>S1-S3</sub> are  $\geq 2$ , pass the UE. Otherwise fail the UE.
- 8. Repeat steps from 1 to 7 for each test point defined in Table 6.2A.3.1.0-6 as appropriate.

#### 6.2A.3.1.3.3.3 Message contents

Same with 6.2A.3.1.1.3.3.

#### 6.2A.3.1.3.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2A.3.1.3.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

# 6.3 Reporting of Precoding Matrix Indicator (PMI)

# 6.3.0 General

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reported PMI compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated with equal probability of each applicable  $i_1$  and  $i_2$  combination and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission scheme 1 with higher layer parameter *codebookType* set to 'typeI-SinglePanel' are specified in terms of the ratio:

$$\gamma = \frac{t_{ue}}{t_{rnd}}$$

In the definition of  $\gamma$ , for 4TX, 8TX, 16TX, and 32TX PMI requirements,  $t_{\mu e}$  is 90 % of the maximum throughput

obtained at  $SNR_{ue}$  using the precoders configured according to the UE reports, and  $t_{rnd}$  is the throughput measured at

 $SNR_{ue}$  with random precoding.

The requirements for transmission scheme 1 with higher layer parameter *codebookType* set to 'typeII' or 'typeII-r16' are specified in terms of the ratio:

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of  $\gamma$ , for 16TX PMI requirements,  $t_{ue, follow1, follow2}$  is 90 % of the maximum throughput obtained at  $SNR_{follow1, follow2}$  using the precoders configured according to the UE reports, and  $t_{rnd1, rnd2}$  is the throughput measured at  $SNR_{follow1, follow2}$  with random precoding.

# 6.3.1 1RX requirements (Void)

- 6.3.2 2RX requirements
- 6.3.2.1 FDD
- 6.3.2.1.1 2Rx FDD FR1 Single PMI with 4TX TypeI-SinglePanel codebook for both SA and NSA
- 6.3.2.1.1.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.1.1.2 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.

#### 6.3.2.1.1.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.1-2.

		11.14	<b>T</b>
Parameter Bandwidth		Unit	<b>Test 1</b>
Subcarrier spacing		MHz	10
	ang	kHz	15 FDD
Duplex Mode	Propagation channel		TDLA30-5
FT0pagation channel			High XP 4 x 2
Antenna configu	uration		(N1,N2) = (2,1)
Beamforming M	lodel		As specified in Annex B.4.1
Dearmonning M	CSI-RS resource		
	Type		Periodic
	Number of CSI-		
	RS ports ( $X$ )		4
	CDM Type		FD-CDM2
	Density (p)		1
	First subcarrier		
ZP CSI-RS	index in the PRB		
configuration	used for CSI-RS		Row 5, (4,-)
C C	(k <sub>0</sub> , k <sub>1</sub> )		
	First OFDM		
	symbol in the PRB		(0.)
	used for CSI-RS		(9,-)
	(l <sub>0</sub> , l <sub>1</sub> )		
	CSI-RS	slot	5/1
	interval and offset	5101	3/1
	CSI-RS resource		Aperiodic
	Туре		
	Number of CSI-		4
	RS ports (X)		55.051/0
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier		
NZP CSI-RS	index in the PRB		Row 4, (0,-)
for CSI	used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		
acquisition	First OFDM		
	symbol in the PRB		
	used for CSI-RS		(13,-)
	$(I_0, I_1)$		
	CSI-RS		
	interval and offset		Not configured
	aperiodicTriggerin		
	gOffset		0
	CSI-IM resource		Apariadia
	Туре		Aperiodic
	CSI-IM RE pattern		Patten 0
CSI-IM	CSI-IM Resource		
configuration	Mapping		(4,9)
	(ксы-ім,Ісы-ім)		
	CSI-IM timeConfig	slot	Not configured
	interval and offset	5101	Ű
ReportConfigTy	ре		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionForChannelMeasure			Not configured
ments			<b>3</b> • • •
timeRestrictionForInterferenceMeas			Not configured
urements	cqi-FormatIndicator		-
			Wideband Wideband
pmi-FormatIndicator		DD	
Sub-band Size		RB	8
csi-ReportingBand CSI-Report interval and offset		alat	1111111 Not configured
		slot	Not configured 4
Aperiodic Repo			1 in slots i, where $mod(i, 5) = 1$ ,
CSI request			otherwise it is equal to $0$

# Table 6.3.2.1.1.3-1: Test parameters (single layer)

reportTrigg	erSize		1
CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typeI-SinglePanel
	Codebook Mode		1
Cadabaak	(CodebookConfig- N1,CodebookConf ig-N2)		(2,1)
Codebook configuratio	(CodebookConfig- O1,CodebookCon fig-O2)		(4,1)
	CodebookSubset Restriction		1111111
	RI Restriction		0000001
Physical ch	annel for CSI report		PUSCH
CQI/RI/PM		ms	6
Maximum r transmissic	number of HARQ n		4
Measureme	ent channel		R.PDSCH.1-6.1 FDD
PDSCH & PDSCH DMRS Precoding configuration for random Precoding			Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity
		ction, the p	recoder shall be updated in each
based on PMI estimation a		at a downlir	k reporting instance at slot#n hk slot not later than slot#(n-3), at the eNB downlink before
Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.			direction shall be used as

#### Table 6.3.2.1.1-2: Minimum requirement

Parameter	Test 1
γ	1.3

#### 6.3.2.1.1.4 Test description

#### 6.3.2.1.1.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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 6.1.2-1 and Table 6.3.2.1.1.3\_1 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, Connected without release *On* for SA 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 content are defined in clause6.3.2.1.1.4.3.

#### 6.3.2.1.1.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.1.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

3. Set SNR to *SNR*<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with

aperiodic CSI request triggered. Measure  $t_{md1, md2}$  according to Annex G.3.3.

4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.1.1.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.1.1.4.3 Message contents

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

6.3.2.1.1.4.3.1 Message exceptions for SA

#### Table 6.3.2.1.1.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41				
Information Element Value/remark Comment Condition				
CSI-ResourceConfig ::= SEQUENCE {				
resourceType	Aperiodic			
}				

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
Row4	001			
}				
nrofPorts	p4			
firstOFDMSymbolInTimeDomain	13			
}				

# Table 6.3.2.1.1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

# Table 6.3.2.1.1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
Row5	000100			
}				
nrofPorts	p4			
firstOFDMSymbolInTimeDomain	9			
}				

# Table 6.3.2.1.1.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34					
Information Element	Value/remark	Comment	Condition		
csi-IM-ResourceElementPattern					
pattern0 SEQUENCE {					
subcarrierLocation-p0	s4				
symbolLocation-p0	9				
}					
periodicityAndOffset	CSI-				
	ResourcePeriodicityAnd				
	Offset				

# Table 6.3.2.1.1.4.3.1-5: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.2-43				
Information Element Value/remark Comment Condit				
CSI-ResourcePeriodicityAndOffset CHOICE {				
Slots5	1			
}				

# Table 6.3.2.1.1.4.3.1-6: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
moreThanTwo SEQUENCE {				
n1-n2 CHOICE {				
two-one-TypeI-SinglePaneI-Restriction	1111111			
}				
}				
}				
typeI-SinglePaneI-ri-Restriction	0000001			

#### Table 6.3.2.1.1.4.3.1-7: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	0		
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands7	[111111]		
}			
}			
subbandSize	8		
}			

#### 6.3.2.1.1.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.1.4.3.1.

#### 6.3.2.1.1.5 Test requirement

#### Table 6.3.2.1.1.5-1: Test requirement

Parameter	Test 1
γ	1.29

# 6.3.2.1.2 2Rx FDD FR1 Single PMI with 8TX TypeI-SinglePanel codebook for both SA and NSA

#### 6.3.2.1.2.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.1.2.2 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.

#### 6.3.2.1.2.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.2.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.2.3-2.

De	romotor	110:4	Teet 4
Bandwidth	rameter	Unit MHz	<b>Test 1</b> 10
Subcarrier space	cina	kHz	15
Duplex Mode	Jing	KI IZ	FDD
Propagation cha	annel		TDLA30-5
			High XP 8 x 2
Antenna config	uration		(N1,N2) = (4,1)
Beamforming N	lodel		As specified in Annex B.4.1
Doamorning	CSI-RS resource		
	Туре		Periodic
	Number of CSI-		
	RS ports (X)		4
	CDM Type		FD-CDM2
	Density (p)		1
	First subcarrier		
ZP CSI-RS	index in the PRB		Pow(F(A))
configuration	used for CSI-RS		Row 5, (4,-)
	(k <sub>0</sub> , k <sub>1</sub> )		
	First OFDM		
	symbol in the PRB		(9,-)
	used for CSI-RS		(9,-)
	$(I_0, I_1)$		
	CSI-RS	slot	5/1
	interval and offset	5101	5/1
	CSI-RS resource		Aperiodic
	Туре		, iponodio
	Number of CSI-		8
	RS ports (X)		
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier		
NZP CSI-RS	index in the PRB used for CSI-RS		Row 8, (4,6)
for CSI	$(k_0, k_1)$		
acquisition	First OFDM		
	symbol in the PRB		
	used for CSI-RS		(5,-)
	$(I_0, I_1)$		
	CSI-RS		
	interval and offset	slot	Not configured
	aperiodicTriggerin		<u>_</u>
	gOffset		0
	CSI-IM resource		Anariadia
	Туре		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuration	Mapping		(4,9)
	(kcsi-iм,lcsi-iм)		
	CSI-IM timeConfig	slot	Not configured
	interval and offset	301	-
ReportConfigTy	/pe		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
	ForChannelMeasure		Not configured
ments			
	ForInterferenceMeas		Not configured
urements	otor		-
cqi-FormatIndic			Wideband
pmi-FormatIndi	cator	90	Wideband
Sub-band Size	and	RB	8
csi-ReportingBa		دا <u>م</u> د	1111111 Not configured
CSI-Report inte		slot	Not configured
Aperiodic Repo	IT SIDE OTISEL		5
CSI request			1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0

# Table 6.3.2.1.2.3-1: Test parameters (dual-layer)

reportTrigg	erSize		1
CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typeI-SinglePanel
	Codebook Mode		1
Cadabaak	(CodebookConfig- N1,CodebookConf ig-N2)		(4,1)
Codebook configurati	fig-O2)		(4,1)
	CodebookSubset Restriction		0x FFFF
	RI Restriction		00000010
	nannel for CSI report		PUSCH
CQI/RI/PM		ms	8
Maximum transmissio	number of HARQ		4
Measurem	ent channel		R.PDSCH.1-6.2
PDSCH & PDSCH DMRS Precoding configuration for random Precoding			Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination, and with Wideband granularity
		ction, the p	recoder shall be updated in each
slot (1 ms granularity). Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the eNB downlink before slot#(n+4).			nk slot not later than slot#(n-4),
Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.			direction shall be used as

Table	6.3.2.	1.2.3-2:	Minimum	requirement
-------	--------	----------	---------	-------------

Parameter	Test 1
γ	1.5

#### 6.3.2.1.2.4 Test description

# 6.3.2.1.2.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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 6.1.2-1 and Table 6.3.2.1.2.3-1 and as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, Connected without release *On* for SA 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 content are defined in clause 6.3.2.1.2.4.3.

#### 6.3.2.1.2.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.2.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

3. Set SNR to *SNR*<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with

aperiodic CSI request triggered. Measure  $t_{md1, md2}$  according to Annex G.3.3.

4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.1.2.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.1.2.4.3 Message contents

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

6.3.2.1.2.4.3.1 Message exceptions for SA

#### Table 6.3.2.1.2.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element	Value/remark	Comment	Condition
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	aperiodic		
}			

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-15				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	001100			
}				
nrofPorts	p8			
firstOFDMSymbolInTimeDomain	5			
cdm-Type	cdm4-FD2-TD2			
}				

# Table 6.3.2.1.2.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

# Table 6.3.2.1.2.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

# Table 6.3.2.1.2.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34			
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			

# Table 6.3.2.1.2.4.3.1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25			
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
moreThanTwo SEQUENCE {			
n1-n2 CHOICE {			
four-one-TypeI-SinglePaneI-Restriction	FFFF		
}			
}			
}			
typeI-SinglePaneI-ri-Restriction	0000010		

#### Table 6.3.2.1.2.4.3.1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	5		
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands7	1111111		
}			
}			
}			

#### 6.3.2.1.2.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.2.4.3.1.6.3.2.1.2.5Test requirement

#### Table 6.3.2.1.2.5-1: Test requirement

Parameter	Test 1
γ	1.49

# 6.3.2.1.3 2Rx FDD FR1 Multiple PMI with 16Tx Type I – SinglePanel Codebook for both SA and NSA

#### 6.3.2.1.3.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.1.3.2 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.

#### 6.3.2.1.3.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.3.3-2.

Pa	rameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier space	sing	kHz	15
Duplex Mode			FDD
Propagation ch	annel		TDLC300-5
Antenna config	uration		High XP 16 x 2 (N1,N2) = (4,2)
Beamforming M	lodel		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
ZP CSI-RS configuration	Number of CSI- RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier		Row 5, (4,-)

#### Table 6.3.2.1.3.3-1: Test parameters (dual-layer)

index in the PRB used for CSI-RS (ko, kt)         (9,-)           First OFDM symbol in the PRB used for CSI-RS (ko, ht)         (9,-)           CSI-RS interval and offset         slot         Not configured           ZP CSI-RS trigger         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           CSI-RS resource         Aperiodic           Number of CSI- RS ports (X)         16           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier         1           index in the PRB used for CSI-RS         Row 12, (2, 4, 6, 8)           (Ko, kr, ko, ko)         First subcarrier           First subcarrier         0           (Sol, Kr, ko, ko)         First oFDM           Symbol in the PRB used for CSI-RS         (5, -)           (Ko, kr, ko, ko)         First oFDM           CSI-IM resource         Aperiodic           Type         Aperiodic           CSI-IM Resource         Aperiodic           CQI-Istable         Table 1           CSI-IM Resource         Aperiodic           CQI-table         Table 1           reportConfigType         Aperiodic           CQI-table         Table 1           reportOuentity         Configured <th></th> <th></th> <th></th> <th>1</th>				1
Image: symbol in the PRB symbol in the PRB used for CSI-RS (6, 1)         (9, -)           CSI-RS interval and offset slot interval and offset interval and offset interval and offset slot interval and offset slot interval and offset slot interval and offset interval and offset interval and offset slot interval and offset slot interval and offset is slot interval and offset slot interval and offset slot interval and offset is slot interval and offset is slot interval and offset slot interva		index in the PRB		
First OFDM symbol in the PRB used for CSI-RS (b, h)         (9,-)           CSI-RS interval and offset         slot         Not configured           ZP CSI-RS trigger         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           CSI-RS resource         Aperiodic           Type         Aperiodic           Number of CSI- RS ports (X)         16           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First OFDM symbol in the PRB used for CSI-RS (b, k, k, k, ks)         Row 12, (2, 4, 6, 8)           index in the PRB used for CSI-RS (b, k, k, k, ks)         Not configured           First OFDM symbol in the PRB used for CSI-RS (b, h)         Slot         Not configured           CSI-IM REsource Type         Aperiodic         Aperiodic           CSI-IM Resource CSI-IM Resource         Aperiodic         CSI-IM Resource           CSI-IM Resource COI-lable         Table 1         CI           CSI-IM Resource Type         Aperiodic         CI           CSI-IM Resource COI-lable         Table 1         CI           CSI-IM Resource Type         Aperiodic         CI           CSI-IM Reconfig interval and offset         slot         Not configured           reportQuantity         cri-RI-PMI-CQI         TimeRestrictionForChannelMeasure Not co				
symbol in the PRB used for CSI-RS (b, h)         (9, -)           CSI-RS interval and offset         slot         Not configured           ZP CSI-RS trigger         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic Number of CSI- EDM Type         16           NZP CSI-RS for CSI acquisition         CDM Type         CDM (FD2, TD2) Density (p)         1           First subcarrier index in the PRB used for CSI-RS (b, h, k, k, k, k)         Row 12, (2, 4, 6, 8)         (6, -)           First OFDM symbol in the PRB used for CSI-RS (b, h, k, k, k, k)         Slot         Not configured           CSI-RS for CSI acquisition         CSI-RS (c, h)         0         0           CSI-RS for CSI-RS (c, h)         Slot         Not configured           aperiodicTriggerin qDffset         0         0           CSI-IM Resource Type         Aperiodic         0           CSI-IM Resource COSI-IM Resource         Aperiodic         0           CSI-IM Resource COSI-IM Resource         Aperiodic         0           CSI-IM Resource Type         Aperiodic         0           CSI-IM InterConfig <slot< td="">         Not configured         0           CSI-IM InterConfig<slot< td="">         Not configured         0           CSI-IM InterConfi</slot<></slot<>				
used for CSI-RS         (0, 1)           CSI-RS         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           CSI-RS resource         Aperiodic           Type         Aperiodic           Number of CSI- RS ports (X)         16           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (b, k, k, k, ks)         Row 12, (2, 4, 6, 8)           First Subcarrier index in the PRB used for CSI-RS (b, k, k, k, ks)         Not configured           First OFDM symbol in the PRB used for CSI-RS (b, h)         0           CSI-RS Type         Aperiodic           CSI-RS CSI-RS (b, h)         Slot           CSI-RS CSI-RS (b, h)         Not configured           Type         Aperiodic           CSI-RS CSI-RS         (6, -)           CSI-RS CSI-RS         (6, -)           CSI-RS CSI-RS         (6, -)           CSI-RS CSI-RS         (6, -)           CSI-RS CSI-RS         Slot           CSI-RS CSI-RS         (6, -)           CSI-RS CSI-RS <td></td> <td>- · -</td> <td></td> <td></td>		- · -		
Lised for CSI-RS         Not configured           interval and offset         slot         Not configured           ZP CSI-RS trigger         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           NZP CSI-RS for CSI         CSI-RS resource         Aperiodic           Number of CSI- RS ports (X)         16         CDM Type           CDM Type         CDM (FD2, TD2)         Density (p)         1           First subcarrier index in the PRB used for CSI-RS (b, 1)         Row 12, (2, 4, 6, 8)         (6, -)           CSI-RS in CSI-RS (b, 1)         (5, -)         (6, -)         (6, -)           CSI-RS interval and offset acquisition         Slot         Not configured         (7, -)           CSI-RS (b, 1)         CSI-RS (c, 1)         0         (7, -)         (7, -)           CSI-IM resource Type         Aperiodic         QOTiset         0         (7, -)           CSI-IM Resource Configuration         CSI-IM Resource Type         Aperiodic         (4, 9)         (6, -)           CSI-IM resource Type         Aperiodic         QOTiset         Table 1         (-)           CSI-IM Resource configuration         CSI-IM meconfig <slot< td="">         Not configured         (-)         (-)           CSI-IM Resource configuration         CSI-IM Resource         Aperiodic<td></td><td></td><td></td><td>(9 -)</td></slot<>				(9 -)
CSI-RS interval and offset         slot         Not configured           ZP CSI-RS trigger         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           CSI-RS resource         Aperiodic           Type         Aperiodic           NUTP CSI-RS for CSI acquisition         16           First Subcarrier index in the PRB used for CSI-RS for CSI acquisition         Row 12, (2, 4, 6, 8)           First OFDM symbol in the PRB used for CSI-RS (b, k1, k2, k3)         Row 12, (2, 4, 6, 8)           CSI-RS index in the PRB used for CSI-RS (b, k1, k2, k3)         0           CSI-RIM resource         Aperiodic           Type         Aperiodic           CSI-IM resource         Aperiodic           CSI-IM RE pattern         Pattern 0           CSI-IM Resource         (4,9)           CSI-IM Resource         Not configured           Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI           CSI-IM Resource         Not configured           Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           cali-FormatIndicator         Wideband           Sub-band Size         RB           Aperiodic Report Siot Offset		used for CSI-RS		(3, )
interval and offset         slot         Not configured           ZP CSI-RS trigger         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           NZP CSI-RS         Number of CSI- RS ports (X)         16           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (ko, ki, ks, ks)         Row 12, (2, 4, 6, 8)           First OFDM         First OFDM           Symbol in the PRB used for CSI-RS (b, 1, 1, ks, ks)         (5, -)           CSI-RS interval and offset         slot           Octingured         Aperiodic           CSI-RS (b, 1, 1)         0           CSI-RS (b, 1, 1)         0           CSI-RS (b, 1, 1)         0           CSI-RS (b, 1)         10           CSI-RS (b, 1)         10           CSI-RS (b, 1)         10           CSI-RS (b, 1)         10           CSI-RA         10		(l <sub>0</sub> , l <sub>1</sub> )		
Interval and onset         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           ZP CSI-RS resource         Aperiodic           Type         Aperiodic           NUME of CSI-RS for CSI-RS (b)         16           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier         1           index in the PRB         Row 12, (2, 4, 6, 8)           used for CSI-RS         (6, 1, 1)           CSI-RS for CSI         (6, 1, 2)           First OFDM         symbol in the PRB           used for CSI-RS         (1, 1)           CSI-RS         (1, 2)           CSI-RS         (1, 1)           CSI-RS         (1, 2)           used for CSI-RS         (1, 2)           (1, 1)         CSI-RS           CSI-IM resource         Aperiodic           Type         CSI-IM resource           CSI-IM resource         Aperiodic           CSI-IM timeConfig         slot           Not configured         interval and offset           cSI-IM timeConfig         slot           Not configured         Table 1           reportQuantity         cci-I-PMI-CQI           timeRestrictionForInterferenceMeas         Not		CSI-RS	alat	Not configured
ZP CoI-RS inggent         otherwise it is equal to 0           NZP CSI-RS resource Type         Aperiodic           NUmber of CSI- RS ports (X)         16           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier         1           RS ports (X)         1           First subcarrier         1           sequisition         First Subcarrier           Version of the PRB used for CSI-RS interval and offset         slot           Not configured         Sinterval           appriodicTriggerin goffset         0           CSI-IRM configuration         CSI-IR resource Type         Aperiodic           CSI-IM resource Type         Aperiodic         Aperiodic           CSI-IM resource Colliguration         CSI-IM RE pattern         Pattern 0           CSI-IM resource Type         Aperiodic         Aperiodic           CQI-table         Table 1         Table 1           reportQuantity         Col-IM Resource interval and offset         Not configured           reportQuantity         Cri-RestrictionForChannelMeasure ments         Not configured           cgi-FormatIndicator         Wideband         Subband           Sub-band Size         RB         8           c		interval and offset	SIOL	Not configured
CSI-RS resource         Aperiodic           NZP CSI-RS         Fype         Aperiodic           NZP CSI-RS         CDM Type         CDM4 (FD2, TD2)           Density (p)         1         First subcarrier           index in the PRB         Row 12, (2, 4, 6, 8)         Row 12, (2, 4, 6, 8)           equisition         First subcarrier         Row 12, (2, 4, 6, 8)         Row 12, (2, 4, 6, 8)           Kin, ka, ka, ka)         First OFDM         Symbol in the PRB         (5, -)         (5, -)           could for CSI-RS         Slot         Not configured         Interval and offset         Interval and offset         Interval and offset           configuration         CSI-IM resource         Aperiodic         Aperiodic         Type           CSI-IM Resource         Mapping         (4,9)         (4,9)         (4,9)           (CSI-IM Resource         Not configured         Interval and offset         Slot         Not configured           configuration         CSI-IM Resource         Not configured         Interval and offset         Slot         Not configured           configuration         CSI-IM Resource         Not configured         Interval and offset         Slot         Not configured           reportConfigType         Aperiodic Report         Not configur		ZD COL DO trigger		1 in slots i, where $mod(i, 5) = 1$ ,
Type         Aperiodic           NZP CSI-RS for CSI acquisition         CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )         Row 12, (2, 4, 6, 8)           Symbol in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )         (5, -)           CSI-RS interval and offset         slot           Not configured         0           CSI-RS interval and offset         slot           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM Resource COSI-IM Resource         Aperiodic           CSI-IM Resource Mapping (Kcs=uk,Lcs=uk)         Not configured           CSI-IM Resource Mapping         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           cqi-FormatIndicator         Wideband           pmi-formatIndicator         Subband           Sub-band Size         RB           CSI-Report Interval and offset         slot           Aperiodic Report Slot Offset         1           CSI-Report Slot Offset         5           CSI-Report Interval and offset         slot           Not con		ZF CSI-KS lingger		otherwise it is equal to 0
NUMBER of CSI- RS ports (X)         16           NUMBER of CSI- RS ports (X)         1           NUMBER of CSI- COM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (lo, k, k, ka, ka)         Row 12, (2, 4, 6, 8)           Acquisition         First OFDM symbol in the PRB used for CSI-RS         (5, -)           CSI-RS (lo, l, l)         0         0           CSI-RS configuration         QOffset         0           CSI-IM resource         Aperiodic Type         Aperiodic (4,9)           CSI-IM Resource configuration         CSI-IM Resource Mapping (KesI-M, LS+MM)         Not configured           CQI-table         Table 1         Table 1           reportConfigType         Aperiodic         CQI-table           reportQuantity         Cri-RI MimeConfig interval and offset         Not configured           timeRestrictionForChannelMeasure ments         Not configured         CGI-table           reportQuantity         Cri-RI-PMI-CQI         Wideband           cgi-FormatIndicator         Wideband         Subband           Sub-band Size         RB         8           cgi-ReportingBand         11111111         CSI-RA           CSI-ReportingBand         111111111		CSI-RS resource		Apariadia
RS ports (X)         16           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier         1           index in the PRB         Row 12, (2, 4, 6, 8)           sequisition         First of CSI-RS           (ko, kt, k2, k3)         Row 12, (2, 4, 6, 8)           First OFDM         Symbol in the PRB           used for CSI-RS         (5, -)           (lo, h)         0           CSI-RS         10           interval and offset         slot           Not configured         CSI-IM resource           Aperiodic Triggerin         0           QOffset         Q           CSI-IM Resource         Aperiodic           CSI-IM Resource         Aperiodic           CSI-IM Resource         Aperiodic           CQI-table         Table 1           reportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForInterferenceMeas         Not configured           urements         Subband           surfamed         Subband           Sub-band Size         RB           CSI-request         1 in s		Туре		Aperiodic
NZP CSI-RS for CSI acquisition         RS ports (X) (DM Type         CDM4 (FD2, TD2) 1           NZP CSI-RS for CSI acquisition         Index in the PRB used for CSI-RS (ko, k1, k2, k3)         Row 12, (2, 4, 6, 8)           First Subcarrier index in the PRB used for CSI-RS (l0, h)         (5, -)         (6, -)           CSI-RS interval and offset aperiodicTriggerin gOffset         0         0           CSI-IM configuration         CSI-IM Resource Type         Aperiodic Type         0           CSI-IM configuration         CSI-IM Resource Mapping (KcsI+M, lcsI+M)         Not configured           CSI-IM configuration         CSI-IM Resource Mapping         Aperiodic Type           CSI-IM Resource configuration         CSI-IM Resource Mapping         Not configured           ReportConfigType         Aperiodic CSI-IM Resource Mapping         Not configured           CSI-IM RE pattern         Pattern 0         CSI-IM CSI-IM Resource         Table 1           reportConfigType         Aperiodic COI-table         Table 1           reportOnfigType         Aperiodic COL         Not configured           timeRestrictionForInterferenceMeas urements         Not configured           cgi-FormatIndicator         Subband         Subband           Sub-band Size         RB         8           cSI request         1 in slots i, where mod(i, 5)		Number of CSI-		16
NZP CSI-RS for CSI acquisition         Density (p) First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )         Row 12, (2, 4, 6, 8)           First Subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )         Row 12, (2, 4, 6, 8)           First OFDM symbol in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         (5, -)           CSI-IM configuration         CSI-RS interval and offset aperiodicTriggerin gOffset         0           CSI-IM configuration         CSI-IM Resource Mapping (KcSI-MLCSI-M)         0           CSI-IM configuration         CSI-IM Resource Mapping         Aperiodic           CQI-table         Table 1           reportConfigType         Aperiodic Table 1           CQI-table         Table 1           timeRestrictionForInterferenceMeas urements         Not configured           cisi-Report Interval and offset sub-band Size         Not configured           cisi-Report Interval and offset sub-band Size         Not configured           CSI-request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         0         One State with one Associated Report Configuration (CodebookConfig- V1, CodebookConfig- V1, CodebookConfig- V1, CodebookConfig- V1, CodebookConfig- V1, CodebookConfig- V1, CodebookConfig- V1, CodebookConfig- V1, CodebookConfig- V1, Codebook		RS ports (X)		10
NZP CSI-RS for CSI acquisition         First subcarrier index in the PRB used for CSI-RS (ko, k1, k2, ks)         Row 12, (2, 4, 6, 8)           First OFDM symbol in the PRB used for CSI-RS (b, h)         (5, -)           CSI-RS (h, h)         0           CSI-RS interval and offset         slot           Not configured         aperiodicTriggerin qOffset         0           CSI-IM configuration         CSI-IM RE pattern         Pattern 0           CSI-IM Resource configuration         CSI-IM Resource (K_SHM_LSHM)         Not configured           CQI-table         CSI-IM meconfig interval and offset         Slot         Not configured           CQI-table         Table 1         Table 1         Table 1           reportConfigType         Aperiodic         Not configured         Table 1           reportQuantity         cri-RI-PMI-CQI         Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI         Not configured         Table 1           reportQuantity         RB         8         Social 1         Slot         Not configured           cqi-FormatIndicator         Wideband         1111111         Sl-Report interval and offset         Slot         Not configured           cgi-FormatIndicator         Slot         Not configured         1         Social 4		CDM Type		CDM4 (FD2, TD2)
NZP CSI-RS for CSI acquisition         First subcarrier index in the PRB used for CSI-RS (ko, k1, k2, ks)         Row 12, (2, 4, 6, 8)           First OFDM symbol in the PRB used for CSI-RS (b, h)         (5, -)           CSI-RS (h, h)         0           CSI-RS interval and offset         slot           Not configured         aperiodicTriggerin qOffset         0           CSI-IM configuration         CSI-IM RE pattern         Pattern 0           CSI-IM Resource configuration         CSI-IM Resource (K_SHM_LSHM)         Not configured           CQI-table         CSI-IM meconfig interval and offset         Slot         Not configured           CQI-table         Table 1         Table 1         Table 1           reportConfigType         Aperiodic         Not configured         Table 1           reportQuantity         cri-RI-PMI-CQI         Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI         Not configured         Table 1           reportQuantity         RB         8         Social 1         Slot         Not configured           cqi-FormatIndicator         Wideband         1111111         Sl-Report interval and offset         Slot         Not configured           cgi-FormatIndicator         Slot         Not configured         1         Social 4		Density (p)		1
N2P CSI-RS for CSI acquisition         used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )         Row 12, (2, 4, 6, 8)           First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )         (5, -)         (6, -)           CSI-RS interval and offset         slot         Not configured           appriodicTriggerin gOffset         0         0           CSI-IM configuration         CSI-IM RE pattern         Pattern 0           CSI-IM RE pattern         Not configured           CSI-IM RE pattern         Pattern 0           CSI-IM RE pattern         Not configured           CSI-IM TimeConfig interval and offset         slot         Not configured           ReportConfigType         Aperiodic         CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI         timeRestrictionForChannelMeasure         Not configured           wrements         Slot         Not configured         Slot         Slot           Sub-band Size         RB         8         scsi-ReportingLand         5         Slot           CSI-Report interval and offset         slot				
for CSI acquisition		index in the PRB		
acquisition         Ko, kt, kg, kg)         Ks, kg)           First OFDM         symbol in the PRB         (5, -)           used for CSI-RS         (b, h)         (c, h)           CSI-RS         interval and offset         0           aperiodicTriggerin         0         0           CSI-IM         cSI-IM resource         Aperiodic           CSI-IM RE pattern         Pattern 0         0           CSI-IM Resource         Mapping         (4,9)           (Ko:LM, LGSI-M)         CSI-IM Resource         Aperiodic           CSI-IM ImeConfig interval and offset         slot         Not configured           ReportConfigType         Aperiodic         CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI         timeRestrictionForChannelMeasure         Not configured           reportQuantity         cri-RI-PMI-CQI         timeRestrictionForInterferenceMeas         Not configured           gei-FormatIndicator         Subband         Slot         Not configured           Sub-band Size         RB         8         Slot           CSI-ReportingBand         1111111         CSI-ReportingUred         1           CSI-ReportingBand         1         slot         Not configured           Aperiod		used for CSI-RS		ROW 12, (2, 4, 6, 8)
Acquisition         First OFDM symbol in the PRB used for CSI-RS         (5, -)           CSI-RS         slot         Not configured           aperiodicTriggerin gOffset         0           CSI-IM resource         Aperiodic           CSI-IM Resource         Aperiodic           CSI-IM Resource         (4,9)           CSI-IM Resource         Aperiodic           CSI-IM Resource         CSI-IM Resource           CSI-IM Resource         Aperiodic           CSI-IM Resource         CSI-IM Resource           CSI-IM Resource         Aperiodic           CSI-IM timeConfig interval and offset         slot         Not configured           ReportConfigType         Aperiodic         Table 1           reportQuantity         cri-RI-PMI-CQI         timeRestrictionForInterferenceMeas           urements         Not configured         Not configured           cgi-FormatIndicator         Wideband         Subband           Sub-band Size         RB         8           CSI-ReportIngBand         11111111         CSI-Report Slot Offset           CSI-Aperiodic Report Slot Offset         5         5           CSI-Aperiodic Report Slot Offset         5         5           CSI-Aperiodic Report Slot Offset         5		(ko, k1, k2, k3)		
used for CSI-RS (l0, 1)         (5, -)           CSI-RS interval and offset aperiodicTriggerin gOffset         slot         Not configured           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM RE pattern         Pattern 0           CSI-IM Resource (KcSI-IM, IcSI-M)         CSI-IM Resource           CSI-IM Resource         Aperiodic           CSI-IM tronconfig interval and offset         slot           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           cqi-FormatIndicator         Wideband           Sub-band Size         RB           csi-ReportIngBand         1111111           CSI-Report Slot Offset         5           CSI request         1           CSI-Report Interval and offset         slot           Slot Offset         5           CSI request         1           CSI-Report Slot Offset         5           CSI request         1           Codebook Mode         1           CSI-Aperiodic TriggerStateList         CodebookConfig- (CodebookConfig- 01, CodebookConfig- 01, CodebookConfig- 01, CodebookConfig- 01, CodebookConfig-	acquisition			
used for CSI-RS (l0, 1)         (5, -)           CSI-RS interval and offset aperiodicTriggerin gOffset         slot         Not configured           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM RE pattern         Pattern 0           CSI-IM Resource (KcSI-IM, IcSI-M)         CSI-IM Resource           CSI-IM Resource         Aperiodic           CSI-IM tronconfig interval and offset         slot           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           cqi-FormatIndicator         Wideband           Sub-band Size         RB           csi-ReportIngBand         1111111           CSI-Report Slot Offset         5           CSI request         1           CSI-Report Interval and offset         slot           Slot Offset         5           CSI request         1           CSI-Report Slot Offset         5           CSI request         1           Codebook Mode         1           CSI-Aperiodic TriggerStateList         CodebookConfig- (CodebookConfig- 01, CodebookConfig- 01, CodebookConfig- 01, CodebookConfig- 01, CodebookConfig-		symbol in the PRB		
Image: Construct of the second seco				(5, -)
CSI-RS interval and offset aperiodicTriggerin QOffset         slot         Not configured           CSI-IM configuration         CSI-IM resource Type         Aperiodic Aperiodic           CSI-IM configuration         CSI-IM Resource Mapping (KcsI-IM, IcsI-IM)         Pattern 0           CSI-IM Resource mapping         Q(4.9)           (CSI-IM Resource Mapping (KcsI-IM, IcsI-IM)         Aperiodic           CQI-table         Table 1           reportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           sub-band Size         RB         8           csi-Report interval and offset         Slot         Not configured           Sub-band Size         RB         8           csi-Report interval and offset         Slot         Not configured           Aperiodic Report Slot Offset         5         5           CSI-Report interval and offset         Slot         Not configured           Aperiodic Report Slot Offset         5         5           CSI-Report interval and offset         Slot         Not configuration           CSI-Report interval and offset         Slot         Not configured           Aperiodi				
interval and offset aperiodicTriggerin gOffset         Slot         Not configured           aperiodicTriggerin gOffset         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM Resource configuration         CSI-IM Resource Mapping         Pattern 0           CSI-IM Resource configuration         CSI-IM Resource Mapping         (4.9)           CSI-IM timeConfig interval and offset         Slot         Not configured           ReportConfigType         Aperiodic         CQI-table           reportQuantity         cri-RI-PMI-CQI         Table 1           timeRestrictionForChannelMeasure ments         Not configured           timeRestrictionForInterferenceMeas urements         Not configured           cqi-FormatIndicator         Subband           Sub-band Size         RB         8           csi-ReportingBand         1111111           CSI-request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1         1         Codebook Mode           codebook configuration         CodebookConfig- N1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, Codeb				
aperiodicTriggerin gOffset         0           CSI-IM resource configuration         CSI-IM Resource Mapping (KcsI-M,IcsI-M)         Aperiodic           CSI-IM Resource mapping (KcsI-M,IcsI-M)         Pattern 0           CSI-IM Resource Mapping (KcsI-M,IcsI-M)         Not configured           CSI-IM timeConfig interval and offset         Slot         Not configured           ReportConfigType         Aperiodic         CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments         Not configured           timeRestrictionForChannelMeasure ments         Not configured         Not configured           goil-FormatIndicator         Wideband         Subband           Sub-band Size         RB         8           csi-Report interval and offset         slot         Not configured           Aperiodic Report Slot Offset         5         5           CSI request         One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM           Codebook config- N1, CodebookConfig- N1, CodebookConfig- Q1, CodebookConfig- Q1, CodebookConfig- Q2         (4,4)			slot	Not configured
gOffset         0           CSI-IM resource Type         Aperiodic           CSI-IM Resource CSI-IM Resource Mapping         Pattern 0           CSI-IM Resource Mapping         (4,9)           (KCSI-IM, ICSI-IM)         CSI-IM Resource           CSI-IM Resource Mapping         Aperiodic           CSI-IM TimeConfig interval and offset         Slot           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           urements         Not configured           cqi-FormatIndicator         Wideband           gui-FormatIndicator         Subband           Sub-band Size         RB           CSI-Report interval and offset         Slot           CSI-request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1           CSI-AperiodicTriggerStateList         Codebook Type           Codebook config- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O2)         (4,2)				
CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM RE pattern configuration         CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-iM, lcSi-iM)         Pattern 0           CSI-IM resource Mapping (kcsi-iM, lcSi-iM)         Slot         Not configured           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           cqi-FormatIndicator         Wideband           pri-FormatIndicator         Subband           Sub-band Size         RB         8           csi-ReportIngBand         1111111           CSI-Report Interval and offset         slot         Not configured           Aperiodic Report Slot Offset         5         5           CSI request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0         1           reportTriggerSize         1         1         Associated Report Configuration           Codebook configuration         Codebook Type         typel-SinglePanel         CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- O2         (4,2)				0
TypeAperiodicCSI-IMCSI-IM RE patternPattern 0CSI-IM Resource Mapping(4,9)(KcsI-IM, IcsI-M)(4,9)CSI-IM timeConfig interval and offsetslotNot configuredReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredcqi-FormatIndicatorWidebandguideRBsurementsSlotcqi-FormatIndicatorSubbandsub-band SizeRBcsi-ReportingBand1111111CSI-Report Interval and offsetslotSub-band Size5CSI request1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0reportTriggerSize1CSI-AperiodicTriggerStateListCodebook Config- (CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- O1, CodebookConfig				
CSI-IM configuration         CSI-IM Repattern         Pattern 0           CSI-IM Resource Mapping (KCSI-IM, CSI-IM) CSI-IM timeConfig interval and offset         (4,9)           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           timeRestrictionForInterferenceMeas urements         Not configured           cqi-FormatIndicator         Wideband           pmi-FormatIndicator         Slot           Sub-band Size         RB           CSI-ReportIngBand         1111111           CSI-ReportIngBand         11111111           CSI-ReportIngGrisze         1           CSI request         1           cSI-Aperiodic TriggerSize         1           CSI-Aperiodic TriggerStateList         Codebook Config- Codebook Config- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- O1, CodebookConfig-				Aperiodic
CSI-IM configuration         CSI-IM Resource Mapping (kcsi-m,lcsi-m)         (4,9)           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           timeRestrictionForChannelMeasure ments         Not configured           cqi-FormatIndicator         Wideband           pmi-FormatIndicator         Slot           Sub-band Size         RB           CSI-ReportIngBand         1111111           CSI-ReportIngBand         11111111           CSI-Report Interval and offset         slot           Aperiodic Report Slot Offset         5           CSI request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1           Codebook Config- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- O1, CodebookConfig-				Pattern 0
configuration       Mapping (kcsi-iM,Icsi-iM) CSI-IM timeConfig interval and offset       slot       Not configured         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Subband         Sub-band Size       RB       8         csi-ReportingBand       1111111         CSI-Report interval and offset       slot       Not configured         Aperiodic Report Slot Offset       5       5         CSI request       1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0       1         reportTriggerSize       1       not configuration         Codebook config- configuration       Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM         Codebook Mode       1       1         CodebookConfig- N1,CodebookConfig- O1,Co	CSLIM	-		Fallelli U
(kcsi-iM,lcsi-iM)         Not configured           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure         Not configured           ments         Not configured           cqi-FormatIndicator         Wideband           pmi-FormatIndicator         Wideband           sub-band Size         RB           csi-ReportingBand         1111111           CSI-Report interval and offset         slot           Aperiodic Report Slot Offset         5           CSI request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1           CSI-AperiodicTriggerStateList         One State with one Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM           Codebook config-N1, CodebookConfig-N1, CodebookConfig-O1,				(4.0)
CSI-IM timeConfig interval and offsetslotNot configuredReportConfigTypeAperiodicCQI-tableTable 1reportQuantityCri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredcqi-FormatIndicatorWidebandcqi-FormatIndicatorWidebandsub-band SizeRBcsi-ReportingBand1111111CSI-Report interval and offsetslotAperiodic Report Slot Offset5CSI request1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0reportTriggerSize1CSI-AperiodicTriggerStateListOne State with one Associated Report Configuration Associated ReportCodebook configurationCodebookConfig- N1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookCon(4,4)	configuration			(4,9)
interval and offsetslotNot conliguredReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandgub-band SizeRBsub-band SizeRBcSI-Report interval and offsetslotAperiodic Report Slot Offset5CSI request1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0reportTriggerSize1CSI-AperiodicTriggerStateListCodebook Config- (CodebookConfig- N1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- (4,4)				
ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure       Not configured         ments       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Subband         Sub-band Size       RB         csi-ReportingBand       1111111         CSI-Report interval and offset       slot         CSI request       1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0         reportTriggerSize       1         CSI-AperiodicTriggerStateList       One State with one Associated Report Configuration         Codebook       CodebookConfig- CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookConfig- O1, CodebookCon fig-O2       (4,4)			slot	Not configured
CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Subband         Sub-band Size       RB       8         csi-ReportingBand       1111111         CSI-Report interval and offset       slot       Not configured         Aperiodic Report Slot Offset       5         CSI request       1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0         reportTriggerSize       1         CSI-AperiodicTriggerStateList       One State with one Associated Report Configuration         Codebook configuration       Associated Report         Codebook configuration       (CodebookConfig-N1, CodebookConfig-N1, CodebookConfig-N1, CodebookConfig-O1, CodebookConfig-	DepartConfigTu			Anariadia
reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           timeRestrictionForInterferenceMeas urements         Not configured           cqi-FormatIndicator         Wideband           pmi-FormatIndicator         Subband           Sub-band Size         RB         8           csi-ReportingBand         1111111           CSI-Report interval and offset         slot         Not configured           Aperiodic Report Slot Offset         5           CSI request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1           CSI-AperiodicTriggerStateList         One State with one Associated Report Configuration Associated Report           Codebook configuration         Codebook Type         typel-SinglePanel           Codebook config- nig-N2)         (4,4)		pe		
TimeRestrictionForChannelMeasure ments         Not configured           timeRestrictionForInterferenceMeas urements         Not configured           cqi-FormatIndicator         Wideband           pmi-FormatIndicator         Subband           Sub-band Size         RB         8           csi-ReportingBand         1111111           CSI-Report interval and offset         slot         Not configured           Aperiodic Report Slot Offset         5           CSI request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1           CSI-AperiodicTriggerStateList         One State with one Associated Report Configuration           Codebook configuration         Associated Report (CodebookConfig- 01,C				
ments         Not configured           timeRestrictionForInterferenceMeas urements         Not configured           cqi-FormatIndicator         Wideband           pmi-FormatIndicator         Subband           Sub-band Size         RB         8           csi-ReportingBand         1111111           CSI-Report interval and offset         slot         Not configured           Aperiodic Report Slot Offset         5           CSI request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1           CSI-AperiodicTriggerStateList         One State with one Associated Report Configuration           CSI-AperiodicTriggerStateList         Codebook Mode         1           Codebook config- N1, CodebookConfig- N1, CodebookConfig- N1, CodebookConfig- O1, CodebookCo				Cri-RI-PIVII-CQI
ments       o         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Subband         Sub-band Size       RB       8         csi-ReportingBand       1111111         CSI-Report interval and offset       slot       Not configured         Aperiodic Report Slot Offset       5         CSI request       1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0         reportTriggerSize       1       one State with one Associated Report Configuration         CSI-AperiodicTriggerStateList       One State with one Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM         Codebook configuration       (CodebookConfig-       (4,2)         (CodebookConfig-       (4,2)       (2,2)         (CodebookConfig-       (4,4)       (4,4)		orChannelivieasure		Not configured
urements         Not configured           cqi-FormatIndicator         Wideband           pmi-FormatIndicator         Subband           Sub-band Size         RB         8           csi-ReportingBand         1111111           CSI-Report interval and offset         slot         Not configured           Aperiodic Report Slot Offset         5         5           CSI request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0         1           reportTriggerSize         1         One State with one Associated Report Configuration           CSI-AperiodicTriggerStateList         Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM           Codebook config- N1, CodebookConfig- N1, CodebookConfig- O1, CodebookConfig- O1, CodebookCon fig-O2         (4,4)				3
cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Subband         Sub-band Size       RB       8         csi-ReportingBand       1111111         CSI-Report interval and offset       slot       Not configured         Aperiodic Report Slot Offset       5         CSI request       1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0         reportTriggerSize       1         CSI-AperiodicTriggerStateList       One State with one Associated Report         Codebook configuration       Associated Report         Codebook configuration       1         (CodebookConfig-N1, CodebookConfig-O1, Codebook		orInterferenceMeas		Not configured
pmi-FormatIndicatorSubbandSub-band SizeRB8csi-ReportingBand1111111CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5CSI request1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0reportTriggerSize1CSI-AperiodicTriggerStateListOne State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IMCodebook configuration1Codebook Mode1(CodebookConfig- ig-N2)(4,2)(CodebookConfig- O1,CodebookCon fig-O2)(4,4)				-
Sub-band SizeRB8csi-ReportingBand1111111CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5CSI request1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0reportTriggerSize1CSI-AperiodicTriggerStateListOne State with one Associated ReportCSI-AperiodicTriggerStateListCodebook TypeCodebook configuration1Codebook configuration1Codebook Config- ig-N2)(4,2)Othebook configuration(4,4)GodebookConfig- O1,CodebookCon fig-O2)(4,4)				
csi-ReportingBand111111CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5CSI request1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0reportTriggerSize1CSI-AperiodicTriggerStateListOne State with one Associated Report Configuration Configuration contains pointers to NZP CSI-RS and CSI-IMCodebook configurationCodebookConfig- ig-N2)CodebookConfig- 01,CodebookCon fig-O2)(4,4)		cator		
CSI-Report interval and offset         slot         Not configured           Aperiodic Report Slot Offset         5           CSI request         1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0           reportTriggerSize         1           CSI-AperiodicTriggerStateList         One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM           Codebook configuration         1           Codebook Mode         1           (CodebookConfig- O1,CodebookConfig- O1,CodebookCon fig-O2)         (4,4)			RB	-
Aperiodic Report Slot Offset       5         CSI request       1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0         reportTriggerSize       1         CSI-AperiodicTriggerStateList       One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM         Codebook configuration       1         Codebook Mode       1         (CodebookConfig- N1,CodebookConfig- O1,CodebookCon fig-O2)       (4,4)				
CSI request       1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0         reportTriggerSize       1         CSI-AperiodicTriggerStateList       One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM         Codebook configuration       1         Codebook Mode       1         (CodebookConfig- N1,CodebookConfig- O1,CodebookCon fig-O2)       (4,4)			slot	-
Construction       otherwise it is equal to 0         reportTriggerSize       1         CSI-AperiodicTriggerStateList       One State with one Associated Report Configuration         CSI-AperiodicTriggerStateList       Associated Report         Configuration contains pointers to NZP CSI-RS and CSI-IM         Codebook Mode       1         (CodebookConfig- N1,CodebookConfig- O1,CodebookCon fig-O2)       (4,2)         (4,4)       (4,4)	Aperiodic Repo	rt Slot Offset		-
Codebook configuration     Codebook Config- ig-N2)     CodebookConfig- (CodebookConfig- o1,CodebookConfig- O1,CodebookConfig- O2)     (4,4)	CSI request			
Colebook       One State with one Associated         Colebook       Report Configuration         Codebook       Associated Report         Codebook       Codebook Mode         Codebook       1         (CodebookConfig-       (4,2)         (CodebookConfig-       (4,2)         (CodebookConfig-       (4,4)         (CodebookConfig-       (4,4)	•			otherwise it is equal to 0
CSI-AperiodicTriggerStateList       Report Configuration         Associated Report       Configuration contains pointers to NZP CSI-RS and CSI-IM         Codebook Type       typel-SinglePanel         Codebook Mode       1         (CodebookConfig- ig-N2)       (4,2)         (CodebookConfig- 01,CodebookConfig- fig-O2)       (4,4)	reportTriggerSiz	ze		
CSI-AperiodicTriggerStateList       Associated Report         Configuration contains pointers to NZP CSI-RS and CSI-IM         Codebook Type       typel-SinglePanel         Codebook Mode       1         (CodebookConfig- ngig-N2)       (4,2)         (CodebookConfig- 01,CodebookConfig- 01,CodebookConfig- 01,CodebookConfig- 01,CodebookConfig- 01,CodebookCon       (4,4)				
Codebook     Codebook Type     Configuration contains pointers to NZP CSI-RS and CSI-IM       Codebook     Mode     1       Codebook     Codebook     1       (CodebookConfig- N1,CodebookConfig- 01,CodebookConfig- 01,CodebookCon     (4,2)       (CodebookConfig- 01,CodebookCon     (4,4)				
Codebook         Codebook Type         typel-SinglePanel           Codebook Mode         1           (CodebookConfig- vn1,CodebookConfig- onfiguration         N1,CodebookConfig- (CodebookConfig- 01,CodebookConfig- 01,CodebookCon         (4,2)           (CodebookConfig- o1,CodebookCon         (4,4)	CSI-AperiodicT	riggerStateList		
Codebook configurationCodebook Typetypel-SinglePanelCodebook Mode1(CodebookConfig- ig-N2)(4,2)(CodebookConfig- O1,CodebookConfig- O1,CodebookCon(4,4)				
Codebook     Codebook     1       Codebook     (CodebookConfig- ig-N2)     (4,2)       (CodebookConfig- 01,CodebookConfig- 01,CodebookCon     (4,4)				
Codebook configuration(CodebookConfig- ig-N2)(4,2)(CodebookConfig- O1,CodebookCon fig-O2)(4,4)				typeI-SinglePanel
Codebook configuration     N1,CodebookConf ig-N2)     (4,2)       (CodebookConfig- O1,CodebookCon fig-O2)     (4,4)				1
configuration     ig-N2)       (CodebookConfig- O1,CodebookCon fig-O2)     (4,4)				
configuration (CodebookConfig- 01,CodebookCon (4,4) fig-O2)	Codebook			(4,2)
O1,CodebookCon fig-O2) (4,4)				
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				(4,4)
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I		Restriction		
		RI Restriction		0000010
	Dhysical	channel for CSI report		PUSCH
				FUSCH
	CQI/RI/PI	VI delay	ms	8
	Maximum	number of HARQ		4
	transmiss	ion		+
	Measuren	nent channel		R.PDSCH.1-6.3 FDD
	Note 1: When Throughput is measured using random precoder selection, the			random precoder selection, the
	<ul> <li>precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i<sub>1</sub>, i<sub>2</sub> combination.</li> <li>Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4),</li> </ul>			nbination. k reporting instance at slot#n k slot not later than slot#(n-4),
	<ul> <li>this reported PMI cannot be applied at the gNB downlink before slot#(n+4).</li> <li>Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.</li> </ul>			5

#### Table 6.3.2.1.3.3-2: Minimum requirement

Parameter	Test 1
γ	2.5

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.1.3.

6.3.2.1.3.4 Test description

#### 6.3.2.1.3.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.2.1.3.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.2.1.3.4.3.

#### 6.3.2.1.3.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.3.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and  $SNR_{follow1, follow2}$  according to Annex G.3.2.

- 3. Set SNR to SNR<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure t<sub>md1, md2</sub> according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.1.3.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.1.3.4.3 Message contents

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

#### 6.3.2.1.3.4.3.1 Message exceptions for SA

#### Table 6.3.2.1.3.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	011110		
}			
nrofPorts	P16		
firstOFDMSymbolInTimeDomain	5		
cdm-Type	cdm4-FD2-TD2		
}			

#### Table 6.3.2.1.3.4.3.1-2: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14			
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
moreThanTwo SEQUENCE {			
n1-n2 CHOICE {			
four-two-Typel-SinglePanel-Restriction	FFFF FFFF FFFF FFFF		
}			
}			
}			
typel-SinglePanel-ri-Restriction	0000010		

#### Table 6.3.2.1.3.4.3.1-3: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	5		
}			
reportFreqConfiguration SEQUENCE {			
pmi-FormatIndicator	subbandPMI		
}			
}			

#### 6.3.2.1.3.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.3.4.3.1.

#### 6.3.2.1.3.5 Test requirement

#### Table 6.3.2.1.3.5-1: Test requirement

Parameter	Test 1
γ	2.49

# 6.3.2.1.4 2Rx FDD FR1 Single PMI with 32Tx Type1 - SinglePanel codebook for both SA and NSA

#### 6.3.2.1.4.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.1.4.2 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.

#### 6.3.2.1.4.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.4.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.4.3-2.

Pa	rameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier space	cing	kHz	15
Duplex Mode			FDD
Propagation ch	annel		TDLA30-5
Antenna config	uration		High XP 32 x 2 (N1,N2) = (4,4)
Beamforming M	lodel		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
ZP CSI-RS configuration	Number of CSI- RS ports (X)		4
-	CDM Type		FD-CDM2
	Density (ρ)		1

# Table 6.3.2.1.4.3-1: Test parameters (dual-layer)

	1		
	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (lo, l1)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		32
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier		
NZP CSI-RS for CSI acquisition	index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )		Row 17, (2, 4, 6, 8)
	First OFDM symbol in the PRB used for CSI-RS (lo, l1)		(5, 12)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin gOffset		0
	CSI-IM resource		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping (k <sub>CSI-IM</sub> ,I <sub>CSI-IM</sub> )		(4,9)
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigType			Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
ments	ForChannelMeasure		Not configured
urements	ForInterferenceMeas		Not configured
cqi-FormatIndic	ator		Wideband
pmi-FormatIndi	cator		Wideband
Sub-band Size		RB	8
csi-ReportingBand			1111111
CSI-Report interval and offset		slot	Not configured
Aperiodic Repo	rt Slot Offset		5
CSI request			1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTriggerSiz	2e		
CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers
			to NZP CSI-RS and CSI-IM
	Codebook Type Codebook Mode		typel-SinglePanel
	(CodebookConfig-		
Codebook configuration	N1,CodebookConf ig-N2)		(4,4)
-	(CodebookConfig- O1,CodebookCon fig-O2)		(4,4)

	CodebookSubset Restriction		0x FFFF
	<b>RI</b> Restriction		0000010
Physical of	channel for CSI report		PUSCH
CQI/RI/PI	VI delay	ms	8
Maximum	number of HARQ		4
transmiss	ion		4
Measurer	nent channel		R.PDSCH.1-6.3 FDD
	DSCH & PDSCH DMRS recoding configuration for random recoding		Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination, and with Wideband granularity
Note 1: Note 2:	precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable $i_1$ , $i_2$ combination.		ot (1 ms granularity) with equal mbination. k reporting instance at slot#n k slot not later than slot#(n-4),
Note 3:			

#### Table 6.3.2.1.4.3-2: Minimum requirement

Parameter	Test 1
γ	5.0

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.1.4.

#### 6.3.2.1.4.4 Test description

#### 6.3.2.1.4.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.2.1.4.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.2.1.4.4.3.

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#### 6.3.2.1.4.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.4.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

3. Set SNR to *SNR*<sub>follow1, follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each

precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with

aperiodic CSI request triggered. Measure  $t_{md1,md2}$  according to Annex G.3.3.

4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.1.4.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.1.4.4.3 Message contents

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

#### 6.3.2.1.4.4.3.1 Message exceptions for SA

#### Table 6.3.2.1.4.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	011110			
}				
nrofPorts	P32			
firstOFDMSymbolInTimeDomain	5			
cdm-Type	cdm4-FD2-TD2			
}				

#### Table 6.3.2.1.4.4.3.1-2: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Tab	ble 5.4.2.5-14		
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
moreThanTwo SEQUENCE {			
n1-n2 CHOICE {			
four-four-TypeI-SinglePanel-Restriction	FFFF FFFF FFFF FFFF		
	FFFF FFFF FFFF FFFF		
	FFFF FFFF FFFF FFFF		
	FFFF FFFF FFFF FFFF		
}			
}			
}			
typeI-SinglePanel-ri-Restriction	0000010		

# Table 6.3.2.1.4.4.3.1-3: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	5		
}			
}			

# 6.3.2.1.4.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.4.4.3.1.

#### 6.3.2.1.4.5 Test requirement

#### Table 6.3.2.1.4.5-1: Test requirement

Parameter	Test 1
γ	4.99

# 6.3.2.1.5 2Rx FDD FR1 Multiple PMI with 16Tx TypeII codebook for both SA and NSA

#### 6.3.2.1.5.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.1.5.2 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.

#### 6.3.2.1.5.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.5.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.5.3-2.

Table 6.3.2.1.5.3-1: T	Test parameters (	(dual-layer)
------------------------	-------------------	--------------

Parameter		Unit	Test 1
Bandwidth		MHz	10
Subcarrier spa	cing	kHz	15
Duplex Mode			FDD
Propagation ch	nannel		TDLA30-5
Antenna config	juration		XP Medium 16 x 2 (N1,N2) = (4,2)
Beamforming I	Model		As specified in Annex B.4.1
~	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports ( <i>X</i> )		4
	CDM Type		FD-CDM2
ZP CSI-RS	Density (ρ)		1
configuration	First subcarrier index in the PRB used for CSI-RS ( $k_0$ , $k_1$ )		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		(9,-)

	CSI-RS		
	interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource		Aperiodic
	Type Number of CSI-RS		
	ports (X)		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS for CSI	First subcarrier index in the PRB used for		Row 12, (2, 4, 6, 8)
acquisition	CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> ) First OFDM symbol		
	in the PRB used for		(5, -)
	CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		
	CSI-RS	slot	Not configured
	interval and offset aperiodicTriggeringO		5
	ffset		0
	CSI-IM resource		Aperiodic
	Туре		•
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping		(4,9)
coniguration	(kcsi-im,lcsi-im)		(4,3)
	CSI-IM timeConfig	slot	Not configured
	interval and offset	5101	
ReportConfigTy CQI-table	уре		Aperiodic
reportQuantity			Table 1 cri-RI-PMI-CQI
	ForChannelMeasurem		
ents			Not configured
timeRestriction ements	ForInterferenceMeasur		Not configured
cqi-FormatIndio			Wideband
pmi-FormatIndi	cator		Subband
Sub-band Size csi-ReportingB	and	RB	8 1111111
		slot	Not configured
CSI-Report interval and offset Aperiodic Report Slot Offset		5101	5
CSI request			1 in slots i, where $mod(i, 5) = 1$ ,
-			otherwise it is equal to 0
reportTriggerSi	ze		1 One State with one Acception
			One State with one Associated Report Configuration
CSI-AperiodicT	riggerStateList		Associated Report
			Configuration contains pointers
	O dah a da T		to NZP CSI-RS and CSI-IM
	Codebook Type L (numberOfBeams)		typell 2
	L (numberOrBeams)		
Codebook configuration	(phaseAlphabetSize)		8
	subbandAmplitude		True
	(CodebookConfig-		
	N1,CodebookConfig- N2)		(4,2)
	(CodebookConfig-		
	O1,CodebookConfig-		(4,4)
	O2)		
	CodebookSubsetRes		
	triction RI Restriction (typell-		FFFF FFFF FFFF FFFF
	RI Restriction (typell-		10
L			

Physical of	channel for CSI report		PUSCH
CQI/RI/PMI delay		ms	8
Maximum	number of HARQ		4
transmiss	sion		4
Measurer	ment channel		R.PDSCH.1-6.3 FDD
Note 1:	When Throughput is measure	ed using ra	indom precoder selection, the
	precoder shall be updated in		
	probability of each applicable i1, i2 combination. The random precoder		
	generation shall follow 'typeI-SinglePanel' codebook configuration as		
	specified in table 6.3.2.1.3-1.		
Note 2:			
	on PMI estimation at a downlink slot not later than slot#(n-4), this		
	reported PMI cannot be applied at the gNB downlink before slot#(n+4).		
Note 3:			
	specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall		
	be fixed as 1 during the test.		

#### Table 6.3.2.1.5.3-2: Minimum requirement

Parameter	Test 1
γ	1.9

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.1.5.

#### 6.3.2.1.5.4 Test description

#### 6.3.2.1.5.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.2.1.5.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.2.1.4.4.3.

#### 6.3.2.1.5.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.5.3-1 as appropriate.

The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish t<sub>ue, follow1, follow2</sub> and SMD

SNR<sub>follow1,follow2</sub> according to Annex G.3.2.

- 3. Set SNR to SNR follow1. follow2. The SS shall transmit PDSCH with randomly selected precoding matrix from
- codebook (Table 5.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities, and the random precoder generation shall follow the codebook configuration as specified in Table 6.3.2.1.3.3-1. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure  $t_{rnd1, rnd2}$  according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.1.5.5-1, then the test is pass.

Otherwise, the test is fail.

### 6.3.2.1.5.4.3 Message contents

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

#### 6.3.2.1.5.4.3.1 Message exceptions for SA

#### Table 6.3.2.1.5.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	'011110'B		
}			
nrofPorts	P16		
firstOFDMSymbolInTimeDomain	5		
cdm-Type	cdm4-FD2-TD2		
}			

Table 6.3.2.1.5.4.3.1-2: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5	5.4.2.5-14		
Information Element	Value/remark	Comment	Condition
CodebookConfig ::= SEQUENCE {			
codebookType CHOICE {			
type2 SEQUENCE {			
subType CHOICE {			
typeII SEQUENCE {			
n1-n2-codebookSubsetRestriction CHOICE {			
four-two	0x 7FF FFFF		
	FFFF FFFF FFFF		
}			
typeII-RI-Restriction	'10'B		
}			
}			
phaseAlphabetSize	8		
subbandAmplitude	TRUE		
numberOfBeams	2		
}			
}			
}			

#### Table 6.3.2.1.5.4.3.1-3: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	5		
}			
reportFreqConfiguration SEQUENCE {			
pmi-FormatIndicator	subbandPMI		
}			
}			

#### 6.3.2.1.5.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.5.4.3.1.

# 6.3.2.1.5.5 Test requirement

#### Table 6.3.2.1.5.5-1: Test requirement

Parameter	Test 1
γ	1.89

# 6.3.2.1.6 2Rx FDD FR1 Multiple PMI with 16Tx Enhanced TypeII codebook for both SA and NSA

#### 6.3.2.1.6.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.1.6.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

# 6.3.2.1.6.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.6.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.6.3-2.

P	arameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier spa	cing	kHz	15
Duplex Mode	•		FDD
Propagation ch	nannel		TDLA30-5
			XP Medium 16 x 2
Antenna config	Juration		(N1,N2) = (4,2)
Beamforming M			As specified in Annex B.4.1
	CSI-RS resource		Aperiodic
	Туре		Aponodio
	Number of CSI-RS		4
	ports (X)		
	CDM Type		FD-CDM2
	Density (ρ)		1
70.001.00	First subcarrier index		
ZP CSI-RS	in the PRB used for		Row 5, (4,-)
configuration	CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		
	First OFDM symbol		(0.)
	in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		(9,-)
	CSI-RS (10, 11)		
	interval and offset	slot	Not configured
			1 in slots i, where $mod(i, 5) = 1$ ,
	ZP CSI-RS trigger		otherwise it is equal to 0
	CSI-RS resource		Aperiodic
	Туре		, iponodio
	Number of CSI-RS		16
	ports (X)		_
	CDM Type		CDM4 (FD2, TD2)
	Density (p)		1
NZP CSI-RS	First subcarrier index		
for CSI	in the PRB used for		Row 12, (2, 4, 6, 8)
acquisition	CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> ) First OFDM symbol		
	in the PRB used for		(5, -)
	CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		(0, )
	CSI-RS		
	interval and offset	slot	Not configured
	aperiodicTriggeringO		
	ffset		0
	CSI-IM resource		Aperiodic
	Туре		
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuration	Mapping		(4,9)
	(kcsi-im,lcsi-im)		
	CSI-IM timeConfig	slot	Not configured
	interval and offset	0.00	i tot configurou

DenertOen	6			
ReportCon	figity	/pe		Aperiodic
	CQI-table			Table 1
reportQuar				cri-RI-PMI-CQI
ents	ction	ForChannelMeasurem		Not configured
timeRestric ements	ction	ForInterferenceMeasur		Not configured
cqi-Format	Indic	ator		Wideband
pmi-Forma				Not configured
Sub-band S			RB	4
csi-Reporti		and		1111111
	<u> </u>	erval and offset	slot	Not configured
		rt Slot Offset	0.01	5
CSI reques				1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTrigg		70		
		riggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
		Codebook Type		typell-r16
		paramCombination-		6
		r16		$(L = 4, p_v = 1/2, \beta = 1/2)$
R(numberOfPl bandsPerCQIS d-r16) (CodebookCor		R(numberOfPMISub bandsPerCQISubban d-r16)		1
		(CodebookConfig- N1,CodebookConfig- N2)		(4,2)
(CodebookConfig- O1,CodebookConfig- O2)			(4,4)	
CodebookSubsetRes triction			0x 7FF FFFF FFFF FFFF FFFF	
		RI Restriction (typell-		
		RI-Restriction-r16)		0010
Physical ch	nann	el for CSI report		PUSCH
CQI/RI/PM			ms	8
		per of HARQ		4
transmissio	transmission			4
Measurem	Measurement channel R.PDSCH.1-6.3			R.PDSCH.1-6.3
Note 1:				ndom precoder selection, the (1 ms granularity) with equal
	generation shall follow 'typel-SinglePanel' codebook configuration as specified in table 6.3.2.1.3-1.			
Note 2:	lf the on P	UE reports in an availal MI estimation at a down	ble uplink r link slot no	eporting instance at slot#n based t later than slot#(n-4), this NB downlink before slot#(n+4)
Note 3:	reported PMI cannot be applied at the gNB downlink before slot#(n+4). Note 3: Randomization of the dual-cluster beam directions shall be used as specified in AnnexB.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.			n directions shall be used as

Table 6.3.2.1.6.3-2:	Minimum	requirement
----------------------	---------	-------------

Parameter	Test 1
γ	2.2

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.2.1.6.

#### 6.3.2.1.6.4 Test description

#### 6.3.2.1.6.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.2.1.6.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.2.1.6.4.3.

#### 6.3.2.1.6.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.6.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish t<sub>ue, follow1, follow2</sub> and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

- 3. Set SNR to SNR<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1.6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure t<sub>md1, md2</sub> according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.1.6.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.1.6.4.3 Message contents

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

#### 6.3.2.1.6.4.3.1

Message exceptions for SA

#### Table 6.3.2.1.6.4.3.1-1: CSI-ReportConfig

Value/remark	Comment	Condition
Not present		
Not present		
Value1		
CodebookConfig-r16		
-	Not present Not present Value1	Not present Not present Value1

# Table 6.3.2.1.6.4.3.1-2: CodebookConfig-r16 (Table 6.3.2.1.6.4.3.1-1)

Derivation Path: TS 38.331 [6], clause 6.3.2			
Information Element	Value/remark	Comment	Condition
CodebookConfig-r16 ::= SEQUENCE {			
codebookType CHOICE {			
type2 SEQUENCE {			
subType CHOICE {			
typeII-r16 SEQUENCE {			
N1-n2-codebookSubsetRestriction-r16			
Four-two	0x 7FF FFFF FFFF FFFF FFFF		
}			
typeII-RI-Restriction-r16	0010		
}			
}			
numberOfPMI-SubbandsPerCQI-Subband-r16	1		
paramCombinatin-r16	6	(L =4, p <sub>v</sub> =1/2, β=1/2 )	
}			
}			
}			

#### 6.3.2.1.6.4.3.2 Message exceptions for NSA

\_

Same as in clause 6.3.2.1.6.4.3.1.

#### 6.3.2.1.6.5 Test requirement

#### Table 6.3.2.1.6.5-1: Test requirement

Parameter	Test 1
γ	2.19

# 6.3.2.2 TDD

6.3.2.2.1 2Rx TDD FR1 Single PMI with 4TX TypeI-SinglePanel codebook for both SA and NSA

#### 6.3.2.2.1.1 Test Purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

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# 6.3.2.2.1.2 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.

# 6.3.2.2.1.3 Minimum Conformance Requirements

For the parameters specified in Table 6.3.2.2.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.1.3-2.

Pa	rameter	Unit	Test 1
Bandwidth		MHz	40
Subcarrier spacing		kHz	30
Duplex Mode			TDD
			FR1.30-1 as specified in Annex
TDD DL-UL configuration			A
DL BWP	First PRB		0
configuration	Number of		106
#1	contiguous PRB		
	Subcarrier spacing	kHz	30
Propagation cha	annel		TDLA30-5
Antenna configu	uration		High XP 4 x 2
•			(N1,N2) = (2,1)
Beamforming M			As specified in Annex B.4.1
	CSI-RS resource		Periodic
	Type		
	Number of CSI-RS		4
	ports (X)		
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier		
configuration	index in the PRB used for CSI-RS		Row 5, (4,-)
	$(k_0, k_1)$		
	First OFDM symbol		
	in the PRB used for		(9,-)
	CSI-RS ( $I_0$ , $I_1$ )		(3;-)
	CSI-RS		
	interval and offset	slot	10/1
	CSI-RS resource		A
	Туре		Aperiodic
	Number of CSI-RS		4
	ports (X)		4
	CDM Type		FD-CDM2
	Density (p)		1
	First subcarrier		
NZP CSI-RS	index in the PRB		Row 4, (0,-)
for CSI	used for CSI-RS		
acquisition	$(k_0, k_1)$		
	First OFDM symbol		(12.)
	in the PRB used for		(13,-)
	CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		
	CSI-RS	slot	Not configured
	interval and offset aperiodicTriggering		_
	Offset		0
	CSI-IM resource		
	Type		Aperiodic
CSI-IM	CSI-IM RE pattern		Patten 0
configuration	CSI-IM Resource		
	Mapping		(4,9)
1	1	I	

Table 6.3.2.2.1.3-1: Test parameters (single layer)

Parameter Unit Test 1				
	(kcsi-im, lcsi-im)	Unit	100(1	
	CSI-IM timeConfig			
interval and offset		slot	Not configured	
ReportConfigType			Aperiodic	
CQI-table			Table 1	
reportQuantity			cri-RI-PMI-CQI	
	ForChannelMeasure			
ments	Forchamilenvieasure		Not configured	
	ForInterferenceMeas			
urements	Formerenceweas		Not configured	
cqi-FormatIndic	ator		Wideband	
pmi-FormatIndi			Wideband	
Sub-band Size	caloi	RB	16	
-	and	ND	1111111	
csi-ReportingBa CSI-Report inte		alat	Not configured	
		slot	<b>.</b>	
Aperiodic Repo			$\frac{8}{1 \text{ in alota i, where mod(i, 10)} - 1}$	
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0	
roportTriggorCi	70			
reportTriggerSiz	ze		One State with one Associated	
	winner Otatal int		Report Configuration	
CSI-AperiodicT	riggerStateList		Associated Report Configuration	
			contains pointers to NZP CSI-RS and CSI-IM	
Codebook	Codobook Typo		typeI-SinglePanel	
	Codebook Type		typei-SingleFaner	
configuration	Codebook Mode			
	(CodebookConfig- N1,CodebookConfi		(2.4)	
	-		(2,1)	
	g-N2) (CodebookConfig-			
	O1,CodebookConfi		(4.1)	
	g-O2)		(4,1)	
	CodebookSubsetR			
	estriction		1111111	
	RI Restriction		0000001	
Physical chann	el for CSI report		PUSCH	
CQI/RI/PMI del		me	5.5	
Maximum num		ms	5.5	
transmission			4	
	hannal			
Measurement of	inannei		R.PDSCH.2-8.1 TDD	
			Single Panel Type I, Random precoder selection updated per	
PDSCH & PDSCH DMRS Precoding configuration for random Precoding			slot, with equal probability of	
			each applicable i <sub>1</sub> , i <sub>2</sub>	
			combination, and with Wideband	
			granularity	
NOTE 1: For random precoder selection, the precoder shall be updated in each				
slot (0.5 ms granularity).				
NOTE 2: If the UE reports in an available uplink reporting instance at slot #n				
based on PMI estimation at a downlink slot not later than slot#[(n-4)],				
			t the eNB downlink before	
	[(n+4)].	applied a		
		ple beam	direction shall be used as	
	ified inAnnex B.2.3.2.3			

Table 6.3.2.2.1.3-2: Minimum requirement

Parameter	Test 1
γ	1.3

#### 6.3.2.2.1.4 Test Description

#### 6.3.2.2.1.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 section A.3.2.2 for UE diagram.
- 2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.2.1.3-1 as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, connected without release *On* for SA 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 content are defined in clause 6.3.2.2.1.4.3.

#### 6.3.2.2.1.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.1.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

3. Set SNR to SNR follow1, follow2. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure t<sub>rnd1, rnd2</sub> according to Annex G.3.3.

4. Calculate 
$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$
. If the ratio  $\geq \gamma$  which is specified in table 6.3.2.2.1.5-1, then the test is pass.

Otherwise, the test is fail.

# 6.3.2.2.1.4.3 Message contents

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

6.3.2.2.1.4.3\_1 Message exceptions for SA

# Table 6.3.2.2.1.4.3\_1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element	Value/remark	Comment	Condition
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	aperiodic		
}			

# Table 6.3.2.2.1.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause5.4.2, Table 5.4.2.0-15				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
Row4	001			
}				
nrofPorts	p4			
firstOFDMSymbolInTimeDomain	13			
}				

# Table 6.3.2.2.1.4.3\_1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause5.4.2, Table5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

# Table 6.3.2.2.1.4.3\_1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34				
Information Element	Value/remark	Comment	Condition	
csi-IM-ResourceElementPattern				
pattern0 SEQUENCE {				
subcarrierLocation-p0	s4			
symbolLocation-p0	9			
}				

# Table 6.3.2.2.1.4.3\_1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
moreThanTwo SEQUENCE {				
n1-n2 CHOICE {				
two-one-TypeI-SinglePanel-Restriction	11111111			
}				
}				
}				
typeI-SinglePanel-ri-Restriction	0000001			

#### Table 6.3.2.2.1.4.3\_1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39				
Information Element	Value/remark	Comment	Condition	
reportConfigType CHOICE {				
aperiodic SEQUENCE {				
reportSlotOffsetList	0			
}				
reportFreqConfiguration SEQUENCE {				
csi-ReportingBand CHOICE {				
subbands7	111111			
}				
}				
subbandSize	value2			
}				

#### 6.3.2.2.1.4.3\_2 Message exceptions for NSA

Same as in clause 6.2.2.1.2.1.4.3\_1.

#### 6.3.2.2.1.5 Test Requirements

#### Table 6.3.2.2.1.5-1: Test requirement (TDD)

Parameter	Test 1
γ	1.29

# 6.3.2.2.2 2Rx TDD FR1 Single PMI with 8TX TypeI-SinglePanel codebook for both SA and NSA

#### 6.3.2.2.2.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.2.2.2 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.

#### 6.3.2.2.2.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.3-2.

BandwidthMHz40Subcarrier spacingkHz30Duplex ModeTDD	Pa	rameter	Unit	Test 1
Subcarrier spacing         kHz         30 TDD           Duplex Mode         First PRB         0           TDD DL-UL configurations         First PRB         0           Propagation channel         Number of configuration         106           Propagation channel         TDLA30-5           Antenna configuration         High XP8 x 2 (N1,N2) = (4,1)           Beamforming Model         As specified in Annex B.4.1           Propagation channel         TDLA30-5           Antenna configuration         (N1,N2) = (4,1)           Beamforming Model         As specified in Annex B.4.1           CSI-RS resource Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier         Row 5, (4,-)           (ka, k1)         First SP resource         Aperiodic           Symbol in the PRB used for CSI-RS ((b, k1)         8         10/1           CSI-RS resource         Aperiodic         1           NZP CSI-RS (not CSI- acquisition         8         10/1           First subcarrier index in the PRB used for CSI-RS ((b, h)         8         6(5,-)           CSI-RS         CDM Type         CDM4 (FD2, TD2) <tr< th=""><th></th><th></th><th></th><th></th></tr<>				
Duplex Mode         TDD           TDD DL-UL configurations         FR1.30-1 as specified in Anne A           DL BWP configuration         Number of contiguous PRB         0           Number of contiguous PRB         106           Subcarrier spacing         kHz         30           Propagation channel         TDLA30-5           Antenna configuration         High XP 8 x 2           Antenna configuration         KHz         30           ECSI-RS resource         Periodic           Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS         Row 5, (4,-)           (lo, lt)         CSI-RS resource Type         Aperiodic           Number of CSI- RS ports (X)         8         10/1           CSI-RS resource Type         Aperiodic         1           Number of CSI- RS prots (X)         8         10/1           CSI-RS resource Type         Aperiodic         1           Number of CSI- RS ports (X)         8         10/1           CSI-RS resource Type         Aperiodic         1           Number of CSI- RS ports (X)         8         <		ing		30
TDD E-OL colligurations         'A           DL BWP configuration         First PRB         0           Mumber of spacing         Number of spacing         106           Subcarrier spacing         KHz         30           Propagation channel         TDLA30-5           Antenna configuration         High XP 8 x 2 (M1,N2) = (4,1)           Beamforming Model         As specified in Annex B.4.1           Earnorming Model         As specified in Annex B.4.1           ZP CSI-RS         CDM Type         Periodic           Number of CSI- RS ports (X)         4         CDM Type           Density (p)         1         First Stress configuration         Row 5, (4,-)           (ke, k1)         First OFDM         Row 5, (4,-)         Kes k1           Symbol in the PRB used for CSI-RS         (9,-)         (0,-)           (ko, k1)         CDM Type         CDM4 (FD2, TD2)           Density (p)         1         First Stobcarrier index in the PRB         Row 8, (4,6)           used for CSI-RS for CSI acquisition         CDM Type         CDM4 (FD2, TD2)           Density (p)         1         First Stobcarrier index in the PRB         Row 8, (4,6)           used for CSI-RS for CSI-RS for CSI-RS interval and offset         slot         Not configured		*		TDD
DL BWP configuration #1         Number of contiguous PRB         106           Subcarrier spacing         kHz         30           Propagation channel         TDLA30-5           Antenna configuration         High XP 8 x 2 (M1,N2) = (4,1)           Beamforming Model         As specified in Annex B.4.1           Esamforming Model         As specified in Annex B.4.1           Event         Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (lo, lt)         Row 5, (4,-)           CSI-RS resource         Aperiodic           VP CSI-RS (lo, lt)         Slot         10/1           CSI-RS resource         Aperiodic           Number of CSI- RS ports (X)         8         10/1           CSI-RS resource         Aperiodic           Number of CSI- RS ports (X)         8         10/1           CSI-RS resource         Aperiodic           Number of CSI- RS ports (X)         8         6(5,-)           CBM Type         CDM4 (FD2, TD2)         1           First Subcarrier index in the PRB used for CSI-RS         8         0           CSI-RM Resource <t< td=""><td>TDD DL-UL cor</td><td>nfigurations</td><td></td><td>FR1.30-1 as specified in Annex A</td></t<>	TDD DL-UL cor	nfigurations		FR1.30-1 as specified in Annex A
configuration #1         contiguous PRB         106           #1         Subcarrier spacing         kHz         30           Propagation channel         TDLA30-5           Antenna configuration         High XP 8 x 2 (N1,N2) = (4,1)           Beamforming Model         As specified in Annex B.4.1           Propagation channel         CSI-RS resource Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier         Index in the PRB used for CSI-RS           (ko, k1)         First Subcarrier           (ko, k1)         First Subcarrier           CSI-RS         Slot           interval and offset         Slot           NZP CSI-RS interval and offset         Slot           NZP CSI-RS interval and offset         Slot           NUmber of CSI- Type         Row 8, (4,6)           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First Subcarrier index in the PRB used for CSI-RS         Row 8, (4,6)           (b, h1)         First OFDM           Symbol in the PRB used for CSI-RS         (5,-)           (b, h2, h1)         ESI-H           First OFD		First PRB		0
spacing         KHz         30           Propagation channel         TDLA30-5           Antenna configuration         High XP 8 x 2 (N1.N2) = (4,1)           Beamforming Model         As specified in Annex B.4.1           Kerner         Periodic           Number of CSI- RS ports (X)         Periodic           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (0, h)         Row 5, (4,-)           (Ko, k1)         First OFDM symbol in the PRB used for CSI-RS (0, h)         Row 5, (4,-)           CSI-RS resource Type         Aperiodic           Number of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First Subcarrier index in the PRB used for CSI-RS for CSI acquisition         Row 8, (4,6)           NZP CSI-RS for CSI acquisition         CDM Type         CDM4 (FD2, TD2)           Density (p)         1         1           First Subcarrier index in the PRB used for CSI-RS (Ko, k.1)         Row 8, (4,6)           CSI-RS interval and offset aperiodic Triggerin qoeffset         0           CSI-IM Resource CSI-IM Resource         Aperiodic           CSI-IM Repattern         Patten 0           CSI-IM Repattern </td <td>configuration</td> <td>contiguous PRB</td> <td></td> <td>106</td>	configuration	contiguous PRB		106
Antenna configuration         High XP 8 x 2 (N1,N2) = (4,1)           Beamforming Model         As specified in Annex B.4.1           CSI-RS resource Type         Periodic           RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier         Row 5, (4, -)           index in the PRB         symbol in the PRB           used for CSI-RS         (9, -)           (b, k, 1)         First SUCARRIER           First SUCARRIER         (9, -)           CSI-RS         slot           interval and offset         slot           NUMBER of CSI-RS         8           CDM Type         Aperiodic           NZP CSI-RS         first subcarrier           index in the PRB         slot           used for CSI-RS         8           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First Subcarrier         nidex in the PRB           used for CSI-RS         Row 8, (4,6)           used for CSI-RS         (5, -)           (b, h, 1)         ESI-RS           cold first         0           CSI-RS         slot           interval and offset <td></td> <td>spacing</td> <td>kHz</td> <td></td>		spacing	kHz	
Antenna consiguration         (NT,N2) = (4,1)           Beamforming Model         As specified in Annex B.4.1           R         CSI-RS resource Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier         Index in the PRB used for CSI-RS         Row 5, (4, -)           (lo, h)         First Subcarrier         Row 5, (4, -)           (lo, h)         CSI-RS         10/1           CSI-RS         slot         10/1           CSI-RS resource         Aperiodic           Type         CDM Type         Aperiodic           NZP CSI-RS for CSI acquisition         RS ports (X)         8           CDM Type         CDM Type         CDM4 (FD2, TD2)           Density (p)         1         1           First subcarrier index in the PRB used for CSI-RS for CSI acquisition         Row 8, (4,6)         6,-)           (lo, h)         CSI-RS         slot         Not configured           aperiodicTriggerin qD/fiset         0         CSI-RS interval and offset         slot           CSI-IM Resource CSI-IM Resource         Aperiodic         CSI-IM Resource         Aperiodic           CSI-IM Resource (CSI-IM Reso	Propagation cha	annel		
ZP CSI-RS configuration         CSI-RS Ports (X)         Periodic           ZP CSI-RS configuration         Number of CSI- RS ports (X)         4           ZP CSI-RS configuration         First subcarrier index in the PRB used for CSI-RS (lo, h1)         1           First OFDM symbol in the PRB used for CSI-RS (lo, h1)         Row 5, (4,-)           CSI-RS interval and offset         10/1           CSI-RS interval and offset         10/1           CSI-RS interval and offset         8           CDI-RS protect         Aperiodic           NUMber of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First Subcarrier index in the PRB used for CSI- sude for CSI- sude for CSI- sude for CSI-RS (lo, h1)         Row 8, (4,6)           First SUFORM symbol in the PRB used for CSI-RS (lo, h1)         0           CSI-IM configuration         CSI-IM resource maperiodicTriggerin gOffset         0           CSI-IM configuration         CSI-IM RE pattern         Patten 0           CSI-IM RE pattern         Patten 0         CSI-IM REsource Mapping         Aperiodic           CSI-IM RE pattern         CAperiodic         Table 1         Table 1           reportConfigType         Aperiodic         Aperiodic         Table 1           C	-			(N1,N2) = (4,1)
Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (ρ)         1           First subcarrier index in the PRB used for CSI-RS         Row 5, (4,-)           (k <sub>0</sub> , k <sub>1</sub> )         First SUbcarrier           First SUBCARIER         (9,-)           (l <sub>0</sub> , h)         CSI-RS           CSI-RS         slot           (l <sub>0</sub> , h)         1           CSI-RS         (9,-)           (l <sub>0</sub> , h)         CSI-RS           CSI-RS resource         Aperiodic           Number of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)           Density (ρ)         1           First subcarrier index in the PRB used for CSI-RS         Row 8, (4,6)           (k <sub>0</sub> , k1)         First Subcarrier index in the PRB         Sold           acquisition         First OFDM symbol in the PRB         (5,-)           (l <sub>0</sub> , h)         CSI-RS         (5,-)           (l <sub>0</sub> , h)         CSI-RS         (5,-)           (l <sub>0</sub> , h)         CSI-RS         (4,9)           CSI-RS         Slot         Not configured           appriodicTriggerin goffset         Slot         Not configured	Beamforming N			As specified in Annex B.4.1
ZP CSI-RS configuration         Number of CSI- RS ports (X)         4           ZP CSI-RS configuration         CDM Type         FD-CDM2           Density (p)         1         First subcarrier index in the PRB used for CSI-RS         Row 5, (4,-)           (k <sub>0</sub> , k <sub>1</sub> )         First OFDM symbol in the PRB used for CSI-RS         (9,-)         (1,-1)           CSI-RS interval and offset         slot         10/1           CSI-RS interval and offset         slot         10/1           VPP         Aperiodic         Number of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)         Density (p)         1           First subcarrier index in the PRB used for CSI-RS for CSI acquisition         Row 8, (4,6)         (5,-)           First OFDM symbol in the PRB used for CSI-RS ((b, k_1)         Row 8, (4,6)         0           CSI-IN resource for CSI-RS for CSI- doftet         0         0           CSI-IM resource for CSI-RS         Slot         Not configured           used for CSI-RS for CSI- for C				Periodic
ZP CSI-RS configuration         CDM Type         FD-CDM2           First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )         (9,-)           CSI-RS interval and offset         slot           NZP CSI-RS for CSI acquisition         CSI-RS interval and offset         slot           NZP CSI-RS for CSI acquisition         CSI-RS interval and offset         slot           First Subcarrier index in the PRB used for CSI-RS for CSI acquisition         Row 8, (4,6)           CSI-RS interval and offset         Row 8, (4,6)           CSI-RS for CSI acquisition         (5,-)           (b, h) CSI-RS interval and offset         slot           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM configuration         CSI-IM resource CSI-IM Resource         Aperiodic           CSI-IM Resource Mapping (kcsHMLcSHM)         Slot         Not configured           CSI-IM Resource Mapping         Slot         Not configured           ReportConfigType         Aperiodic         Table 1           CPopU         Table 1         TeporQuantity         cri-RI-PMI-CQI           timeRestrictionForIChannelMeasur ements         Not configured         Not configured		Number of CSI-		4
ZP CSI-RS configuration         Density (p)         1           First subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS (lo, h)         (9,-)           CSI-RS interval and offset         slot         10/1           CSI-RS interval and offset         slot         10/1           NZP CSI-RS for CSI acquisition         CSI-RS interval and offset         slot         10/1           NZP CSI-RS for CSI acquisition         CSI-RS (bo, k1)         8         RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)         Density (p)         1         1           First subcarrier index in the PRB used for CSI-RS (bo, k1)         Row 8, (4,6)         6         6           Symbol in the PRB used for CSI-RS (lo, h)         goffset         0				ED-CDM2
ZP CSI-RS configuration       First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )       Row 5, (4,-)         First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , h)       (9,-)         CSI-RS interval and offset       slot         NZP CSI-RS for CSI acquisition       CSI-RS (DM Type       Aperiodic         NZP CSI-RS for CSI acquisition       CSI-RS index in the PRB used for CSI- RS ports (X)       8         NZP CSI-RS for CSI acquisition       CSI-RS index in the PRB used for CSI-RS (l <sub>0</sub> , h)       Row 8, (4,6)         CSI-RS for CSI acquisition       First OFDM First OFDM Symbol in the PRB used for CSI-RS (l <sub>0</sub> , h)       Row 8, (4,6)         CSI-RS interval and offset interval and offset interval and offset       slot       Not configured         CSI-RS (l <sub>0</sub> , h1)       CSI-RS (l <sub>0</sub> , h1)       0       CSI-IM CSI-RS         CSI-IM configuration       CSI-IM resource Type       Aperiodic         CSI-IM Resource Mapping (k <sub>CSI-IM</sub> [c <sub>SI+M</sub> ]       Patten 0       CSI-IM Resource Type         CQI-table       CSI-IM Resource Mapping       Aperiodic         CQI-table       Table 1       TeportQuantity         reportConfigType       Aperiodic       Table 1         CQI-table       Table 1       TeportQuantity <td></td> <td></td> <td></td> <td></td>				
First OFDM symbol in the PRB used for CSI-RS (lo, l1)         (9,-)           CSI-RS interval and offset         slot         10/1           CSI-RS interval and offset         slot         10/1           CSI-RS interval and offset         slot         10/1           Number of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 8, (4,6)           First OFDM symbol in the PRB used for CSI-RS (lo, l1)         (5,-)           CSI-RS interval and offset         slot           Not configured aperiodic Triggerin gOffset         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM configuration         CSI-IM RE pattern         Patten 0           CSI-IM Resource Mapping         (4,9)         (4,9)           (Ko_I-IM)         Slot         Not configured           ReportConfigType         Aperiodic         Table 1           reportQuantity         cri-RI-PMI-CQI         Table 1           reportQuantity         cri-RI-PMI-CQI         Not configured		First subcarrier index in the PRB used for CSI-RS		Row 5, (4,-)
interval and offset         Slot         10/1           CSI-RS resource Type         Aperiodic           Number of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 8, (4,6)           First OFDM symbol in the PRB used for CSI-RS (lo, h)         (5,-)           CSI-RS interval and offset         slot           Not configured         aperiodicTriggerin gOffset         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM configuration         CSI-IM RE pattern         Patten 0           CSI-IM Resource Mapping (kcsI-M, lcSI-M)         glot         Not configured           ReportConfigType         Aperiodic         Aperiodic           CQI-table         Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI         Not configured		First OFDM symbol in the PRB used for CSI-RS		(9,-)
CSI-RS resource Type         Aperiodic           Number of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 8, (4,6)           Symbol in the PRB used for CSI-RS (lo, l1)         (5,-)           CSI-RS interval and offset         slot           Not configured         aperiodic Type           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM RE pattern         Patten 0           CSI-IM Resource Mapping (KcsHM, IcsHM)         Q           CSI-IM Resource Mapping         (4,9)           CSI-IM timeConfig interval and offset         slot           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForInterferenceMeas         Not configured			slot	10/1
NZP CSI-RS for CSI acquisitionRS ports (X)BNZP CSI-RS for CSI acquisitionindex in the PRB used for CSI-RS (ko, k1)Row 8, (4,6)First SUbcarrier index in the PRB used for CSI-RS (ko, k1)Row 8, (4,6)First OFDM symbol in the PRB used for CSI-RS (lo, l1)(5,-)CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM configurationCSI-IM Resource Mapping (kcsi-interval and offset(4,9)CSI-IM resource TypeAperiodicCSI-IM Resource Mapping(4,9)CSI-IM Resource Mapping (tcsi-interval and offsetNot configuredReportConfigType CQI-tableAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForIChannelMeasur ementsNot configured		CSI-RS resource		Aperiodic
NZP CSI-RS for CSI acquisitionCDM TypeCDM4 (FD2, TD2)NZP CSI-RS for CSI acquisitionFirst subcarrier index in the PRB used for CSI-RS (ko, k1)Row 8, (4,6)First OFDM symbol in the PRB used for CSI-RS (lo, l1)(5,-7)CSI-RS interval and offsetSlotNot configuredOCSI-IM CSI-IM resource Type0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsI-M, lcsI-IM)(4,9)CQI-tableCSI-IM timeConfig interval and offsetReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForIChannelMeasur ementsNot configuredurementsNot configured		Number of CSI-		8
NZP CSI-RS for CSI acquisitionFirst subcarrier index in the PRB used for CSI-RS (ko, k1)Row 8, (4,6)First OFDM symbol in the PRB used for CSI-RS (lo, l1)(5,-)CSI-RS interval and offsetslotNot configuredaperiodicTriggerin gOffset0CSI-IM configurationCSI-IM resource TypeCSI-IM RE patternPatten 0CSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsI-IM, IcsI-IM)(4,9)CQI-tableTable 1reportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForIChannelMeasur urementsNot configuredtimeRestrictionForInterferenceMeas urementsNot configured				CDM4 (FD2, TD2)
NZP CSI-RS for CSI acquisition index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> ) First OFDM symbol in the PRB used for CSI-RS (lo, l <sub>1</sub> ) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM RE pattern CSI-IM Resource Mapping (kcsI-IM, lcsI-IM) CSI-IM timeConfig interval and offset Slot Not configured (4,9) (4,9) (4,9) (4,9) (4,9) CQI-table ReportConfigType CQI-table ReportQuantity timeRestrictionForIChannelMeasur ements timeRestrictionForInterferenceMeas urements Not configured Not configured		Density (ρ)		1
First OFDM       symbol in the PRB       (5,-)         symbol in the PRB       (5,-)         used for CSI-RS       slot       Not configured         interval and offset       slot       Not configured         aperiodicTriggerin       0       0         CSI-IM       CSI-IM resource       Aperiodic         configuration       Type       Aperiodic         CSI-IM RE pattern       Patten 0         CSI-IM Resource       (4,9)         (kcsi-im, lcsi-im)       CSI-IM timeConfig         CSI-IM timeConfig       slot         Not configured       Table 1         reportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForIChannelMeasur       Not configured         urements       Not configured	for CSI	index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 8, (4,6)
Interval and offset     Slot     Not configured       aperiodicTriggerin gOffset     0       CSI-IM configuration     CSI-IM resource Type     Aperiodic       CSI-IM RE pattern     Patten 0       CSI-IM Resource Mapping (kcsi-iM,lcsi-iM)     (4,9)       CSI-IM timeConfig interval and offset     slot       ReportConfigType     Aperiodic       CQI-table     Table 1       reportQuantity     cri-RI-PMI-CQI       timeRestrictionForIChannelMeasur ements     Not configured	acquisition	symbol in the PRB used for CSI-RS		(5,-)
aperiodicTriggerin gOffset0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsi-iM,lcsi-iM)(4,9)CSI-IM timeConfig interval and offsetslotReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForIChannelMeasur ementsNot configuredtimeRestrictionForInterferenceMeas urementsNot configured			slot	Not configured
CSI-IM configuration       CSI-IM resource Type       Aperiodic         CSI-IM RE pattern       Patten 0         CSI-IM Resource Mapping (kcsi-iM,lcsi-iM)       (4,9)         CSI-IM timeConfig interval and offset       slot       Not configured         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForIChannelMeasur ements       Not configured         timeRestrictionForInterferenceMeas urements       Not configured		aperiodicTriggerin		0
CSI-IM RE pattern       Patten 0         CSI-IM Resource       (4,9)         Mapping       (4,9)         (kcsi-iM,Icsi-iM)       Not configured         CSI-IM timeConfig       slot         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForIChannelMeasur       Not configured         ements       Not configured		CSI-IM resource		Aperiodic
CSI-IM Resource Mapping (kcsi-iM,Icsi-iM)       (4,9)         CSI-IM timeConfig interval and offset       slot       Not configured         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForIChannelMeasur ements       Not configured         timeRestrictionForInterferenceMeas urements       Not configured	5			Patten 0
CSI-IM timeConfig interval and offset       slot       Not configured         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForIChannelMeasur ements       Not configured         timeRestrictionForInterferenceMeas urements       Not configured		CSI-IM Resource Mapping		(4,9)
ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForIChannelMeasur         Not configured           timeRestrictionForInterferenceMeas         Not configured		CSI-IM timeConfig	slot	Not configured
CQI-table     Table 1       reportQuantity     cri-RI-PMI-CQI       timeRestrictionForIChannelMeasur ements     Not configured       timeRestrictionForInterferenceMeas urements     Not configured	ReportConfigTy			Aperiodic
timeRestrictionForIChannelMeasur ements Not configured timeRestrictionForInterferenceMeas Not configured				Table 1
ements     Not configured       timeRestrictionForInterferenceMeas     Not configured       urements     Not configured	reportQuantity			
urements Not configured	timeRestriction	ForIChannelMeasur		Not configured
cqi-FormatIndicator Wideband	timeRestriction	ForInterferenceMeas		-
	cqi-FormatIndic	ator		Wideband

# Table 6.3.2.2.3-1: Test parameters (dual-layer)

pmi-Formatl	ndicator		Wideband
Sub-band Si		RB	16
csi-Reportin			1111111
	nterval and offset	slot	Not configured
	eport Slot Offset	0101	8
			1 in slots i, where mod(i, 10) =
CSI request			1, otherwise it is equal to 0
reportTrigge	rSize		1
			One State with one Associated
			Report Configuration
CSI-Aperiod	icTriggerStateList		Associated Report
			Configuration contains pointers
O a dala a a la	O a daharah Tura	-	to NZP CSI-RS and CSI-IM
Codebook	Codebook Type		typel-SinglePanel
configuration			1
	(CodebookConfig- N1,CodebookConf		(4,1)
	ig-N2)		(4,1)
	(CodebookConfig-		
	O1,CodebookCon		(4,1)
	fig-O2)		(-, -)
	CodebookSubset		
	Restriction		0x FFFF
	RI Restriction		00000010
Physical cha	innel for CSI report		PUSCH
CQI/RI/PMI		ms	6.5
Maximum nu	umber of HARQ		4
transmission			•
Measureme	nt channel		R.PDSCH.2-8.2 TDD
			Single Panel Type I, Random
PDSCH & P	DSCH DMRS		precoder selection updated per
	onfiguration for random		slot, with equal probability of
Precoding			each applicable i1, i2
3			combination, and with
		ation than	Wideband granularity
		cuon, the p	recoder shall be updated in each
	ot (0.5 ms granularity).	ilahla unlin	k reporting instance at slot#n
	based on PMI estimation at a downlink slot not later than slot#[(n-6)], this reported PMI cannot be applied at the eNB downlink before		
slot#[(n+6)].			
Note 3: Randomization of the principle beam direction shall be used as			
	becified inAnnex B.2.3.2.		

Table 6.3.2.2.2.3-2:	Minimum	requirement
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Parameter	Test 1
γ	1.5

#### 6.3.2.2.2.4 Test description

#### 6.3.2.2.2.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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 6.1.2-1 and Table 6.3.2.2.3-1 as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, connected without release *On* for SA 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 content are defined in clause 6.3.2.2.2.4.3.

#### 6.3.2.2.2.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1,follow2</sub> according to Annex G.3.2.

Set SNR to SNR<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure t<sub>md1, rnd2</sub> according to Annex G.3.3.

4. Calculate 
$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{md1, md2}}$$
. If the ratio  $\geq \gamma$  which is specified in table 6.3.2.2.2.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.2.2.4.3 Message contents

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

#### 6.3.2.2.2.4.3\_1 Message exceptions for SA

#### Table 6.3.2.2.2.4.3\_1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element	Value/remark	Comment	Condition
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	aperiodic		
}			

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-15				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	001100			
}				
nrofPorts	p8			
firstOFDMSymbolInTimeDomain	5			
cdm-Type	cdm4-FD2-TD2			
}				

### Table 6.3.2.2.2.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

# Table 6.3.2.2.2.4.3\_1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

### Table 6.3.2.2.2.4.3\_1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34			
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			

### Table 6.3.2.2.2.4.3\_1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
moreThanTwo SEQUENCE {				
n1-n2 CHOICE {				
four-one-TypeI-SinglePaneI-Restriction	FFFF			
}				
}				
}				
typeI-SinglePaneI-ri-Restriction	0000010			

#### Table 6.3.2.2.2.4.3\_1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39				
Information Element	Value/remark	Comment	Condition	
reportConfigType CHOICE {				
aperiodic SEQUENCE {				
reportSlotOffsetList	8			
}				
reportFreqConfiguration SEQUENCE {				
csi-ReportingBand CHOICE {				
subbands7	1111111			
}				
}				
}				

#### 6.3.2.2.2.4.3\_2 Message exceptions for NSA

Same as in clause 6.3.2.2.4.3\_1.

#### 6.3.2.2.2.5 Test requirement

#### Table 6.3.2.2.2.5-1: Test requirement (TDD)

Parameter	Test 1
γ	1.49

# 6.3.2.2.3 2Rx TDD FR1 Multiple PMI with 16Tx Type1 - SinglePanel codebook for both SA and NSA

#### 6.3.2.2.3.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.2.3.2 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.

#### 6.3.2.2.3.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.3.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.3.3-2.

Pa	rameter	Unit	Test 1
Bandwidth	amelei	MHz	40
Subcarrier spacing		kHz	30
Duplex Mode		NI IZ	TDD
•			FR1.30-1 as specified in Annex
TDD DL-UL cor	nfigurations		A
Propagation cha	annel		TDLC300-5
Antenna configu	iration		High XP 16 x 2
Beamforming M			(N1,N2) = (4,2) As specified in Annex B.4.1
Beamonning W	CSI-RS resource		•
	Туре		Aperiodic
	Number of CSI-		4
	RS ports (X)		<b>FD 00140</b>
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (lo, lı)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports ( <i>X</i> )		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS for CSI	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )		Row 12, (2, 4, 6, 8)
acquisition	First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )		(5, -)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin gOffset		0
<u> </u>	CSI-IM resource		Anoriodic
	Туре		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping (keeping		(4,9)
	(kcsI-IM,lcsI-IM) CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigTv	ReportConfigType		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionForIChannelMeasur			Not configured
ements timeRestrictionForInterferenceMeas			-
urements			Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndicator			Subband
Sub-band Size		RB	16
csi-ReportingBand			1111111

# Table 6.3.2.2.3.3-1: Test parameters (dual-layer)

CSI-Report in	terval and offset	slot	Not configured
	Aperiodic Report Slot Offset		8
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
reportTrigger	Size		1
CSI-Aperiodic	TriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig- N1,CodebookConf ig-N2)		(4,2)
configuration	(CodebookConfig- O1,CodebookCon fig-O2)		(4,4)
	CodebookSubset Restriction		0x FFFF
	RI Restriction		00000010
Physical char	nel for CSI report		PUSCH
CQI/RI/PMI d	elay	ms	6.5
Maximum nui	nber of HARQ		4
transmission			4
Measuremen	t channel		R.PDSCH.2-8.3 TDD
pre pro	Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equa probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination.		
ba thi slo	Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before slot#(n+6).		
Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.			direction shall be used as

#### Table 6.3.2.2.3.3-2: Minimum requirement

Parameter	Test 1
γ	2.5

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.2.2.3.

#### 6.3.2.2.3.4 Test description

#### 6.3.2.2.3.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.2.2.3.3-1 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, connected without release *On* for SA 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 content are defined in clause 6.3.2.2.3.4.3.

#### 6.3.2.2.3.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.3.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

3. Set SNR to *SNR*<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1.6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with

aperiodic CSI request triggered. Measure  $t_{md1,md2}$  according to Annex G.3.3.

4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.2.3.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.2.3.4.3 Message contents

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

6.3.2.2.3.4.3\_1 Message exceptions for SA

#### Table 6.3.2.2.3.4.3\_1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element	Value/remark	Comment	Condition
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	aperiodic		
}			

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	011110		
}			
nrofPorts	p16		
firstOFDMSymbolInTimeDomain	5		
cdm-Type	cdm4-FD2-TD2		
}			

### Table 6.3.2.2.3.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

# Table 6.3.2.2.3.4.3\_1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

#### Table 6.3.2.2.3.4.3\_1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34			
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			

#### Table 6.3.2.2.3.4.3\_1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25			
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
moreThanTwo SEQUENCE {			
n1-n2 CHOICE {			
four-one-TypeI-SinglePaneI-Restriction	FFFF		
}			
}			
}			
typeI-SinglePaneI-ri-Restriction	0000010		

#### Table 6.3.2.2.3.4.3\_1-6: CSI-ReportConfig

Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	8		
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands7	1111111		
}			
}			
}			

#### 6.3.2.2.3.4.3\_2 Message exceptions for NSA

Same as in clause 6.3.2.2.3.4.3\_1.

#### 6.3.2.2.3.5 Test requirement

#### Table 6.3.2.2.3.5-1: Test requirement (TDD)

Parameter	Test 1
γ	2.49

# 6.3.2.2.4 2Rx TDD FR1 Single PMI with 32Tx Type1 - SinglePanel codebook for both SA and NSA

#### 6.3.2.2.4.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.2.4.2 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.

#### 6.3.2.2.4.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.4.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.4.3-2.

Pa	rameter	Unit	Test 1
Bandwidth		MHz	40
Subcarrier spacing		kHz	30
Duplex Mode			TDD
TDD DL-UL cor	figurations		FR1.30-1 as specified in Annex A
Propagation cha	annel		TDLA30-5
Antenna configu	uration		High XP 32 x 2 (N1,N2) = (4,4)
Beamforming M	lodel		As specified in Annex B.4.1
Ŭ	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports ( <i>X</i> )		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (Io, Iı)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports ( <i>X</i> )		32
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS for CSI	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )		Row 17, (2, 4, 6, 8)
acquisition	First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )		(5, 12)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin gOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)
	CSI-IM,ICSI-IM) CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigTv	ReportConfigType		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionForIChannelMeasur ements			Not configured
timeRestrictionForInterferenceMeas urements			Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndia	pmi-FormatIndicator		Wideband
Sub-band Size		RB	16
csi-ReportingBand			1111111

# Table 6.3.2.2.4.3-1: Test parameters (dual-layer)

CSI-Report inte	erval and offset	slot	Not configured
Aperiodic Repo			8
CSI request			1 in slots i, where $mod(i, 10) =$
•			1, otherwise it is equal to 0
reportTriggerSi	ze		One State with one Associated
CSI AporiodioT	riggorStatel ist		Report Configuration Associated Report
CSI-AperiodicT	nggerstateList		Configuration contains pointers
			to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Node		
	(CodebookConfig-		I
	N1,CodebookConf		(4,4)
	ig-N2)		(4,4)
Codebook	(CodebookConfig-		
configuration	O1,CodebookCon		(4,4)
	fig-O2)		(+,+)
	CodebookSubset		
	Restriction		0x FFFF
	RI Restriction		0000010
Physical chann	el for CSI report		PUSCH
CQI/RI/PMI del		ms	6.5
Maximum num			4
transmission			4
Measurement of	channel		R.PDSCH.2-8.3 TDD
			Single Panel Type I, Random
PDSCH & PDS			precoder selection updated per
	iguration for random		slot, with equal probability of
Precoding	iguration for failuon		each applicable i1, i2
riecoung			combination, and with
			Wideband granularity
			random precoder selection, the
			ot (0.5 ms granularity) with equal
	ability of each applical		
			k reporting instance at slot#n
based on PMI estimation at a downlink slot not la			
this reported PMI cannot be applied at the gNB downlink before			at the gNB downlink before
	¢(n+6).		dimension also de la construcción d
			direction shall be used as
specified in Annex B.2.3.2.3.			

Table 6.3.2.2.4.3-2: Minimum requirement

Parameter	Test 1
γ	5.0

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.2.2.4.

6.3.2.2.4.4 Test description

6.3.2.2.4.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10TBD 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 6.1.2-1 and Table 6.3.2.2.4.3-1 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, connected without release *On* for SA 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 content are defined in clause 6.3.2.2.4.4.3.

#### 6.3.2.2.4.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.4.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

- Set SNR to SNR<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure t<sub>md1, md2</sub> according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{l_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.2.4.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.2.4.4.3 Message contents

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

#### 6.3.2.2.4.4.3\_1 Message exceptions for SA

#### Table 6.3.2.2.4.4.3\_1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41				
Information Element Value/remark Comment Condi				
CSI-ResourceConfig ::= SEQUENCE {				
resourceType	aperiodic			
}				

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Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-15				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	011110			
}				
nrofPorts	p32			
firstOFDMSymbolInTimeDomain	5			
cdm-Type	cdm4-FD2-TD2			
}				

### Table 6.3.2.2.4.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

# Table 6.3.2.2.4.4.3\_1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-21				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	000100			
}				
nrofPorts	p4			
firstOFDMSymbolInTimeDomain	9			
}				

### Table 6.3.2.2.4.4.3\_1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34				
Information Element	Value/remark	Comment	Condition	
csi-IM-ResourceElementPattern				
pattern0 SEQUENCE {				
subcarrierLocation-p0	s4			
symbolLocation-p0	9			
}				

#### Table 6.3.2.2.4.4.3\_1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
moreThanTwo SEQUENCE {				
n1-n2 CHOICE {				
four-one-Typel-SinglePanel-Restriction	FFFF			
}				
}				
}				
typeI-SinglePaneI-ri-Restriction	0000010			

#### Table 6.3.2.2.4.4.3\_1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39				
Information Element	Value/remark	Comment	Condition	
reportConfigType CHOICE {				
aperiodic SEQUENCE {				
reportSlotOffsetList	8			
}				
reportFreqConfiguration SEQUENCE {				
csi-ReportingBand CHOICE {				
subbands7	1111111			
}				
}				
}				

#### 6.3.2.2.4.4.3\_2 Message exceptions for NSA

Same as in clause 6.3.2.2.4.4.3\_1.

#### 6.3.2.2.4.5 Test requirement

#### Table 6.3.2.2.4.5-1: Test requirement (TDD)

Parameter	Test 1
γ	4.99

#### 6.3.2.2.5 2Rx TDD FR1 Multiple PMI with 16Tx TypeII codebook for both SA and NSA

#### 6.3.2.2.5.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.2.5.2 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.

#### 6.3.2.2.5.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.5.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.5.3-2.

Parameter		Unit	Test 1
Bandwidth		MHz	40
Subcarrier sp	pacing	kHz	30
Duplex Mode	1		TDD
TDD DL-UL configurations			FR1.30-1 as specified in Annex A
Propagation channel			TDLA30-5
Antenna configuration			XP Medium 16 x 2 (N1,N2) = (4,2)
Beamforming	Model		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
ZP CSI-RS configuratio	Number of CSI-RS ports ( <i>X</i> )		4
n	CDM Type		FD-CDM2

#### Table 6.3.2.2.5.3-1: Test parameters (dual-layer)

	Density (ρ)		1
	First subcarrier index		
	in the PRB used for		Row 5, (4,-)
	CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		
	First OFDM symbol in		
	the PRB used for CSI-		(9,-)
	RS (I <sub>0</sub> , I <sub>1</sub> )		
	CSI-RS	slot	Not configured
	interval and offset	0.00	-
	ZP CSI-RS trigger		1 in slots i, where $mod(i, 10) =$
			1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS		16
	ports (X)		-
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-	First subcarrier index		
RS for CSI-	in the PRB used for		Row 12, (2, 4, 6, 8)
acquisition	CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )		
acquisition	First OFDM symbol in the PRB used for CSI-		(E)
			(5, -)
	RS (l₀, l₁) CSI-RS		
	interval and offset	slot	Not configured
	aperiodicTriggeringOff		-
	set		0
	CSI-IM resource Type		Aperiodic
			Pattern 0
CSI-IM	CSI-IM RE pattern		Fallelli U
configuratio	CSI-IM Resource		(4.0)
n	Mapping (kasum lasum)		(4,9)
11	(kcsi-im,lcsi-im)		
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfig			Aperiodic
CQI-table	пура		Table 1
	N/		cri-RI-PMI-CQI
reportQuantity timeRestrictionForIChannelMeasurem			
ents			Not configured
	onForInterferenceMeasur		-
ements	on onnenerenceweasul		Not configured
cqi-FormatIng	dicator		Wideband
pmi-Formatin			Subband
Sub-band Siz		RB	16
csi-Reporting		ΝD	10
	nterval and offset	slot	Not configured
	port Slot Offset	5101	8
Apenouic Re			1 in slots i, where mod(i, 10) =
CSI request			1, otherwise it is equal to $0$
	Sizo		
reportTrigger			One State with one Associated
			Report Configuration
CSI-Aporiodi	cTriggerStateList		Associated Report
	o nyyel SlaleLISI		Configuration contains pointers
			to NZP CSI-RS and CSI-IM
	Codebook Type		typell
	L (numberOfBeams)		2
	NPSK		<i>L</i>
	(phaseAlphabetSize)		8
	subbandAmplitude		True
Codebook	(CodebookConfig-		IIUG
configuratio	N1,CodebookConfig-		(4.2)
n	N1,CodebookConing-		(4,2)
	(CodebookConfig-		
	O1,CodebookConfig-		(4,4)
	O1,CodebookConing-		(-,-)
	CodebookSubsetRestri		0x 7FF
	ction		FFFF FFFF FFFF FFFF

	RI Restriction (typell- RI-Restriction)		10
Physical channel for CSI report			PUSCH
CQI/RI/P	MI delay	ms	6.5
	n number of HARQ		4
transmiss			
Measure	ment channel		R.PDSCH.2-8.3 TDD
Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equiprobability of each applicable i1, i2 combination. The random precoder generation shall follow 'typel-SinglePanel' codebook configuration a specified in table 6.3.2.2.3-1.		0.5 ms granularity) with equal bination. The random precoder el' codebook configuration as	
Note 2: If the UE reports in an available uplink reporting instance at slot#n bas on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before slot#(n+6)		t later than slot#(n-6), this NB downlink before slot#(n+6).	
Note 3: Randomization of the dual-cluster beam directions shall be used as specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.			

Parameter	Test 1
γ	1.9

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.2.5.

6.3.2.2.5.4 Test description

#### 6.3.2.2.5.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.2.2.5.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.2.1.4.4.3.

#### 6.3.2.2.5.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.5.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1,follow2</sub> according to Annex G.3.2.

- 3. Set SNR to  $SNR_{follow1, follow2}$ . The SS shall transmit PDSCH with randomly selected precoding matrix from
- codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities, and the random precoder generation shall follow the codebook configuration as specified in Table 6.3.2.2.3.3-1. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure  $t_{rnd1, rnd2}$  according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.2.5.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.2.5.4.3 Message contents

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

#### 6.3.2.2.5.4.3.1 Message exceptions for SA

#### Table 6.3.2.2.5.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table	e 5.4.2.5-2		
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	'011110'B		
}			
nrofPorts	P16		
firstOFDMSymbolInTimeDomain	5		
cdm-Type	cdm4-FD2-TD2		
}			

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table	5.4.2.5-14		
Information Element	Value/remark	Comment	Condition
CodebookConfig ::= SEQUENCE {			
codebookType CHOICE {			
type2 SEQUENCE {			
subType CHOICE {			
typeII SEQUENCE {			
n1-n2-codebookSubsetRestriction CHOICE {			
four-two	0x 7FF FFFF		
	FFFF FFFF FFFF		
}			
typeII-RI-Restriction	'10'B		
}			
}			
phaseAlphabetSize	8		
subbandAmplitude	TRUE		
numberOfBeams	2		
}			
}			
}			

#### Table 6.3.2.2.5.4.3.1-2: CodebookConfig

#### Table 6.3.2.2.5.4.3.1-3: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13				
Information Element	Value/remark	Comment	Condition	
reportConfigType CHOICE {				
aperiodic SEQUENCE {				
reportSlotOffsetList	5			
}				
reportFreqConfiguration SEQUENCE {				
pmi-FormatIndicator	subbandPMI			
}				
}				

#### 6.3.2.2.5.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.2.5.4.3.1.

#### 6.3.2.2.5.5 Test requirement

#### Table 6.3.2.2.5.5-1: Test requirement

Parameter	Test 1
γ	1.89

# 6.3.2.2.6 2Rx TDD FR1 Multiple PMI with 16Tx Enhanced TypeII codebook for both SA and NSA

#### 6.3.2.2.6.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.2.2.6.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

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This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

#### 6.3.2.2.6.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.6.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.6.3-2.

	Parameter	Unit	Test 1
Bandwidth		MHz	40
Subcarrier spacing		kHz	30
Duplex Mode		1112	TDD
			FR1.30-1 as specified in Annex
IDD DL-UL o	configurations		A
Propagation	channel		TDLA30-5
Antenna conf	iguration		XP Medium 16 x 2 (N1,N2) = (4,2)
Beamforming	Model		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS		4
	ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier index		
ZP CSI-RS	in the PRB used for		Row 5, (4,-)
configuratio	CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		
n	First OFDM symbol in		
	the PRB used for CSI-		(9,-)
	RS (I <sub>0</sub> , I <sub>1</sub> )		
	CSI-RS	slot	Not configured
	interval and offset	0101	-
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) =
			1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS		16
	ports (X)		
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier index		
NZP CSI-	in the PRB used for		Row 12, (2, 4, 6, 8)
RS for CSI	CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )		
acquisition	First OFDM symbol in		(5.)
	the PRB used for CSI-		(5, -)
	RS (l <sub>0</sub> , l <sub>1</sub> )		
	CSI-RS	slot	Not configured
	interval and offset aperiodicTriggeringOff		
	set		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		Falleniu
configuratio	Mapping		(4.0)
n			(4,9)
	(kcsi-ім,lcsi-ім) CSI-IM timeConfig		
	•	slot	Not configured
L	interval and offset		-

## Table 6.3.2.2.6.3-1: Test parameters (dual-layer)

Denertor	T		
ReportConfig	Туре		Aperiodic
CQI-table			Table 1
reportQuantit			cri-RI-PMI-CQI
ents	timeRestrictionForIChannelMeasurem ents		Not configured
timeRestrictionForInterferenceMeasur ements Not configured		Not configured	
cqi-FormatIng	dicator		Wideband
pmi-FormatIn			Not configured
Sub-band Siz		RB	8
csi-Reporting		ND ND	111111
	iterval and offset	slot	Not configured
	port Slot Offset	5101	8
CSI request			1 in slots i, where mod(i, 10) =
-			1, otherwise it is equal to 0
reportTrigger	Size		1
CSI-Aperiodio	cTriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers
	Codobook Type		to NZP CSI-RS and CSI-IM
	Codebook Type		typell-r16 6
	paramCombination-r16		(L =4, <i>p</i> <sub>v</sub> =1/2, β=1/2 )
	R(numberOfPMISubba ndsPerCQISubband- r16)		1
Codebook configuratio	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)
n (CodebookConfig- O1,CodebookConfig- O2)			(4,4)
	CodebookSubsetRestri		0x 7FF
	ction		FFFF FFFF FFFF FFFF
	RI Restriction (typell- RI-Restriction-r16)		0010
Physical char	nnel for CSI report		PUSCH
CQI/RI/PMI d		ms	6.5
	mber of HARQ		
transmission			4
Measurement channel			R.PDSCH.2-8.3 TDD
Note 1: W	hen Throughput is measure	ed using ra	andom precoder selection, the
			0.5 ms granularity) with equal
probability of each applicable i1, i2 combination. The random precoder			
generation shall follow 'typeI-SinglePanel' codebook configuration as			
specified in table 6.3.2.2.3-1.			
Note 2: If the UE reports in an available uplink reporting instance at slot#n based			eporting instance at slot#n based
on PMI estimation at a downlink slot not later than slot#(n-6), this			
reported PMI cannot be applied at the gNB downlink before slot#(n+6).			
Note 3: Randomization of the dual-cluster beam directions shall be used as specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall			
be	fixed as 1 during the test.		

Parameter	Test 1
γ	2.2

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.2.2.6.

#### 6.3.2.2.6.4 Test description

#### 6.3.2.2.6.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.2.2.6.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.2.2.6.4.3.

#### 6.3.2.2.6.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.6.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI

request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

3. Set SNR to *SNR*<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with apariodia CSI request triggered. Measure *t* = according to Appen C 3.2

aperiodic CSI request triggered. Measure  $t_{md1, md2}$  according to Annex G.3.3.

4. Calculate  $\gamma = \frac{l_{ue, follow1, follow2}}{t_{md1, md2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.2.6.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.2.2.6.4.3 Message contents

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

#### 6.3.2.2.6.4.3.1

Message exceptions for SA

### Table 6.3.2.2.6.4.3.1-1: CSI-ReportConfig

Information Element	Value/remark	Comment	Condition
CSI-ReportConfig ::= SEQUENCE {			
reportFreqConfiguration SEQUENCE {			
pmi-FormatIndicator	Not present		
}			
codebookConfig	Not present		
subbandSize	Value1		
codebookConfig-r16	CodebookConfig-r16		

### Table 6.3.2.2.6.4.3.1-2: CodebookConfig-r16 (Table 6.3.2.2.6.4.3.1-1)

Derivation Path: TS 38.331 [6], clause 6.3.2			
Information Element	Value/remark	Comment	Condition
CodebookConfig-r16 ::= SEQUENCE {			
codebookType CHOICE {			
type2 SEQUENCE {			
subType CHOICE {			
typeII-r16 SEQUENCE {			
N1-n2-codebookSubsetRestriction-r16			
Four-two	0x 7FF FFFF FFFF FFFF FFFF		
}			
typeII-RI-Restriction-r16	0010		
}			
}			
numberOfPMI-SubbandsPerCQI-Subband-r16	1		
paramCombinatin-r16	6	(L =4, p <sub>v</sub> =1/2, β=1/2 )	
}			
}			
}			

### 6.3.2.2.6.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.2.6.4.3.1.

6.3.2.2.6.5 Test requirement

### Table 6.3.2.2.6.5-1: Test requirement

Parameter	Test 1
γ	2.19

# 6.3.3 4RX requirements

- 6.3.3.1 FDD
- 6.3.3.1.1 4Rx FDD FR1 Single PMI with 4TX TypeI-SinglePanel codebook for both SA and NSA
- 6.3.3.1.1.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.1.1.2 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.

#### 6.3.3.1.1.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.1-2.

Pa	rameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier space	ing	kHz	15
Duplex Mode			FDD
Propagation cha	annel		TDLA30-5
Antenna configu	uration		High XP 4 x 4
			(N1,N2) = (2,1)
Beamforming N			As specified in Annex B.4.1
	CSI-RS resource		Periodic
	Type Number of CSI-		
			4
	RS ports (X) CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier		I
ZP CSI-RS	index in the PRB		
configuration	used for CSI-RS		Row 5, (4,-)
<b>J</b>	$(k_0, k_1)$		
	First OFDM		
	symbol in the PRB		(0.)
	used for CSI-RS		(9,-)
	(l <sub>0</sub> , l <sub>1</sub> )		
	CSI-RS	slot	5/1
	interval and offset	3101	5/1
	CSI-RS resource		Aperiodic
	Туре		
	Number of CSI-		4
	RS ports (X)		
	CDM Type		FD-CDM2
	Density (ρ) First subcarrier		1
	index in the PRB		
NZP CSI-RS	used for CSI-RS		Row 4, (0,-)
for CSI	$(k_0, k_1)$		
acquisition	First OFDM		
	symbol in the PRB		
1	used for CSI-RS		(13,-)
	$(I_0, I_1)$		
	CSI-RS	alat	Not configured
	interval and offset	slot	Not conligured
	aperiodicTriggerin		0
	gOffset		0
	CSI-IM resource		Aperiodic
	Туре		
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		(4.0)
configuration	Mapping (keep we leep we)		(4,9)
	(kcsi-ім,lcsi-ім) CSI-IM timeConfig		
	interval and offset	slot	Not configured
ReportConfigTy			Aperiodic
CQI-table	~~		Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionForChannelMeasure			
ments			Not configured
	orInterferenceMeas		Not configured
urements			Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndi	cator		Wideband
Sub-band Size		RB	8
csi-ReportingBa			1111111
CSI-Report inte		slot	Not configured
Aperiodic Repo	rt Slot Offset		4
CSI request			1 in slots i, where $mod(i, 5) = 1$ ,
			otherwise it is equal to 0

# Table 6.3.3.1.1.3-1: Test parameters (single layer)

reportTrig	gerSize		1
	odicTriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typeI-SinglePanel
	Codebook Mode		1
Cadabaal	(CodebookConfig- N1,CodebookConf ig-N2)		(2,1)
Codebook configurat	// 'odobook/ 'ontig		(4,1)
	CodebookSubset Restriction		1111111
	RI Restriction		0000001
Physical c	hannel for CSI report		PUSCH
CQI/RI/PN		ms	6
	Maximum number of HARQ transmission		4
Measurem	nent channel		R.PDSCH.1-6.1 FDD
Precoding	PDSCH & PDSCH DMRS Precoding configuration for random Precoding		Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity
Note 1:			
Note 2:	<ul> <li>slot (1 ms granularity).</li> <li>2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-3), this reported PMI cannot be applied at the eNB downlink before slot#(n+3).</li> </ul>		nk slot not later than slot#(n-3),
Note 3:			

Table 6.3.3.1.1.3-2: Minimum requirement

Parameter	Test 1
γ	1.3

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.1.

#### 6.3.3.1.1.4 Test description

#### 6.3.3.1.1.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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 6.1.2-1 and Table 6.3.3.1.1\_1 and as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, Connected without release *On* for SA 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 content are defined in clause 6.3.3.1.1.4.3.

6.3.3.1.1.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.1.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

 $SNR_{follow1, follow2}$  according to Annex G.3.2.

3. Set SNR to *SNR*<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with

aperiodic CSI request triggered. Measure  $t_{md1, md2}$  according to Annex G.3.3.

4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.2.1.1.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.3.1.1.4.3 Message contents

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

6.3.3.1.1.4.3.1 Message exceptions for SA

#### Table 6.3.3.1.1.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element	Value/remark	Comment	Condition
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	Aperiodic		
}			

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
Row4	001		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	13		
}			

### Table 6.3.3.1.1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

### Table 6.3.3.1.1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
Row5	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

## Table 6.3.3.1.1.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34			
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			
periodicityAndOffset	CSI-		
	ResourcePeriodicityAnd		
	Offset		

### Table 6.3.3.1.1.4.3.1-5: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.2-43			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset CHOICE {			
Slots5	1		
}			

#### Table 6.3.3.1.1.4.3.1-6: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25			
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
moreThanTwo SEQUENCE {			
n1-n2 CHOICE {			
two-one-TypeI-SinglePaneI-Restriction	1111111		
}			
}			
}			
typeI-SinglePaneI-ri-Restriction	0000001		

#### Table 6.3.3.1.1.4.3.1-7: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	0		
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands7	[111111]		
}			
}			
subbandSize	8		
}			

#### 6.3.3.1.1.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.1.4.3.1.

#### 6.3.3.1.1.5 Test requirement

#### Table 6.3.3.1.1.5-1: Test requirement

Parameter	Test 1
γ	1.29

# 6.3.3.1.2 4Rx FDD FR1 Single PMI with 8TX TypeI-SinglePanel codebook for both SA and NSA

#### 6.3.3.1.2.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.3.1.2.2 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.

#### 6.3.3.1.2.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.2.3-2.

Parameter         Unit         Test 1           Bandwidth         MHz         10           Subcarrier spacing         kHz         15           Duplex Mode         FDD         Propagation channel         TDLA30-5           Antenna configuration         High XP 8 x 4         (M1.N2) = (4.1)           Beamforming Model         As specified in Section Annex         B4.1           Subcarrier         Sports (X)         4         4           CDM Type         Periodic         Number of CSI-RS         4           CDM Type         FD-CDM2         Density (p)         1           First Subcarrier         index in the PRB         Row 5, (4,-)         (6, h)           CSI-RS resource         Aperiodic         Type         Symbol in the PRB         (9,-)           Used for CSI-RS         (6, h)         CDM Type         CDM (FD2, TD2)         Density (p)           CSI-RS resource         Type         Aperiodic         Symbol in the PRB         (9,-)         (1           NZP CSI-RS         interval and offset         slot         5/1         1         1           First OFDM         symbol in the PRB         used for CSI-RS         Row 8, (4,6)         (6,-)         (6, h)         1         1 <t< th=""><th>Ba</th><th>romotor</th><th>Unit</th><th>Test 1</th></t<>	Ba	romotor	Unit	Test 1
Subcarrier spacing         kHz         15           Duplex Mode         FDD           Propagation channel         TDLA30-5           Antenna configuration         (N1.N2) = (4,1)           Beamforming Model         As specified in Section Annex B.4.1           Esamforming Model         As specified in Section Annex B.4.1           ZP CSI-RS configuration         CDM Type         Periodic           Type         Periodic         Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2         Density (p)         1           First Subcarrier index in the PRB used for CSI-RS (ko, kt)         Row 5, (4,-)         (ko, kt)           First OFDM symbol in the PRB used for CSI-RS (lo, h)         Slot         5/1           CSI-RS resource Type         Aperiodic         Number of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)         Density (p)         1           First Subcarrier interval and offset or CSI- acquisition         First OFDM symbol in the PRB used for CSI-RS (ko, kt)         Row 8, (4,6)           CSI-IM Tesource (lo, h)         CSI-RS interval and offset         slot         Not configured           aperiodicTriggerin g0Offset         0         CSI-IM Resource         Aperiodic           CSI-IM Resource Mapping         GS-1		เล่าแย่เย่า		<b>Test 1</b>
Duplex Mode         FDD           Propagation channel         TDLA30-5           Antenna configuration         High XP 8 x 4 (N1,N2) = (4,1)           Beamforming Model         As specified in Section Annex B.4.1           ZP CSI-RS configuration         CSI-RS resource Type         Periodic           Type         Periodic           Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (h_0, h)         Row 5, (4,-)           (Ko, k1)         First subcarrier index in the PRB         (9,-)           (Log)         Symbol in the PRB used for CSI-RS (h_0, h)         Solot           CSI-RS resource         Aperiodic           Type         Aperiodic           Number of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (k_0, h)         Row 8, (4,6)           (Ko, ki)         Symbol in the PRB used for CSI-RS         (5,-)           (b, h)         CSI-RS         (5,-)           (b, h)         CSI-RS         (5,-)           (b, h)         CSI-RS         (5,-)           (b, h)         CSI-RS         (5,-)				
Propagation channel         TDLA30-5           Antenna configuration         High XP 8 x 4 (N1,N2) = (4,1)           Beamforming Model         As specified in Section Annex B.4.1           Sector Science Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (ko, k.)         Row 5, (4,-)           CSI-RS resource tor CSI-RS (ko, k.)         First Subcarrier index in the PRB used for CSI-RS (ko, k.)         Row 5, (4,-)           CSI-RS interval and offset         slot         5/1           CSI-RS for CSI acquisition         CSI-RS (ko, k.)         8           NZP CSI-RS for CSI acquisition         Row 6 (CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)         1           First OFDM symbol in the PRB used for CSI-RS (ko, k.)         Row 8, (4,6)           CSI-RS for CSI acquisition         Goffset         0           CSI-RS (bc, h.)         GSI-RS         Row 8, (4,6)           CSI-RS interval and offset interval and offset         slot         Not configured           aperiodic Triggerin aperiodic Triggerin goffset         0         CSI-IM Resource Mapping         (4.9)           (Kcs:=kk.lcs:=kM) CSI-IM Resource Mapping		ing .	KI IZ	
Antenna configuration         High XP 8 x 4 (N1,N2) = (4,1)           Beamforming Model         As specified in Section Annex B.4.1           RS ports (X)         Periodic           Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First Subcarrier index in the PRB used for CSI-RS (b, k)         Row 5, (4,-)           CSI-RS resource configuration         First OFDM symbol in the PRB used for CSI-RS (b, h)         (9,-)           CSI-RS resource tor CSI-RS (b, h)         Aperiodic           VEP CSI-RS (b, h)         Slot         5/1           CSI-RS resource Type         Aperiodic           Number of CSI- RS ports (X)         8         8           CDM Type         CDM4 (FD2, TD2)           Density (p)         1         1           First OFDM symbol in the PRB used for CSI-RS (ko, k1)         Row 8, (4,6)           CSI-RS interval and offset interval and offset         Slot           SI-RS interval and offset interval and offset         Slot           CSI-IM Resource Type         Aperiodic           CSI-IM Resource Type         Aperiodic           CSI-IM Resource Type         Aperiodic           CSI-IM Resource Type         Aperi		annel		
Antermine configuration         (N1,N2) = (4, 1)           Beamforming Model         As specified in Section Annex B.4.1           ZP cSI-RS configuration         CDM Type         Periodic           Type         Periodic         1           First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 5, (4,-)         1           First Subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 5, (4,-)         1           VEXP CSI-RS configuration         First Subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         (9,-)         1           VEXP CSI-RS configuration         CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Solut         5/1           VEXP CSI-RS for CSI acquisition         CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         8         5/1           NZP CSI-RS for CSI acquisition         CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         8         8           VEX CSI-RS for CSI acquisition         CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         6(5,-)         1           First Subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         GSI-M (k <sub>1</sub> , k <sub>1</sub> )         0         0           CSI-RS for CSI acquisition         CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         GSI-RS (k <sub>0</sub> , k <sub>1</sub> )         0         0           CSI-RS for CSI-RS for CSI-RS for CSI-RS for CSI-RS for CSI-RS for CSI-RS for CSI-RS for CSI-RS         Solut         Not configured           CSI-IM mesource (k <sub>0</sub> , k <sub>1</sub> )				
Beamforming Model         As specified in Section Annex B.4.1           First sector CSI- RS ports (X)         Periodic           ZP CSI-RS         CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (do, h1)         Row 5, (4,-)           (Ko, k1)         First OFDM symbol in the PRB used for CSI-RS (do, h1)         (9,-)           CSI-RS (do, h1)         CSI-RS interval and offset         slot         5/1           NUMber of CSI- RS ports (X)         8         CDM Type         Aperiodic           NUmber of CSI- RS ports (X)         8         CDM Type         CDM4 (FD2, TD2)           Density (p)         1         First Subcarrier index in the PRB used for CSI-RS (do, h1)         8           V2P CSI-RS for CSI acquisition         CDM Type         CDM4 (FD2, TD2)         Density (p)           First Subcarrier index in the PRB used for CSI-RS (do, h1)         Row 8, (4,6)         (4,6)           CSI-RS for CSI acquisition         CSI-RS (do, h1)         Got CSI-RS (do, h2)         Got CSI-RS (do, h2)           CSI-IM configuration         First Subcarrier index in the PRB used for CSI-RS (CSI-IM Resource CSI-IM Resource CSI-RS (do, h2)         Got CSI-RS (do, h2)         Got CSI-RS (do, h3)           CSI-IM configuration         CSI-IM Resource Type         Aperiodic	Antenna config	uration		
ZP CSI-RS         CSI-RS resource Type         Periodic           Number of CSI- Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (lo, h1)         Row 5, (4,-)           CSI-RS (lo, h1)         First OFDM symbol in the PRB used for CSI-RS (lo, h1)         (9,-)           CSI-RS (lo, h2)         CSI-RS (lo, h2)         8           CSI-RS (lo, h1)         CSI-RS (lo, h2)         8           CSI-RS (lo, h2)         CSI-RS (lo, h2)         8           CSI-RS (lo, h2)         CDM Type         CDM4 (FD2, TD2)           Density (p)         1         1           First subcarrier index in the PRB used for CSI-RS (lo, h1)         8           CSI-RS (lo, h2)         First OFDM         8           Symbol in the PRB used for CSI-RS (lo, h1)         Row 8, (4,6)           CSI-RS (lo, h2)         CSI-RS (lo, h2)         0           CSI-RS (lo, h2)         Slot         Not configured           aperiodic Triggerin gOffset         0         0           CSI-IM RE pattern         Patten 0         CSI-IM RE pattern           CSI-IM Resource         Aperiodic         COI- Mapping         (4,9)           (Kcsi=MA, ICSI=M3	Beamforming N	lodel		As specified in Section Annex
ZP CSI-RS configuration         Number of CSI- RS ports (X)         4           ZDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS         Row 5, (4,-)           (ko, k1)         First OFDM symbol in the PRB used for CSI-RS         (9,-)           (b, h)         CSI-RS         (9,-)           Number of CSI- RS ports (X)         8         (20M Type           Density (p)         1         1           First subcarrier index in the PRB used for CSI-RS (ko, ki)         Row 8, (4,6)           GCSI-RS (lo, h)         CSI-RS         (5,-)           CSI-RS (lo, h)         Solt         Not configured           Aperiodic Triggerin gOffset         0         0           CSI-IM resource         Aperiodic         Aperiodic           CSI-IM Resource         (4,9)         (4,9)           (kcsi-M, Lesi-M)         CSI-IM timeConfig interval and offset         Slot           COSI-IM timeConfig interval and offset         Slot         Not configured <td></td> <td></td> <td></td> <td></td>				
ZP CSI-RS configuration         CDM Type Density (p)         FD-CDM2           ZP CSI-RS configuration         index in the PRB used for CSI-RS (ko, kr)         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS (lo, h)         (9,-)           CSI-RS interval and offset         slot           CSI-RS for CSI- for CSI- acquisition         CSI-RS cDM Type         Aperiodic           NZP CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic           NZP CSI-RS for CSI acquisition         First Subcarrier index in the PRB used for CSI-RS (ko, kr)         Row 8, (4,6)           First Subcarrier index in the PRB used for CSI-RS (lo, h)         Row 8, (4,6)         (5,-)           CSI-IM symbol in the PRB used for CSI-RS (lo, h)         G,-)         0           CSI-RS for CSI acquisition         CSI-RS (lo, h)         Slot         Not configured           CSI-IM symbol in the PRB used for CSI-RS (lo, h)         Slot         Not configured           CSI-IM symbol in the PRB used for CSI-RS (lo, h)         G,-)         0           CSI-RS (lo, h)         CSI-RS (lo, h)         Mot configured           CSI-IM symbol in the PRB used for CSI-RS (lo, h)         Slot         Not configured           CSI-RS (lo, h)         CSI-RS (lo, h)         CSI-RS (lo, h)         G,-)           CSI-RS (lo, h)         CSI-RS		Number of CSI-		4
ZP CSI-RS configuration         Density (p)         1           First subcarrier index in the PRB used for CSI-RS (lo, lr)         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS (lo, lr)         (9,-)           CSI-RS interval and offset         slot           CSI-RS for CSI-RS f				
ZP CSI-RS configuration         First subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS (lo, h1)         (9,-)         (9,-)           CSI-RS interval and offset         slot         5/1           CSI-RS interval and offset         slot         5/1           NZP CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic           NZP CSI-RS for CSI acquisition         Type         CDM (FD2, TD2)           Density (p)         1         First Subcarrier index in the PRB used for CSI-RS (lo, h2)         Row 8, (4,6)           Symbol in the PRB used for CSI-RS (lo, h2)         Slot         Not configured           CSI-RS interval and offset         slot         Not configured           ZP CSI-RS for CSI acquisition         CSI-IM resource         Aperiodic           CSI-RS interval and offset         slot         Not configured           CSI-IM configuration         CSI-IM RE pattern         Patten 0           CSI-IM Resource mapping (kcsI+ML/SI+M)         GI-RI-RDI-CQI         Table 1           CSI-IM Reporting         Slot         Not configured           ReportConfigType         Aperiodic         Toble 1           CSI-IM Reportiner         Table 1         TeperofQuantity           timeRestrictionFo				
ZP CSI-RS configuration         index in the PRB used for CSI-RS (ko, kr)         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS (b, h)         (9,-)           CSI-RS interval and offset         slot         5/1           CSI-RS interval and offset         slot         5/1           NUMber of CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic           Number of CSI- RS ports (X)         CDM4 (FD2, TD2)         0           Density (p)         1         1           First Subcarrier index in the PRB used for CSI-RS (ko, ki)         Row 8, (4,6)         (5,-)           CSI-RS (lo, h)         CSI-RS         (5,-)         (4,6)           CSI-RS (lo, h)         Slot         Not configured         aperiodic Type         Aperiodic           CSI-IM resource (lo, h)         CSI-IM resource         Aperiodic         Aperiodic           CSI-IM resource (CSI-IM Resource Mapping (kcsHMLCsHM)         Patten 0         CSI-IM Resource         Aperiodic           CSI-IM Resource mapping interval and offset         slot         Not configured         Table 1           reportConfigType         Aperiodic         Table 1         Table 1           reportQuantity         cri-RI-PML-CQI         Table 1         Table 1           reportQuantity         C				I
First OFDM symbol in the PRB used for CSI-RS         (9,-)           CSI-RS interval and offset         slot         5/1           CSI-RS interval and offset         slot         5/1           NZP CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic           NZP CSI-RS for CSI acquisition         index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         8           First Subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 8, (4,6)           CSI-RS interval and offset acquisition         (5,-)           CSI-RS interval and offset acquisition         slot         Not configured           Symbol in the PRB used for CSI-RS ((0, h)         slot         Not configured           CSI-IM configuration         CSI-IM resource CSI-IM resource         Aperiodic CSI-IM Resource         Aperiodic CSI-IM Resource           CSI-IM RE pattern         Patten 0         CSI-IM Resource         CSI-IM Resource           CSI-IM Resource         Mapping (kcsI+M)         Slot         Not configured           ReportConfigType         Aperiodic Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI         Table 1           reportQuantity         cri-RI-PMI-CQI         Table 1           reportQuantity         cri-RI-PMI-CQI         Wideband           timeRestrictionForChan		index in the PRB used for CSI-RS		Row 5, (4,-)
CSI-RS interval and offset         slot         5/1           VZP CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic           NZP CSI-RS for CSI acquisition         EDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 8, (4,6)           Symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )         (5,-)           CSI-RS interval and offset         slot         Not configured           Aperiodic Type         Q         Q           CSI-IM configuration         CSI-IM resource Type         Aperiodic CSI-IM RE pattern         Patten 0           CSI-IM RE pattern         Patten 0         CSI-IM Resource Mapping         (4,9)           (kcsi-M, lcsi-M)         CSI-IM timeConfig interval and offset         slot         Not configured           ReportConfigType         Aperiodic         Table 1         Table 1           CQI-table         Table 1         Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments         Not configured           cqi-FormatIndicator         Wideband         Mitheband         Mitheband           guideband         Mitheband         Slot         Not configured		First OFDM symbol in the PRB used for CSI-RS		(9,-)
CSI-RS resource Type         Aperiodic           Number of CSI- RS ports (X)         8           CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 8, (4,6)           First OFDM symbol in the PRB used for CSI-RS (lo, l <sub>1</sub> )         (5,-)           CSI-RS interval and offset         slot           Vot configured         aperiodic Type           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM resource Type         Slot         Not configured           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           cqi-FormatIndicator         Wideband           qui-FormatIndicator         Wideband           qui-FormatIndicator         Wideband           qui-FormatIndicator         RB           Resource         RB           Aperiodic         CSI-RIM           CSI-IM resource         Wideband           cqi-FormatIndicator         Wideband <t< td=""><td></td><td>CSI-RS</td><td>slot</td><td>5/1</td></t<>		CSI-RS	slot	5/1
Number of CSI- RS ports (X)         8           NZP CSI-RS for CSI acquisition         CDM Type         CDM4 (FD2, TD2)           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 8, (4,6)           First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )         (5,-)           CSI-IRS (l <sub>0</sub> , l <sub>1</sub> )         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM Resource Mapping (k <sub>0</sub> SI-ML/CSI-IM)         Pattern           CSI-IM Resource Mapping         Slot           CSI-IM Resource Mapping         Slot           CSI-IM Resource Mapping         Slot           CQI-table         Table 1           reportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForInterferenceMeas urements         Not configured           timeRestrictionForInterferenceMeas urements         Not configured           cqi-FormatIndicator         Wideband           Sub-band Size         RB         8           csi-ReportingBand         1111111         CSI-RIP		CSI-RS resource		Aperiodic
NZP CSI-RS for CSI acquisitionCDM TypeCDM4 (FD2, TD2) Density (p)NZP CSI-RS for CSI acquisitionFirst subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )Row 8, (4,6)First OFDM symbol in the PRB used for CSI-RS (lo, l1)(5,-)CSI-RS interval and offsetslotNot configuredQOffset00CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsI-IM, ICSI-IM)SlotNot configuredReportConfigTypeAperiodicCQI-tableTable 1reportQuantityCri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorRB8csi-Report interval and offsetslotStareport interval and offsetSlottimeRestrictionForInterferenceMeas urementsNot configuredCSI-Report interval and offset8cqi-FormatIndicatorWidebandSub-band SizeRBReport interval and offsetslotSlot Offset5		Number of CSI-		8
NZP CSI-RS for CSI acquisitionDensity (p)1First subcarrier index in the PRB used for CSI-RS (ko, k1)Row 8, (4,6)First OFDM symbol in the PRB used for CSI-RS (lo, l1)(5,-)CSI-RS interval and offsetSlotNot configuredCSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM configurationCSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsI-M, ICSI-IM)(4,9)CSI-IM Resource mapping (kcsI-M, ICSI-IM)SlotNot configuredReportConfigTypeAperiodicReportConfigTypeAperiodicCQI-table mentsTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredcqi-FormatIndicatorWidebandSub-band SizeRB8csi-ReportingBand1111111CSI-Report Interval and offsetSlotSub-band SizeRB4				CDM4 (FD2_TD2)
NZP CSI-RS for CSI acquisition       First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )       Row 8, (4,6)         First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )       (5,-)         CSI-RS interval and offset       slot         Not configured       aperiodicTriggerin gOffset       0         CSI-IM configuration       CSI-IM resource Type       Aperiodic         CSI-IM RE pattern       Patten 0         CSI-IM Resource Mapping (kcsi-M,lcsi-M)       (4,9)         CSI-IM timeConfig interval and offset       slot         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         urements       Not configured         cqi-FormatIndicator       Wideband         Sub-band Size       RB       8         csi-Report interval and offset       slot       Not configured				
NZP CSI-RS for CSI acquisition       index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )       Row 8, (4,6)         Acquisition       First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )       (5,-)         CSI-RS interval and offset       slot       Not configured         AperiodicTriggerin gOffset       0       0         CSI-IM configuration       CSI-IM resource Type       Aperiodic         CSI-IM RE pattern       Patten 0         CSI-IM Resource Mapping       (4,9)         (kcsi-ini,lcsi-ini)       Slot         CSI-IM Resource Mapping       Aperiodic         CQI-table       Table 1         reportConfigType       Aperiodic         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         sub-band Size       RB       8         csi-ReportingBand       1111111       CSI-MI Size				
Acquisition       First OFDM       symbol in the PRB       (5,-)         symbol in the PRB       used for CSI-RS       (0, 1,)         CSI-RS       interval and offset       slot       Not configured         aperiodicTriggerin       0       0       0         CSI-IM       CSI-IM resource       Aperiodic       Aperiodic         configuration       CSI-IM Resource       Aperiodic       0         CSI-IM Resource       Mapping       (4,9)       (4,9)         (kcsi-iM, Icsi-iM)       CSI-IM meconfig       slot       Not configured         CQI-table       Table 1       Table 1       Table 1         reportQuantity       cri-RI-PMI-CQI       Mideband       Mot configured         timeRestrictionForChannelMeasure       Not configured       Not configured         timeRestrictionForInterferenceMeas       RB       8       Sci-FormatIndicator       Wideband         cqi-FormatIndicator       RB       8       8       Sci-FormatIndicator       Wideband	for CSI	index in the PRB used for CSI-RS		Row 8, (4,6)
CSI-RS interval and offsetslotNot configuredaperiodicTriggerin gOffset0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsi-iM,lcsi-iM)(4,9)CSI-IM timeConfig interval and offsetslotReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandSub-band SizeRB8csi-ReportingBand1111111CSI-Report interval and offsetslotSub-band SizeRB8csi-Report interval and offsetslotSub-band SizeRBSub-band SizeRBAperiodic Report Slot OffsetSlotAperiodic Report Slot OffsetSlotColl-Report Slot OffsetSlot	acquisition	First OFDM symbol in the PRB used for CSI-RS		(5,-)
aperiodicTriggerin gOffset0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsi-iM,lcsi-iM)(4,9)CSI-IM timeConfig interval and offsetslotReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorRBSub-band SizeRBSiotNot configuredCSI-Report Interval and offsetslotSub-band SizeRBSiotNot configuredSub-band SizeRBSiotNot configuredSub-band SizeRBSiotNot configuredSiotNot configuredSiot-Report interval and offsetslotAperiodic Report Slot Offset5		CSI-RS	slot	Not configured
CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsi-iM,Icsi-iM)(4,9)CSI-IM timeConfig interval and offsetslotReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRBCSI-Report interval and offsetSlotSub-band SizeRBSizeRBAperiodic Report Slot OffsetSlotAperiodic Report Slot OffsetSlot		aperiodicTriggerin		0
Configuration       Type       Patten 0         CSI-IM RE pattern       Patten 0         CSI-IM Resource       (4,9)         Mapping       (4,9)         (kcsi-iM,Icsi-iM)       Slot         CSI-IM timeConfig interval and offset       slot         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas       Not configured         urements       Videband         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       RB       8         csi-ReportingBand       1111111         CSI-Report interval and offset       slot       Not configured		CSI-IM resource		Aperiodic
CSI-IM Resource Mapping (kcsi-iM,Icsi-iM)(4,9)CSI-IM timeConfig interval and offsetslotNot configuredReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB8csi-ReportingBand1111111CSI-Report Interval and offsetslotNot configuredAperiodic Report Slot OffsetSlotSlot	configuration			· · · · · · · · · · · · · · · · · · ·
CSI-IM timeConfig interval and offsetslotNot configuredReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRBcsi-ReportingBand1111111CSI-Report interval and offsetslotAperiodic Report Slot Offset5		CSI-IM Resource Mapping		
ReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB8csi-ReportingBand1111111CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5		CSI-IM timeConfig	slot	Not configured
CQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB8csi-ReportingBand1111111CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5	ReportConfigTy	rpe		Aperiodic
timeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRBcsi-ReportingBand1111111CSI-Report interval and offsetslotAperiodic Report Slot Offset5				Table 1
timeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB8csi-ReportingBand1111111CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5				cri-RI-PMI-CQI
timeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRBSub-band SizeRBCSi-ReportingBand1111111CSI-Report interval and offsetslotAperiodic Report Slot Offset5	timeRestrictionForChannelMeasure			Not configured
cqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRBSub-band SizeRBCsi-ReportingBand1111111CSI-Report interval and offsetslotAperiodic Report Slot Offset5	timeRestrictionForInterferenceMeas			Not configured
pmi-FormatIndicatorWidebandSub-band SizeRB8csi-ReportingBand1111111CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5				Wideband
Sub-band SizeRB8csi-ReportingBand1111111CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5				
csi-ReportingBand111111CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5			RB	
CSI-Report interval and offsetslotNot configuredAperiodic Report Slot Offset5				-
Aperiodic Report Slot Offset 5			slot	
				1 in slots i, where $mod(i, 5) = 1$ ,

# Table 6.3.3.1.2.3-1: Test parameters (dual-layer)

			otherwise it is equal to 0
reportTriggerSize			1
CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
Codebook	Codebook Type		typel-SinglePanel
configuration			1
	(CodebookConfig- N1,CodebookConf ig-N2)		(4,1)
	(CodebookConfig- O1,CodebookCon fig-O2)		(4,1)
	CodebookSubset Restriction		0x FFFF
	RI Restriction		0000010
Physical ch	nannel for CSI report		PUSCH
CQI/RI/PM		ms	8
Maximum transmissio	number of HARQ		4
Measurem	ent channel		R.PDSCH.1-6.2 FDD
PDSCH & PDSCH DMRS Precoding configuration for random Precoding			Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination, and with Wideband granularity
	Note 1: For random precoder selection, the precoder shall be updated in each slot (1 ms granularity).		
Note 2: If the UE reports in an available uplink reporting instance at slot# based on PMI estimation at a downlink slot not later than slot#[(n this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].			ik slot not later than slot#[(n-4)], it the eNB downlink before
Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3			direction shall be used as

#### Table 6.3.3.1.2.3-2: Minimum requirement

Parameter	Test 1
γ	1.5

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.2.

6.3.3.1.2.4 Test description

6.3.3.1.2.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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 6.1.2-1 and Table 6.3.3.1.2.3-1 and as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, Connected without release *On* for SA 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 content are defined in clause 6.3.3.1.2.4.3.

#### 6.3.3.1.2.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.2.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

 $SNR_{follow1, follow2}$  according to Annex G.3.2.

3. Set SNR to  $SNR_{follow1, follow2}$ . The SS shall transmit PDSCH with randomly selected precoding matrix from

codebook (Table 5.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with

aperiodic CSI request triggered. Measure  $t_{md1, md2}$  according to Annex G.3.3.

4. Calculate  $\gamma = \frac{l_{ue, follow1, follow2}}{t_{md1, md2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.1.2.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.3.1.2.4.3 Message contents

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

6.3.3.1.2.4.3.1 Message exceptions for SA

#### Table 6.3.3.1.2.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element Value/remark Comment Condit			
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	aperiodic		
}			

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-15			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	001100		
}			
nrofPorts	p8		
firstOFDMSymbolInTimeDomain	5		
cdm-Type	cdm4-FD2-TD2		
}			

# Table 6.3.3.1.2.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

# Table 6.3.3.1.2.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

#### Table 6.3.3.1.2.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34			
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			

#### Table 6.3.3.1.2.4.3.1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25			
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
moreThanTwo SEQUENCE {			
n1-n2 CHOICE {			
four-one-TypeI-SinglePaneI-Restriction	FFFF		
}			
}			
}			
typeI-SinglePaneI-ri-Restriction	0000010		

#### Table 6.3.3.1.2.4.3.1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	5		
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands7	1111111		
}			
}			
}			

#### 6.3.3.1.2.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.2.4.3.

#### 6.3.3.1.2.5 Test requirement

#### Table 6.3.3.1.2.5-1: Test requirement

Parameter	Test 1
γ	1.49

# 6.3.3.1.3 4Rx FDD FR1 Multiple PMI with 16Tx Type I – SinglePanel Codebook for both SA and NSA

#### 6.3.3.1.3.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.3.1.3.2 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.

#### 6.3.3.1.3.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.3.3-2.

Parameter		Unit	Test 1
Bandwidth		MHz	10
Subcarrier space	cing	kHz	15
Duplex Mode			FDD
Propagation ch	annel		TDLC300-5
Antenna configuration			High XP 16 x 4 (N1,N2) = (4,2)
Beamforming N	lodel		As specified in Annex B.4.1
ZP CSI-RS	CSI-RS resource Type		Aperiodic
configuration	Number of CSI- RS ports ( <i>X</i> )		4

#### Table 6.3.3.1.3.3-1: Test parameters (dual-layer)

		-	
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier		
	index in the PRB		Row 5, (4,-)
	used for CSI-RS		
	$(k_0, k_1)$		
	First OFDM		
	symbol in the PRB		(9,-)
	used for CSI-RS		(0, )
	(lo, l1)		
	CSI-RS	slot	Not configured
	interval and offset	0.01	
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource		Aperiodic
	Туре		/ periodic
	Number of CSI-		16
	RS ports (X)		_
	CDM Type		CDM4 (FD2, TD2)
	Density (p)		1
	First subcarrier		
	index in the PRB		
NZP CSI-RS	used for CSI-RS		Row 12, (2, 4, 6, 8)
for CSI	(ko, k1, k2, k3)		
acquisition	First OFDM		
	symbol in the PRB		
	used for CSI-RS		(5, -)
	(l <sub>0</sub> , l <sub>1</sub> )		
	CSI-RS		
	interval and offset	slot	Not configured
	aperiodicTriggerin		
			0
	gOffset		
	CSI-IM resource		Aperiodic
			Bettern 0
001.04	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		(1.0)
configuration	Mapping		(4,9)
	(k <sub>csi-im</sub> ,l <sub>csi-im</sub> )		
	CSI-IM timeConfig	slot	Not configured
Denerio	interval and offset		Ũ
ReportConfigTy	pe		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
	ForChannelMeasure		Not configured
ments			
	ForInterferenceMeas		Not configured
urements			
cqi-FormatIndic			Wideband
pmi-FormatIndio	cator		Subband
Sub-band Size		RB	8
csi-ReportingBa			1111111
CSI-Report inte		slot	Not configured
Aperiodic Repo	rt Slot Offset		5
CSI request			1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTriggerSiz	ze		1
			One State with one Associated
			Report Configuration
CSI-AperiodicT	riggerStateList		Associated Report
			Configuration contains pointers
			to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig-		
configuration	N1,CodebookConf		(4,2)
<b>U</b>	ig-N2)		
	(CodebookConfig-	-	(4,4)
	, could be a		( ', ')

	O1,CodebookCon fig-O2)			
	CodebookSubset Restriction		0x FFFF	
	RI Restriction		0000010	
Physical	channel for CSI report		PUSCH	
CQI/RI/P	MI delay	ms	8	
Maximum transmiss	Maximum number of HARQ		4	
Measurement channel			R.PDSCH.1-6.3 FDD	
		ured usina	random precoder selection, the	
Note 2:	precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable $i_1$ , $i_2$ combination.			
Note 3:	slot#(n+4). Iote 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.			

Parameter	Test 1
γ	3.0

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.3.

6.3.3.1.3.4 Test description

#### 6.3.3.1.3.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.3.1.3.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.3.1.3.4.3.

## 6.3.3.1.3.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.3.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

 $SNR_{follow1, follow2}$  according to Annex G.3.2.

- 3. Set SNR to SNR<sub>follow1, follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1.6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure t<sub>md1, md2</sub> according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.1.3.5-1, then the test is pass.

Otherwise, the test is fail.

# 6.3.3.1.3.4.3 Message contents

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

6.3.3.1.3.4.3.1 Message exceptions for SA

## Table 6.3.3.1.3.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2					
Information Element	Value/remark	Comment	Condition		
CSI-RS-ResourceMapping ::= SEQUENCE {					
frequencyDomainAllocation CHOICE {					
other	011110				
}					
nrofPorts	P16				
firstOFDMSymbolInTimeDomain	5				
cdm-Type	cdm4-FD2-TD2				
}					

## Table 6.3.3.1.3.4.3.1-2: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14					
Information Element	Value/remark	Comment	Condition		
nrOfAntennaPorts CHOICE {					
moreThanTwo SEQUENCE {					
n1-n2 CHOICE {					
four-two-TypeI-SinglePaneI-Restriction	FFFF FFFF FFFF FFFF				
}					
}					
}					
typeI-SinglePaneI-ri-Restriction	0000010				

# Table 6.3.3.1.3.4.3.1-3: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13					
Information Element	Value/remark	Comment	Condition		
reportConfigType CHOICE {					
aperiodic SEQUENCE {					
reportSlotOffsetList	5				
}					
reportFreqConfiguration SEQUENCE {					
pmi-FormatIndicator	subbandPMI				
}					
}					

### 6.3.3.1.3.4.3.2 Message exceptions for NSA

-

Same as in clause 6.3.3.1.3.4.3.1.

6.3.3.1.3.5 Test requirement

### Table 6.3.3.1.3.5-1: Test requirement

Parameter	Test 1
γ	2.99

# 6.3.3.1.4 4Rx FDD FR1 Single PMI with 32Tx Type1 - SinglePanel codebook for both SA and NSA

# 6.3.3.1.4.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

### 6.3.3.1.4.2 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.

### 6.3.3.1.4.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.4.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.4.3-2.

Pa	rameter	Unit	Test 1	
Bandwidth		MHz	10	
Subcarrier spa	cing	kHz	15	
Duplex Mode			FDD	
Propagation ch	annel		TDLA30-5	
Antenna configuration			High XP 32 x 4 (N1,N2) = (4,4)	
Beamforming Model			As specified in Annex B.4.1	
	CSI-RS resource Type		Aperiodic	
ZP CSI-RS	Number of CSI- RS ports (X)		4	
configuration	CDM Type		FD-CDM2	
-	Density (ρ)		1	
	First subcarrier index in the PRB		Row 5, (4,-)	

### Table 6.3.3.1.4.3-1: Test parameters (dual-layer)

<b>I</b>			
	used for CSI-RS		
	$(k_0, k_1)$		
	First OFDM		
	symbol in the PRB		(9,-)
	used for CSI-RS		(3,-)
	(lo, l1)		
	CSI-RS	-1-1	Not confirming d
	interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource		
	Туре		Aperiodic
	Number of CSI-		22
	RS ports (X)		32
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier		
	index in the PRB		
NZP CSI-RS	used for CSI-RS		Row 17, (2, 4, 6, 8)
for CSI	$(k_0, k_1, k_2, k_3)$		
acquisition	First OFDM		
	symbol in the PRB used for CSI-RS		(5, 12)
	$(I_0, I_1)$		
	CSI-RS	slot	Not configured
	interval and offset		
	aperiodicTriggerin		0
	gOffset		
	CSI-IM resource		Aperiodic
	Туре		Aponodio
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuration	Mapping		(4,9)
-	(k <sub>csi-im</sub> , l <sub>csi-im</sub> )		
	CSI-IM timeConfig		
	interval and offset	slot	Not configured
ReportConfigTy	rpe		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
	orChannelMeasure		
ments			Not configured
	orInterferenceMeas		
urements	onnenereneemeds		Not configured
cqi-FormatIndic	ator		Wideband
pmi-FormatIndi			Wideband
	Jalui		
Sub-band Size		RB	8
csi-ReportingBa			1111111
CSI-Report inte	rval and offset	slot	Not configured
Aperiodic Repo	rt Slot Offset		5
CSI request			1 in slots i, where $mod(i, 5) = 1$ ,
			otherwise it is equal to 0
reportTriggerSiz			
	ze		1
	ze		1 One State with one Associated
			Report Configuration
CSI-AperiodicT			Report Configuration Associated Report
			Report Configuration Associated Report Configuration contains pointers
	riggerStateList		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	riggerStateList Codebook Type		Report Configuration Associated Report Configuration contains pointers
	riggerStateList Codebook Type Codebook Mode		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	riggerStateList Codebook Type		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel
	riggerStateList Codebook Type Codebook Mode		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel
	riggerStateList Codebook Type Codebook Mode (CodebookConfig-		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1
CSI-AperiodicT Codebook	riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConf ig-N2)		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1
CSI-AperiodicT	riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConf ig-N2) (CodebookConfig-		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4)
CSI-AperiodicT Codebook	riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConfi ig-N2) (CodebookConfig- O1,CodebookCon		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1
CSI-AperiodicT Codebook	riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConfi ig-N2) (CodebookConfig- O1,CodebookCon fig-O2)		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4) (4,4)
CSI-AperiodicT Codebook	riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConfi ig-N2) (CodebookConfig- O1,CodebookCon		Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4)

	RI Restriction		0000010
Physical channel for CSI report			PUSCH
CQI/RI/P	MI delay	ms	8
Maximum number of HARQ transmission			4
Measure	ment channel		R.PDSCH.1-6.3 FDD
PDSCH & PDSCH DMRS Precoding configuration for random Precoding			Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination, and with Wideband granularity
<ul> <li>Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i<sub>1</sub>, i<sub>2</sub> combination.</li> <li>Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).</li> </ul>			ot (1 ms granularity) with equal mbination. k reporting instance at slot#n k slot not later than slot#(n-4),
Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.			

### Table 6.3.3.1.4.3-2: Minimum requirement

Parameter	Test 1
γ	7.0

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.4.

### 6.3.3.1.4.4 Test description

### 6.3.3.1.4.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.3.1.4.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.3.1.4.4.3.

## 6.3.3.1.4.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.4.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

 $SNR_{follow1, follow2}$  according to Annex G.3.2.

- 3. Set SNR to SNR<sub>follow1, follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1.6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure t<sub>md1, md2</sub> according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.1.4.5-1, then the test is pass.

Otherwise, the test is fail.

# 6.3.3.1.4.4.3 Message contents

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

6.3.3.1.4.4.3.1 Message exceptions for SA

### Table 6.3.3.1.4.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2					
Information Element	Value/remark	Comment	Condition		
CSI-RS-ResourceMapping:: = SEQUENCE {					
frequencyDomainAllocation CHOICE {					
other	011110				
}					
nrofPorts	P32				
firstOFDMSymbolInTimeDomain	5				
cdm-Type	cdm4-FD2-TD2				
}					

## Table 6.3.3.1.4.4.3.1-2: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14			
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
moreThanTwo SEQUENCE {			
n1-n2 CHOICE {			
four-four-TypeI-SinglePanel-Restriction	FFFF FFFF FFFF FFFF		
	FFFF FFFF FFFF FFFF		
	FFFF FFFF FFFF FFFF		
	FFFF FFFF FFFF FFFF		
}			
}			
}			
typeI-SinglePanel-ri-Restriction	0000010		

# Table 6.3.3.1.4.4.3.1-3: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	5		
}			
}			

# 6.3.3.1.4.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.4.4.3.1.

### 6.3.3.1.4.5 Test requirement

# Table 6.3.3.1.4.5-1: Test requirement

Parameter	Test 1
γ	6.99

# 6.3.3.1.5 4Rx FDD FR1 Multiple PMI with 16Tx TypeII codebook for both SA and NSA

# 6.3.3.1.5.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

### 6.3.3.1.5.2 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.

### 6.3.3.1.5.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.5.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.5.3-2.

P	arameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier spa	cing	kHz	15
Duplex Mode			FDD
Propagation ch	nannel		TDLA30-5
Antenna config	juration		XP Medium 16 x 4 (N1,N2) = (4,2)
Beamforming I	Vodel		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports ( <i>X</i> )		4
	CDM Type		FD-CDM2
ZP CSI-RS	Density (ρ)		1
configuration	First subcarrier index in the PRB used for CSI-RS ( $k_0$ , $k_1$ )		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		(9,-)

	CSI-RS		
	interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource		Aperiodic
	Type Number of CSI-RS		
	ports (X)		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS for CSI	First subcarrier index in the PRB used for		Row 12, (2, 4, 6, 8)
acquisition	CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> ) First OFDM symbol		
	in the PRB used for		(5, -)
	CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		
	CSI-RS	slot	Not configured
	interval and offset aperiodicTriggeringO		5
	ffset		0
	CSI-IM resource		Aperiodic
	Туре		•
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping		(4,9)
coniguration	(kcsi-im,lcsi-im)		(4,3)
	CSI-IM timeConfig	slot	Not configured
	interval and offset	5101	
ReportConfigTy CQI-table	уре		Aperiodic
reportQuantity			Table 1 cri-RI-PMI-CQI
	ForChannelMeasurem		
ents			Not configured
timeRestriction ements	ForInterferenceMeasur		Not configured
cqi-FormatIndio			Wideband
pmi-FormatIndi	cator		Subband
Sub-band Size	and	RB	8 1111111
csi-ReportingBand CSI-Report interval and offset		slot	Not configured
Aperiodic Repo		5101	5
CSI request			1 in slots i, where $mod(i, 5) = 1$ ,
-			otherwise it is equal to 0
reportTriggerSi	ze		1 One State with one Acception
			One State with one Associated Report Configuration
CSI-AperiodicT	riggerStateList		Associated Report
			Configuration contains pointers
	October als T		to NZP CSI-RS and CSI-IM
	Codebook Type L (numberOfBeams)		typell 2
	L (numberOrBeams)		
	(phaseAlphabetSize)		8
	subbandAmplitude		True
	(CodebookConfig-		
Codebook	N1,CodebookConfig- N2)		(4,2)
configuration	(CodebookConfig-		
	O1,CodebookConfig-		(4,4)
	O2)		
	CodebookSubsetRes		
	triction RI Restriction (typell-		FFFF FFFF FFFF FFFF
	RI Restriction (typell-		10
L			

Physical of	channel for CSI report		PUSCH	
CQI/RI/PI	CQI/RI/PMI delay ms 8		8	
Maximum	number of HARQ		4	
transmiss	sion		4	
Measurer	ment channel		R.PDSCH.1-6.3 FDD	
Note 1:	When Throughput is measure	ed using ra	indom precoder selection, the	
	precoder shall be updated in each slot (1 ms granularity) with equal			
	probability of each applicable i1, i2 combination. The random precoder			
	generation shall follow 'typeI-SinglePanel' codebook configuration as			
	specified in table 6.3.3.1.3-1.			
Note 2:				
	on PMI estimation at a downlink slot not later than slot#(n-4), this			
	reported PMI cannot be applied at the gNB downlink before slot#(n+4).			
Note 3:	· · · ·			
	specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall			
	be fixed as 1 during the test.			

#### Table 6.3.3.1.5.3-2: Minimum requirement

Parameter	Test 1
γ	1.9

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.5.

### 6.3.3.1.5.4 Test description

### 6.3.3.1.5.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.3.1.5.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.2.1.4.4.3.

# 6.3.3.1.5.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.5.3-1 as appropriate.

- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Establish t<sub>ue,follow1,follow2</sub> and SNR<sub>follow1,follow2</sub> according to Annex G.3.2.
- 3. Set SNR to  $SNR_{follow1, follow2}$ . The SS shall transmit PDSCH with randomly selected precoding matrix from

codebook (Table 5.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities, and the random precoder generation shall follow the codebook configuration as specified in Table 6.3.3.1.3.3-1. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Measure  $t_{md1,md2}$  according to

Annex G.3.3.

4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{md1, md2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.1.5.5-1, then the test is pass.

Otherwise, the test is fail.

### 6.3.3.1.5.4.3 Message contents

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

### 6.3.3.1.5.4.3.1 Message exceptions for SA

### Table 6.3.3.1.5.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	'011110'B		
}			
nrofPorts	P16		
firstOFDMSymbolInTimeDomain	5		
cdm-Type	cdm4-FD2-TD2		
}			

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14			
Information Element	Value/remark	Comment	Condition
CodebookConfig ::= SEQUENCE {			
codebookType CHOICE {			
type2 SEQUENCE {			
subType CHOICE {			
typeII SEQUENCE {			
n1-n2-codebookSubsetRestriction CHOICE {			
four-two	0x 7FF FFFF FFFF FFFF FFFF		
}			
typeII-RI-Restriction	'10'B		
}			
}			
phaseAlphabetSize	8		
subbandAmplitude	TRUE		
numberOfBeams	2		
}			
}			
}			

# Table 6.3.3.1.5.4.3.1-2: CodebookConfig

# Table 6.3.3.1.5.4.3.1-3: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	5		
}			
reportFreqConfiguration SEQUENCE {			
pmi-FormatIndicator	subbandPMI		
}			
}			

### 6.3.3.1.5.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.5.4.3.1.

### 6.3.3.1.5.5 Test requirement

### Table 6.3.3.1.5.5-1: Test requirement

Parameter	Test 1
γ	1.89

# 6.3.3.1.6 4Rx FDD FR1 Multiple PMI with 16Tx Enhanced TypeII codebook for both SA and NSA

### 6.3.3.1.6.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

### 6.3.3.1.6.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

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This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

# 6.3.3.1.6.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.6.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.6.3-2.

P	arameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier spacing		kHz	15
Duplex Mode			FDD
Propagation ch	annel		TDLA30-5
Antenna config			XP Medium 16 x 2 (N1,N2) = (4,2)
Beamforming N	Nodel		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports ( <i>X</i> )		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS ( $I_0$ , $I_1$ )		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports ( <i>X</i> )		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )		Row 12, (2, 4, 6, 8)
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		(5, -)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggeringO ffset		0
	CSI-IM resource Type		Aperiodic
CSI-IM configuration	CSI-IM RE pattern		Pattern 0
	CSI-IM Resource Mapping (k <sub>CSI-IM</sub> ,I <sub>CSI-IM</sub> )		(4,9)
	CSI-IM timeConfig interval and offset	slot	Not configured

Table 6.3.3.1.6.3-1: Test parameters (dual-layer)

DenertConfint			Americalia	
ReportConfigT	уре		Aperiodic	
CQI-table			Table 1	
reportQuantity	ForChannelMeasurem		cri-RI-PMI-CQI	
ents			Not configured	
timeRestriction ements	ForInterferenceMeasur		Not configured	
cqi-FormatIndi	cator		Wideband	
pmi-FormatInd			Not configured	
Sub-band Size		RB	4	
csi-ReportingB			111111	
	erval and offset	slot	Not configured	
Aperiodic Repo			5	
CSI request			1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	
reportTriggerS	ize		1	
	TriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM	
	Codebook Type		typell-r16	
	paramCombination-		6	
	r16		$(L = 4, p_v = 1/2, \beta = 1/2)$	
	R(numberOfPMISub bandsPerCQISubban d-r16)		1	
Codebook configuration	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)	
	(CodebookConfig- O1,CodebookConfig- O2)		(4,4)	
	CodebookSubsetRes triction		0x 7FF FFFF FFFF FFFF FFFF	
	RI Restriction (typell-			
	RI-Restriction-r16)		0010	
Physical chanr	nel for CSI report		PUSCH	
CQI/RI/PMI de	lay	ms	8	
Maximum num	ber of HARQ		4	
transmission			4	
Measurement			R.PDSCH.1-6.3	
Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination. The random precoder generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.3.1.3-1.				
Note 2: If th on F	e UE reports in an availal PMI estimation at a down	ble uplink r link slot no	eporting instance at slot#n based t later than slot#(n-4), this nB downlink before slot#(n+4).	
Note 3: Ran spe	Note 3: Randomization of the dual-cluster beam directions shall be used as specified in AnnexB.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.			

Parameter	Test 1
γ	2.2

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.3.1.6.

# 6.3.3.1.6.4 Test description

### 6.3.3.1.6.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.3.1.6.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.3.1.6.4.3.

# 6.3.3.1.6.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.6.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish t<sub>ue,follow1,follow2</sub> and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

- 3. Set SNR to SNR<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure t<sub>md1, md2</sub> according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{md1, md2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.1.6.5-1, then the test is pass.

Otherwise, the test is fail.

# 6.3.3.1.6.4.3 Message contents

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

### 6.3.3.1.6.4.3.1

Message exceptions for SA

# Table 6.3.3.1.6.4.3.1-1: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Information Element	Value/remark	Comment	Condition
CSI-ReportConfig ::= SEQUENCE {	raido, roman		
reportFreqConfiguration SEQUENCE {			
pmi-FormatIndicator	subbandPMI		
}			
codebookConfig	Not present		
subbandSize	Value1		
codebookConfig-r16	CodebookConfig-r16		
}			

# Table 6.3.3.1.6.4.3.1-2: CodebookConfig-r16 (Table 6.3.3.1.6.4.3.1-1)

Derivation Path: TS 38.331 [6], clause 6.3.2			
Information Element	Value/remark	Comment	Condition
CodebookConfig-r16 ::= SEQUENCE {			
codebookType CHOICE {			
type2 SEQUENCE {			
subType CHOICE {			
typeII-r16 SEQUENCE {			
N1-n2-codebookSubsetRestriction-r16			
Four-two	0x 7FF FFFF FFFF FFFF FFFF		
}			
typeII-RI-Restriction-r16	0010		
}			
}			
numberOfPMI-SubbandsPerCQI-Subband-r16	1		
paramCombinatin-r16	6	(L =4, p <sub>v</sub> =1/2, β=1/2 )	
}			
}			
}			

### 6.3.3.1.6.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.6.4.3.1.

# 6.3.3.1.6.5 Test requirement

# Table 6.3.3.1.6.5-1: Test requirement

Parameter	Test 1
γ	2.19

# 6.3.3.2 TDD

6.3.3.2.1 4Rx TDD FR1 Single PMI with 4TX TypeI-SinglePanel codebook for both SA and NSA

# 6.3.3.2.1.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

# 6.3.3.2.1.2 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.

# 6.3.3.2.1.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.1.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.1.3-2.

Parameter         Unit         Pest 1           Subcarrier spacing         KHz         30           Duplex Mode         TDD           DD L-UL configuration         FR1.30-1 as specified in Annex A           Propagation channel         TDLA30-5           Antenna configuration         High XP 4 x 4           Mitting Model         As specified in Section Annex B.4.1           Beamforming Model         As specified in Section Annex B.4.1           ZP CSI-RS configuration         CSI-RS resource Type         Periodic           Number of CSI- R S ports (X)         4         CDM Type           Density (p)         1         First subcarrier index in the PRB used for CSI-RS (k, k, 1)         Row 5, (4,-)           ESI-RS resource Type         Aperiodic         Type         Proceedic           VB, h         First OFDM symbol in the PRB used for CSI-RS resource Type         Aperiodic         Type           NZP CSI-RS for CSI- Gr CSI mode in the PRB used for CSI- Strot CAI         4         Strot CAI         4           RS ports (X)         4         Strot CAI         4         Strot CAI           NZP CSI-RS source Type         Aperiodic         Type         1         First Subcarrier index in the PRB used for CSI-RS (k, k, 1)         4         Strot CAI             CSI-RS r						
Subcarrier spacing         kHz         30           Duplex Mode         TDD           TDD DL-UL configuration         FR1.30-1 as specified in Annex A           Propagation channel         TDLA30-5           Antenna configuration         (N1,N2) = (2,1)           Beamforming Model         As specified in Section Annex B.4.1           Beamforming Model         As specified in Section Annex B.4.1           ZP CSI-RS         CDM Type           Cold Type         FD-CDM2           Density (p)         1           First Subcarrier index in the PRB used for CSI-RS (b, h)         Row 5, (4,-)           CSI-RS resource Type         Aperiodic           Very CSI-RS configuration         First Subcarrier index in the PRB used for CSI-RS (b, h)         (9,-)           CSI-RS resource Type         Aperiodic           NZP CSI-RS for CSI acquisition         Subcarrier index in the PRB used for CSI-RS (k, k, t)         first subcarrier index in the PRB used for CSI-RS (k, k, t)           First Subcarrier index in the PRB used for CSI-RS (k, k, t)         first Subcarrier index in the PRB used for CSI-RS (k, k, t)         first Subcarrier index in the PRB used for CSI-RS (k, k, t)           CSI-IM TREOUTCE Type         Aperiodic         CSI-RS (k, k, t)           CSI-IM REsource Type         Aperiodic           CSI-IM Resource Type	Parameter			Test 1		
Duplex Mode         TDD           TDD DL-UL configuration         FR1.30-1 as specified in Annex A           Propagation channel         TDLA30-5           Antenna configuration         High XP 4 x 4 (N1,N2) = (2,1)           Beamforming Model         As specified in Section Annex B.4.1           ZP CSI-RS configuration         CSI-RS resource Type         Periodic           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (k_0, k_1)         Row 5, (4,-)           K(b, h)         First Subcarrier index in the PRB         (9,-)           V(b, h)         CSI-RS resource type         Aperiodic           Virype         FD-CDM2         Ensity (p)           CSI-RS configuration         First Subcarrier index in the PRB         (9,-)           V(b, h)         CSI-RS resource Type         Aperiodic           NZP CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic           Namber of CSI- RS ports (X)         4         CSI- RS ports (X)         4           CDM Type         FD-CDM2         Ensity (p)         1           First OFDM symbol in the PRB used for CSI-RS (0, h)         (13,-)         (13,-)           CSI-IM resource         Aperiodic         Aperiodic           CSI-IM RE patterm         Patten		ing		-		
TDD DL-UL configuration         FR1.30-1 as specified in Annex A           Propagation channel         TDLA30-5           Antenna configuration         (N1,N2) = (2,1)           Beamforming Model         As specified in Section Annex B,4.1           Esamforming Model         As specified in Section Annex B,4.1           Value         CSI-RS resource         Periodic           Number of CSI- RS ports (X)         4         COM Type           ZP CSI-RS configuration         Edit Number of CSI- Index in the PRB used for CSI-RS (ko, k1)         Row 5, (4,-)           First Subcarrier index in the PRB used for CSI-RS (ko, k1)         First OFDM Symbol in the PRB used for CSI-RS (ko, k1)         (9,-)           CSI-RS resource         Aperiodic         Aperiodic           Type         First Subcarrier index in the PRB used for CSI-RS (k0, h1)         10/1           CSI-RS resource         Aperiodic         Aperiodic           Type         First Subcarrier index in the PRB used for CSI-RS (k0, k1)         1           RS ports (X)         4         CDM Type         10/1           Density (p)         1         First Subcarrier index in the PRB used for CSI-RS (k0, k1)         4           CSI-RS (cold)         GSI-RS (k0, k1)         4         CSI-RS (k0, k1)           CSI-IM RE patterin         CPCDM <td< td=""><td colspan="2"></td><td>KHZ</td><td></td></td<>			KHZ			
TDD DC-DL configuration       TA         Propagation channel       TDLA30-5         Antenna configuration       High XP 4 x 4 (N1,N2) = (2,1)         Beamforming Model       As specified in Section Annex B.4.1         ZP CSI-RS       CSI-RS resource       Periodic         Type       Periodic       Number of CSI- RS ponts (X)       4         ZP CSI-RS configuration       Interval and offset       Row 5, (4,-)         idex in the PRB used for CSI-RS (ide, h1)       Row 5, (4,-)       1         First subcarrier index in the PRB used for CSI-RS (ide, h1)       10/1         CSI-RS resource       Aperiodic         NZP CSI-RS interval and offset       slot       10/1         CSI-RS resource       Aperiodic         NZP CSI-RS interval and offset       Row 4, (0,-)         Ko, k1 )       Ensity (p)       1         First subcarrier index in the PRB used for CSI-RS (do, h1)       Row 4, (0,-)         CSI-RS resource       Aperiodic         NUTP CSI-RS interval and offset       Not configured         acquisition       CSI-RS resource       Aperiodic         CSI-RS resource       Aperiodic       CSI-RS         (b, h1)       CSI-RS       (13,-)         (b, h1)       CSI-RS       (4,9)	Duplex Mode					
Antenna configuration         High XP 4 x 4 (N1,N2) = (2,1)           Beamforming Model         As specified in Section Annex B.4.1           ESI-RS resource Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS ((b, k))         Row 5, (4,-)           (ko, k1)         First Subcarrier index in the PRB         (9,-)           CSI-RS ((b, h2)         Slot         10/1           CSI-RS interval and offset         slot         10/1           CSI-RS interval and offset         slot         10/1           RS ports (X)         4         CDM Type           CSI-RS resource         Aperiodic           NUMber of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS         Row 4, (0,-)           (br, h1)         First OFDM symbol in the PRB used for CSI-RS         (13,-)           (br, h1)         CSI-RS         (13,-)           (cDM Type         Aperiodic         CSI-RS           CSI-IM Resource         Aperiodic         CSI-RS           CSI-IM Resource		-		A		
Anternia configuration         (N1,N2) = (2,1)           Beamforming Model         As specified in Section Annex B.4.1           As specified in Section Annex E.4.1         Section Annex B.4.1           XP CSI-RS         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 5, (4,-)           CSI-RS         (lo, h)           CSI-RS         (9,-)           (lo, h)         CSI-RS           (lo, h)         Symbol in the PRB used for CSI-RS (ko, k1)         4           CDM Type         FD-CDM2           Density (p)         1           First Subcarrier index in the PRB used for CSI-RS (ko, k1)         4           CDM Type         FD-CDM2           Density (p)         1           First Subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 4, (0,-)           CSI-RS for CSI acquisition         CSI-RS (ko, k1)         1           First Subcarrier index aperiodic Triggerin aperiodic Triggerin qOffset         0           CSI-IM Resource Type         Aperiodic           CSI-IM Resource CSI-IM Resource Mapping (kcsi-M, lcsi-M)         0           CSI-IM Resource Type <td>Propagation cha</td> <td>annel</td> <td></td> <td></td>	Propagation cha	annel				
Beamforming Model         As specified in Section Annex B.4.1           ZP CSI-RS configuration         CSI-RS resource Type         Periodic           ZP CSI-RS configuration         Number of CSI- Bensity (p)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS ((b, h)         Row 5, (4, -)           CSI-RS interval and offset         slot         10/1           CSI-RS for CSI acquisition         CSI-RS resource         Aperiodic           Number of CSI- RS ports (X)         4         CSI- RS resource         Aperiodic           NUMber of CSI- RS ports (X)         4         CSI- RS ports (X)         4           CDM Type         FD-CDM2         Density (p)         1           First Subcarrier index in the PRB used for CSI- RS ports (X)         Row 4, (0, -)         (0, -)           CSI-RS (b, h)         CSI-RS         Row 4, (0, -)         (13, -)           CSI-RS (b, h)         CSI-RS         Row 4, (0, -)         (13, -)           CSI-RS (b, h)         CSI-RS         Row 4, (0, -)         (13, -)           CSI-RS (b, h)         CSI-RS         Row 4, (0, -)         (13, -)           CSI-RS (b, h)         CSI-RS         Row 4, (0, -)         (13, -) <td>Antenna config</td> <td>uration</td> <td></td> <td></td>	Antenna config	uration				
Type         Periodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (k_0, k_1)         Row 5, (4,-)           First Subcarrier index in the PRB used for CSI-RS (l_0, l_1)         (9,-)           CSI-RS interval and offset         10/1           CSI-RS for CSI acquisition         CSI-RS interval and offset         10/1           NZP CSI-RS for CSI acquisition         CSI-RS (k_0, k_1)         4           RS ports (X)         4         2           Density (p)         First Subcarrier index in the PRB used for CSI-RS for CSI acquisition         Row 4, (0,-)           First Subcarrier index in the PRB used for CSI-RS (l_0, l_1)         Row 4, (0,-)           CSI-IM configuration         CSI-RS (l_0, l_1)         (13,-)           CSI-IM resource aperiodicTriggerin qOffset         0         0           CSI-IM RE pattern         Patten 0         CSI-IM Resource Mapping         (4,9)           (KcsI-IAL/ESI-M)         CSI-IM Type         Aperiodic           CQI-table         Table 1         Table 1           reportConfigType         Aperiodic         CQI-table           CSI-IM Resource Mapping interval and offset         Not configured     <	Beamforming N	lodel		As specified in Section Annex		
ZP CSI-RS configurationNumber of CSI- RS ports (X)4ZP CSI-RS configurationFirst subcarrier index in the PRB used for CSI-RS ( $k_0, k_1$ )Row 5, (4,-) ( $k_0, k_1$ )First SUbcarrier index in the PRB used for CSI-RS ( $l_0, l_1$ )(9,-) CSI-RS interval and offsetSlot10/1 CSI-RS for CSI-RS ( $l_0, l_1$ )CSI-RS resource TypeAperiodicNZP CSI-RS for CSI-RS for CSI- acquisitionCSI-RS resource TypeAperiodicNZP CSI-RS for CSI- acquisitionFirst OFDM symbol in the PRB used for CSI-RS ( $k_0, k_1$ )Row 4, (0,-) CSI-RS for CSI- acquisitionCSI-RS ( $k_0, k_1$ )Row 4, (0,-) CSI-IM configurationCSI-RS interval and offsetNot configured aperiodic Triggerin aperiodic Triggerin aperiodic Triggerin gOffset0CSI-IM RE pattern configurationCSI-IM Resource TypeAperiodic Aperiodic Triggerin gOffsetCSI-IM Resource Mapping ( $k_{CSI-M, RE pattern$ Not configured interval and offsetReportConfigTypeAperiodic Table 1CQI-table reportQuantityCSI-IM Resource Table 1ReportConfigTypeAperiodic Table 1cqi-FormatIndicatorWideband Sub-band SizeSub-band SizeRB16 C				Periodic		
RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier         1           index in the PRB         Row 5, (4,-)           used for CSI-RS         (9,-)           (b, h)         10/1           CSI-RS         (9,-)           (b, h)         10/1           CSI-RS         (9,-)           (b, h)         10/1           CSI-RS         10/1           CSI-RS         Row 5, (4,-)           (b, h)         CSI-RS           (b, h)         10/1           CSI-RS         10/1           NUmber of CSI-RS         4           RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First or CSI-RS         Row 4, (0,-)           acquisition         First OFDM           symbol in the PRB         gaeriodic Triggerin           used for CSI-RS         (13,-)           (b, h)         CSI-RS           interval and offset         Not configured           aperiodicTriggerin         0           QOFfset         O           CSI-IM resource <td< td=""><td></td><td></td><td></td><td></td></td<>						
ZP CSI-RS configuration         CDM Type         FD-CDM2           ZP CSI-RS configuration         Index in the PRB used for CSI-RS         Row 5, (4,-)           (ko, k, 1)         First SUbcarrier         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS         (9,-)           (lo, h)         CSI-RS         10/1           CSI-RS interval and offset         Slot         10/1           NZP CSI-RS for CSI acquisition         CSI-RS resource         Aperiodic           NZP CSI-RS for CSI acquisition         First Subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 4, (0,-)           First Subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 4, (0,-)           CSI-RS interval and offset         0           CSI-RS interval and offset         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic CSI-IM Resource Mapping           CSI-IM RE pattern         Patten 0           CSI-IM RE pattern         Patten 0           CSI-IM REpattern         Patten 0				4		
ZP CSI-RS configuration         Density (p)         1           First subcarrier index in the PRB used for CSI-RS (lo, kr)         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS (lo, h)         (9,-)           CSI-RS interval and offset         slot         10/1           CSI-RS interval and offset         slot         10/1           NZP CSI-RS for CSI acquisition         CSI-RS interval and offset         slot         10/1           First SUCARTIER for CSI acquisition         Type         Aperiodic           NZP CSI-RS for CSI acquisition         Type         First SUCARTIER index in the PRB used for CSI-RS (lo, h)         Row 4, (0,-)           First SOFDM symbol in the PRB used for CSI-RS (lo, h)         Row 4, (0,-)         Row 4, (0,-)           CSI-RS interval and offset         Not configured         aperiodic Tiggerin qOffset         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic         Aperiodic           CSI-IM resource futureal and offset         Not configured         CSI-IM Resource Mapping         Aperiodic           CSI-IM Resource Mapping (kcsi-kk_ICSI-M)         CSI-IM Resource Mapping         Aperiodic         CSI-IM Resource Mapping         Aperiodic           CSI-IM Resource Mapping         Slot         Not configured         Table 1         reportOcl				FD-CDM2		
ZP CSI-RS configuration       First subcarrier index in the PRB used for CSI-RS (ko, k1)       Row 5, (4,-)         First OFDM symbol in the PRB used for CSI-RS (lo, h)       (9,-)         CSI-RS interval and offset       10/1         CSI-RS interval and offset       10/1         NZP CSI-RS for CSI acquisition       Slot       10/1         NZP CSI-RS for CSI acquisition       CI-RS resource Type       Aperiodic         NZP CSI-RS for CSI acquisition       First subcarrier index in the PRB used for CSI-RS (ko, k1)       Row 4, (0,-)         First Subcarrier index in the PRB used for CSI-RS (lo, h1)       Row 4, (0,-)         CSI-RS interval and offset       Not configured         acquisition       CSI-RS (ko, k1)       Not configured         CSI-IM configuration       CSI-IM resource CSI-IM REsource       Aperiodic         CSI-IM configuration       CSI-IM REsource Type       Aperiodic         CSI-IM RE pattern       Patten 0         CSI-IM Resource mapping (kcsi-M,lcsi-M)       K4,9)       (4,9)         CSI-IM Resource ments       Slot       Not configured         ReportConfigType       Aperiodic       Aperiodic         CSI-IM Resource ments       Not configured       Table 1						
ZP CSI-RS configuration         index in the PRB used for CSI-RS         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS         (9,-)           CSI-RS interval and offset         10/1           CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic           NZP CSI-RS for CSI acquisition         CDM Type         FD-CDM2           Density (p)         1         1           First Subcarrier index in the PRB used for CSI-RS for CSI acquisition         Row 4, (0,-)         1           First Subcarrier index in the PRB used for CSI-RS (b, k) 1         Row 4, (0,-)         1           First Subcarrier index in the PRB used for CSI-RS (b, k) 1         Row 4, (0,-)         1           First OFDM symbol in the PRB used for CSI-RS (b, h)         Row 4, (0,-)         1           CSI-IM configuration         CSI-RS (b, h)         0         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic         0           CSI-IM configuration         CSI-IM RE pattern         Patten 0         0           CSI-IM RE pattern         CSI-IM Resource Mapping (kcsi-M,lcsi-M)         Qifset         Not configured           ReportConfigType         Aperiodic         Table 1         1           reportQuantity         cri-RI-PMI-CQI         Table 1 <t< td=""><td></td><td></td><td></td><td></td></t<>						
configuration         used for CSI-RS (ko, k1)         Row 5, (4,-)           First OFDM symbol in the PRB used for CSI-RS (lo, l1)         (9,-)           CSI-RS interval and offset         10/1           CSI-RS interval and offset         10/1           NZP CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic           NZP CSI-RS for CSI acquisition         First subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 4, (0,-)           First OFDM symbol in the PRB used for CSI-RS (lo, l1)         Row 4, (0,-)           CSI-RS for CSI acquisition         CSI-RS (sol, k1)         Row 4, (0,-)           CSI-RS (co, k1)         CSI-RS (sol, k1)         Row 4, (0,-)           CSI-RS (co, l1)         CSI-RS (sol, k1)         Row 4, (0,-)           CSI-RS (co, l1)         CSI-RS (sol, k1)         Row 4, (0,-)           CSI-RS (co, l1)         CSI-RS         (13,-)           (b, l2)         CSI-RS         0           CSI-IM resource Type         Aperiodic         CSI-IM CSI-IM Resource           CSI-IM Resource Mapping (kcsi-MLCsi-M)         Slot         Not configured           ReportConfigType         Aperiodic         Table 1           reportQuantity         Cri-RI-PMI-CQI         TimeRestrictionForChannelMeasure ments         Not configured           ti	ZP CSI-RS					
(k0, k1)         First OFDM symbol in the PRB used for CSI-RS         (9,-)           (lo, l1)         CSI-RS interval and offset         slot         10/1           CSI-RS interval and offset         slot         10/1           NZP CSI-RS for CSI acquisition         CSI-RS resource Type         Aperiodic           NZP CSI-RS for CSI acquisition         First subcarrier index in the PRB used for CSI-RS (k0, k1)         Row 4, (0,-)           First Subcarrier index in the PRB used for CSI-RS (l0, l1)         Row 4, (0,-)           CSI-RS for CSI acquisition         CSI-RS (l0, l1)         Row 4, (0,-)           CSI-RS for CSI-RS for CSI-RS (l0, l1)         Not configured           Symbol in the PRB used for CSI-RS (l0, l1)         Not configured           CSI-INF         0         CSI-IN (l0, l1)         O           CSI-IN resource coffiguration         CSI-IM resource Type         Aperiodic           CSI-IM Resource Mapping (kcsi-IM, Icsi-IM)         QIS         Not configured           CSI-IM Resource Mapping         Slot         Not configured           ReportConfigType         Aperiodic         Table 1           Correntity         cri-RI-PMI-CQI         TimeRestrictionForChannelMeasure ments         Not configured           timeRestrictionForInterferenceMeas         Not configured         Slob-band Size	configuration			Row 5, (4,-)		
First OFDM symbol in the PRB used for CSI-RS         (9,-)           CSI-RS         slot         10/1           CSI-RS         slot         10/1           Interval and offset         slot         10/1           CSI-RS         slot         10/1           RS ports (X)         4         10/1           NZP CSI-RS         FD-CDM2         1           First subcarrier         First subcarrier         1           index in the PRB         used for CSI-RS         Row 4, (0,-)           for CSI         Ko, k1         1           First OFDM         symbol in the PRB         (13,-)           used for CSI-RS         (0, h)         0           CSI-RS         Interval and offset         0           CSI-RS         0         0           CSI-RS         CSI-IM resource         Aperiodic           configuration         CSI-IM Resource         Aperiodic           CSI-IM Resource         CSI-IM Resource         Aperiodic           CSI-IM Resource         CSI-IM Resource         Aperiodic           CQI-table         CSI-IM Resource         Aperiodic           CQI-table         Table 1         TeportQuantity         Cri-RI-PMI-CQI           timeRestr	g					
symbol in the PRB used for CSI-RS (l0, l)         (9,-)           CSI-RS interval and offset         slot         10/1           CSI-RS interval and offset         slot         10/1           NZP CSI-RS for CSI acquisition         CSI-RS vorts (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 4, (0,-)           First OFDM symbol in the PRB used for CSI-RS (l0, l)         (13,-)           CSI-RS interval and offset         Not configured           aperiodicTriggerin gOffset         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM Resource mapping (kcsHM, lcsHM)         GSI-IM resource Mapping         (4,9)           CSI-IM timeConfig interval and offset         slot         Not configured           ReportConfigType         Aperiodic         CI-IM resource Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI         timeRestrictonForChannelMeasure ments         Not configured           reportQuantity         cri-RI-PMI-CQI         Table 1         16           cgi-FormatIndicator         Wideband         Wideband         1111111						
used for CSI-RS         (9,-7)           CSI-RS         interval and offset         slot         10/1           CSI-RS         interval and offset         slot         10/1           NUMBER of CSI-RS         Aperiodic         Aperiodic           NUMBER of CSI-RS         4         CSI-RS           CDM Type         FD-CDM2         Density (p)         1           First subcarrier         index in the PRB         Row 4, (0,-)         Sint (0, -)           Kor CSI         (ko, k1)         Row 4, (0,-)         Sint (0, -)         Sint (0, -)           First OFDM         symbol in the PRB         (13,-)         Sint (0, -)         Sint (0, -)           CSI-RS         interval and offset         0         O         CSI-RS         Sint (0, -)           CSI-IM         CSI-IM resource         Aperiodic         Aperiodic         CSI-IM Resource         Aperiodic           CSI-IM RE pattern         Patten 0         CSI-IM Resource         Aperiodic         CSI-IM Resource         Aperiodic           CQI-table         Table 1         TreportConfigType         Aperiodic         Aperiodic           CQI-table         Table 1         TreportConfigured         Not configured         Table 1           reportorentificator						
(lo, It)         CSI-RS           interval and offset         slot         10/1           CSI-RS         interval and offset         slot         10/1           Korrest         CSI-RS resource         Aperiodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier         index in the PRB           used for CSI-RS         (to, k1)           acquisition         First OFDM           Symbol in the PRB         (13,-)           Used for CSI-RS         (13,-)           (b, h)         Sinterval and offset           aperiodic Triggerin         0           QOffset         0           CSI-IM         CSI-IM resource           Mapping         (4,9)           (Kcs.Im, IcsI-M)         (4,9)           CSI-IM timeConfig         slot           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure         Not configured           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForInterferenceMeas         Not configured <td></td> <td></td> <td></td> <td>(9,-)</td>				(9,-)		
CSI-RS interval and offset         slot         10/1           CSI-RS resource         Aperiodic           Type         Aperiodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (ko, k1)         Row 4, (0,-)           First OFDM symbol in the PRB used for CSI-RS (lo, l1)         (13,-)           CSI-IM configuration         CSI-IN aperiodicTriggerin gOffset         Not configured           CSI-IM configuration         CSI-IM Resource Type         Aperiodic           CSI-IM Resource Mapping (kcSI-IM, Resource Mapping         (4,9)           CSI-IM Resource mapping         Slot         Not configured           ReportConfigType         Aperiodic Triggerin goffset         Not configured           CSI-IM Resource mapping         Slot         Not configured           CI-IM Resource mapping         Slot         Not configured           ReportConfigType         Aperiodic         Aperiodic           CQI-table         Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI         Not configured           timeRestrictionForInterferenceMeas urements         Not configured           csi-ReportingBand         Ta						
interval and offset         Slot         10/1           Value         CSI-RS resource Type         Aperiodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 4, (0,-)           First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )         (13,-)           CSI-RS interval and offset         Not configured           aperiodicTriggerin qOffset         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM Resource Mapping (kcsHM, IcsIHM)         Patten 0           CSI-IM Resource Mapping         slot         Not configured           ReportConfigType         Aperiodic           CQI-table         Table 1           reportQuantity         cri-RI-PMI-CQI           timeRestrictionForChannelMeasure ments         Not configured           urements         Not configured           sub-band Size         RB         16						
CSI-RS resource Type         Aperiodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (ρ)         1           First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 4, (0,-)           First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )         (13,-)           CSI-RS interval and offset         Not configured           Aperiodic Type         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM resource Mapping         (4,9)         (4,9)           (kcsi-m, lcsi-m)         CSI-IM resource Mapping         Not configured           ReportConfigType         Aperiodic         Table 1           CQI-table         Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI         TimeRestrictionForChannelMeasure ments         Not configured           memts         Not configured         Mideband         Not configured           genitation         RB         16         Csi-RE			slot	10/1		
Type         Aperiodic           Number of CSI- RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS for CSI acquisition         Row 4, (0,-)           Ko, k1)         First OFDM symbol in the PRB used for CSI-RS (lo, l1)         Row 4, (0,-)           CSI-RS interval and offset         Not configured           QOffset         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM configuration         CSI-IM resource Type         Aperiodic           CSI-IM resource configuration         CSI-IM Resource Mapping         Aperiodic           CSI-IM resource mapping         Slot         Not configured           ReportConfigType         Aperiodic         CQI-table           reportQuantity         cri-RI-PMI-CQI         Table 1           reportQuantity         cri-RI-PMI-CQI         Table 1           reportQuantity         cri-RI-PMI-CQI         Not configured           ments         Not configured         Not configured           ments         RB         16         Csi-RB           csi-ReportingBand         1111111         1111111						
NZP CSI-RS for CSI acquisition         Number of CSI- RS ports (X)         4           NZP CSI-RS for CSI acquisition         First subcarrier index in the PRB used for CSI-RS (k_0, k_1)         Row 4, (0,-)           First SUPCATION acquisition         First OFDM symbol in the PRB used for CSI-RS (l_0, l_1)         Row 4, (0,-)           CSI-IM configuration         CSI-RS (l_0, l_1)         0           CSI-IM configuration         CSI-IM resource Type         Aperiodic CSI-IM Resource Mapping (kcsI-ML/CSI-M)         0           CSI-IM RE pattern         Patten 0         CSI-IM Resource Type         Aperiodic           CSI-IM RE pattern         Patten 0         CSI-IM Resource Mapping (kcsI-ML/CSI-M)         (4,9)           CQI-table         CSI-IM Resource Mapping         Slot         Not configured           ReportConfigType         Aperiodic         Table 1           CQI-table         Table 1         Table 1           reportQuantity         cri-RI-PMI-CQI         Table 1           timeRestrictionForChannelMeasure ments         Not configured         Not configured           timeRestrictionForInterferenceMeas urements         Not configured         Not configured           timeRestrictionForInterferenceMeas urements         Not configured         Not configured				Aperiodic		
RS ports (X)         4           CDM Type         FD-CDM2           Density (p)         1           First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )         Row 4, (0,-)           acquisition         First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )         (13,-)           CSI-RS interval and offset         Not configured           aperiodicTriggerin qOffset         0           CSI-IM configuration         CSI-IM resource         Aperiodic           CSI-IM coll-IM Resource Mapping         CSI-IM Resource         Aperiodic           CSI-IM resource         Mapping         (4,9)           (kc_SI-IM, ICSI-IM)         CSI-IM Resource         Aperiodic           CQI-table         Table 1         Table 1           reportQuantity         Cri-RI-PMI-CQI         TimeRestrictionForChannelMeasure ments         Not configured           timeRestrictionForInterferenceMeas urements         Not configured         Not configured           timeRestrictionForInterferenceMeas urements         Not configured         Not configured           timeRestrictionForInterferenceMeas urements         Not configured         Not configured           timeRestrictionForInterferenceMeas urements         RB         16         Si-RB		Number of CSI-				
NZP CSI-RS for CSI acquisitionCDM TypeFD-CDM2NZP CSI-RS for CSI acquisitionFirst subcarrier index in the PRB used for CSI-RS (ko, k1)Row 4, (0,-)First OFDM symbol in the PRB used for CSI-RS (lo, h)(13,-)First OFDM symbol in the PRB used for CSI-RS (lo, h)(13,-)CSI-RS interval and offsetNot configuredaperiodicTriggerin gOffset0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsI-M, ICSI-IM)(4,9)CSI-IM Resource mapping(4,9)CQI-tableTable 1reportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredmineRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandsub-band SizeRBCsi-ReportingBand1111111				4		
NZP CSI-RS for CSI acquisitionDensity (p)1NZP CSI-RS for CSI acquisitionFirst subcarrier index in the PRB used for CSI-RS (ko, k1)Row 4, (0,-)First OFDM symbol in the PRB used for CSI-RS (lo, l1)(13,-)CSI-RS interval and offsetNot configuredaperiodicTriggerin gOffset0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM Resource Mapping (kcsi-iki,lcsi-iki)0CSI-IM timeConfig interval and offsetSlotReportConfigTypeAperiodicCQI-table reportQuantityCSI-IM timeConfig interval and offsetreportQuantityCri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandsub-band SizeRB10SizeRB1111111				ED-CDM2		
NZP CSI-RS for CSI acquisition       First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )       Row 4, (0,-)         First OFDM symbol in the PRB used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )       (13,-)         CSI-RS interval and offset       Not configured         aperiodicTriggerin gOffset       0         CSI-IM configuration       CSI-IM resource Type       Aperiodic         CSI-IM configuration       CSI-IM resource Type       Aperiodic         CSI-IM RE pattern       Patten 0         CSI-IM Resource Mapping (KcSI-IM, ICSI-IM)       Slot       Not configured         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Wideband         sub-band Size       RB       16						
NZP CSI-RS for CSI acquisition       index in the PRB used for CSI-RS (ko, k1)       Row 4, (0,-)         First OFDM symbol in the PRB used for CSI-RS (lo, l1)       (13,-)         CSI-RS interval and offset       Not configured         aperiodicTriggerin gOffset       0         CSI-IM configuration       CSI-IM resource Mapping (kcsi-interval and offset       0         CSI-IM configuration       CSI-IM Resource Mapping (kcsi-interval and offset       0         CSI-IM configuration       CSI-IM Resource Mapping (kcsi-interval and offset       0         CSI-IM Resource Mapping (kcsi-interval and offset       0       0         CSI-IM timeConfig interval and offset       slot       Not configured         ReportConfigType       Aperiodic       0         CQI-table       Table 1       1         reportQuantity       cri-RI-PMI-CQI       0         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband       0				1		
NZP CSI-RS for CSI acquisition used for CSI-RS (ko, k1) First OFDM symbol in the PRB used for CSI-RS (lo, l1) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Mapping (KCSI-IM RE pattern CSI-IM Resource Mapping (KCSI-IM Resource Mapping (KCSI-IM timeConfig interval and offset Slot Not configured ReportConfigType CQI-table ReportConfigType CQI-table reportQuantity timeRestrictionForInterferenceMeas urements timeRestrictionForInterferenceMeas urements Cqi-FormatIndicator Sub-band Size RB 16 csi-ReportingBand CSI-IM RE CSI-IM RE CSI-						
Interval       (ko, k1)         acquisition       First OFDM symbol in the PRB used for CSI-RS (lo, l₁)       (13,-)         CSI-RS       Not configured         interval and offset       0         CSI-IM       CSI-IM resource         configuration       CSI-IM RE pattern         CSI-IM Resource       Aperiodic         CSI-IM Resource       Aperiodic         (kcsI-IM, IcSI-IM)       (4,9)         (kcsI-IM, IcSI-IM)       CSI-IM resource         CSI-IM Resource       Aperiodic         Mapping       (4,9)         (kcsI-IM, IcSI-IM)       CSI-IM resource         CQI-table       Table 1         reportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Wideband         sub-band Size       RB       16				Row 4, (0,-)		
Acquisition       First OFDM symbol in the PRB used for CSI-RS (lo, l1)       (13,-)         CSI-RS interval and offset       Not configured         aperiodicTriggerin gOffset       0         CSI-IM configuration       CSI-IM resource       Aperiodic         CSI-IM RE pattern       Patten 0         CSI-IM Resource Mapping (kcsi-iM, lcsi-iM)       (4,9)         CSI-IM timeConfig interval and offset       slot         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       RB       16	for CSI					
symbol in the PRB used for CSI-RS (lo, l₁)(13,-)CSI-RS interval and offsetNot configuredaperiodicTriggerin gOffset0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsi-IM,lcsi-IM)(4,9)CSI-IM Resource Mapping interval and offsetslotReportConfigTypeAperiodicCQI-tableCSI-IM timeConfig interval and offsetreportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredgoif-FormatIndicatorWidebandpmi-FormatIndicatorRBSub-band SizeRBcsi-ReportingBandRB	acquisition	(K0, K1)				
used for CSI-RS       (13,-)         (lo, l1)       CSI-RS         interval and offset       Not configured         aperiodicTriggerin       0         gOffset       0         CSI-IM       CSI-IM resource         configuration       Type         CSI-IM RE pattern       Patten 0         CSI-IM Resource       (4,9)         (kcsi-iM, Icsi-iM)       CSI-IM Resource         CSI-IM Resource       Aperiodic         Mapping       (4,9)         (kcsi-iM, Icsi-iM)       Slot         CSI-IM timeConfig       slot         reportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure       Not configured         timeRestrictionForInterferenceMeas       Not configured         urements       Not configured         timeRestrictionForInterferenceMeas       Not configured         urements       RB       16         cqi-FormatIndicator       Wideband       1111111						
Lused for CSI-RS       Not configured         (Io, Ir)       CSI-RS         interval and offset       0         aperiodicTriggerin       0         gOffset       0         CSI-IM       CSI-IM resource         ronfiguration       CSI-IM Resource         CSI-IM Resource       Aperiodic         CSI-IM Resource       (4,9)         CSI-IM Resource       (4,9)         CSI-IM timeConfig interval and offset       Not configured         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       RB       16         csi-ReportingBand       1111111				(13,-)		
CSI-RS interval and offsetNot configuredaperiodicTriggerin gOffset0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsi-im,lcsi-im)(4,9)CSI-IM Resource Mapping (kcsi-im,lcsi-im)(4,9)CSI-IM timeConfig interval and offsetslotReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorRBSub-band SizeRBcsi-ReportingBand1111111						
interval and offsetNot configuredaperiodicTriggerin gOffset0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsi-iM,lcsi-iM)(4,9)CSI-IM timeConfig interval and offsetslotReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandSub-band SizeRB16csi-ReportingBand1111111						
Interval and onset       0         aperiodicTriggerin gOffset       0         CSI-IM configuration       CSI-IM resource Type       Aperiodic         CSI-IM RE pattern       Patten 0         CSI-IM Resource Mapping (kcsi-iM,Icsi-iM)       (4,9)         CSI-IM timeConfig interval and offset       slot         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       RB       16         csi-ReportingBand       1111111				Not configured		
gOffset0CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsi-im,lcsi-im)(4,9)CSI-IM timeConfig interval and offsetslotReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorRBSub-band SizeRBCi-ReportingBand1111111				<u> </u>		
CSI-IM configurationCSI-IM resource TypeAperiodicCSI-IM RE patternPatten 0CSI-IM Resource Mapping (kcsi-im,lcsi-im)(4,9)CSI-IM timeConfig interval and offsetslotNot configuredReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorRB16csi-ReportingBand1111111				0		
configuration     Type     Aperiodic       CSI-IM RE pattern     Patten 0       CSI-IM Resource     (4,9)       Mapping     (4,9)       (kcsi-im,lcsi-im)     Slot       CSI-IM timeConfig interval and offset     Not configured       ReportConfigType     Aperiodic       CQI-table     Table 1       reportQuantity     cri-RI-PMI-CQI       timeRestrictionForChannelMeasure ments     Not configured       timeRestrictionForInterferenceMeas urements     Not configured       cqi-FormatIndicator     Wideband       pmi-FormatIndicator     Wideband       Sub-band Size     RB     16       csi-ReportingBand     1111111						
configuration       Type       Patten 0         CSI-IM RE pattern       Patten 0         CSI-IM Resource       (4,9)         Mapping       (4,9)         (kcsi-iM,lcsi-iM)       Not configured         CSI-IM timeConfig interval and offset       slot         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Wideband         Sub-band Size       RB       16         csi-ReportingBand       1111111				Aperiodic		
CSI-IM Resource Mapping (kcsi-iM,lcsi-iM)       (4,9)         CSI-IM timeConfig interval and offset       slot       Not configured         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Wideband         Sub-band Size       RB       16         csi-ReportingBand       1111111	configuration					
Mapping (kcsi-iM,lcsi-iM)       (4,9)         CSI-IM timeConfig interval and offset       slot       Not configured         ReportConfigType       Aperiodic         CQI-table       Table 1         reportQuantity       cri-RI-PMI-CQI         timeRestrictionForChannelMeasure ments       Not configured         timeRestrictionForInterferenceMeas urements       Not configured         cqi-FormatIndicator       Wideband         pmi-FormatIndicator       Wideband         Sub-band Size       RB       16         csi-ReportingBand       1111111				Patten U		
(kcsi-iM,lcsi-iM)Not configuredCSI-IM timeConfig interval and offsetslotNot configuredReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB16csi-ReportingBand1111111				(4.5)		
CSI-IM timeConfig interval and offsetslotNot configuredReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB16csi-ReportingBand1111111				(4,9)		
interval and offsetslotNot configuredReportConfigTypeAperiodicCQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB16csi-ReportingBand1111111						
ReportConfigType     Aperiodic       CQI-table     Table 1       reportQuantity     cri-RI-PMI-CQI       timeRestrictionForChannelMeasure ments     Not configured       timeRestrictionForInterferenceMeas urements     Not configured       cqi-FormatIndicator     Wideband       pmi-FormatIndicator     Wideband       Sub-band Size     RB     16       csi-ReportingBand     1111111			slot	Not configured		
CQI-tableTable 1reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB16csi-ReportingBand1111111	<b>D 10 -</b>			-		
reportQuantitycri-RI-PMI-CQItimeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB16csi-ReportingBand1111111		pe				
timeRestrictionForChannelMeasure mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB16csi-ReportingBand1111111						
mentsNot configuredtimeRestrictionForInterferenceMeas urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRB16csi-ReportingBand1111111				cri-RI-PMI-CQI		
Imens     Imens       timeRestrictionForInterferenceMeas     Not configured       urements     Wideband       pmi-FormatIndicator     Wideband       Sub-band Size     RB     16       csi-ReportingBand     1111111				Not configured		
urementsNot configuredcqi-FormatIndicatorWidebandpmi-FormatIndicatorWidebandSub-band SizeRBCsi-ReportingBand1111111				-		
cqi-FormatIndicator     Wideband       pmi-FormatIndicator     Wideband       Sub-band Size     RB     16       csi-ReportingBand     1111111				Not configured		
pmi-FormatIndicatorWidebandSub-band SizeRB16csi-ReportingBand1111111		atar		-		
Sub-band SizeRB16csi-ReportingBand1111111						
csi-ReportingBand 1111111						
			RB	-		
CSI-Report interval and offset slot Not configured						
	CSI-Report inte	rval and offset	slot	Not configured		

# Table 6.3.3.2.1.3-1: Test parameters (single layer)

CSI request       1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0         reportTriggerSize       1         CSI-AperiodicTriggerStateList       One State with one Associated Report Configuration Associated Report         Codebook configuration       Codebook Type       typel-SinglePanel         Codebook configuration       Codebook Mode       1         (CodebookConfig- N1, CodebookConfig- 01, CodebookCon	Aperiodic	Report Slot	Offset		8
reportTriggerSize         1           CSI-AperiodicTriggerStateList         One State with one Associated Report Configuration Associated Report           Codebook         Codebook Type         typel-SinglePanel           Codebook         CodebookConfig- N1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookSubset         11111111           Restriction         0000001           Physical channel for CSI report         PUSCH           CQI/RI/PMI delay         ms           PDSCH & PDSCH DMRS         Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity           Note 1:         For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).           Note 2:         If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].	CSI request				
CSI-AperiodicTriggerStateList       One State with one Associated Report Configuration Associated Report Configuration Configuration Configuration         Codebook configuration       Codebook Type       typel-SinglePanel         Codebook configuration       CodebookConfiguration       1         (CodebookConfiguration       (CodebookConfiguration)       (2,1)         (CodebookConfiguration)       (2,1)       (2,1)         (CodebookConfiguration)       (2,1)       (2,1)         (CodebookConfiguration)       (4,1)       (2,1)         (CodebookSubset       11111111       Restriction         Restriction       00000001       Physical channel for CSI report       PUSCH         CQI/RI/PMI delay       ms       5.5         Maximum number of HARQ       4         transmission       4       Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable in, iz combination, and with Wideband granularity         Note 1:       For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).         Note 2:       If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].	reportTria	perSize			
Codebook configuration         Codebook Mode         1           Codebook Mode         1           (CodebookConfig- N1, CodebookConfig- O1, CodebookConfig- O1, CodebookCon         (2,1)           (CodebookSubset Restriction         (4,1)           RI Restriction         00000001           Physical channel for CSI report         PUSCH           CQI/RI/PMI delay         ms           Maximum number of HARQ         4           transmission         4           Measurement channel         R.PDSCH.2-8.1 TDD           PDSCH & PDSCH DMRS         Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination, and with Wideband granularity           Note 1:         For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).           Note 2:         If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].				Report Configuration Associated Report Configuration contains pointers	
configuration         Codebook Mode         1           (CodebookConfig- N1,CodebookConfig- 01,CodebookConfig- 01,CodebookCon         (2,1)           (CodebookSubset Restriction         (4,1)           Restriction         00000001           Physical channel for CSI report         PUSCH           CQU/RI/PMI delay         ms           Maximum number of HARQ         4           transmission         Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity           Note 1:         For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).           Note 2:         If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].	Codebook	Code	ebook Type		
N1,CodebookConf       (2,1)         ig-N2)       (CodebookConfig- O1,CodebookCon       (4,1)         O1,CodebookSubset Restriction       11111111         RI Restriction       00000001         Physical channel for CSI report       PUSCH         CQI/RI/PMI delay       ms         Maximum number of HARQ       4         transmission       4         Measurement channel       R.PDSCH.2-8.1 TDD         PDSCH & PDSCH DMRS       Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable in, i2 combination, and with Wideband granularity         Note 1:       For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).         Note 2:       If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].	configurati				1
O1,CodebookCon fig-O2)         (4,1)           CodebookSubset Restriction         11111111           RI Restriction         00000001           Physical channel for CSI report         PUSCH           CQI/RI/PMI delay         ms         5.5           Maximum number of HARQ transmission         4           Measurement channel         R.PDSCH.2-8.1 TDD           PDSCH & PDSCH DMRS Precoding configuration for random Precoding         Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity           Note 1:         For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).           Note 2:         If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].		N1,C	CodebookConf		(2,1)
Restriction         11111111           RI Restriction         00000001           Physical channel for CSI report         PUSCH           CQI/RI/PMI delay         ms         5.5           Maximum number of HARQ         4           transmission         4           Measurement channel         R.PDSCH.2-8.1 TDD           PDSCH & PDSCH DMRS         Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable in, i2 combination, and with Wideband granularity           Note 1:         For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).           Note 2:         If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].		Ò1,C fig-O	CodebookCon		(4,1)
Physical channel for CSI report       PUSCH         CQI/RI/PMI delay       ms       5.5         Maximum number of HARQ       4         transmission       4         Measurement channel       R.PDSCH.2-8.1 TDD         PDSCH & PDSCH DMRS       Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity         Note 1:       For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).         Note 2:       If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].					1111111
CQI/RI/PMI delay       ms       5.5         Maximum number of HARQ       4         transmission       4         Measurement channel       R.PDSCH.2-8.1 TDD         PDSCH & PDSCH DMRS       Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity         Note 1:       For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).         Note 2:       If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].		RI R	estriction		0000001
Maximum number of HARQ transmission       4         Measurement channel       R.PDSCH.2-8.1 TDD         PDSCH & PDSCH DMRS Precoding configuration for random Precoding       Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity         Note 1:       For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).         Note 2:       If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].	Physical channel for CSI report			PUSCH	
transmission       4         Measurement channel       R.PDSCH.2-8.1 TDD         PDSCH & PDSCH DMRS       Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity         Note 1:       For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).         Note 2:       If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].			ms	5.5	
PDSCH & PDSCH DMRS       Single Panel Type I, Random         Precoding configuration for random       precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with         Wideband granularity       Note 1: For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).         Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].				4	
PDSCH & PDSCH DMRS       precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity         Note 1:       For random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity).         Note 2:       If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].				R.PDSCH.2-8.1 TDD	
<ul> <li>slot (0.5 ms granularity).</li> <li>Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].</li> </ul>	Precoding configuration for random				precoder selection updated per slot, with equal probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination, and with Wideband granularity
Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].	Note 1:			ction, the p	recoder shall be updated in each
specified in Annex B.2.3.2.3	Note 2: Note 3:	Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-4)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+4)].			

Table 6.3.3.2.1.3-2: Minimum requirement

Parameter	Test 1
γ	1.3

# 6.3.3.2.1.4 Test description

6.3.3.2.1.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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 6.1.2-1 and Table 6.3.3.2.1.3-1 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.
- Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On for SA 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 content are defined in clause 6.3.3.2.1.4.3.

# 6.3.3.2.1.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.1.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

 $SNR_{follow1, follow2}$  according to Annex G.3.2.

3. Set SNR to  $SNR_{follow1, follow2}$ . The SS shall transmit PDSCH with randomly selected precoding matrix from

codebook (Table 5.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with exercise to CSI represent triggered. Macrony,  $f_{\rm exercise}$  to exercise to Armony C 2.2

aperiodic CSI request triggered. Measure  $t_{md1, md2}$  according to Annex G.3.3.

4. Calculate  $\gamma = \frac{I_{ue, follow1, follow2}}{I_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.1.1.5-1, then the test is pass.

Otherwise, the test is fail.

### 6.3.3.2.1.4.3 Message contents

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

6.3.3.2.1.4.3.1 Message exceptions for SA

### Table 6.3.3.2.1.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41				
Information Element Value/remark Comment Conditi				
CSI-ResourceConfig ::= SEQUENCE {				
resourceType	Aperiodic			
}				

Derivation Path: TS 38.508-1 [6], clause5.4.2, Table5.4.2.0-15						
Information Element	Value/remark	Comment	Condition			
CSI-RS-ResourceMapping ::= SEQUENCE {						
frequencyDomainAllocation CHOICE {						
Row4	001					
}						
nrofPorts	p4					
firstOFDMSymbolInTimeDomain	13					
}						

# Table 6.3.3.2.1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

# Table 6.3.3.2.1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
Row5	000100			
}				
nrofPorts	p4			
firstOFDMSymbolInTimeDomain	9			
}				

# Table 6.3.3.2.1.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34			
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			

# Table 6.3.3.2.1.4.3.1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
moreThanTwo SEQUENCE {				
n1-n2 CHOICE {				
two-one-TypeI-SinglePaneI-Restriction	1111111			
}				
}				
}				
typeI-SinglePanel-ri-Restriction	0000001			

# Table 6.3.3.2.1.4.3.1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39				
Information Element	Value/remark	Comment	Condition	
reportConfigType CHOICE {				
aperiodic SEQUENCE {				
reportSlotOffsetList	0			
}				
reportFreqConfiguration SEQUENCE {				
csi-ReportingBand CHOICE {				
subbands7	[111111]			
}				
}				
subbandSize	value2			
}				

### 6.3.3.2.1.4.3.2 Message exception for NSA

Same as in 6.3.3.2.1.4.3.1.

## 6.3.3.2.1.5 Test requirement

### Table 6.3.3.2.1.5-1: Test requirement

Parameter	Test 1
γ	1.29

# 6.3.3.2.2 4Rx TDD FR1 Single PMI with 8TX TypeI-SinglePanel codebook for both SA and NSA

# 6.3.3.2.2.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

### 6.3.3.2.2.2 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.

## 6.3.3.2.2.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.2.3-2.

	ameter	Unit	Test 1
Bandwidth	ameter	MHz	40
Subcarrier spaci	na	kHz	30
Duplex Mode	ng	KI IZ	TDD
			FR1.30-1 as specified in Annex
TDD DL-UL conf	igurations		A
Propagation cha	nnel		TDLA30-5
Antenna configu	ration		High XP 8 x 4
, and a conliga			(N1,N2) = (4,1)
Beamforming Mo			As specified in Section Annex B.4.1
	CSI-RS resource		Periodic
	Type Number of CSI-		
	RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier		
ZP CSI-RS	index in the PRB		
configuration	used for CSI-RS		Row 5, (4,-)
g	(k <sub>0</sub> , k <sub>1</sub> )		
	First OFDM		
	symbol in the PRB		
	used for CSI-RS		(9,-)
	(l <sub>0</sub> , l <sub>1</sub> )		
	CSI-RS	slot	10/1
	interval and offset	SIOU	10/1
	CSI-RS resource		Aperiodic
	Туре		Apellodic
	Number of CSI-		8
	RS ports (X)		
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier		
NZP CSI-RS	index in the PRB		Row 8, (4,6)
for CSI	used for CSI-RS		
acquisition	(k <sub>0</sub> , k <sub>1</sub> )		
	First OFDM		
	symbol in the PRB used for CSI-RS		(5,-)
-	$(I_0, I_1)$		
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin		
	gOffset		0
CSI-IM	CSI-IM resource		
configuration	Туре		Aperiodic
J	CSI-IM RE pattern		Patten 0
	CSI-IM Resource		
	Mapping		(4,9)
	(kcsi-iм,lcsi-iм)		(
	CSI-IM timeConfig	- I - 1	Nat
	interval and offset	slot	Not configured
ReportConfigTyp	)e		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFe	orChannnelMeasur		Not configured
ements			
timeRestrictionFe	orInterferenceMeas		Not configured
urements			-
cqi-FormatIndicator			Wideband
pmi-FormatIndica	ator		Wideband
Sub-band Size		RB	16
	csi-ReportingBand		
		slot	1111111 Not configured

# Table 6.3.3.2.2.3-1: Test parameters (dual-layer)

Aperiodic R	eport Slo	t Offset		8
CSI reques	CSI request			1 in slots i, where mod(i, 10) =
	•			1, otherwise it is equal to 0
reportTrigg	erSize			1
				One State with one Associated
		o		Report Configuration
CSI-Aperio	dic I rigger	StateList		Associated Report
				Configuration contains pointers
Codebook		Johook Turo		to NZP CSI-RS and CSI-IM
configuratio		debook Type		typel-SinglePanel
conliguratio		debook Mode		1
		debookConfig- CodebookConf		(4.4)
				(4,1)
	ig-N	debookConfig-		
		CodebookCon		(4,1)
	fig-0			(4,1)
		debookSubset		
		striction		0x FFFF
		Restriction		0000010
Physical ch	annel for	CSI report		PUSCH
CQI/RI/PM		•	ms	6.5
Maximum r	umber of	HARQ		4
transmissio	n			4
Measureme	ent channe	el		R.PDSCH.2-8.2 TDD
				Single Panel Type I, Random
PDSCH & F	ם אכאמ	MRS		precoder selection updated per
		ion for random		slot, with equal probability of
Precoding	Johngulat			each applicable i1, i2
Treeeding				combination, and with
-				Wideband granularity
			ction, the p	recoder shall be updated in each
		is granularity).	9 - 1 - 1	
	Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#[(n-6)],			
	this reported PMI cannot be applied at the eNB downlink before slot#[(n+6)].			
				direction shall be used as
		n Annex B.2.3.2.		

Table 6.3.3.2.2.3-2: Minimum requirement

Parameter	Test 1
γ	1.5

# 6.3.3.2.2.4 Test description

6.3.3.2.2.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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 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 6.2.1-2 and Table 6.3.3.2.2.3-1 and as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, Connected without release *On* for SA 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 content are defined in clause 6.3.3.2.2.4.3.

# 6.3.3.2.2.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.2.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1,follow2</sub> according to Annex G.3.2.

- 3. Set SNR to SNR<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure t<sub>md1, md2</sub> according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{I_{ue, follow1, follow2}}{I_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.2.2.5-1, then the test is pass.

Otherwise, the test is fail.

### 6.3.3.2.2.4.3 Message contents

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

6.3.3.2.2.4.3.1 Message contents for SA

## Table 6.3.3.2.2.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element	Value/remark	Comment	Condition
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	Aperiodic		
}			

Derivation Path: TS 38.508-1 [6], clause5.4.2, Table5.4.2.0-15				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	001100			
}				
nrofPorts	p8			
firstOFDMSymbolInTimeDomain	5			
cdm-Type	cdm4-FD2-TD2			
}				

# Table 6.3.3.2.2.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

# Table 6.3.3.2.2.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

# Table 6.3.3.2.2.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34			
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			

# Table 6.3.3.2.2.4.3.1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
moreThanTwo SEQUENCE {				
n1-n2 CHOICE {				
four-one-TypeI-SinglePaneI-Restriction	FFFF			
}				
}				
}				
typeI-SinglePaneI-ri-Restriction	0000010			

# Table 6.3.3.2.2.4.3.1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39				
Information Element	Value/remark	Comment	Condition	
reportConfigType CHOICE {				
aperiodic SEQUENCE {				
reportSlotOffsetList	8			
}				
reportFreqConfiguration SEQUENCE {				
csi-ReportingBand CHOICE {				
subbands7	1111111			
}				
}				
}				

### 6.3.3.2.2.4.3.2 Message contents for NSA

Same as in clause 6.3.3.2.2.4.3.1.

### 6.3.3.2.2.5 Test requirement

### Table 6.3.3.2.2.5-1: Test requirement

Parameter	Test 1
γ	1.49

# 6.3.3.2.3 4Rx TDD FR1 Multiple PMI with 16Tx Type1 - SinglePanel codebook for both SA and NSA

# 6.3.3.2.3.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

### 6.3.3.2.3.2 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.

### 6.3.3.2.3.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.3.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.3.3-2.

Pa	rameter	Unit	Test 1
Bandwidth	ametei	MHz	40
Subcarrier space	ing	kHz	30
Duplex Mode	5		TDD
TDD DL-UL cor	nfigurations		FR1.30-1 as specified in Annex A
Propagation cha	annel		TDLC300-5
Antenna configu			High XP 16 x 4 (N1,N2) = (4,2)
Beamforming M	lodel		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		4
	CDM Type		FD-CDM2
	Density (p)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (lo, lı)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports ( <i>X</i> )		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS for CSI	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )		Row 12, (2, 4, 6, 8)
acquisition	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		(5, -)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin gOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)
	CSI-IM, ICSI-IM) CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigTy			Aperiodic
CQI-table	·		Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionF ements	ForChannnelMeasur		Not configured
timeRestrictionF urements	ForInterferenceMeas		Not configured
cqi-FormatIndic	ator		Wideband
pmi-FormatIndio			Subband
Sub-band Size		RB	16
csi-ReportingBand			1111111

# Table 6.3.3.2.3.3-1: Test parameters (dual-layer)

CSI-Report in	terval and offset	slot	Not configured
	ort Slot Offset		8
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
reportTrigger	Size		1
CSI-Aperiodic	TriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig- N1,CodebookConf ig-N2)		(4,2)
configuration	(CodebookConfig- O1,CodebookCon fig-O2)		(4,4)
	CodebookSubset Restriction		0x FFFF
	RI Restriction		00000010
Physical chan	nel for CSI report		PUSCH
CQI/RI/PMI d	elay	ms	6.5
Maximum nur	nber of HARQ		4
transmission			4
Measurement	channel		R.PDSCH.2-8.3 TDD
Note 1: When Throughput is measured using random precoder selection, t precoder shall be updated in each slot (0.5 ms granularity) with eq probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination.		ot (0.5 ms granularity) with equal	
Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before slot#(n+6).			k reporting instance at slot#n nk slot not later than slot#(n-6),
Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.			direction shall be used as

### Table 6.3.3.2.3.3-2: Minimum requirement

Parameter	Test 1
γ	3.0

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.3.2.3.

### 6.3.3.2.3.4 Test description

### 6.3.3.2.3.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.2.1-2 and Table 6.3.3.2.3.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.3.2.3.4.3.

### 6.3.3.2.3.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.3.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

- 3. Set SNR to SNR<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure t<sub>rnd1</sub> md<sub>2</sub> according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.2.3.5-1, then the test is pass.

Otherwise, the test is fail.

### 6.3.3.2.3.4.3 Message contents

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

6.3.3.2.3.4.3.1 Message contents for SA

### Table 6.3.3.2.3.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element	Value/remark	Comment	Condition
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	Aperiodic		
}			

Derivation Path: TS 38.508-1 [6], clause5.4.2, Table	5.4.2.0-15		
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	011110		
}			
nrofPorts	p16		
firstOFDMSymbolInTimeDomain	5		
cdm-Type	cdm4-FD2-TD2		
}			

# Table 6.3.3.2.3.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

# Table 6.3.3.2.3.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-21			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

# Table 6.3.3.2.3.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34			
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			

# Table 6.3.3.2.3.4.3.1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
moreThanTwo SEQUENCE {				
n1-n2 CHOICE {				
four-two-TypeI-SinglePaneI-Restriction	FFFF FFFF FFFF FFFF			
}				
}				
}				
typeI-SinglePaneI-ri-Restriction	0000010			

# Table 6.3.3.2.3.4.3.1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39				
Information Element	Value/remark	Comment	Condition	
reportConfigType CHOICE {				
aperiodic SEQUENCE {				
reportSlotOffsetList	8			
}				
reportFreqConfiguration SEQUENCE {				
pmi-FormatIndicator	subbandPMI			
csi-ReportingBand CHOICE {				
subbands7	1111111			
}				
}				
}				

### 6.3.3.2.3.4.3.2 Message contents for NSA

Same as in clause 6.3.3.2.3.4.3.1.

# 6.3.3.2.3.5 Test requirement

## Table 6.3.3.2.3.5-1: Test requirement

Parameter	Test 1
γ	2.99

# 6.3.3.2.4 4Rx TDD FR1 Single PMI with 32Tx Type1 - SinglePanel codebook for both SA and NSA

### 6.3.3.2.4.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

### 6.3.3.2.4.2 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.

### 6.3.3.2.4.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.4.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.4.3-2.

Pa	rameter	Unit	Test 1
Bandwidth	lameter	MHz	40
	Subcarrier spacing		30
Duplex Mode			TDD
			FR1.30-1 as specified in Annex
TDD DL-UL coi	nfigurations		A
Propagation ch	annel		TDLA30-5
			High XP 32 x 4
Antenna config	uration		(N1,N2) = (4,4)
Beamforming M	lodel		As specified in Annex B.4.1
	CSI-RS resource		Aperiodic
	Туре		Apenodic
	Number of CSI-		4
	RS ports (X)		
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier		
ZP CSI-RS	index in the PRB used for CSI-RS		Row 5, (4,-)
configuration	$(k_0, k_1)$		
configuration	First OFDM		
	symbol in the PRB		
	used for CSI-RS		(9,-)
	(l <sub>0</sub> , l <sub>1</sub> )		
	CSI-RS	-1-4	Not a suffering d
	interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
	CSI-RS resource		•
	Туре		Aperiodic
	Number of CSI-		32
	RS ports (X)		-
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier index in the PRB		
NZP CSI-RS	used for CSI-RS		Row 17, (2, 4, 6, 8)
for CSI	$(k_0, k_1, k_2, k_3)$		
acquisition	First OFDM		
	symbol in the PRB		
	used for CSI-RS		(5, 12)
	$(I_0, I_1)$		
	CSI-RS	slot	Not configured
	interval and offset	SIOL	Not conliguied
	aperiodicTriggerin		0
	gOffset		
	CSI-IM resource		Aperiodic
	Туре		
001.04	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource		(4.2)
	Mapping		(4,9)
	(kcsi-ім,lcsi-ім) CSI-IM timeConfig		
	interval and offset	slot	Not configured
	interval and onset		

Table 6.3.3.2.4.3-1: Test	parameters (dual-layer)

DenertConfigT			Americalia	
	ReportConfigType		Aperiodic	
CQI-table			Table 1	
reportQuantity			cri-RI-PMI-CQI	
	timeRestrictionForChannnelMeasur		Not configured	
ements			-	
	ForInterferenceMeas		Not configured	
urements	-t		-	
cqi-FormatIndic			Wideband	
pmi-FormatIndi	cator		Wideband	
Sub-band Size		RB	16	
csi-ReportingBa			1111111	
CSI-Report inte		slot	Not configured	
Aperiodic Repo	rt Slot Offset		8 4 in alata i whan na al(i 40)	
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0	
reportTriggerSiz	ze		1	
			One State with one Associated	
			Report Configuration	
CSI-AperiodicT	riggerStateList		Associated Report	
			Configuration contains pointers	
			to NZP CSI-RS and CSI-IM	
	Codebook Type		typel-SinglePanel	
	Codebook Mode		1	
	(CodebookConfig-			
	N1,CodebookConf		(4,4)	
	ig-N2)			
Cadabaali	(CodebookConfig-			
Codebook	O1,CodebookCon		(4,4)	
configuration	fig-O2) CodebookSubset		0.4	
	Restriction		0x FFFF FFFF FFFF FFFF	
	Restriction		FFFF FFFF FFFF FFFF	
			FFFF FFFF FFFF FFFF	
			FFFF FFFF FFFF FFFF	
	RI Restriction		0000010	
Physical channe	el for CSI report		PUSCH	
CQI/RI/PMI dela		ms	6.5	
Maximum numb		1110		
transmission			4	
Measurement c	hannel		R.PDSCH.2-8.3 TDD	
			Single Panel Type I, Random	
			precoder selection updated per	
PDSCH & PDS			slot, with equal probability of	
	guration for random		each applicable i1, i2	
Precoding			combination, and with	
Wideband granularit				
Note 1: When Throughput is measured using random precoder selection, the				
precoder shall be updated in each slot (0.5 ms granularity) with equal				
probability of each applicable i1, i2 combination.				
Note 2: If the UE reports in an available uplink reporting instance at slot#n				
based on PMI estimation at a downlink slot not later than slot#(n-6),				
		e applied a	at the gNB downlink before	
	(n+6).			
			direction shall be used as	
specified in Annex B.2.3.2.3.				

Parameter	Test 1
γ	7.0

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.3.2.4.

# 6.3.3.2.4.4 Test description

### 6.3.3.2.4.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 4.3.1.1.

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.3.1.7.10 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 6.2.1-2 and Table 6.3.3.2.4.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.3.2.4.4.3.

# 6.3.3.2.4.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.4.3-1 as appropriate.
- The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Establish t<sub>ue,follow1,follow2</sub> and SNR<sub>follow1,follow2</sub> according to Annex G.3.2.
- 3. Set SNR to  $SNR_{follow1, follow2}$ . The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1.6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure  $t_{rnd1}$  according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.2.4.5-1, then the test is pass.

Otherwise, the test is fail.

# 6.3.3.2.4.4.3 Message contents

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

### 6.3.3.2.4.4.3.1

Message contents for SA

# Table 6.3.3.2.4.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element	Value/remark	Comment	Condition
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	Aperiodic		
}			

# Table 6.3.3.2.4.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause5.4.2, Table 5.4.2.0-15				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	011110			
}				
nrofPorts	p32			
firstOFDMSymbolInTimeDomain	5			
cdm-Type	cdm4-FD2-TD2			
}				

# Table 6.3.3.2.4.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-21				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	000100			
}				
nrofPorts	p4			
firstOFDMSymbolInTimeDomain	9			
}				

### Table 6.3.3.2.4.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34				
Information Element	Value/remark	Comment	Condition	
csi-IM-ResourceElementPattern				
pattern0 SEQUENCE {				
subcarrierLocation-p0	s4			
symbolLocation-p0	9			
}				

# Table 6.3.3.2.4.4.3.1-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
moreThanTwo SEQUENCE {				
n1-n2 CHOICE {				
four-four-TypeI-SinglePaneI-Restriction	FFFF FFFF FFFF FFFF			
	FFFF FFFF FFFF FFFF			
}				
}				
}				
typel-SinglePanel-ri-Restriction	0000010			

# Table 6.3.3.2.4.4.3.1-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39				
Information Element	Value/remark	Comment	Condition	
reportConfigType CHOICE {				
aperiodic SEQUENCE {				
reportSlotOffsetList	8			
}				
reportFreqConfiguration SEQUENCE {				
pmi-FormatIndicator	subbandPMI			
csi-ReportingBand CHOICE {				
subbands7	1111111			
}				
}				
}				

### 6.3.3.2.4.4.3.2 Message contents for NSA

Same as in clause 6.3.3.2.4.4.3.1.

# 6.3.3.2.4.5 Test requirement

## Table 6.3.3.2.4.5-1: Test requirement

Parameter	Test 1
γ	6.99

# 6.3.3.2.5 4Rx TDD FR1 Multiple PMI with 16Tx TypeII codebook for both SA and NSA

# 6.3.3.2.5.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

### 6.3.3.2.5.2 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.

### 6.3.3.2.5.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.5.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.5.3-2.

### Table 6.3.3.2.5.3-1: Test parameters (dual-layer)

Parameter		Unit	Test 1
Bandwidth		MHz	40
Subcarrier spacing		kHz	30
Duplex Mode			TDD
TDD DL-UL configurations			FR1.30-1 as specified in Annex A
Propagation channel			TDLA30-5
Antenna configuration			XP Medium 16 x 4 (N1,N2) = (4,2)
Beamforming Model			As specified in Annex B.4.1
ZP CSI-RS	CSI-RS resource Type		Aperiodic
configuratio n	Number of CSI-RS ports ( <i>X</i> )		4

	1	1	
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier index		
	in the PRB used for		Row 5, (4,-)
	CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		
	First OFDM symbol in		(0.)
	the PRB used for CSI-		(9,-)
	RS (l₀, l₁) CSI-RS		
	interval and offset	slot	Not configured
			1 in slots i, where mod(i, 10) =
	ZP CSI-RS trigger		1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS		16
	ports (X)		10
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier index		
NZP CSI- RS for CSI	in the PRB used for		Row 12, (2, 4, 6, 8)
acquisition	CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> ) First OFDM symbol in		
acquisition	the PRB used for CSI-		(5, -)
	RS (l <sub>0</sub> , l <sub>1</sub> )		(0, )
	CSI-RS		
	interval and offset	slot	Not configured
	aperiodicTriggeringOff		0
	set		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuratio	Mapping		(4,9)
n	(kcsi-im,lcsi-im)		
	CSI-IM timeConfig	slot	Not configured
PoportConfig	interval and offset		-
ReportConfig CQI-table	Туре		Aperiodic Table 1
reportQuantit	V		cri-RI-PMI-CQI
	onForIChannelMeasurem		
ents			Not configured
timeRestrictio	onForInterferenceMeasur		Neteenfigured
ements			Not configured
cqi-FormatInd			Wideband
pmi-FormatIn			Subband
Sub-band Siz		RB	16
csi-Reporting			1111111
	terval and offset	slot	Not configured
Aperioaic Re	port Slot Offset		$\frac{8}{1 \text{ in slots i, where mod(i, 10)}}$
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
reportTrigger	Size		
			One State with one Associated
			Report Configuration
CSI-Aperiodic	cTriggerStateList		Associated Report
	- •		Configuration contains pointers
			to NZP CSI-RS and CSI-IM
	Codebook Type		typell
	L (numberOfBeams)		2
	NPSK		8
Codebook configuratio	(phaseAlphabetSize)		_
	subbandAmplitude		True
	(CodebookConfig-		(4.2)
n	N1,CodebookConfig- N2)		(4,2)
	(CodebookConfig-		
	O1,CodebookConfig-		(4,4)
	01,00000000000000000000000000000000000		( · , · /
	CodebookSubsetRestri		0x 7FF

	ction		FFFF FFFF FFFF FFFF
	RI Restriction (typell- RI-Restriction)		10
Physical	channel for CSI report		PUSCH
CQI/RI/P	MI delay	ms	6.5
Maximum	n number of HARQ		4
transmiss	sion		4
Measurement channel			R.PDSCH.2-8.3 TDD
Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination. The random precoder generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.3.2.3-1.			0.5 ms granularity) with equal pination. The random precoder l' codebook configuration as
Note 2:	e 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before slot#(n+6).		
Note 3:	: Randomization of the dual-cluster beam directions shall be used as specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.		

Parameter	Test 1
γ	1.8

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.2.5.

6.3.3.2.5.4 Test description

6.3.3.2.5.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.3.2.5.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.2.1.4.4.3.

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#### 6.3.3.2.5.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.5.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic

CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

3. Set SNR to  $SNR_{follow1, follow2}$ . The SS shall transmit PDSCH with randomly selected precoding matrix from

codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities, and the random precoder generation shall follow the codebook configuration as specified in Table 6.3.3.2.3.3-1. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure  $t_{md1, md2}$  according to Annex G.3.3.

4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.2.5.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.3.2.5.4.3 Message contents

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

#### 6.3.3.2.5.4.3.1 Message exceptions for SA

#### Table 6.3.3.2.5.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	'011110'B		
}			
nrofPorts	P16		
firstOFDMSymbolInTimeDomain	5		
cdm-Type	cdm4-FD2-TD2		
}			

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14			
Information Element	Value/remark	Comment	Condition
CodebookConfig ::= SEQUENCE {			
codebookType CHOICE {			
type2 SEQUENCE {			
subType CHOICE {			
typeII SEQUENCE {			
n1-n2-codebookSubsetRestriction CHOICE {			
four-two	0x 7FF FFFF FFFF FFFF FFFF		
}			
typeII-RI-Restriction	'10'B		
}			
}			
phaseAlphabetSize	8		
subbandAmplitude	TRUE		
numberOfBeams	2		
}			
}			
}			

#### Table 6.3.3.2.5.4.3.1-2: CodebookConfig

#### Table 6.3.3.2.5.4.3.1-3: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13			
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	5		
}			
reportFreqConfiguration SEQUENCE {			
pmi-FormatIndicator	subbandPMI		
}			
}			

#### 6.3.3.2.5.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.2.5.4.3.1.

#### 6.3.3.2.5.5 Test requirement

#### Table 6.3.3.2.5.5-1: Test requirement

Parameter	Test 1
γ	1.79

# 6.3.3.2.6 4Rx TDD FR1 Multiple PMI with 16Tx Enhanced TypeII codebook for both SA and NSA

#### 6.3.3.2.6.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

#### 6.3.3.2.6.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

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This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

#### 6.3.3.2.6.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.6.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.6.3-2.

	Parameter	Unit	Test 1
Bandwidth		MHz	40
Subcarrier spacing		kHz	30
Duplex Mode			TDD
	configurations		FR1.30-1 as specified in Annex A
Propagation (	channel		TDLA30-5
Antenna conf	iguration		XP Medium 16 x 2 (N1,N2) = (4,2)
Beamforming	Model		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuratio	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 5, (4,-)
n	First OFDM symbol in the PRB used for CSI- RS (I <sub>0</sub> , I <sub>1</sub> )		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports ( <i>X</i> )		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI- RS for CSI	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> , k <sub>2</sub> , k <sub>3</sub> )		Row 12, (2, 4, 6, 8)
acquisition	First OFDM symbol in the PRB used for CSI- RS (I <sub>0</sub> , I <sub>1</sub> )		(5, -)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggeringOff set		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuratio n	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)
	CSI-IM timeConfig interval and offset	slot	Not configured

Table 6.3.3.2.6.3-1: Test parameters (dual-layer)

			A 1 11
ReportConfigType			Aperiodic
CQI-table			Table 1
reportQuantity timeRestrictionForIChannelMeasurem			cri-RI-PMI-CQI
timeRestricti	onForIChannelMeasurem		Not configured
	onForInterferenceMeasur		Not configured
cqi-Formatlr	dicator		Wideband
pmi-Formatl			Not configured
Sub-band Si		RB	8
csi-Reportin			111111
	nterval and offset	slot	Not configured
	eport Slot Offset	0.01	8
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
reportTrigge	rSizo		
reportingge			One State with one Associated
CSI-Aperiod	icTriggerStateList		Report Configuration Associated Report Configuration contains pointers
	1		to NZP CSI-RS and CSI-IM
	Codebook Type		typell-r16
	paramCombination-r16		6 (L =4, p <sub>v</sub> =1/2, β=1/2 )
	R(numberOfPMISubba ndsPerCQISubband- r16)		1
Codebook configuratio	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)
n	(CodebookConfig- O1,CodebookConfig- O2)		(4,4)
	CodebookSubsetRestri ction		0x 7FF FFFF FFFF FFFF FFFF
	RI Restriction (typell-		
	RI-Restriction-r16)		0010
Physical cha	innel for CSI report		PUSCH
CQI/RI/PMI		ms	6.5
	umber of HARQ		
transmission			4
	Measurement channel		R.PDSCH.2-8.3 TDD
Note 1: When Throughput is measure		ed using ra	andom precoder selection, the
			0.5 ms granularity) with equal bination. The random precoder
	generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.3.2.3-1.		
Note 2: If the UE reports in an available uplink reporting instance at slot#n bas			eporting instance at slot#n based
on PMI estimation at a downlink slot not later than slot#(n-6), this			
reported PMI cannot be applied at the gNB downlink before slot#(n+6			
Note 3: Randomization of the dual-cluster beam directions shall be used as specified in Annex B.2.3.2.3A. The value of relative power ratio (p) sha			n directions shall be used as
	e fixed as 1 during the test.		

Parameter	Test 1
γ	2.2

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.3.2.6.

#### 6.3.3.2.6.4 Test description

#### 6.3.3.2.6.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 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 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.3.1.7.10 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 6.1.2-1 and Table 6.3.3.2.6.3-1 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, Connected without release *On* for SA 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 content are defined in clause 6.3.3.2.6.4.3.

#### 6.3.3.2.6.4.2 Test procedure

- 1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.6.3-1 as appropriate.
- 2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI

request triggered. No transport block is sent in parallel to the CQI feedback. Establish  $t_{ue, follow1, follow2}$  and

SNR<sub>follow1, follow2</sub> according to Annex G.3.2.

- 3. Set SNR to SNR<sub>follow1,follow2</sub>. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure t<sub>md1, md2</sub> according to Annex G.3.3.
- 4. Calculate  $\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$ . If the ratio  $\geq \gamma$  which is specified in table 6.3.3.2.6.5-1, then the test is pass.

Otherwise, the test is fail.

#### 6.3.3.2.6.4.3 Message contents

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

#### 6.3.3.2.6.4.3.1

Message exceptions for SA

#### Table 6.3.3.2.6.4.3.1-1: CSI-ReportConfig

Value/remark	Comment	Condition
Not present		
Not present		
Value1		
CodebookConfig-r16		
	Not present Not present Value1	Not present       Not present       Value1

#### Table 6.3.3.2.6.4.3.1-2: CodebookConfig-r16 (Table 6.3.3.2.6.4.3.1-1)

Derivation Path: TS 38.331 [6], clause 6.3.2			
Information Element	Value/remark	Comment	Condition
CodebookConfig-r16 ::= SEQUENCE {			
codebookType CHOICE {			
type2 SEQUENCE {			
subType CHOICE {			
typeII-r16 SEQUENCE {			
N1-n2-codebookSubsetRestriction-r16			
Four-two	0x 7FF FFFF FFFF FFFF FFFF		
}			
typeII-RI-Restriction-r16	0010		
}			
}			
numberOfPMI-SubbandsPerCQI-Subband-r16	1		
paramCombinatin-r16	6	(L =4, p <sub>v</sub> =1/2, β=1/2 )	
}			
}			
}			

#### 6.3.3.2.6.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.2.6.4.3.1.

#### 6.3.3.2.6.5 Test requirement

#### Table 6.3.3.2.6.5-1: Test requirement

Parameter	Test 1
γ	2.19

# 6.4 Reporting of Rank Indicator (RI)

- 6.4.1 1RX requirements (Void)
- 6.4.2 2RX requirements
- 6.4.2.1 FDD

#### 6.4.2.1\_1 2Rx FDD FR1 RI reporting for both SA and NSA

#### 6.4.2.1\_1.1 Test Purpose

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

#### 6.4.2.1\_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.

#### 6.4.2.1\_1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.2.1\_1.3-2 is defined as:

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 6.4.2.1\_1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.2.1\_1.3-2.

Parameter		Unit	Test 1	Test 2	Test 3
Bandwidth		MHz	10	10	10
Subcarrier sp	acing	kHz	15	15	15
Duplex Mode			FDD	FDD	FDD
SNR		dB	0	20	20
Propagation of	channel		TDLA30-5	TDLA30-5	TDLA30-5
Antenna conf	iguration		ULA Low 2x2	ULA Low 2x2	ULA High 2x2
Beamforming	Model		As defined in Annex B.4.1	As defined in Annex B.4.1	As defined in Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		4	4	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
ZP CSI-RS	Density (ρ)		1	1	1
configuratio	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> )		Row 5,(4)	Row (5,4)	Row 5,(4)
n	First OFDM symbol in the PRB used for CSI-RS ( $I_0$ )		(9)	(9)	(9)
	CSI-RS periodicity and offset	slot	5/1	5/1	5/1
	CSI-RS resource Type		Periodic	Periodic	Periodic
NZP CSI-	Number of CSI-RS ports (X)		2	2	2
RS for CSI	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
acquisition	Density (ρ)		1	1	1
	First subcarrier index in the		Row 3 (6)	Row 3 (6)	Row 3 (6)

#### Table 6.4.2.1\_1.3-1: RI Test (FDD)

	PRB used for CSI-RS (k <sub>0</sub> )				
	First OFDM symbol in the PRB used for CSI-RS ( $I_0$ )		(13)	(13)	(13)
	NZP CSI-RS-timeConfig periodicity and offset	slot	5/1	5/1	5/1
	CSI-IM resource Type		Periodic	Periodic	Periodic
	CSI-IM RE pattern		Pattern 0	Pattern 0	Pattern 0
CSI-IM configuratio	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)	(4,9)	(4,9)
n	CSI-IM timeConfig periodicity and offset	slot	5/1	5/1	5/1
ReportConfig			Periodic	Periodic	Periodic
CQI-table	71		Table 2	Table 2	Table 2
reportQuantity	1		cri-RI-PMI-CQI	cri-RI-PMI- CQI	cri-RI-PMI- CQI
timeRestriction	nForChannelMeasurements		not configured	not configured	not configured
timeRestrictio	nForInterferenceMeasurements		not configured	not configured	not configured
cqi-FormatInd	icator		Wideband	Wideband	Wideband
pmi-FormatInd	dicator		Wideband	Wideband	Wideband
Sub-band Size	e	RB	8	8	8
csi-Reporting			1111111	1111111	1111111
CSI-Report pe	eriodicity and offset	slot	5/0	5/0	5/0
	Codebook Type		typel- SinglePanel	typel- SinglePanel	typel- SinglePanel
	Codebook Mode		1	1	1
Codebook	(CodebookConfig- N1,CodebookConfig-N2)		N/A	N/A	N/A
configuration	CodebookSubsetRestriction		010000 for fixed rank 2, 010011 for following rank	000011 for fixed rank 1, 010011 for following rank	000011 for fixed rank 1, 010011 for following rank
	RI Restriction		N/Â	N/Ā	N/Ā
	nel for CSI report		PUCCH	PUCCH	PUCCH
CQI/RI/PMI de	elay	ms	8	8	8
Maximum nun	nber of HARQ transmission		1	1	1
RI Configurati			Fixed RI = 2 and follow RI	Fixed RI = 1 and follow RI	Fixed RI = 1 and follow RI
	asurements channels are specified sed for Rank 2 case.	d in Table			

Table 6.4.2.1	_1.3-2:	Minimum	requirement	(FDD)
---------------	---------	---------	-------------	-------

	Test 1	Test 2	Test 3
<i>)</i> /1	N/A	1.05	0.9
<i>j</i> /2	1.0	N/A	N/A

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.2.1.

6.4.2.1\_1.4 Test Description

#### 6.4.2.1\_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 of 38.521-1.

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

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

Frequencies to be tested: Mid Range as defined in TS 38.508 [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 6.1.2-1 and Table 6.4.2.1\_1.3-1 as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, *Connected without release On* and Test Mode ON for SA or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On* and Test Mode ON for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.4.2.1\_1.4.3.

#### 6.4.2.1\_1.4.2 Test procedure

- 1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.2.1\_1.3-1 as appropriate.
- The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.2.1\_1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure the t<sub>fix</sub> according to Annex G.3. 3.
- 3. Propagation conditions are set according to Annex B.2.
- 4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.2.1\_1.3-1.
- 5. The UE shall transmit RRC Connection Reconfiguration Complete message.
- 6. Propagation conditions are set according to Table 6.4.2.1\_1.3-1.
- The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure t<sub>reported</sub> according to Annex G.3.3.

If the ratio  $(t_{reported} / t_{fix})$  satisfies the requirement in Table 6.4.2.1\_1.5-1, then pass the UE for this test and go to step 8. Otherwise, declare a FAIL verdict.

- 8. If all tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the Table 6. 4.2. 1\_1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.
- 6.4.2.1\_1.4.3 Message Contents
- 6.4.2.1\_1.4.3.1 Message exceptions for SA

#### Table 6.4.2.1\_1.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41				
Information Element	Value/remark	Comment	Condition	
CSI-ResourceConfig ::= SEQUENCE {				
resourceType	periodic			
}				

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	001000	row3, k0=6		
}				
nrofPorts	p2			
firstOFDMSymbolInTimeDomain	13			
}				

#### Table 6.4.2.1\_1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

#### Table 6.4.2.1\_1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45					
Information Element	Value/remark	Comment	Condition		
CSI-RS-ResourceMapping ::= SEQUENCE {					
frequencyDomainAllocation CHOICE {					
other	000100	row5, k0=4			
}					
nrofPorts	p4				
firstOFDMSymbolInTimeDomain	9				
}					

#### Table 6.4.2.1\_1.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34					
Information Element	Value/remark	Comment	Condition		
csi-IM-ResourceElementPattern					
pattern0 SEQUENCE {					
subcarrierLocation-p0	s4				
symbolLocation-p0	9				
}					
periodicityAndOffset	CSI-				
	ResourcePeriodicityAnd				
	Offset				

#### Table 6.4.2.1\_1.4.3.1-5: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-43					
Information Element	Value/remark	Comment	Condition		
CSI-ResourcePeriodicityAndOffset CHOICE {					
Slots5	1				
}					

#### Table 6.4.2.1\_1.4.3.1-6: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
Two SEQUENCE {				
twoTX-CodebookSubsetRestriction	010000	Fixed rank 2		
	000011	Fixed rank 1		
	010011	Following rank		
}				
}				
}				
typeI-SinglePanel-ri-Restriction	1111111	Non restriction		

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table	4.6.3-39		
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
periodic SEQUENCE {			
reportSlotConfig CHOICE {	slots5		
slots5	0		
}			
pucch-CSI-ResourceList	9	PUCCH format Id=9	
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands7	1111111		
}			
}			
}			

#### Table 6.4.2.1\_1.4.3.1-7: CSI-ReportConfig

#### 6.4.2.1\_1.4.3.2 Message exceptions for NSA

Same as in clause 6.4.2.1\_1.4.3.1.

#### 6.4.2.1\_1.5 Test Requirements

#### Table 6.4.2.1\_1.5-1: Test Requirement (FDD)

	Test 1	Test 2	Test 3
<i>)</i> /1	N/A	1.04	0.89
1/2	0.99	N/A	N/A

#### 6.4.2.2 TDD

#### 6.4.2.2\_1 2Rx TDD FR1 RI reporting for both SA and NSA

#### 6.4.2.2\_1.1 Test Purpose

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

#### 6.4.2.2\_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.

#### 6.4.2.2\_1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.2.2\_1.3-2 is defined as:

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 6.4.2.2\_1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.2.2\_1.3-2.

	Parameter	Unit	Test 1	Test 2	Test 3
Bandwidth		MHz	40	40	40
Subcarrier s	pacing	kHz	30	30	30
Duplex Mod	e		TDD	TDD	TDD
TDD Slot Co	onfiguration		FR1.30-1	FR1.30-1	FR1.30-1
SNR		dB	0	20	20
Propagation	channel		TDLA30-5	TDLA30-5	TDLA30-5
Antenna cor	figuration		ULA Low 2x2	ULA Low 2x2	ULA High 2x2
Beamformin	g Model		As defined in Annex B.4.1	As defined in Annex B.4.1	As defined in Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		4	4	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
ZP CSI-	Density (ρ)		1	1	1
RS configurati	First subcarrier index in the PRB used for CSI-RS ( $k_0$ )		Row 5, (4)	Row 5, (4)	Row 5, (4)
on	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		(9)	(9)	(9)
	CSI-RS periodicity and offset	slot	10/1	10/1	10/1
	CSI-RS resource Type		Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		2	2	2
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
NZP CSI-	Density (ρ)		1	1	1
RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> )		Row 3 (6)	Row 3 (6)	Row 3 (6)
acquisition	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		(13)	(13)	(13)
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1	10/1	10/1
CSI-IM	CSI-IM resource Type		Periodic	Periodic	Periodic
configurati	CSI-IM RE pattern		Pattern 0	Pattern 0	Pattern 0
on	CSI-IM Resource Mapping (kcsi-ім,lcsi-ім)		(4,9)	(4,9)	(4,9)
	CSI-IM timeConfig periodicity and offset	slot	10/1	10/1	10/1
ReportConfig	дТуре		Periodic	Periodic	Periodic
CQI-table			Table 2	Table 2	Table 2
reportQuanti	ity		cri-RI-PMI-CQI	cri-RI-PMI-CQI	cri-RI-PMI- CQI
timeRestricti	onForChannelMeasurements		not configured	not configured	not configured
timeRestricti s	onForInterferenceMeasurement		not configured	not configured	not configured
cqi-FormatIr			Wideband	Wideband	Wideband
pmi-Formatl	ndicator		Wideband	Wideband	Wideband
Sub-band Si		RB	16	16	16
csi-Reporting			1111111	1111111	1111111
	periodicity and offset	slot	10/9	10/9	10/9
Codebook	Codebook Type		typel-	typel-	typel-
configuratio			SinglePanel	SinglePanel	SinglePanel
n	Codebook Mode		1	1	1
	(CodebookConfig- N1,CodebookConfig-N2)		N/A	N/A	N/A
	CodebookSubsetRestriction		010000 for	000011 for	000011 for
			fixed rank 2,	fixed rank 1,	fixed rank 1,
			010011 for	010011 for	010011 for
			following rank	following rank	following
				-	rank
<u> </u>	RI Restriction		N/A	N/A	N/A
	Innel for CSI report		PUCCH	PUCCH	PUCCH
CQI/RI/PMI		ms	9.5	9.5	9.5
Maximum nu	umber of HARQ transmission		1	1	1

# Table 6.4.2.2\_1.3-1: RI Test (TDD)

RI Config	guration		Fixed RI = 2 and follow RI	Fixed RI = 1 and follow RI	Fixed RI = 1 and follow RI
Note 1:	Measurements channels are specifi	ed in Tab	le A.4-2. TBS.2-3	is used for Rank	1 case. TBS.2-
	4 is used for Rank 2 case.				

#### Table 6.4.2.2\_1.3-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3
<i>)</i> /1	N/A	1.05	0.9
<i>γ</i> 2	1.0	N/A	N/A

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.2.2.

#### 6.4.2.2\_1.4 Test Description

#### 6.4.2.2\_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 D.

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

Frequencies to be tested: Mid Range as defined in TS 38.508 [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 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 6.1.2-1 and Table 6.4.2.2\_1.3-1 as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, *Connected without release On* and Test Mode ON for SA or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On* and Test Mode ON for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.4.2.2\_1.4.3.

#### 6.4.2.2\_1.4.2 Test procedure

- 1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.2.2\_1.3-1 as appropriate.
- The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.2.2\_1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure the t<sub>fix</sub> according to Annex G.3. 3.
- 3. Propagation conditions are set according to Annex B.2.
- 4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.2.2\_1.3-1.
- 5. The UE shall transmit RRC Connection Reconfiguration Complete message.

- 6. Propagation conditions are set according to Table 6.4.2.2\_1.3-1.
- The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure t<sub>reported</sub> according to Annex G.3.3.

If the ratio  $(t_{reported} / t_{fix})$  satisfies the requirement in Table 6.4.2.2\_1.5-1, then pass the UE for this test and go to step 8. Otherwise, declare a FAIL verdict.

8. If all tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the Table 6.4.2.2\_1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.

#### 6.4.2.2\_1.4.3 Message Contents

6.4.2.2\_1.4.3.1 Message Contents for SA

#### Table 6.4.2.2\_1.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41				
Information Element	Value/remark	Comment	Condition	
CSI-ResourceConfig ::= SEQUENCE {				
resourceType	periodic			
}				

#### Table 6.4.2.2\_1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	001000	row3, k0=6		
}				
nrofPorts	p2			
firstOFDMSymbolInTimeDomain	13			
}				

#### Table 6.4.2.2\_1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	000100	row5, k0=4		
}				
nrofPorts	p4			
firstOFDMSymbolInTimeDomain	9			
}				

#### Table 6.4.2.2\_1.4.3.1-4: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, 1	Table 4.6.3-34		
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			
periodicityAndOffset	CSI-		
	ResourcePeriodicityAnd Offset		

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Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43				
Information Element	Value/remark	Comment	Condition	
CSI-ResourcePeriodicityAndOffset CHOICE {				
Slots10	1			
}				

#### Table 6.4.2.2\_1.4.3.1-5: CSI-ResourcePeriodicityAndOffset

#### Table 6.4.2.2\_1.4.3.1-6: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
nrOfAntennaPorts CHOICE {				
Two SEQUENCE {				
twoTX-CodebookSubsetRestriction	010000	Fixed rank 2		
	000011	Fixed rank 1		
	010011	Following rank		
}				
}				
}				
typel-SinglePanel-ri-Restriction	1111111	Non restriction		

#### Table 6.4.2.2\_1.4.3.1-7: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table	9 4.6.3-39		
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
periodic SEQUENCE {			
reportSlotConfig CHOICE {	slots10		
slots10	9		
}			
pucch-CSI-ResourceList	9	PUCCH format Id=9	
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands7	1111111		
}			
}			
}			

#### 6.4.2.2\_1.4.3.2 Message exceptions for NSA

Same as in clause 6.4.2.1.2.1.4.3\_1.

#### 6.4.2.2\_1.5 Test Requirements

#### Table 6.4.2.2\_1.5-1: Test Requirement (TDD)

	Test 1	Test 2	Test 3
<i>γ</i> 1	N/A	1.04	0.89
<i>γ</i> 2	0.99	N/A	N/A

## 6.4.3 4RX requirements

#### 6.4.3.1 FDD

#### 6.4.3.1\_1 4Rx FDD FR1 RI reporting for both SA and NSA

#### 6.4.3.1\_1.1 Test Purpose

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

#### 6.4.3.1\_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.

#### 6.4.3.1\_1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.3.1\_1.3-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 6.4.3.1\_1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.3.1\_1.3-2.

	Parameter	Unit	Test 1	Test 2	Test 3	Test 4
Bandwidth		MHz	10	10	10	10
Subcarrier spa	acing	kHz	15	15	15	15
Duplex Mode			FDD	FDD	FDD	FDD
SNR		dB	-2	16	16	22
Propagation of	channel		TDLA30-5	TDLA30-5	TDLA30-5	TDLA30-5
Antenna confi			ULA Low 2x4	ULA Low 2x4	ULA High 2x4	ULA Low 4x4
	•		As defined in	As defined in	As defined in	As defined in
Beamforming			Annex B.4.1	Annex B.4.1	Annex B.4.1	Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		4	4	4	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2	FD-CDM2
ZP CSI-RS	Density (ρ)		1	1	1	1
configuratio	First subcarrier index in the		Row 5, (4)	Row 5, (4)	Row 5, (4)	Row 5, (4)
n	PRB used for CSI-RS (k <sub>0</sub> )		1000 3, (4)	1.0w 3, (4)	1.0w 3, (4)	1.0W 3, (4)
	First OFDM symbol in the PRB used for CSI-RS ( $I_0$ )		(9)	(9)	(9)	(9)
	CSI-RS	slot	5/1	5/1	5/1	5/1
	periodicity and offset	0.00				
	CSI-RS resource Type		Periodic	Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		2	2	2	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2	FD-CDM2
NZP CSI-	Density (ρ)		1	1	1	1
RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS ( $k_0$ )		Row 3 (6)	Row 3 (6)	Row 3 (6)	Row 4 (0)
acquicition	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> )		(13)	(13)	(13)	(13)
	NZP CSI-RS-timeConfig	slot	5/1	5/1	5/1	5/1
	periodicity and offset		Deriedie	Dariadia	Dariadia	Deriedie
	CSI-IM resource Type		Periodic	Periodic	Periodic	Periodic
CSI-IM	CSI-IM RE pattern		Pattern 0	Pattern 0	Pattern 0	Pattern 0
configuratio n	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)	(4,9)	(4,9)	(4,9)
	CSI-IM timeConfig periodicity and offset	slot	5/1	5/1	5/1	5/1
ReportConfig	Туре		Periodic	Periodic	Periodic	Periodic
CQI-table			Table 2	Table 2	Table 2	Table 2
roportOuoptit	,		ori DI DMI COL	cri-RI-PMI-	cri-RI-PMI-	cri-RI-PMI-
reportQuantity	y		cri-RI-PMI-CQI	CQI	CQI	CQI
timeRestrictio	nForChannelMeasurements		not configured	not	not	not
umercestrictio	The oremaintenneasurements		not conligured	configured	configured	configured
timeRestrictio	nForInterferenceMeasurements		not configured	not	not	not
			_	configured	configured	configured
cqi-FormatInd			Wideband	Wideband	Wideband	Wideband
pmi-Formatin			Wideband	Wideband	Wideband	Wideband
Sub-band Siz		RB	8	8	8	8
csi-Reporting			1111111	1111111	1111111	1111111
CSI-Report pe	eriodicity and offset	slot	5/0	5/0	5/0	5/0
Codebook	Codebook Type		typel-	typel-	typel-	typel-
			SinglePanel	SinglePanel	SinglePanel	SinglePanel
	Codebook Mode		1	1	1	1
	(CodebookConfig-		N/A	N/A	N/A	(2,1)
	N1,CodebookConfig-N2)					,
	CodebookSubsetRestriction		010000 for	000011 for	000011 for	
			fixed rank 2,	fixed rank 1,	fixed rank 1,	11111111
configuration			010011 for	010011 for	010011 for	
	DI Destriction		following rank	following rank	following rank	00000040.6-
	RI Restriction					00000010 for fixed Rank 2
			N/A	N/A	N/A	and
						00001111 fo
						follow RI
	nel for CSI report		PUCCH	PUCCH	PUCCH	PUCCH
CQI/RI/PMI de	elav	ms	8	8	8	8

Table 6.4.3.1_	_1.3-1: RI	Test (	(FDD)
----------------	------------	--------	-------

Maximum number of HARQ transmission 1 1 1 1							
RI Configuration Fixed RI = 2 Fixed RI = 1 Fixed RI = 1 Fixed RI = 2							
and follow RI							
Note 1: Measurements channels are specified in Table A.4-2 and Table A.4-3. TBS.2-1 is used for Rank 1 case. TBS.2-2							
is used for Rank 2 case. TBS.3-1 is used for Rank 3 case. TBS.3-2 is used for Rank 4 case.							

Table 6.4.3.1_1.3-2: Minimum requirement (FDD)
--

	Test 1	Test 2	Test 3	Test 4
<i>γ</i> 1	N/A	1.05	0.9	N/A
<i>γ</i> 2	0.9	N/A	N/A	0.9

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.3.1.

#### 6.4.3.1\_1.4 Test Description

#### 6.4.3.1\_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 subcarrier 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 [6] clause 4.1.

Frequencies to be tested: Mid Range as defined in TS 38.508 [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 or A.3.1.7.5 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 6.1.2-1, Table 6.4.3.1\_1.3-1 as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, *Connected without release On* and Test Mode ON for SA 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 6.4.3.1\_1.4.3.

#### 6.4.3.1\_1.4.2 Test procedure

- 1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.3.1\_1.3-1 as appropriate.
- The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.3.1\_1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure the t<sub>fix</sub> according to Annex G.3. 3.
- 3. Propagation conditions are set according to Annex B.2. 4
- 4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.3.1\_1.3-1.
- 5. The UE shall transmit RRC Connection Reconfiguration Complete message.

- 6. Propagation conditions are set according to Table 6.4.3.1\_1.3-1.
- The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure t<sub>reported</sub> according to Annex G.3.3.

If the ratio  $(t_{reported} / t_{fix})$  satisfies the requirement in Table 6.4.3.1\_1.5-1, then pass the UE for this test and go to step 8. Otherwise, declare a FAIL verdict.

8. If all tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the Table 6.4.3.1\_1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.

#### 6.4.3.1\_1.4.3 Message Contents

6.4.3.1\_1.4.3.1 Message exceptions for SA

#### Table 6.4.3.1\_1.4.3.1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41				
Information Element	Value/remark	Comment	Condition	
CSI-ResourceConfig ::= SEQUENCE {				
resourceType	periodic			
}				

#### Table 6.4.3.1\_1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table	4.6.3-45		
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	001000	row3, ko=6 for test 1,2,3	
row 4	001	row4, ko=0 for test 4	
}			
nrofPorts	p2	Test 1,2,3	
	p4	Test 4	
firstOFDMSymbolInTimeDomain	13		
}			

#### Table 6.4.3.1\_1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45				
Information Element	Value/remark	Comment	Condition	
CSI-RS-ResourceMapping ::= SEQUENCE {				
frequencyDomainAllocation CHOICE {				
other	000100	row5, k0=4		
}				
nrofPorts	p4			
firstOFDMSymbolInTimeDomain	9			
}				

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Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4	4.6.3-34		
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			
periodicityAndOffset	CSI-		
	ResourcePeriodicityAnd Offset		

#### Table 6.4.3.1\_1.4.3.1-4: CSI-IM-Resource

#### Table 6.4.3.1\_1.4.3.1-5: CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-43				
Information Element	Value/remark	Comment	Condition	
CSI-ResourcePeriodicityAndOffset CHOICE {				
Slots5	1			
}				

#### Table 6.4.3.1\_1.4.3.1-6: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Ta	ble 4.6.3-25		
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
Two SEQUENCE {			
twoTX-CodebookSubsetRestriction	010000	Fixed rank 2	
	000011	Fixed rank 1	
	010011	Following rank for	
		test 1,2,3	
	1111111	Test 4	
}			
}			
}			
typeI-SinglePanel-ri-Restriction	1111111	Non restriction for	
		test 1,2,3	
	0000010	For fixed Rank2	
		for test 4	
	00001111	For follow RI for	
		test 4	

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Tabl	e 4.6.3-39		
Information Element	Value/remark	Comment	Condition
reportConfigType CHOICE {			
periodic SEQUENCE {			
reportSlotConfig CHOICE {	slots5		
slots5	0		
}			
pucch-CSI-ResourceList	8	PUCCH format Id=8	
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands7	1111111		
}			
}			
}			

#### Table 6.4.3.1\_1.4.3.1-7: CSI-ReportConfig

#### 6.4.3.1\_1.4.3.2 Message exceptions for NSA

Same as in clause 6.4.3.1\_1.4.3.1.

#### 6.4.3.1\_1.5 Test Requirements

#### Table 6.4.3.1\_1.5-1: Minimum requirement (FDD)

	Test 1	Test 2	Test 3	Test 4
<i>γ</i> 1	N/A	1.04	0.89	N/A
γ2	0.89	N/A	N/A	0.89

#### 6.4.3.2 TDD

#### 6.4.3.2\_1 4Rx TDD FR1 RI reporting for both SA and NSA

#### 6.4.3.2\_1.1 Test Purpose

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

#### 6.4.3.2\_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.

#### 6.4.3.2\_1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.3.2\_1.3-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 6.4.3.2\_1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.3.2\_1.3-2.

Table	6.4	.3.2	_1.3·	·1: F	RI Tes	t (TDD)
-------	-----	------	-------	-------	--------	---------

	Parameter	Unit	Test 1	Test 2	Test 3	Test 4
Bandwidth		MHz	40	40	40	40
Subcarrier spa	acing	kHz	30	30	30	30
Duplex Mode	long	KI IZ	TDD	TDD	TDD	TDD
TDD Slot Con	figuration		FR1.30-1	FR1.30-1	FR1.30-1	FR1.30-1
SNR	igulation	dB	-2	16	16	22
Propagation c	hannel	uв	TDLA30-5	TDLA30-5	TDLA30-5	TDLA30-5
Antenna confi			ULA Low 2x4	ULA Low 2x4	ULA High 2x4	ULA Low 4x4
			As defined in	As defined in	As defined in	As defined in
Beamforming	Model		Annex B.4.1	Annex B.4.1	Annex B.4.1	Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic	Periodic	Periodic
	Number of CSI-RS ports ( <i>X</i> )		4	4	4	4
F	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2	FD-CDM2
ł	Density (ρ)		1	1	1	1
ZP CSI-RS	First subcarrier index in the					•
configuratio	PRB used for CSI-RS (k <sub>0</sub> )		Row 5, (4)	Row 5, (4)	Row 5, (4)	Row 5, (4)
n	First OFDM symbol in the PRB					
	used for CSI-RS (I <sub>0</sub> )		(9)	(9)	(9)	(9)
ł	CSI-RS					
	periodicity and offset	slot	10/1	10/1	10/1	10/1
	CSI-RS resource Type		Periodic	Periodic	Periodic	Periodic
-	Number of CSI-RS ports (X)		2	2	2	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2	FD-CDM2
-	Density (ρ)		1	1 <u>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 </u>	1	1 D-CDIVIZ
NZP CSI-	First subcarrier index in the		•		1	I
RS for CSI	PRB used for CSI-RS (k <sub>0</sub> )		Row 3 (6)	Row 3 (6)	Row 3 (6)	Row 4 (0)
acquisition	First OFDM symbol in the PRB					
	used for CSI-RS (I <sub>0</sub> )		(13)	(13)	(13)	(13)
	NZP CSI-RS-timeConfig					
	periodicity and offset	slot	10/1	10/1	10/1	10/1
CSI-IM			Periodic	Periodic	Periodic	Periodic
	CSI-IM resource Type		Pattern 0	Pattern 0	Pattern 0	
configuratio	CSI-IM RE pattern		Pattern 0	Pattern U	Pattern U	Pattern 0
n	CSI-IM Resource Mapping		(4,9)	(4,9)	(4,9)	(4,9)
-	(kcsi-im,lcsi-im)					
	CSI-IM timeConfig	slot	10/1	10/1	10/1	10/1
DenertConfini	periodicity and offset		Periodic	Periodic	Periodic	Periodic
ReportConfigT CQI-table	уре					
CQI-table			Table 2	Table 2	Table 2	Table 2
reportQuantity	,		cri-RI-PMI-CQI	cri-RI-PMI-	cri-RI-PMI-	cri-RI-PMI-
				CQI	CQI	CQI
timeRestriction	nForChannelMeasurements		not configured	not	not	not
				configured	configured	configured
timeRestriction	nForInterferenceMeasurements		not configured	not	not	not
a ai Ea mar atha d	i e e t e v		Wideband	configured	configured	configured Wideband
cqi-FormatInd				Wideband	Wideband	
pmi-Formating			Wideband	Wideband	Wideband	Wideband
Sub-band Size		RB	16	16	16	16
csi-Reporting			1111111	1111111	1111111	1111111
	eriodicity and offset	slot	10/9	10/9	10/9	10/9
Codebook	Codebook Type		typel-	typel-	typel-	typel-
configuration	Cadabaak Mada		SinglePanel	SinglePanel	SinglePanel	SinglePanel
	Codebook Mode		1	1	1	1
	(CodebookConfig-		N/A	N/A	N/A	(2,1)
	N1,CodebookConfig-N2)					· · /
	CodebookSubsetRestriction		010000 for	000011 for	000011 for	
			fixed rank 2,	fixed rank 1,	fixed rank 1,	11111111
			010011 for	010011 for	010011 for	
			following rank	following rank	following rank	000000404
	RI Restriction					00000010 for
			N 1 / A	N 1 / A	N 1 / A	fixed Rank 2
			N/A	N/A	N/A	and
						00001111 for
			PUCCH	PUCCH	PUCCH	follow RI PUCCH
Physical chan						

CQI/RI/PMI delay	ms	9.5	9.5	9.5	9.5
Maximum number of HARQ transmission		1	1	1	1
RI Configuration		Fixed RI = 2 and follow RI	Fixed RI = 1 and follow RI	Fixed RI = 1 and follow RI	Fixed RI = 2 and follow RI
Note 1: Measurements channels are specified in Table A.4-2 and Table A.4-3. TBS.2-3 is used for Rank 1 case. TBS.2-4 is used for Rank 2 case. TBS.3-3 is used for Rank 3 case. TBS.3-4 is used for Rank 4 case.					

#### Table 6.4.3.2\_1.3-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3	Test 4
<i>γ</i> 1	N/A	1.05	0.9	N/A
γ2	0.9	N/A	N/A	0.9

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.3.2.

#### 6.4.3.2\_1.4 Test Description

#### 6.4.3.2\_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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 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 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 6.1.2-1 and Table 6.4.3.2\_1.3-1 as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, 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, *Connected without release On* and Test Mode ON for SA or EN-DC, DC bearer *MCG* and *SCG*, *Connected without release On* and Test Mode ON for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.4.3.2\_1.4.3.

#### 6.4.3.2\_1.4.2 Test procedure

- 1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.3.2\_1.3-1 as appropriate.
- The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.3.2\_1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure the t<sub>fix</sub> according to Annex G.3.3.
- 3. Propagation conditions are set according to Annex B.2.
- 4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.3.2\_1.3-1.

- 5. The UE shall transmit RRC Connection Reconfiguration Complete message.
- 6. Propagation conditions are set according to Table 6.4.3.2\_1.3-1.
- The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure t<sub>reported</sub> according to Annex G.3.3.

If the ratio  $(t_{reported} / t_{fix})$  satisfies the requirement in Table 6.4.3.2\_1.5-1, then pass the UE for this test and go to step 8. Otherwise, declare a FAIL verdict.

8. If all tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the Table 6.4.3.2\_1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.

#### 6.4.3.2\_1.4.3 Message Contents

Message contents are according to TS 38.508-1 [6] clause 4.6 with the following exceptions:

#### Table 6.4.3.2\_1.4.3-1: CSI-RS-ResourceMapping for NZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table	4.6.3-45		
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	001000		Test1, 2, 3
row4	001		Test4
}			
nrofPorts	p2		Test1, 2, 3
	p4		Test4
firstOFDMSymbolInTimeDomain	13		
}			

#### Table 6.4.3.2\_1.4.3-2: CSI-RS-ResourceMapping for ZP-CSI-RS

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Tab	le 4.6.3-45		
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
other	000100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	9		
}			

#### Table 6.4.3.2\_1.4.3-3: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table	4.6.3-34		
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern			
pattern0 SEQUENCE {			
subcarrierLocation-p0	s4		
symbolLocation-p0	9		
}			
periodicityAndOffset	CSI-		
	ResourcePeriodicityAnd		
	Offset		

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Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-43				
Information Element	Value/remark	Comment	Condition	
CSI-ResourcePeriodicityAndOffset CHOICE {				
slots10	1			
}				

#### Table 6.4.3.2\_1.4.3-4: CSI-ResourcePeriodicityAndOffset

#### Table 6.4.3.2\_1.4.3-5: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, T	able 4.6.3-25		
Information Element	Value/remark	Comment	Condition
nrOfAntennaPorts CHOICE {			
two SEQUENCE {			
twoTX-CodebookSubsetRestriction	010000		Fixed rank 2
	000011		Fixed rank 1
	010011		Following rank
}			
}			
typeI-SinglePaneI-ri-Restriction	1111111		

#### Table 6.4.3.2\_1.4.3-6: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39					
Information Element	Value/remark	Comment	Condition		
CSI-ReportConfig ::= SEQUENCE {					
reportConfigType CHOICE {					
periodic SEQUENCE {					
reportSlotConfig CHOICE {	slot10				
slot10	9				
}					
}					
}					
reportFreqConfiguration SEQUENCE {					
csi-ReportingBand CHOICE {					
subbands7	1111111				
}					
}					
}					

6.4.3.2\_1.5 Test Requirements

### Table 6.4.3.2\_1.5-1: Test Requirement (TDD)

	Test 1	Test 2	Test 3	Test 4
<i>γ</i> 1	N/A	1.04	0.89	N/A
<i>γ</i> 2	0.89	N/A	N/A	0.89

# 7 Demodulation performance requirements (Radiated requirements)

# 7.1 General

For conformance testing involving FR2 test cases in this specification, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

# 7.1.1 Applicability of requirements

#### 7.1.1.1 General

The minimum performance requirements are applicable to the FR2 operating bands defined in TS 38.101-2 [3] with  $F_{DL_high}$  not exceeding 40000 MHz.

The minimum performance requirements in Clause 7 are mandatary for UE supporting NR operation, except test cases listed in Clause 7.1.1.3, 7.1.1.4.

#### 7.1.1.2 Applicability of requirements for different number of RX antenna ports

UE shall support 2 RX ports for different RF operating bands. The UE requirements applicability is defined in Table 7.1.1.2-1.

Supported RX antenna ports	Test type	Test list
UE supports 2RX	PDSCH	All tests in Clause 7.2.2
antenna ports	PDCCH	All tests in Clause 7.3.2
	PBCH	All tests in Clause 7.4.2

Table 7.1.1.2-1: Requirements applicability

#### 7.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 7.1.1.3-1 shall apply for UEs which support optional UE features only.

Table 7.1.1.3-1: Requirements applicability for optional UE features

UE feature/capability [14]	Test t	ype	Test list	Applicability notes
SU-MIMO Interference Mitigation advanced receiver	FR2 TDD	PDSCH	Clause 7.2.2.2.1 (Test 3-1)	
Basic DL NR-NR CA operation (supportedBandCombinationList)	NR CA	SDR	Clause 7.5A.1	1)Up to 16 DL carriers 2)Same numerology across carrier for data/control channel at a given time
PDSCH repetitions over multiple slots ( <i>pdsch-</i> <i>RepetitionMultiSlots</i> )	FR2 TDD	PDSCH	Clause 7.2.2.2.2	
256QAM for PDSCH (pdsch-256QAM-FR2)	FR2 TDD	PDSCH	Clause 7.2.2.2.1 (Test 1-4)	
256QAM for PDSCH (pdsch- 256QAM-FR2)	FR2 TDD	SDR	Clause 7.5A.1	For UE capable of <i>pdsch</i> - 256QAM-FR2 for certain band(s), <i>mcs-Table</i> is configured to '64QAM' for SDR test.

# 7.1.1.4 Applicability of requirements for mandatory UE features with capability signaling

The performance requirements in Table 7.1.1.4-1 shall apply for UEs which support mandatory UE features with capability signalling only.

Table 7.1.1.4-1: Requirements applicability for mandatory fe	features with UE capability signalling
--	--

UE feature/capability [14]	Test t	уре	Test list	Applicability notes
Supported maximum number of PDSCH MIMO layers ( <i>maxNumberMIMO- LayersPDSCH</i> )	FR2 TDD	PDSCH	Clause 7.2.2.2.1 (Tests from 2-1 to 2-6)	The requirements apply only in case the PDSCH MIMO rank in the test case does not exceed UE PDSCH MIMO layers capability
	FR2 TDD	PDSCH	Clause 7.2	
Support of PT-RS with one antenna port for DL reception ( <i>onePortsPTRS</i> )		SDR	Clause 7.5.1 Clause 7.5A.1	
PCell operation on FR2 ( <i>pCell-FR2</i> )	FR2 TDD	SDR	Clause 7.5A.1	
PDSCH mapping type B ( <i>pdsch-</i> <i>MappingTypeB</i> )	FR2 TDD	PDSCH	Clause 7.2.2.3	

### 7.1.1.5 Applicability of CA requirements

#### 7.1.1.5.1 Definition of CA capability

The definition with respect to CA capabilities is given as in Table 7.1.1.5.1-1.

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 38.101-2 [3].			
CA_N corresponds to NR CA configurations and bandwidth combination sets defined in Section 5.5A.2 of TS 38.101-2 [3]. CA_AX corresponds to NR CA configurations and bandwidth combination sets defined in Clause 5.5A.3 of TS 38.101-2 [3].			

# 7.1.1.5.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Clause 7.2A are defined independent of CA configurations and bandwidth combination sets specified in Section 5.5A of TS 38.101-2 [3]. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined in Table 7.1.1.5.2-1 and Table 7.1.1.5.2-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

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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 7.2A.2.1	CA_C, CA_N, CA_AX	Table 7.1.1.5.2-2	Largest aggregated CA bandwidth combination	Any of CCs

#### Table 7.1.1.5.2-1: Applicability and test rules for CA UE demodulation tests

#### Table 7.1.1.5.2-2: Selection of CA configurations

CA capability	Step 1	Step 2	Step 3		
CA_C or CA_N or CA_AX	Select CA configuration(s), which contain all CA bandwidth combinations requiring SNR below test equipment maximum achievable SNR	Select the CA configurations with the maximum number of CCs, for which the supported maximum number of MIMO layers is not lower than 2, among all the selected CA configurations from Step 1.	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 date rate, among all the selected CA configurations from Step 2.		
NOTE 1: Maximum supported data rate for Step 3 is calculated based clause 4.1.2 of TS 38.306 [14]					
NOTE 2: Tested data rate for Step 3 is calculated based on the equation $DataRate = 10^{-3} \sum_{j=1}^{J} TBS_j 2^{\mu_j}$ and FRCs used in the test.					

# 7.1.1\_1 Applicability of test requirements due to maximum achievable SNR

Table 7.1.1\_1-1 and Table 7.1.1\_1.1-1a specify the current assumption of maximum testable SNR<sub>BB</sub> for indirect farfield (IFF), PC3, Max device size  $\leq$  30 cm under fading conditions.

Operating Band	Maximum testable SNR <sub>BB</sub> (dB)			
/ Frequency	CHBW 50 MHz	CHBW 100 MHz	CHBW 200 MHz	
n257 mid	30.6	27.5	24.4	
n258 mid	30.6	27.5	24.4	
n259 mid	20.4	17.2	14.1	
n260 mid	24.4	21.2	18.2	
n261 mid	30.6	27.5	24.4	

Table 7.1.1\_1-1: maximum testable SNR<sub>BB</sub> under fading conditions for modulations up to 64 QAM

# Table 7.1.1\_1-1a: maximum testable SNR<sub>BB</sub> under fading conditions for 256QAM modulation for DEMOD scenarios

<b>Operating Band</b>	Maximum testable SNR <sub>BB</sub> (dB)			
/ Frequency	CHBW 50 MHz	CHBW 100 MHz	CHBW 200 MHz	
n257 mid	29.1	25.9	22.9	
n258 mid	29.1	25.9	22.9	
n259 mid	18.8	15.6	12.5	
n260 mid	22.9	19.7	16.6	
n261 mid	29.1	25.9	22.9	

Based on the current assumption of maximum testable  $SNR_{BB}$ , the applicability of test points is defined in Table 7.1.1\_1-2 for indirect farfield (IFF), PC3, Max device size size  $\leq 30$  cm under fading conditions.

Test Ores	Testusint	CHBW /		SNR test		Test Po	int Appli	cability	
Test Case	Test point	MHz	Fading	requirement	n257	n258	n259	n260	n261
7.2.2.2.1_1	1-1	100	Yes	1.4	Х	х	х	Х	х
	1-2	100	Yes	3.6	х	х	х	Х	х
	1-3	100	Yes	14.2	Х	х	Х	Х	х
	2-1	100	Yes	5.8	Х	х	Х	Х	х
	2-2	100	Yes	16.0	х	х	х	Х	х
	2-3	50	Yes	15.7	х	х	х	Х	х
	2-4	200	Yes	15.8	х	х	-	Х	х
	2-5	50	Yes	16	х	х	х	Х	х
	2-6	100	Yes	20.3	х	х	-	х	х
7.2.2.2.1_2	3-1	100	Yes	20.7	Х	х	-	Х	х
7.2.2.2.1_3	1-4	50	Yes	22.0	х	х		Х	х
7.2.2.2.2_1	1-1	100	Yes	TBD	TBD	TBD	TBD	TBD	TBD
7.2.2.3_1	1-1	100	Yes	3.1	х	х	х	Х	Х
7.2A.2.1	1,2	BW <sub>agg</sub> <mark>≤</mark> 200	Yes	12.0	х	х	х	х	х
	3,4	BW <sub>agg</sub> <mark>≥</mark> 200	Yes	12.0	TBD	TBD	TBD	TBD	TBD
7.2A.2.2	1,2	BW <sub>agg</sub> <mark>≤</mark> 200	Yes	12.0	х	х	x	х	х
	3,4	BW <sub>agg</sub> <mark>≥</mark> 200	Yes	12.0	TBD	TBD	TBD	TBD	TBD
7.3.2.2.1	1-1	100	Yes	7.7	х	х	х	Х	х
	1-2	100	Yes	4.3	х	х	х	Х	х
7.3.2.2.2	2-1	100	Yes	3.2	х	х	х	Х	х
	2-2	100	Yes	0.2	х	х	Х	Х	х
7.3.2.2.3	1-1	100	Yes	4.7	х	Х	Х	Х	х
7.5.1	-	100	No	NA	Х	Х	Х	Х	Х
	-	200	No	NA	Х	Х	Х	Х	Х
	-	400	No	NA	TBD	TBD	TBD	TBD	TBD
7.5A.1	-	BWagg ≤ 200	No	NA	Х	х	х	Х	х
	-	BWagg ≤ 200	No	NA	TBD	TBD	TBD	TBD	TBD

Table 7.1.1\_1-2: Testability of test requirements due to maximum achievable SNR per band

# 7.2 PDSCH demodulation requirements

The parameters specified in Table 7.2-1 are valid for all PDSCH demodulation tests unless otherwise stated.

	Parameter	Unit	Value
PDSCH transmission	scheme		Transmission scheme 1
PTRS epre-Ratio			0
Actual carrier	Offset between Point A and the lowest usable subcarrier on this carrier (Note 2)	RBs	0
configuration	Subcarrier spacing	kHz	60 or 120
	Cyclic prefix		Normal
	RB offset	RBs	0
DL BWP configuration #1	Number of contiguous PRB	PRBs	Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-2 [3] for tested channel bandwidth and subcarrier spacing
Common serving	Physical Cell ID		0
cell parameters	SSB position in burst		1
cell parameters	SSB periodicity	ms	20
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH		0
	Number of PRBs in CORESET		Table 7.2-2 for tested channel bandwidth and subcarrier spacing
	Number of PDCCH candidates and aggregation levels		1/AL8
	CCE-to-REG mapping type		Non-interleaved
PDCCH	DCI format		1_1
configuration	TCI state		TCI state #1
	PDCCH & PDCCH DMRS Precoding configuration		Single Panel Type I, Random per slot with equal probability of each applicable i <sub>1</sub> , i <sub>2</sub> combination, and with REG bundling granularity for number of Tx larger than 1
Cross carrier scheduli	ng		Not configured
	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 ( <i>lo</i> )		6 for CSI-RS resource 1 and 3 10 for CSI-RS resource 2 and 4
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
	СDМ Туре		'No CDM' for CSI-RS resource 1,2,3,4
	Density ( <i>p</i> )		3 for CSI-RS resource 1,2,3,4
CSI-RS for tracking	CSI-RS periodicity	Slots	60 kHz SCS: 80 for CSI- RS resource 1,2,3,4 120 kHz SCS: 160 for CSI-RS resource 1,2,3,4
	CSI-RS offset	Slots	60 kHz SCS: 40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4 120 kHz SCS: 80 for CSI-RS resource 1 and 2 81 for CSI-RS resource 3 and 4

Table 7.2-1:	Common	Test	Parameters
--------------	--------	------	------------

ſ	1			
	Frequency Occ	upation		Start PRB 0 Number of PRB = BWP size
	QCL info			TCI state #0
	First subcarrier ( <i>k</i> <sub>0</sub> )	index in the PRB used for CSI-RS		0
	First OFDM syn	nbol in the PRB used for CSI-RS		12
	Number of CSI-	RS ports (X)		2
	CDM Type			FD-CDM2
NZP CSI-RS for CSI	Density (p)			1
acquisition	CSI-RS periodic	sity	Slots	60 kHz SCS: 80 120 kHz SCS: 160
	CSI-RS offset			0
	Frequency Occ	upation		Start PRB 0 Number of PRB = BWP size
	QCL info			TCI state #1
	(k <sub>0</sub> )	index in the PRB used for CSI-RS		4
	First OFDM syn	nbol in the PRB used for CSI-RS		12
	Number of CSI-	RS ports ( <i>X</i> )		4
ZP CSI-RS for CSI	CDM Type			FD-CDM2
acquisition	Density (ρ)			1
	CSI-RS periodic	sity	Slots	60 kHz SCS: 80 120 kHz SCS: 160
	CSI-RS offset			0
	Frequency Occ	upation		Start PRB 0 Number of PRB = BWP size
	First subcarrier	index in the PRB used for CSI-RS		k <sub>0</sub> =0 for CSI-RS resource 1,2
	First OFDM syn	nbol in the PRB used for CSI-RS		$l_0 = 8$ for CSI-RS resource 1 $l_0 = 9$ for CSI-RS resource 2
	Number of CSI-	RS ports (X)		1 for CSI-RS resource 1,2
CSI-RS for beam	CDM Type			'No CDM' for CSI-RS resource 1,2
refinement	Density (ρ)			3 for CSI-RS resource 1,2
	CSI-RS periodic	sity	Slots	60 kHz SCS: 80 for CSI- RS resource 1,2 120 kHz SCS: 160 for CSI-RS resource 1,2
	CSI-RS offset		Slots	0 for CSI-RS resource 1,2
	Repetition			ON
	QCL info			TCI state #1
PDSCH DMRS	Antenna ports ir	ndexes		{1000} for Rank 1 tests {1000, 1001} for Rank 2 tests
configuration	Position of the f type A	irst DMRS for PDSCH mapping		2
	Number of PDS data	CH DMRS CDM group(s) without		1
	Type 1 QCL	SSB index		SSB #0
TOL state #0	information	QCL Type		Type C
TCI state #0	Type 2 QCL	SSB index		SSB #0
	information	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	Тур	be A
				ource 1 from
	Type 2 QCL	CSI-RS resource		or tracking'
	information		¥	uration
		QCL Type	Тур	be D
	Frequency den			2
PTRS configuration	Time density (L			1
	Resource Elem			2
Maximum number of	code block group	s for ACK/NACK feedback		1
Maximum number of	HARQ transmissi	วท		4
HARQ ACK/NACK bu	undling		Multip	olexed
Redundancy version	coding sequence			2,3,1}
				nel Type I,
				precoder
				updated per
PDSCH & PDSCH DI	MRS Precoding o	onfiguration		th equal
	winter recouning of	singulation		ty of each
				ıble i1, i2
				on, and with
				granularity
Symbols for all unuse	ed REs		OCNG in	Annex A.5
Physical signals, cha	nnels manning an	d precoding		ed in Annex
				4.1
Note 1: UE assum transmissio		ate for the PDSCH is identical to the	TCI state applied for the PI	DCCH
	incides with minim andwidth and sub	num guard band as specified in Table carrier spacing.	5.3.3-1 from TS 38.101-2	[3] for tested

Table 7.2-2: Number of PRBs in CORESET

SCS (kHz)	50 MHz	100 MHz	200 MHz	400 MHz
60	66	132	264	N.A
120	30	66	132	264

- 7.2.1 1RX requirements (Void)
- 7.2.2 2RX requirements
- 7.2.2.1 FDD (Void)
- 7.2.2.2 TDD
- 7.2.2.2.1 2Rx TDD FR2 PDSCH mapping Type A performance
- 7.2.2.2.1\_0 Minimum conformance requirements

For PDSCH Type-A scheduling, the requirements are specified in Table 7.2.2.2.1\_0-3, 7.2.2.2.1\_0-4 and 7.2.2.2.1\_0-5, with the addition of the parameters in Table 7.2.2.2.1\_0-2 and the downlink physical channel setup according to Annex C.5.1. The purpose is to verify the performance of PDSCH Type-A scheduling.

The test purposes are specified in Table 7.2.2.2.1\_0-1.

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

### Table 7.2.2.2.1\_0-1: Tests purpose

	Parameter	Unit	Value		
Duplex mode			TDD		
Active DL BWP index			1		
CSI-RS for tracking	First OFDM symbol in the PRB used for CSI-RS ( <i>l</i> <sub>0</sub> )		For Test 1-1 and 1-2: 3 for CSI-RS resource 1 and 3 7 for CSI-RS resource 2 and 4		
oor no for tracking	CSI-RS offset	Slots	For Test 1-2: 82 for CSI-RS resource 1 and 2 83 for CSI-RS resource 3 and 4		
PDCCH configuration	Number of PDCCH candidates and aggregation levels		1/AL4 for Test 1-4 and 2-3 1/AL8 for other tests		
	Mapping type		Type A 0		
	Starting symbol (S)		1		
	Length (L)		Specific to each Reference channel as defined in A.3.2.2		
	PDSCH aggregation factor		1		
	PRB bundling type		Static		
PDSCH configuration	PRB bundling size		WB for 1-1, 2 for other tests		
	Resource allocation type		Test 2-1: Type 1 with start RB = 30, $L_{RBs} = 6$ Other tests: Type 0		
	RBG size		Test 2-1: N/A Other tests: Config2		
	VRB-to-PRB mapping type		Non-interleaved		
	VRB-to-PRB mapping interleaver bundle size		N/A		
	DMRS Type		Type 1		
PDSCH DMRS	Number of additional DMRS		1		
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1		
Number of HARQ Proc	esses		8 for Test 1-1, 1-3, 1-4, 2-2, 2-4 10 for Test 2-1, 2-3, 2-5, 2-6, 3-1 16 for Test 1-2		
K1 value (PDSCH-to-HARQ-timi	ng-indicator)		As defined in Annex A.1.3		

### Table 7.2.2.2.1\_0-2: Test Parameters

**Reference value** Correlation TDD UL-Bandwidth Modulation Fraction of Test Reference Propagation matrix and (MHz)/Subcarrier and code DL maximum **SNR**BB num. channel condition antenna spacing (kHz) rate pattern throughput (dB) configuration (%) R.PDSCH.5-FR2.120-QPSK, 0.30 1-1 100/120 TDLC60-300 2x2 ULA Low 70 -0.4 1.1TDD 1. A R.PDSCH.5-16QAM, FR2.120-1-2 100/120 TDLA30-300 2x2 ULA Low 30 1.7 2.1 TDD 0.48 1 R.PDSCH.5-64QAM, FR2.120-TDLA30-300 2x2 XPL Med 70 1-3 100/120 12.4 3.1TDD 0.46 1 R.PDSCH.5-256QAM FR2.120-1-4 50/120 TDLD30-75 2x2 ULA Low 70 20.2 10.1 TDD 0.67 1

Table 7.2.2.2.1\_0-3: Minimum performance for Rank 1 (FRC)

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Table 7.2.2.2.1\_0-4: Minimum performance for Rank 2 (FRC)

						Correlation	Referenc	e value
Test num	Reference channel	Bandwidth (MHz)/Subcar rier spacing (kHz)	Modulatio n and code rate	TDD UL-DL pattern	Propagatio n condition	matrix and antenna configuratio n	Fraction of maximum throughp ut (%)	SNR <sub>вв</sub> (dB)
2-1	R.PDSCH.5 -4.1 TDD	100/120	QPSK, 0.30	FR2.120 -2	TDLA30-75	2x2 ULA Low	70	4.1
2-2	R.PDSCH.5 -2.2 TDD	100/120	16QAM, 0.48	FR2.120 -1	TDLA30- 300	2x2 ULA Low	70	14.4
2-3	R.PDSCH.5 -5.2 TDD	50/120	16QAM,0.4 8	FR2.120 -2	TDLA30-75	2x2 ULA Low	70	14.0
2-4	R.PDSCH.5 -2.3 TDD	200/120	16QAM, 0.48	FR2.120 -1	TDLA30- 300	2x2 ULA Low	70	14.2
2-5	R.PDSCH.4 -1.1 TDD	50/60	16QAM, 0.48	FR2.60- 1	TDLA30-75	2x2 ULA Low	70	14.3
2-6	R.PDSCH.5 -6.1 TDD	100/120	64QAM, 0.43	FR2.120 -2	TDLA30-75	2x2 ULA Low	70	18.6

#### Table 7.2.2.2.1\_0-5: Minimum performance for Rank 2 (FRC) for Enhanced Type X Receiver

						Correlation	Reference value	
Test num.	Reference channel	Bandwidth (MHz)/Subcarrier spacing (kHz)	Modulation and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR <sub>BB</sub> (dB)
3-1	R.PDSCH.5- 5.1TDD	100/120	16QAM, 0.48	FR2.120- 2	TDLA30-75	2x2 ULA Medium	70	19.0

The normative reference for this requirement is TS 38.101-4 [5] clause 7.2.2.2.1.

7.2.2.2.1\_1 2Rx TDD FR2 PDSCH mapping Type A performance - 2x2 MIMO with baseline receiver for SA and NSA

#### 7.2.2.2.1\_1.1 Test Purpose

Verify the PDSCH mapping Type A normal performance with different channel models, MCSs and number of MIMO layers.

#### 7.2.2.2.1\_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.

7.2.2.2.1\_1.3 Test Description

7.2.2.2.1\_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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [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.

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 7.2-1 and Table 7.2.2.2.1.0-2 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 38.521-2 [8].
- 4. Propagation conditions for 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 content are defined in clause 7.2.2.1\_1.3.3.

#### 7.2.2.2.1\_1.3.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O.If no direction found, mark the test as inconclusive.
- 2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 7.2.2.1\_1.4-1 and 7.2.2.1\_1.4-2.. The SS sends downlink MAC padding bits on the DL RMC.
- 3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 7.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2 as appropriate.
- 4. 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 Tables G.1.5-1 in Annex G.
- 5. Repeat steps from 1 to 4 for each subtest in Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2 as appropriate.

#### 7.2.2.2.1\_1.3.3 Message Contents

Message contents are according to TS 38.508-1 [6] subclause 4.6.1 and 5.4.2 with the following exceptions:

# 7.2.2.2.1\_1.3.3\_1 Message exceptions for SA

# Table 7.2.2.2.1\_1.3.3\_1-1: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-157			
Information Element	Value/remark	Comment	Condition
SchedulingRequestResourceConfig ::= SEQUENCE {			
periodicityAndOffset CHOICE {			
sl80	7	Test point 2-1, 2- 3, 2-6	
}			
}			

# Table 7.2.2.2.1\_1.3.3\_1-2: 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	3	$I_0 = 3$ for CSI-RS	TRS, Test 1-			
		resource 1 and 3	1, 1-2			
	7	$I_0 = 7$ for CSI-RS	TRS, Test 1-			
		resource 2 and 4	1, 1-2			
nrofPorts	p1	1 for CSI-RS	TRS			
		resource 1,2,3,4				
}						

# Table 7.2.2.2.1\_1.3.3\_1-3: CSI-ResourcePeriodicityAndOffset for TRS

Derivation Path: TS 38.508-1 [6] Table 4.6.3-43			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
Slots160	82	Periodicity 20 slots and offset 10 for CSI-RS resource 1 and 2	
Slots160	83	Periodicity 20 slots and offset 11 for CSI-RS resource 3 and 4	
}			

# Table 7.2.2.2.1\_1.3.3\_1-4: PDCCH Search Space

Derivation Path: TS 38.508-1 [6] Table 4.6.3-162			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n0		
aggregationLevel4	n1		Test 2-3
aggregationLevel8	n1	AL8	Other than test 2-3
aggregationLevel16	n0		
}			
}			

Derivation Path: TS 38.508-1 [6] Table 4.6.3-50			
Information Element	Value/remark	Comment	Condition
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-Type	Type 1		
dmrs-AdditionalPosition	pos1		
maxLength	len1		
}			

# Table 7.2.2.2.1\_1.3.3\_1-5: DMRS-DownlinkConfig

# Table 7.2.2.2.1\_1.3.3\_1-6: *PDSCH-Config*

Derivation Path: TS 38.508-1 [6] Table 4.6.3-100			
Information Element	Value/remark	Comment	Condition
PDSCH-Config ::= SEQUENCE {			
vrb-ToPRB-Interleaver	Not present		
resourceAllocation	resourceAllocationType0		
pdsch-AggregationFactor	Not present		
prb-BundlingType CHOICE {			
staticBundling SEQUENCE {			
bundleSize	Not present	PRB Bundling	Other than
		size of 2	test 1-1
	Wideband		Test 1-1
}			
}			
}			

# Table 7.2.2.2.1\_1.3.3\_1-7: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6] Table 4.6.3-102	Derivation Path: TS 38.508-1 [6] Table 4.6.3-102					
Information Element	Value/remark	Comment	Condition			
PDSCH-ServingCellConfig ::= SEQUENCE {						
nrofHARQ-ProcessesForPDSCH	Set according to the test id		8 for Test 1- 1, 1-3, 2-2, 2-4 10 for Test 2-1, 2-3, 2- 5, 2-6, 3-1 16 for Test 1-2			
}						

# 7.2.2.2.1\_1.3.3\_2 Message exceptions for NSA

Same as 7.2.2.2.1\_1.3.3\_1.

# 7.2.2.1\_1.4 Test Requirements

Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2 for each throughput test shall meet or exceed the specified value in Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2 for the specified SNR including test tolerances for all throughput tests.

**Reference value** Correlation TDD UL-Bandwidth Modulation Fraction of Test Reference Propagation matrix and (MHz)/Subcarrier and code DL **SNR**BB maximum num. channel condition antenna spacing (kHz) rate pattern throughput (dB) configuration (%) R.PDSCH.5-FR2.120-1-1 100/120 QPSK, 0.30 TDLC60-300 2x2 ULA Low 70 1.4 1.1TDD 1 A R.PDSCH.5-16QAM, FR2.120-1-2 100/120 TDLA30-300 2x2 ULA Low 30 3.6 2.1TDD 0.48 1 R.PDSCH.5-FR2.120-2x2 XPL 64QAM, 100/120 TDLA30-300 70 1-3 14.2 3.1TDD 0.46 Medium 1

Table 7.2.2.2.1\_1.4-1: Test Requirement for Rank 1 (FRC)

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# Table 7.2.2.2.1\_1.4-2: Test Requirement for Rank 2 (FRC)

						Correlation	Referenc	e value
Test num	Reference channel	Bandwidth (MHz)/Subcar rier spacing (kHz)	Modulatio n and code rate	TDD UL-DL pattern	Propagatio n condition	matrix and antenna configuratio n	Fraction of maximum throughp ut (%)	SNR <sub>BB</sub> (dB)
2-1	R.PDSCH.5 -4.1TDD	100/120	QPSK, 0.30	FR2.120 -2	TDLA30-75	2x2 ULA Low	70	5.8
2-2	R.PDSCH.5 -2.2TDD	100/120	16QAM, 0.48	FR2.120 -1	TDLA30- 300	2x2 ULA Low	70	16.0
2-3	R.PDSCH.5 -5.2TDD	50/120	16QAM,0.4 8	FR2.120 -2	TDLA30-75	2x2 ULA Low	70	15.7
2-4	R.PDSCH.5 -2.3TDD	200/120	16QAM, 0.48	FR2.120 -1	TDLA30- 300	2x2 ULA Low	70	15.8
2-5	R.PDSCH.4 -1.1TDD	50/60	16QAM, 0.48	FR2.60- 1	TDLA30-75	2x2 ULA Low	70	16
2-6	R.PDSCH.5 -6.1TDD	100/120	64QAM, 0.43	FR2.120 -2	TDLA30-75	2x2 ULA Low	70	20.3

# 7.2.2.2.1\_2 2Rx TDD FR2 PDSCH mapping Type A performance - 2x2 MIMO with enhanced type 1 receiver for SA and NSA

#### 7.2.2.2.1\_2.1 Test Purpose

Verify the PDSCH mapping Type A normal performance with different channel models, MCSs and number of MIMO layers.

#### 7.2.2.2.1\_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.

#### 7.2.2.2.1\_2.3 Test Description

Same test description as in clause 7.2.2.1\_1.3 with following exception:

- Table 7.2.2.2.1\_2.4-1 instead of Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2

#### 7.2.2.2.1\_2.3.1 Message contents

Message contents are according to TS 38.508-1 [6] subclause 4.6.1 and 5.4.2 with the following exceptions:

## 7.2.2.2.1\_2.3.1\_1 Message exceptions for SA

Same as 7.2.2.2.1\_1.3.3\_1 with following exceptions:

### Table 7.2.2.2.1\_2.3.1\_1-1: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-157					
Information Element	Value/remark	Comment	Condition		
SchedulingRequestResourceConfig ::= SEQUENCE {					
periodicityAndOffset CHOICE {					
SI80	7		Test 3-1		
}					
}					

# 7.2.2.2.1\_2.3.1\_2 Message exceptions for NSA

Same as 7.2.2.1\_2.3.1\_1.

# 7.2.2.2.1\_2.4 Test Requirements

Table 7.2.2.1\_2.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2 for each throughput test shall meet or exceed the specified value in Table 7.2.2.1\_2.4-1 for the specified SNR including test tolerances for all throughput tests.

# Table 7.2.2.2.1\_2.4-1: Test Requirement for Rank 2 (FRC) for Enhanced Type 1 Receiver

						Correlation	Reference	e value
Test num.	Reference channel	Bandwidth (MHz)/Subcarrier spacing (kHz)	Modulation and code rate	TDD UL- DL pattern	Propagation condition	Correlation matrix and antenna configuration	Fraction of maximum throughput (%)	SNR <sub>BB</sub> (dB)
3-1	R.PDSCH.5- 5.1TDD	100/120	16QAM, 0.48	FR2.120- 2	TDLA30-75	2x2 ULA Med	70	20.7

# 7.2.2.2.1\_3 2Rx TDD FR2 PDSCH mapping Type A performance - 2x2 MIMO with 256QAM for SA and NSA (Rel-16 and forward)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Test point applicability is TBD for all bands in Table 7.1.1\_1-2.

#### 7.2.2.2.1\_3.1 Test Purpose

Verify the PDSCH mapping Type A normal performance with different channel models, MCSs and number of MIMO layers.

#### 7.2.2.2.1\_3.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting 256QAM for PDSCH.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and NR 256QAM for PDSCH.

# 7.2.2.2.1\_3.3 Test Description

Same test description as in clause 7.2.2.1\_1.3 with following exception:

- Table 7.2.2.2.1\_3.4-1 instead of Table 7.2.2.2.1\_1.4-1

## 7.2.2.2.1\_3.3.1 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

#### 7.2.2.2.1\_3.3.1\_1 Message exceptions for SA

Same as 7.2.2.1\_1.3.3\_1 with following exceptions:

#### Table 7.2.2.2.1\_3.3.1\_1-1: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-157					
Information Element	Value/remark	Comment	Condition		
SchedulingRequestResourceConfig ::= SEQUENCE {					
periodicityAndOffset CHOICE {					
SI80	7		Test 1-4		
}					
}					

#### Table 7.2.2.2.1\_3.3.1\_1-2: SearchSpace

Derivation Path: TS 38.508-1 Table 4.6.3-162			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel1	n0		
aggregationLevel2	n0		
aggregationLevel4	n1	AL4	Test 1-4
aggregationLevel8	n0		
aggregationLevel16	n0		
}			
}			

#### Table 7.2.2.2.1\_3.3.1\_1-3: PDSCH-Config

Derivation Path: TS 38.508-1 Table 5.4.2.0-26 with condition DEMOD_FR2				
Information Element	Value/remark	Comment	Condition	
PDSCH-Config ::= SEQUENCE {				
mcs-Table	qam256		Test 1-4	
}				

# Table 7.2.2.2.1\_3.3.1\_1-4: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 Table 5.4.2.0-25 with condition DEMOD_FR2					
Information Element	Value/remark	Comment	Condition		
PDSCH-ServingCellConfig ::= SEQUENCE {					
nrofHARQ-ProcessesForPDSCH	8		Test 1-4		
}					

7.2.2.2.1\_3.3.1\_2 Message exceptions for NSA

Same as 7.2.2.1\_3.3.1\_1.

7.2.2.2.1\_3.4 Test Requirements

Table 7.2.2.2.1.0-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2 for each throughput test shall meet or exceed the specified value in Table 7.2.2.1\_3.4-1 for the specified SNR including test tolerances for all throughput tests.

					Correlation	Correlation	Reference	value
Test num.	Reference channel	Bandwidth (MHz)/Subcarrier spacing (kHz)	Modulation and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR <sub>BB</sub> (dB)
1-4	R.PDSCH.5- 10.1 TDD	50/120	256QAM 0.67	FR2.120- 1	TDLD30-75	2x2 ULA Low	70	22.0

Table 7.2.2.2.1\_3.4-1: Test Requirement for Rank 1 (FRC) for 256QAM

# 7.2.2.2.2 2Rx TDD FR2 PDSCH repetitions over multiple slots

# 7.2.2.2.2\_0 Minimum conformance requirements

For PDSCH with slot aggregation, the requirements are specified in Table 7.2.2.2.2\_0-3, additional parameters in Table 7.2.2.2\_0-2 and the downlink physical channel setup according to Annex C.5.1.

The test purpose is specified in Table 7.2.2.2\_0-1.

## Table 7.2.2.2.2\_0-1: Test purpose

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

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index			1
	Mapping type		Туре А
	kO		0
	Starting symbol (S)		1
	Length (L)		13
	PDSCH aggregation factor		2
PDSCH configuration	PRB bundling type		Static
1 Deerr comgaration	PRB bundling size		2
	Resource allocation type		Туре 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver		N/A
	bundle size		N/A
	DMRS Type		Type 1
PDSCH DMRS	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
Number of HARQ Processes			2
The number of slots betwe	een final repetition of PDSCH and		As defined in Annex A.1.3
corresponding HARQ-AC	K information		(Note 1)
Note 1: ACK/NACK fee frame; i = {0,,	dback is generated for PDSCH on slot i, where 79}	e mod(i,4) =	1, where i is the slot index per

#### Table 7.2.2.2.2\_0-2: Test Parameters

		Bandwidth (MHz) /	Modulation			Correlation			Reference	e value
Test num	Reference channel	Subcarrier spacing (kHz)	and code rate	TDD UL-DL pattern	Propagation condition	matrix and antenna configuration	Target BLER	SNR (dB)		
1-1	R.PDSCH. 5-11.1 TDD	100 / 120	16QAM, 0.37	FR2.120-2	TDLA30-75	2x2 ULA Low	1% (Note 1)	-1.1		
Note 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.									

Table 7.2.2.2.2\_0-3: Minimum performance for Rank 1 (FRC)

The normative reference for this requirement is TS 38.101-4 [5] clause 7.2.2.2.2.

# 7.2.2.2\_1 2Rx TDD FR2 PDSCH repetitions over multiple slots - 2x2 MIMO with baseline receiver for SA and NSA

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- MU factor due to finite test time needs further study

- Test point applicability is TBD for all bands in Table 7.1.1\_1-2.

#### 7.2.2.2.2\_1.1 Test Purpose

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

#### 7.2.2.2\_1.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting capability IE pdsch-RepetitionMultiSlots-r16.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC supporting capability IE *pdsch-RepetitionMultiSlots-r16*.

#### 7.2.2.2\_1.3 Test Description

#### 7.2.2.2\_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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [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.

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 7.2-1 and Table 7.2.2.2.0-2 and as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

- 4. Propagation conditions for 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 content are defined in clause 7.2.2.2\_1.3.3.

#### 7.2.2.2\_1.3.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O.If no direction found, mark the test as inconclusive.
- 2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 7.2.2.2\_1.4-1. 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.
- 3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 7.2.2.2\_1.4-1 as appropriate.
- 4. 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 Tables G.1.5-1a in Annex G.

#### 7.2.2.2\_1.3.3 Message Contents

Message contents are according to TS 38.508-1 [6] subclause 4.6.1 and 5.4.2 with the following exceptions:

#### 7.2.2.2\_1.3.3\_1 Message exceptions for SA

#### Table 7.2.2.2.1.3.3\_1-1: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-157			
Information Element	Value/remark	Comment	Condition
SchedulingRequestResourceConfig ::= SEQUENCE {			
periodicityAndOffset CHOICE {			
sl80	7		
}			
}			

#### Table 7.2.2.2.2\_1.3.3\_1-2: *PDSCH-Config*

Derivation Path: TS 38.508-1 [6] Table 4.6.3-100				
Information Element	Value/rema	rk	Comment	Condition
PDSCH-Config ::= SEQUENCE {				
pdsch-AggregationFactor	2			
}				

#### Table 7.2.2.2\_1.3.3\_1-3: 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	4		
}			

#### 7.2.2.2\_1.3.3\_2 Message exceptions for NSA

Same as 7.2.2.2\_1.3.3\_1.

#### 7.2.2.2\_1.4 Test Requirements

Table 7.2.2.2.1.4-1 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 7.2.2.2\_1.4-1 for the specified SNR including test tolerances for all BLER tests.

		Bandwidth (MHz) /	Modulation	Adulation		Modulation Correlation				ce value
Test num	Reference channel	Subcarrier spacing (kHz)	and code rate	TDD UL-DL pattern	Propagation condition	matrix and antenna configuration	Target BLER	SNR (dB)		
1-1	R.PDSCH. 5-11.1 TDD	100 / 120	16QAM, 0.37	FR2.120-2	TDLA30-75	2x2 ULA Low	1% (Note 1)	- 1.1+TT		
Note 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.									

### Table 7.2.2.2.1.4-1: Test Requirement for Rank 1

# 7.2.2.2.3 2Rx TDD FR2 PDSCH Mapping Type B

#### 7.2.2.3\_0 Minimum conformance requirements

The performance requirements are specified in Table 7.2.2.2.3.0-3, with the addition of test parameters in Table 7.2.2.2. 3.0-2 and the downlink physical channel setup according to Annex C.5.1. The purpose is to verify the performance of PDSCH Type B scheduling.

The test purposes are specified in Table 7.2.2.3.0-1.

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

Parameter			Value
Duplex mode			TDD
Active DL BWP inde	x		1
PDCCH configuration	Number of PDCCH candidates and aggregation levels		1/AL8
	Mapping type		Туре В
	k0 Starting symbol (S)		0 1
	Length (L)		2
PDSCH	PDSCH aggregation factor PRB bundling type		Static
configuration	PRB bundling size		2
	Resource allocation type		Туре 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
	DMRS Type		Туре 1
PDSCH DMRS	Number of additional DMRS		0
configuration	Maximum number of OFDM symbols for DL front loaded DMRS	1	
Number of HARQ Pr	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.1.3

#### Table 7.2.2.3.0-2: Test parameters

 Table 7.2.2.3.0-3: Minimum performance for Rank 1

		Bandwidth		Correlation Reference value			lue	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 5-1.2 TDD	100 / 120	QPSK, 0.30	FR2.120- 1	TDLA30-75	2x2, ULA Low	70	1.3

The normative reference for this requirement is TS 38.101-4 [5] clause 7.2.2.2.3.

7.2.2.3\_1 2Rx TDD FR2 PDSCH mapping Type B performance - 2x2 MIMO with baseline receiver for SA and NSA

#### 7.2.2.3\_1.1 Test Purpose

Verify the PDSCH mapping Type B performance under 2 receive antenna conditions.

#### 7.2.2.3\_1.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and PDSCH mapping type B.

# 7.2.2.3\_1.3 Test Description

#### 7.2.2.3\_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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [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.

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 7.2-1 and Table 7.2.2.3.0-2 and as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].
- 4. Propagation conditions for 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 content are defined in clause 7.2.2.3\_1.3.3.

#### 7.2.2.3\_1.3.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O.If no direction found, mark the test as inconclusive.
- 2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 7.2.2.3\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
- 3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 7.2.2.3\_1.4-1 as appropriate.
- 4. 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 Tables G.1.5-1 in Annex G.

# 7.2.2.3\_1.3.3 Message Contents

Message contents are according to TS 38.508-1 [6] subclause 4.6.1 and 5.4.2 with the following exceptions:

7.2.2.3\_1.3.3\_1 Message exceptions for SA

#### Table 7.2.2.3\_1.3.3\_1-3: 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	8		
}			

Derivation Path: TS 38.508-1 [6], Table 4.6.3-103			
Information Element	Value/remark	Comment	Condition
PDSCH-TimeDomainResourceAllocationList::=	2 entry		
SEQUENCE(SIZE(1maxNrofDL-Allocations)) OF {			
PDSCH-TimeDomainResourceAllocation[1]			
SEQUENCE {			
KO	Not present		
mappingType	typeB		
startSymbolAndLength	15	Start	
		symbol(S)=1,	
		Length(L)=2	
}			
}			

Table 7.2.2.2.3\_1.3.3\_1-4: PDSCH-TimeDomainResourceAllocationList

#### 7.2.2.3\_1.3.3\_2 Message exceptions for NSA

Same as 7.2.2.3\_1.3.3\_1.

7.2.2.3\_1.4 Test Requirements

Table 7.2.2.3\_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 for each throughput test shall meet or exceed the specified value in Table 7.2.2.3\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 7.2.2.2.3_1.4	-1: Test Requirement for Rank 1
---------------------	---------------------------------

		Bandwidth				Correlation	n Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 5-1.2 TDD	100 / 120	QPSK, 0.30	FR2.120- 1	TDLA30-75	2x2, ULA Low	70	3.1

# 7.2A PDSCH demodulation requirements for CA

The parameters specified in Table 7.2-1 for PDSCH single carrier tests are reused for PDSCH CA test unless otherwise stated.

# 7.2A.1 1RX requirements (Void)

# 7.2A.2 2RX requirements

# 7.2A.2.0 Minimum conformance requirements

For CA with different numbers of DL component carriers, the requirements are defined in Table 7.2A.2.0-3-3 based on the single carrier requirements for different bandwidth specified in Table 7.2A.2.0-2, with the parameters in Table 7.2A.2.0-1 and the downlink physical channel setup according to Annex C.2.2. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

Parameter			Value
Duplex mode			TDD
Active DL BWP inde	X		1
	Mapping type		Туре А
	k0		0
	Starting symbol (S)		1
	Length (L)		Specific to each Reference channel
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	PRB bundling size		2
	Resource allocation type		Туре 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle		N/A
	size		N/A
	DMRS Type		Type 1
PDSCH DMRS	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		I
Number of HARQ Processes			8
TDD UL-DL pattern			120kHz SCS: FR2.120-1
The number of slots ACK information	between PDSCH and corresponding HARQ-		As defined in Annex A.1.3

# Table 7.2A.2.0-1: Test parameters for CA

Table 7.2A.2.0-2: Single carrier performance for TDD 120 kHz SCS for CA configurations

	D. (	Modulation	D	Correlation	Reference value	
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)
50	R.PDSCH.5- 9.1 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	10.4
100	R.PDSCH.5- 9.2 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	10.2
200	R.PDSCH.5- 9.3 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	10.3
400	R.PDSCH.5- 9.4 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	10.3

# Table 7.2A.2.0-3: Minimum performance for multiple CA configurations

Test number	CA duplex mode	Minimum performance requirements			
1	TDD 120 kHz + TDD 120 kHz	As defined in Table 7.2A.2.1_0-2			
Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 7.1.1.5.					

The normative reference for this requirement is TS 38.101-4 [5] clause 7.2A.2.1

# 7.2A.2.1 2Rx TDD FR2 CA requirements for normal PDSCH Demodulation Performance for both SA and NSA (2DLCA)

# 7.2A.2.1.1 Test Purpose

Verify the PDSCH mapping Type A normal performance with different channel models, MCSs and number of MIMO layers.

#### 7.2A.2.1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward that support NR 2DL CA.

7.2A.2.1.3 Test Description

#### 7.2A.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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-2.

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.

CA capability to be tested: Any one of the supported CA capability as per the selection criteria specified in Table 7.1.1.5.2-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 7.2-1, 7.2A.2.0-1 and Table 7.2A.2.0-2 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 38.521-2 [8].
- 4. Propagation conditions for NR cell are set according to Annex B.0.
- 6. 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 7.2A.2.1.3.3.

#### 7.2A.2.1.3.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O. If no direction found, mark the test as inconclusive.
- 2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 7.2A.2.1.4-1. The SS sends downlink MAC padding bits on the DL RMC.
- 3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 7.2A.2.1.4-1
- 4. 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 Tables G.1.5-1 in Annex G.
- 5. Repeat steps from 1 to 4 for each subtest in Table 7.2A.2.1.4-1.

#### 7.2A.2.1.3.3 Message Contents

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

#### 7.2A.2.1.4 Test Requirements

#### Table 7.2A.2.1.4-1: Single carrier performance for TDD 120 kHz SCS for CA configurations

-	– Modulation		<b>-</b>	Correlation	Reference value	
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)
50	R.PDSCH.5- 9.1 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	12.1
100	R.PDSCH.5- 9.2 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	11.9
200	R.PDSCH.5- 9.3 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	12.0
400	R.PDSCH.5- 9.4 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	12.0

# 7.2A.2.2 2Rx TDD FR2 CA requirements for normal PDSCH Demodulation Performance for both SA and NSA (3DLCA)

7.2A.2.2.1 Test Purpose

Same as 7.2A.2.1.1

7.2A.2.2.2 Test Applicability

This test applies to all types of NR UE release 15 and forward that support NR 3DL CA.

7.2A.2.2.3 Test Description

7.2A.2.2.3.1 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 subcarrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-2.

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.

CA capability to be tested: Any one of the supported CA capability as per the selection criteria specified in Table 7.1.1.5.2-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 7.2-1, 7.2A.2.0-1 and Table 7.2A.2.0-2 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 38.521-2 [8].

- 4. Propagation conditions for NR cell are set according to Annex B.0.
- 6. 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 7.2A.2.1.3.3.

# 7.2A.2.2.3.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O. If no direction found, mark the test as inconclusive.
- 2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 7.2A.2.2.4-1 on each CC. The SS sends downlink MAC padding bits on the DL RMC.
- 3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 7.2A.2.2.4-1.
- 4. 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 Tables G.1.5-1 in Annex G.
- 5. Repeat steps from 1 to 4 for each subtest in Table 7.2A.2.2.4-1.

#### 7.2A.2.2.3.3 Message Contents

Same as 7.2A.2.1.3.3

400

#### 7.2A.2.2.4 Test Requirements

R.PDSCH.5-

9.4 TDD

Table 7.27	Table 7.2A.2.2.4-1: Single carrier performance for TDD 120 kHz SCS for CA configurations						
Dandaridah	Defenses	Modulation	Description	Correlation	Reference val	ue	
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)	
50	R.PDSCH.5- 9.1 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	12.1	
100	R.PDSCH.5- 9.2 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	11.9	
200	R.PDSCH.5- 9.3 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	12.0	

TDLA30-75

2x2. ULA Low

70

12.0

# Table 7.2A.2.2.4-1: Single carrier performance for TDD 120 kHz SCS for CA configurations

# 7.3 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 7.3-1 are valid for all PDCCH tests unless otherwise stated.

16QAM, 0.33

Parameter		Unit	Value	Parameter
Carrier	Offset betwee	n Point A and the		0
configuration		subcarrier on this		
	carrier (Note 1	1)		
DL BWP configuration #1	Cyclic prefix			Normal
	Physical Cell			0
Common serving cell parameters	SSB position			1
cell parameters	SSB periodici		ms	20
		CH monitoring		Each slot
DDOOL	Number of PD	OCCH candidates		
PDCCH configuration	Frequency do allocation for (	main resource CORESET		Start from RB = 0 with contiguous RB allocation
	TCI state			TCI state #1
		er index in the PRB		0
	used for CSI-I	RS (k0)		-
	First OFDM sy used for CSI-I	ymbol in the PRB RS (l0)		CSI-RS resource 1: 4 CSI-RS resource 2: 8 CSI-RS resource 3: 4 CSI-RS resource 4: 8
		SI-RS ports (X)		1
	CDM Type			No CDM
CSI-RS for	Density (ρ)			3
tracking	CSI-RS period	dicity	Slots	160
	CSI-RS offset		Slots	80 for CSI-RS resource 1 and 2 81 for CSI-RS resource 3 and 4
	Frequency Oc	cupation		Start PRB 0 Number of PRB = BWP size
	QCL info			TCI state #0
	First subcarrie	er index in the PRB RS (k0)		0
	First OFDM sy used for CSI-I	mbol in the PRB		CSI-RS resource 1: 8 CSI-RS resource 2: 9
		GI-RS ports (X)		1
NZP CSI-RS for	CDM Type			No CDM
beam	Density (ρ)			3
management	CSI-RS period	dicity	Slots	120 kHz SCS: 160 for CSI-RS resource 1,2
	CSI-RS offset		Slots	0 for CSI-RS
				resource 1,2
	Repetition QCL info			ON TCI state #1
PDCCH & PDCCH DMRS Precoding configuration				Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1
	Type 1 QCL	SSB index		SSB #0
TCI state #0	information	QCL Type		Туре С
	Type 2 QCL	SSB index		SSB #0
	information	QCL Type		Type D
TOL atota #4	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking' configuration
TCI state #1		QCL Type		Туре А
	Type 2 QCL	CSI-RS resource		CSI-RS resource 1
	information			from 'CSI-RS for

Table 7.3-1: Common test Para	imeters
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		tracking' configuration		
	QCL Type	Туре D		
Physical signals, c	hannels mapping and precoding	As specified in Annex B.4.1		
Symbols for all uni	used REs	OP.1 FDD as defined in Annex A.5.1.1 OP.1 TDD as defined in Annex A.5.2.1		
	ts between PDSCH and RQ-ACK information	Specific to each TDD UL-DL pattern and as defined in Annex A.1.3.		
Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [3] for tested channel bandwidth and subcarrier spacing.				

# 7.3.1 1RX requirements

(Void)

- 7.3.2 2RX requirements
- 7.3.2.1 FDD

(Void)

- 7.3.2.2 TDD
- 7.3.2.2.1 2Rx TDD FR2 PDCCH 1 Tx antenna performance for both SA and NSA

#### 7.3.2.2.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH for a single-antenna port 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 7.3.2.2.1.3-1.

#### 7.3.2.2.1.2 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.

#### 7.3.2.2.1.3 Minimum conformance requirements

For the parameters specified in Table 7.3.2.2.1.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.1.3-2. The downlink physical setup is in accordance with Annex C.2.2.

Parameter	Unit	1 Tx Antenna	2 Tx Antenna
TDD UL-DL pattern		FR2.12	20-1
CCE to REG mapping type		Interleaved	
REG bundle size		2 for test 1-1	2
REG buildle size		6 for test 1-2	2
Interleaver size		3 for test 1-1	2
inteneaver size		2 for test 1-2	3
Shift index		0	

#### Table 7.3.2.2.1.3-1: Test Parameters

			CORES				Antenna	Referen	ce value
Test numb er	Bandwid th	CORE SET RB	ET duratio n	Aggreg ation level	Reference Channel	Propagation Condition	configurati on and correlation Matrix	Pm- dsg (%)	SNR <sub>BB</sub> (dB)
1-1	100 MHz	60	1	2 CCE	R.PDCCH.5-1.1 TDD	TDLA30-75	1x2 Low	1	6.0
1-2	100 MHz	60	1	4 CCE	R.PDCCH.5-1.2 TDD	TDLA30-300	1x2 Low	1	2.6

#### Table 7.3.2.2.1.3-2: Minimum performance requirements with 120 kHz SCS for 1Tx antenna

The normative reference for this requirement is TS 38.101-4 [5] clause 7.3.2.2.1.

#### 7.3.2.2.1.4 Test Description

#### 7.3.2.2.1.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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.

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 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.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the cell are set up according to Table 7.3-1 and Table 7.3.2.2.1.3-1 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 38.521-2 [8].
- 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 7.3.2.2.1.4.3.

#### 7.3.2.2.1.4.2 Test procedure

- 1. Set the UE in a direction found using one of the test procedures defined in Annex H. If no direction found, mark the test as inconclusive.
- 2. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 7.3.2.2.1.4.4-1. The details of PDCCH are specified in Table 7.3.2.2.1.3-1 and Table 7.3.2.2.1.3-2. The details of PDSCH are specified in Table A.3.3.2.5-3. 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 7.3.2.2.1.4.4-1 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 7.3.2.2.1.4.4-1, pass the UE. Otherwise fail the UE.

5. Repeat steps from 1 to 4 for each subtest in Table 7.3.2.2.1.4.4-1 as appropriate.

#### 7.3.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] subclause 4.6.1 and 5.4.2 with the following exceptions:

7.3.2.2.1.4.3.1 Message exceptions for SA

#### Table 7.3.2.2.1.4.3.1-1: 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 11000000 0000000 00000000 0000000 00000	CORESET to use the least significant 60 RBs of the BWP	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {	Null		
reg-BundleSize	n2		2 for test 1-1
	n6		6 for test 1-2
interleaverSize	n3		3 for test 1-1
}	n2		2 for test 1-2
}			
}			

# Table 7.3.2.2.1.4.3.1-2: 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 {			
aggregationLevel2	n1	AL2	Test 1-1
aggregationLevel4	n1	AL4	Test 1-2
}			
}			

# 7.3.2.2.1.4.3.2 Message exceptions for NSA

Same as 7.3.2.2.1.4.3.1.

7.3.2.2.1.4.4 Test requirement

Table 7.3.2.2.1.4.4-1 defines the primary level settings.

For the parameters specified in Table 7.3.2.2.1.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.1.4.4-1.

#### Table 7.3.2.2.1.4.4-1: Test requirements with 120 kHz SCS for 1Tx antenna

			CORES				Antenna	Refere	ence value
Test iumb er	Bandwidth	COR ESE T RB	ET duratio n	Aggreg ation level	Reference Channel	Propagation Condition	configurati on and correlation Matrix	Pm- dsg (%)	SNR <sub>BB</sub> (dB)
1-1	100 MHz	60	1	2 CCE	R.PDCCH.5-1.1 TDD	TDLA30-75	1x2 Low	1	7.7
1-2	100 MHz	60	1	4 CCE	R.PDCCH.5-1.2 TDD	TDLA30-300	1x2 Low	1	4.3

# 7.3.2.2.2 2Rx TDD FR2 PDCCH 2 Tx antenna performance for both SA and NSA

#### 7.3.2.2.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH for two-antenna port 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 7.3.2.2.3-1.

#### 7.3.2.2.2.2 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.

#### 7.3.2.2.2.3 Minimum conformance requirements

For the parameters specified in Table 7.3.2.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.3-2. The downlink physical setup is in accordance with Annex C.2.2.

Parameter	Unit	1 Tx Antenna	2 Tx Antenna
TDD UL-DL pattern		FR2.12	20-1
CCE to REG mapping type		Interlea	aved
REG bundle size		2 for test 1-1	2
		6 for test 1-2	Z
Interleaver size		3 for test 1-1	3
Interleaver Size		2 for test 1-2	5
Shift index		0	

#### Table 7.3.2.2.3-1: Test Parameters

#### Table 7.3.2.2.3-2: Minimum performance requirements with 120 kHz SCS for 2Tx Antenna

Test	Bandwidt	CORE	CORE SET	Aggreg		Propagation	Antenna configurati	Refer va	
num ber	h	SET RB	durati on	ation level	Reference Channel	Condition	on and correlation Matrix	Pm- dsg (%)	SNR <sub>BB</sub> (dB)
2-1	100 MHz	60	1	8 CCE	R.PDCCH.5-1.3 TDD	TDLA30-75	2x2 Low	1	1.4
2-2	100 MHz	60	2	16 CCE	R.PDCCH.5-2.1 TDD	TDLA30-75	2x2 Low	1	-1.6

The normative reference for this requirement is TS 38.101-4 [5] clause 7.3.2.2.2.

#### 7.3.2.2.2.4 Test Description

#### 7.3.2.2.2.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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.

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 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.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the cell are set up according to Table 7.3-1 and Table 7.3.2.2.3-1 as appropriate.
- 3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].
- 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 7.3.2.2.1.4.3.

#### 7.3.2.2.2.4.2 Test procedure

- 1. Set the UE in a direction found using one of the test procedures defined in Annex H If no direction found, mark the test as inconclusive.
- 2. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 7.3.2.2.2.4.4-1. The details of PDCCH are specified in Table 7.3.2.2.2.3-1 and Table 7.3.2.2.2.3-2. The details of PDSCH are specified in Table A.3.3.2.5-3. 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 7.3.2.2.2.4.4-1 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 7.3.2.2.2.4.4-1, pass the UE. Otherwise fail the UE.
- 5. Repeat steps from 1 to 4 for each subtest in Table 7.3.2.2.2.4.4-1 as appropriate.

#### 7.3.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] subclause 4.6.1 and 5.4.2 with the following exceptions:

#### 7.3.2.2.4.3.1 Message exceptions for SA

#### Table 7.3.2.2.2.4.3.1-1: 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 11000000 00000000 00000000 00000000	CORESET to use the least significant 60 RBs of the BWP	
Duration	2	SearchSpace Duration of 2 symbols	Test 2-2
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {	Null		
reg-BundleSize	n2		
interleaverSize	n3		
}			
}			

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

Table 7.3.2.2.2.4.3.1-2: PDSCH-TimeD	omainResourceAllocationList
--------------------------------------	-----------------------------

## Table 7.3.2.2.2.4.3.1-3: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7	7		
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel8	n1	AL8	Test 2-1
aggregationLevel16	n1	AL16	Test 2-2
}			
}			

# 7.3.2.2.4.3.2 Message exceptions for NSA

Same as 7.3.2.2.4.3.1.

# 7.3.2.2.2.4.4 Test requirement

Table 7.3.2.2.2.4.4-1 defines the primary level settings.

For the parameters specified in Table 7.3.2.2.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.4.4-1.

ſ				CORES				Antenna	Reference	e value
I	Test numb er	Bandwidt h	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	Pm-dsg (%)	SNR <sub>BB</sub> (dB)
	2-1	100 MHz	60	1	8 CCE	R.PDCCH.5-1.3 TDD	TDLA30-75	2x2 Low	1	3.2
	2-2	100 MHz	60	2	16 CCE	R.PDCCH.5-2.1 TDD	TDLA30-75	2x2 Low	1	0.2

# 7.3.2.2.3 2Rx TDD FR2 PDCCH 1 Tx antenna performance for power saving

## 7.3.2.2.3.1 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 7.3.2.2.3.3-2 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.

#### 7.3.2.2.3.2 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.

#### 7.3.2.2.3.3 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 7.3.2.2.3.3-1 are valid for normal PDCCH in DRX on period and PDCCH in DRX off period.

	Parameter	Unit	1 Tx Antenna		
TDI	DUL-DL pattern		FR2.120-1		
CCE to	REG mapping type		Interleaved		
RE	G bundle size		6		
In	terleaver size		2		
	Shift index		0		
	DRX cycle	ms	10		
ps	-WakeUp-r16		absent		
Wake-up indic	ation bit in DCI format 2_6		1		
	PS-offset		(T <sub>minimumTimeGap</sub> +1)/ <sub>2</sub> µ/0.125		
PDCCH DCI format 2 6	Number of PDCCH candidates		1		
configuration	That 2_0 Erequency domain resource		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: TminimumTimeGap is sigr	nalled as a part of drx-Adaptation-r16 L	JE capability			

#### Table 7.3.2.2.3.3-1: Test Parameters

For the parameters specified in Table 7.3.2.2.3.3-2, 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 7.3.2.2.3.3-2. The downlink physical setup is in accordance with Annex C.5.1.

#### Table 7.3.2.2.3.3-2: Minimum performance requirements with 120 kHz SCS

Teet	Bandwidth	CODESET	CODESET	Aggregation	Reference	Drenegation	Antenna configuration		rence lue
Test number	(MHz)	CORESET RB	CORESET duration	Aggregation level	Channel	Propagation Condition	and correlation Matrix	Pm- dsg (%)	SNR <sub>вв</sub> (dB)
3-1	100	60	1	4	R.PDCCH. 5-1.2 TDD		1x2 Low	1	3.0
5-1	100	00		8	R.PDCCH. 5-1.4 TDD		TAZ LOW	I	3.0

The normative reference for this requirement is TS 38.101-4 [5] clause 7.3.2.2.3.

7.3.2.2.3.4 Test description

7.3.2.2.3.4.1 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 subcarrier 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 DRX, DCP, PDCCH before measurement are specified in 7.3.2.2.3.4.3.1 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 source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the cell are set up according to Table 7.3-1 and Table 7.3.2.2.3.3-1as 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 38.521-2 [8].
- 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 7.3.2.2.3.4.3.

#### 7.3.2.2.3.4.2 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. Set the UE in a direction found using one of the test procedures defined in Annex H. If no direction found, mark the test as inconclusive.
- 3. SS transmits PDCCH with DCI format1\_1 as specified in PDCCH Reference Channel R.PDCCH. 5-1.2 TDD for C\_RNTI to transmit the DL RMC according to Table 7.3.2.2.3.4.4-1. The details of PDCCH are specified in Table 7.3.2.2.3.3-1 and Table 7.3.2.2.3.3-2. The details of PDSCH are specified in Table A.3.3.2.5-3. The SS sends downlink MAC padding bits on the DL RMC.
- 4. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 7.3.2.2.3.4.4-1 as appropriate.
- 5. 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 7.3.2.2.3.4.4-1, pass the UE. Otherwise fail the UE.
- 6. Repeat steps from 2 to 5 for each subtest in Table 7.3.2.2.3.4.4-1 as appropriate.

#### 7.3.2.2.3.4.3 Message contents

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

# 7.3.2.2.3.4.3.1

Message exceptions for SA

# Table 7.3.2.2.3.4.3.1-1: 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 7.3.2.2.3.4.3.1-2: DCP-Config

Derivation Path: TS 38.508-1 [6], Table 4.6.3-106	3		
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 7.3.2.2.3.4.3.1-3: 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(SEQUENCE(SIZE (13)) OF			
ControlResourceSet ::= SEQUENCE {			
ControlResourceSet[1]	ControlResourceSet1		
ControlResourceSet[2]	ControlResourceSet2		
}			
searchSpacesToAddModList	1 entry		
SEQUENCE(SIZE (110)) OF SearchSpace ::=			
SEQUENCE {			
SearchSpace[1]	SearchSpace		
}			
searchSpacesToAddModListExt-r16	1 entry		
SEQUENCE(SIZE (110)) OF SearchSpace {			
searchSpaceExt-r16[1]	SearchSpaceExt		
}			
}			

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6	6		
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
frequencyDomainResources	11111111 11000000 0000000 00000000 0000000 00000	CORESET to use the least significant 60 RBs of the BWP	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {	Null		
reg-BundleSize	n6		2
interleaverSize	n2		3
}			
}			
}			

# Table 7.3.2.2.3.4.3.1-4: PDCCH-ControlResourceSet1

# Table 7.3.2.2.3.4.3.1-5: PDCCH-ControlResourceSet2

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6	6		
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
controlResourceSetId	2		
frequencyDomainResources	11111111 11000000 0000000 00000000 0000000 00000	CORESET to use the least significant 60 RBs of the BWP	
Duration	1	SearchSpace duration of 1 symbol	
cce-REG-MappingType CHOICE {			
Interleaved SEQUENCE {			
reg-BundleSize	n6		
interleaverSize	n2		
}			
}			
tci-StatesPDCCH-ToAddList {	1	TCI State #1	
}			
}			

# Table 7.3.2.2.3.4.3.1-6: PDCCH Search Space

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7			
Information Element	Value/remark	Comment	Condition
SearchSpace ::= SEQUENCE {			
nrofCandidates SEQUENCE {			
aggregationLevel4	n1	AL4	
}			
}			

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 7.3.2.2.3.4.3.1-7: PDCCH Search Space Ext

#### 7.3.2.2.3.4.3.2 Message exceptions for NSA

Same as 7.3.2.2.3.4.3.1.

#### 7.3.2.2.3.4.4 Test requirement

Table 7.3.2.2.3.4.4-1 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 7.3.2.2.3.4.4-1.

# Table 7.3.2.2.3.4.4-1: Minimum performance with 120 kHz SCS

Test	Dendwidth CODECET CODECET Annagetian Deference Drenegatio		Droposition	Antenna configuration	Reference value							
Test number	00 0	Reference Channel		and correlation Matrix	Pm- dsg (%)	SNR <sub>BB</sub> (dB)						
2.1	100	100 60	1	1 4 8	1	4	4	R.PDCCH. 5-1.2 TDD		1/2   0//	1	4.7
3-1					8 R.PDCCH. 5-1.4 TDD TDLA30-300 1x2 Low	DCCH.	I	4.7				

# 7.4 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.

# 7.5 Sustained downlink data rate provided by lower layers

# 7.5.1 FR2 Sustained downlink data rate performance for single carrier

# 7.5.1.1 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.

#### 7.5.1.2 Test Applicability

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

#### 7.5.1.3 Minimum conformance requirements

The requirements in this clause are applicable to the FR2 single carrier case.

The requirements and procedure defined below apply using operating band instead of CA configuration, and bandwidth instead of bandwidth combination.

The test parameters are determined by the following procedure:

- Step 1: Calculate the date rate for all supported CA configurations and set of per component carrier (CC) UE capabilities among all supported UE capabilities:
  - Use Table 7.5.1.3-3 to determine the MCS (=MCS1) achieving the largest data rate [clause 4.1.2 of TS 38.306 [14]] based on UE capabilities.
  - Use Table 7.5.1.3-4 to determine the largest MCS (=MCS2) requiring SNR below test equipment maximum achievable SNR for that CA configuration.
  - Compute the data rate for CA configuration using the MCS = min(MCS1,MCS2) and the following equation for each CC in CA bandwidth combination.

$$DataRate = 10^{-3} \sum_{i=1}^{J} TBS_i 2^{\mu_j}$$

where

J is the number of aggregated component carriers in CA bandwidth combination

TBS<sub>j</sub> is the total number of DL-SCH transport block bits calculated based on methodology in Clause 5.1.3.2 of TS 38.214 [12] and using parameters from Table 7.5.1.3-1

 $\mu_j$  is provided in Clause 4.2 of TS 38.211 for different subcarrier spacing values

- Step 2: Choose the CA bandwidth combination among all supported CA configurations that achieves maximum data rate in step 1 among all UE capabilities.
  - 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 data rate, select one among sets with the smallest aggregated channel bandwidth.
- Step 3: For each CC in chosen CA bandwidth combination, use determined MCS for each CC in step 1 for that CA configuration based on test parameters and indicated UE capabilities.

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.3.1.

The TB success rate is defined as 100% \*NDL\_correct\_rx/ (NDL\_newtx + NDL\_retx), where NDL\_newtx is the number of newly transmitted DL transport blocks, NDL\_retx is the number of retransmitted DL transport blocks, and NDL\_correct\_rx is the number of correctly received DL transport blocks.

The test parameters are specified in Table 7.5.1.3-1.

Unless otherwise stated, no user data is scheduled on slot #0, 40 and 41 within 20 ms for SCS 60 kHz.

Unless otherwise stated, no user data is scheduled on slot #0, 80 and 81 within 20 ms for SCS 120 kHz.

	Parameter	Unit	Value
PDSCH transmission	n scheme		Transmission scheme 1
PTRS epre-Ratio			0
Channel bandwidth		MHz	Channel bandwidth from selected CA bandwidth combination
	Physical Cell ID		0
•	SSB position in burst		First SSB in Slot #0
Common serving	SSB periodicity	ms	20
cell parameters	First DMRS position for Type A PDSCH	110	
	mapping		2
Cross carrier schedu			Not configured
Active DL BWP index			1
	Offset between Point A and the lowest		
Actual carrier	usable subcarrier on this carrier (Note 3)	RBs	0
configuration	Subcarrier spacing	kHz	60 or 120
	RB Offset	NI IZ	0
	RD Olisel		Maximum transmission bandwidth
DL BWP configuration #1	Number of contiguous PRB		configuration as specified in clause 5.3.2 of TS 38.101-2 [7] for tested channel bandwidth and subcarrier spacing
	Subcarrier spacing	kHz	60 or 120
	Cyclic prefix		Normal
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH		Symbols #0
	Number of PRBs in CORESET		Table 7.5A.1-2
	Number of PDCCH candidates and		
	aggregation levels		1/8
	CCE-to-REG mapping type		Non-interleaved
PDCCH	DCI format		1-1
configuration	TCI State		TCI state #1
	PDCCH &PDCCH DMRS Precoding configuration		Single Panel Type I, Random per slo with equal probability of precoder index 0 and 2, and with REG bundling granularity for number of Tx larger than 1
	Mapping type		Type A
	k0		0
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		wideband
PDSCH	v		Type 0
	Resource allocation type RBG size		
configuration			Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
	Starting symbol (S)		1
	Length (L)		13
	DMRS Type		Туре 1
	Number of additional DMRS		1
	Length		1
PDSCH DMRS configuration	Antenna ports indexes		{1000} for 1 Layer CCs {1000, 1001} for 2 Layers CCs
	Number of PDSCH DMRS CDM group(s)		1
DTDO	without data		
PTRS	Frequency density ( <i>K</i> <sub>PT-RS</sub> )		2
configuration	Time density ( <i>L<sub>PT-RS</sub></i> )		1
	Subcarrier indexes in the PRB used for CSI-RS		$k_0 = 3$ for CSI-RS resource 1,2,3,4
CSI-RS for tracking	OFDM symbols in the PRB used for CSI- RS		$I_0 = 6$ for CSI-RS resource 1 and 3 $I_0 = 10$ for CSI-RS resource 2 and 4
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
			'No CDM' for CSI-RS resource
	CDM Type		1,2,3,4

# Table 7.5.1.3-1: Test parameters for FR2 TDD

	Density (a)			3 for CSI-RS resource 1,2,3,4
	Density (ρ)			60 kHz SCS: 80 for CSI-RS resource
			01-1-	1,2,3,4
	CSI-RS periodicity		Slots	120 kHz SCS: 160 for CSI-RS
				resource 1,2,3,4
				60 kHz SCS:
				40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4
	CSI-RS offset		Slots	
			0.010	120 kHz SCS:
				80 for CSI-RS resource 1 and 2
				81 for CSI-RS resource 3 and 4
	Frequency Occupa	tion		Start PRB 0 Number of PRB = ceil(BWP size/4)*4
	QCL info			TCI state #0
		in the PRB used for		
	CSI-RS			k <sub>0</sub> = 4
		he PRB used for CSI-		lo = 13
	RS			
	Number of CSI-RS	ports (X)		Same as number of transmit antenna
NZP CSI-RS for	CDM Type Density (ρ)			'FD-CDM2' 1
CSI acquisition				60 kHz SCS: 80
	CSI-RS periodicity		Slots	120 kHz SCS: 160
	CSI-RS offset			0
	Frequency Occupa	tion		Start PRB 0
				Number of PRB = ceil(BWP size/4)*4
	QCL info	in the DDD used for		TCI state #1
	Subcarrier indexes in the PRB used for CSI-RS			$k_0 = 0$
	OFDM symbols in the PRB used for CSI-			1 10
	RS			$I_0 = 12$
	Number of CSI-RS	ports (X)		4
ZP CSI-RS for CSI	CDM Type			'FD-CDM2'
acquisition	Density (ρ)			1 60 kHz SCS: 80
	CSI-RS periodicity		Slots	120 kHz SCS: 160
	CSI-RS offset			0
	Frequency Occupa	tion		Start PRB 0
				Number of PRB = ceil(BWP size/4)*4
	First subcarrier inde	ex in the PRB used for		$k_0=0$ for CSI-RS resource 1,2
		in the PRB used for		$I_0 = 8$ for CSI-RS resource 1
	CSI-RS	( ))		$l_0 = 9$ for CSI-RS resource 2
	Number of CSI-RS	ports (X)		1 for CSI-RS resource 1,2
	CDM Type Density (ρ)			'No CDM' for CSI-RS resource 1,2 3 for CSI-RS resource 1,2
CSI-RS for beam				60 kHz SCS: 80 for CSI-RS resource
refinement	CSI BS pariodiaity		Slota	1,2
	CSI-RS periodicity		Slots	120 kHz SCS: 160 for CSI-RS
			01.1	resource 1,2
	CSI-RS offset		Slots	0 for CSI-RS resource 1,2 Start PRB 0
	Frequency Occupa	tion		Number of PRB = ceil(BWP size/4)*4
	Repetition			ON
	QCL info			TCI state #1
	Type 1 QCL	SSB index		SSB #0
		QCL Type		Туре С
TCI state #0	information			
TCI state #0	Type 2 QCL	SSB index		SSB #0 Type D
TCI state #0	Type 2 QCL information	SSB index QCL Type		SSB #0 Type D CSI-RS resource 1 from 'CSI-RS for
TCI state #0	Type 2 QCL information Type 1 QCL	SSB index		Type D
	Type 2 QCL information	SSB index QCL Type		Type D CSI-RS resource 1 from 'CSI-RS for tracking' configuration Type A
TCI state #0 TCI state #1	Type 2 QCL information Type 1 QCL information	SSB index QCL Type CSI-RS resource QCL Type		Type D CSI-RS resource 1 from 'CSI-RS for tracking' configuration Type A CSI-RS resource 1 from 'CSI-RS for
	Type 2 QCL information Type 1 QCL	SSB index QCL Type CSI-RS resource		Type D CSI-RS resource 1 from 'CSI-RS for tracking' configuration Type A

Maximum number o	f code block groups for ACK/NACK			
feedback	5	1		
Number of HARQ P	rocesses	10 for FR2.60-1 and 8 for FR2.120-1		
K1 value		Specific to each UL-DL pattern		
Maximum number o	f HARQ transmission	4		
HARQ ACK/NACK	oundling	Multiplexed		
Redundancy version	n coding sequence	{0,2,3,1}		
TDD UL-DL pattern		60 kHz SCS: FR2.60-1 120 kHz SCS: FR2.120-1		
PDSCH & PDSCH DMRS Precoding configuration		Single Panel Type I, Precoder index 0 per slot with Wideband granularity for Rank 2		
Symbols for all unus	sed 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	on	Static propagation condition No external noise sources are applied		
Antenna	1 layer CCs	1x2 or 1x4		
configuration	2 layers CCs	2x2 or 2x4		
	annels mapping and precoding	As specified in Annex B.4.1		
<ul> <li>Note 1: PDSCH is scheduled only on full DL slots not containing SSB or TRS.</li> <li>Note 2: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission.</li> <li>Note 3: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [7] for tested</li> </ul>				
channel bandwidth and subcarrier spacing.				

Table 7.5.1.3-2: Number of PRBs in CORESET

SCS (kHz)	50 MHz	100 MHz	200 MHz	400 MHz
60	66	132	264	N.A
120	30	66	132	264

Maximum number of PDSCH MIMO layers	Maximum modulation format (Note 1)	Scaling factor	MCS (Note 2)		
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	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		
format" of 8, 1 "Maximum m Note 2: MCS Index is	format" of 8, the MCS index is derived from the rows with "Maximum modulation format" of 6.				
5.1.3.1 of TS	38.214 [12].				

 Table 7.5.1.3-3: MCS indexes for indicated UE capabilities

Table 7.5.1.3-4: SNR required to achieve 85% of peak throughput under AWGN conditions

MCS Index (Note 1)	SNR <sub>BB</sub> (dB) for maximum number of PDSCH MIMO Layers = 1	SNR <sub>BB</sub> (dB) for maximum number of PDSCH MIMO Layers = 2		
13	6.2	9.0		
14	7.2	9.9		
15	8.2	10.9		
16	8.7	11.6		
17	10.1	13.2		
18	10.7	13.7		
19	11.7	14.7		
20	12.7	15.6		
21	13.6	16.5		
22	14.8	17.6		
23	15.6	18.6		
24	16.9	19.7		
25	18.3	21.2		
26	19.3	22.3		
27	20.5	23.3		
Note 1: MCS Index is based on MCS index Table 1 defined in clause 5.1.3.1 of TS 38.214 [12].				

The normative reference for this requirement is TS 38.101-4 [5], clause 7.5.1.

# 7.5.1.4 Test description

#### 7.5.1.4.1 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 subcarrier 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 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.3.1.7.1 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 7.5.1.3-1 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.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 7.5.1.4.3.
- 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 7.5.1.3 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.

#### 7.5.1.4.2 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<sub>DL\_newtx</sub> by one
- 5. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments N<sub>DL\_retx</sub> 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.

#### 7.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

# Table 7.5.1.4.3-0: CLOSE UE TEST LOOP (in the preamble)

Derivation Path: 38.509 clause 6.3.1					
Information Element	Value/remark	Comment	Condition		
Protocol discriminator	1111				
Skip indicator	0000				
Message type	1000000				
UE test loop mode	00000000	UE test loop mode A			
UE test loop mode A LB setup					
Length of UE test loop mode A LB setup list in bytes	00000011	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, 0 0 Q5 Q4 Q3 Q2 Q1 Q0	UL PDCP SDU size = 0 Q5 = 1 (for NR Data Radio Bearers) Q4Q0 = 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 7.5.1.4.3-1: 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 (1maxDRB))	1 entry		DRB1		
OF SEQUENCE {					
cnAssociation CHOICE {					
sdap-Config	SDAP-Config				
}					
drb-Identity	DRB-Identity using				
	condition DRB1				
reestablishPDCP	true		DRB1 AND		
			Re-		
			establish_P		
			DCP		
pdcp-Config	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				
}					

## Table 7.5.1.4.3-2: PDCP-Config

## 7.5.1.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames.

# 7.5A.1 FR2 Sustained downlink data rate performance for carrier aggregation

## 7.5A.1.1 FR2 SDR performance for CA

#### 7.5A.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.

#### 7.5A.1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward supporting 2DLCA.

7.5A.1.3 Minimum conformance requirements

Same as 7.5.1.3

7.5A.1.4 Test description

7.5A.1.4.1 Initial conditions

- 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 7.5.1.3-1 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.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 7.5.1.4.3.

- 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 [18], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[19], clause9.3).
- 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 7.5.1.3 determine one set of parameters that would provide the largest data rate.
- 12. Setup up the NR cells using these parameters for the test.
- Configure the TBsize, DL RMC, UL RMC, PDCP size from Annex A.3.2\_1 and Annex A.2.2 for UL as appropriate.

#### 7.5A.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<sub>DL newtx</sub> 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  $A \ge 85\%$  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.

#### 7.5A.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

Derivation Path: 38.509 clause 6.3.1					
Information Element	Value/remark	Comment	Condition		
Protocol discriminator	1111				
Skip indicator	0000				
Message type	1000000				
UE test loop mode	00000000	UE test loop mode A			
UE test loop mode A LB setup					
Length of UE test loop mode A LB setup list in	00000011	Length of one LB			
bytes		setup DRB (3 bytes)			
LB setup DRB	00000000,	UL PDCP SDU size			
	00000000,	= 0			
	0 0 Q5 Q4 Q3 Q2 Q1	Q5 = 1 (for NR Data			
	Q0	Radio Bearers)			
		Q4Q0 = 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 7.5A.1.4.3-0: CLOSE UE TEST LOOP (in the preamble)

## Table 7.5A.1.4.3-1: RadioBearerConfig

Derivation Path: TS	38.508-1 [6], clause 4.6.3-1	32	
Information Element	Value/remark	Comment	Condition
RadioBearerConfig ::= SEQUENCE {			
drb-ToAddModList SEQUENCE (SIZE (1maxDRB)) OF SEQUENCE {	1 entry		DRB1
cnAssociation CHOICE {			
sdap-Config	SDAP-Config		
}			
drb-Identity	DRB-Identity using condition DRB1		
reestablishPDCP	true		DRB1 AND Re- establish_P DCP
pdcp-Config	PDCP-Config		
}			

## Table 7.5A.1.4.3-2: 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				
}					

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#### 7.5A.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.

## 8 CSI reporting requirements (Radiated requirements)

## 8.1 General

This clause includes radiated requirements for the reporting of channel state information (CSI).

For conformance testing involving FR2 test cases in this specification, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

## 8.1.1 Applicability of requirements

## 8.1.1.1 General

The minimum performance requirements are applicable to the FR2 operating bands defined in TS 38.101-2 [3] with  $F_{DL\_high}$  not exceeding 40000 MHz.

The minimum performance requirements in Clause 8 are mandatory for UE supporting NR operation, except test cases listed in Clause 8.1.1.3, 8.1.1.4.

## 8.1.1.2 Applicability of requirements for different number of RX antenna ports

UE shall support 2 RX ports for different RF operating bands. The UE requirements applicability is defined in Table 8.1.1.2-1.

Supported RX antenna ports	Test type	Test list
UE supports 2RX	CQI	All tests in Clause 8.2.2
antenna	PMI	All tests in Clause 8.3.2
	RI	All tests in Clause 8.4.2

Table 8.1.1.2-1:	Requirements	applicability
------------------	--------------	---------------

## 8.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 8.1.1.3-1 shall apply for UEs which support optional UE features only.

## Table 8.1.1.3-1: Requirements applicability for optional UE features

UE feature/capability [14]	Test	type	Test list	Applicability notes
256QAM modulation scheme for PDSCH for FR2 ( <i>pdsch-256QAM- FR</i> 2)	FR2 TDD	CQI	Clause 8.2.2.2.1_1 (Tests 3 and 4)	The test coverage can be considered fulfilled without executing of Test 1 and 2 from Clause 8.2.2.2.2.1 if UE passes Test 3 and 4 from Clause 8.2.2.2.1_1

# 8.1.1.4 Applicability of requirements for mandatory UE features with capability signalling

The performance requirements in Table 8.1.1.4-1 shall apply for UEs which support mandatory UE features with capability signalling only.

UE feature/capability [14]	Test	type	Test list	Applicability notes
Supported maximum number of PDSCH MIMO layers ( <i>maxNumberMIMO-</i> <i>LayersPDSCH</i> )	FR2 TDD	CQI	Clause 8.2.2.2.1.1	The requirements apply only in case the PDSCH MIMO rank in the test case does not exceed UE PDSCH
Layersr DSG(1)		RI	Clause 8.4.2.2	MIMO layers capability
Support of 1 part DTDS	FR2 TDD	CQI	Clause 8.2	
Support of 1 port PTRS		PMI	Clause 8.3	
(onePortsPTRS)		RI	Clause 8.4	

## Table 8.1.1.4-1: Requirements applicability for mandatory features with UE capability signalling

## 8.1.1.5 Applicability of Channel Quality Indicator (CQI) reporting requirements for CA

# 8.1.1.5.1 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in clause 8.2A are defined independent of CA configurations and bandwidth combination sets specified in clause 5.5A in TS 38.101-2 [7].

For UEs supporting multiple CA capabilities, test any one of the supported CA capabilities with largest aggregated CA bandwidth combination. The categorization of CA capability is specified in clause 7.1.1.5.1.

For UEs supporting multiple CA configurations from the selected CA capability, test any one of the supported CA configurations with largest aggregated CA bandwidth combination. For simplicity, the CA configuration refers to combination of CA configuration and bandwidth combination set.

A single uplink CC is configured for all tests.

## 8.1.1.5.2 Test coverage for different number of component carriers

For CA CQI tests specified in clause 8.2A, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

## 8.1.1\_1 Applicability of test requirements due to maximum achievable SNR

The current assumption of maximum testable SNR<sub>BB</sub> for PC3, Max device size  $\leq$  30 cm under fading conditions is specified in Tables 7.1.1\_1-1 and 7.1.1\_1-1a.

The current assumption of maximum testable SNR<sub>BB</sub> for indirect far field (IFF), PC3, Max device size  $\leq$  30 cm without fading conditions is specified in Tables 8.1.1\_1-0 and 8.1.1\_1-1.

Operating Band	Maximum testable SNR <sub>BB</sub> (dB)					
/ Frequency	CHBW 50 MHz	CHBW 100 MHz	CHBW 200 MHz			
n257 mid	26.3	23.2	20.1			
n258 mid	26.3	23.2	20.1			
n259 mid	16.0	12.8	9.6			
n260 mid	20.1	16.9	13.8			
n261 mid	26.3	23.2	20.1			

# Table 8.1.1\_1-0: Current assumption of maximum testable SNR<sub>BB</sub> under fading for modulations up to 256 QAM for CSI scenarios

# Table 8.1.1\_1-1: Current assumption of maximum testable SNR<sub>BB</sub> without fading for modulations up to 256 QAM

Operating Band	Maximum testable SNR BB (dB)					
/ Frequency	CHBW 50 MHz	CHBW 100 MHz	CHBW 200 MHz			
n257 mid	28.7	25.5	22.5			
n258 mid	28.7	25.5	22.5			
n259 mid	18.4	15.2	12.1			
n260 mid	22.5	19.3	16.3			
n261 mid	28.7	25.5	22.5			

Based on the current assumption of maximum testable SNR<sub>BB</sub>, the applicability of test points is defined in Table 8.1.1\_1-2 for indirect far field (IFF), PC3, Max device size  $\leq$  30 cm under fading conditions.

Test Case	Test point	CHBW / MHz	Fading	SNR test		Test Po	int Appli	cability	
Test Case	Test point		Fading	requirement	n257	n258	n259	n260	n261
8.2.2.2.1.1	1	100	No	9	Х	Х	х	х	х
	2	100	No	15	х	Х	х	х	х
8.2.2.2.2.1	1	100	Yes	7	х	Х	х	х	х
	2	100	Yes	13	х	Х	х	х	х
8.2.2.2.2.1_1	3	50	Yes	8	х	Х	х	х	х
	4	50	Yes	21	Х	Х	TBD	TBD	Х
8.2A.3.1.1	1	BW <sub>agg</sub> ≤ 200	No	10	Х	Х	х	х	Х
0.2A.3.1.1	1	$BW_{agg} > 200$	No	10	TBD	TBD	TBD	TBD	TBD
8.2A.3.1.2	1	BW <sub>agg</sub> ≤ 200	No	12	х	Х	х	х	х
0.2A.3.1.2	1	$BW_{agg} > 200$	No	12	TBD	TBD	TBD	TBD	TBD
8.2A.3.1.3	1	BW <sub>agg</sub> ≤ 200	No	12	х	Х	х	х	х
0.2A.3.1.3	1	$BW_{agg} > 200$	No	12	TBD	TBD	TBD	TBD	TBD
8.4.2.2.1	1	100	Yes	0	Х	Х	Х	х	Х
	2	100	Yes	16	х	Х	х	х	х
	3	100	Yes	16	х	х	х	х	х

## 8.1.2 Common test parameters

Parameters specified in Table 8.1.2-1 are applied for all test cases in this section unless otherwise stated.

	Parameter	Unit	Value
PDSCH transmiss	ion scheme		Transmission scheme 1
Duplex Mode			TDD
PTRS epre-Ratio			0
	Offset between Point A and the		
Actual carrier	lowest usable subcarrier on this	RBs	0
configuration	carrier (Note 3)		
	Subcarrier spacing	kHz	120
	Cyclic prefix		Normal
	RB offset	RBs	0
DL BWP configuration #1	Number of contiguous PRB	PRBs	Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-2 [3] for tested channel bandwidth and subcarrier spacing
Active DL BWP in			1
Common	Physical Cell ID		0
serving cell	SSB position in burst		First SSB in Slot #0
parameters	SSB periodicity	ms	20
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH Number of PDCCH candidates		0,1
			1/AL8
	and aggregation levels DCI format		1 1
	TCI state		TCI state #1
			Multi-path fading propagation
PDCCH configuration	PDCCH & PDCCH DMRS Precoding configuration		conditions: Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1 Static propagation conditions: Single Panel Type I, Random precoder chosen from precoder index 0 and 2, selection updated
			per slot
Cross carrier sche			Not configured
	Mapping type		Туре А
	kO		0
	Starting symbol (S)		2
	Length (L)		12
550011	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver		N/A
	bundle size		Tupo 1
	DMRS Type Number of additional DMRS		Type 1
	DMRS ports indexes		ا {1000} for Rank1 {1000,1001} for Rank2
PDSCH DMRS configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
	Number of PDSCH DMRS CDM group(s) without data	pcarrier on this       RBs         g       kHz         RBs       M         uous PRB       PRBs         PRBs       Spectroscope         urst	2
DTD0	Frequency density ( <i>K</i> <sub>PT-RS</sub> )		2
PTRS	Time density ( <i>L</i> <sub>PT-Rs</sub> )		1
configuration	Resource Element Offset		2
		1	-

## Table 8.1.2-1: Test parameters for CSI test cases

			1		
		ier index in the PRB		0 for CSI-RS resource 1,2,3,4	
	used for CSI				
		symbol in the PRB		4 for CSI-RS resource 1 and 3	
	used for CSI	SI-RS ports ( <i>X</i> )		8 for CSI-RS resource 2 and 4 1 for CSI-RS resource 1,2,3,4	
	• • • • •			No CDM for CSI-RS resource	
	CDM Type			1,2,3,4	
CSI-RS for	Density (p)			3 for CSI-RS resource 1,2,3,4	
tracking			-1-4	120kHz SCS: 160 for CSI-RS	
Ū	CSI-RS perio	Daicity	slot	resource 1,2,3,4	
				120 kHz SCS:	
	CSI-RS offset		slot	80 for CSI-RS resource 1 and 2	
				81 for CSI-RS resource 3 and 4	
	Frequency C	Occupation		Start PRB 0	
	QCL info	•		Number of PRB = BWP size TCI state #0	
				Start PRB 0	
NZP CSI-RS for	Frequency C	occupation		Number of PRB = BWP size	
CSI acquisition	QCL info			TCI state #1	
ZP CSI-RS for				Start PRB 0	
CSI acquisition	Frequency C	•		Number of PRB = BWP size	
		ier index in the PRB		k <sub>0</sub> =0 for CSI-RS resource 1,2	
	used for CSI				
	used for CSI	symbol in the PRB		$l_0 = 8$ for CSI-RS resource 1	
		-RS SI-RS ports (X)		l <sub>0</sub> = 9 for CSI-RS resource 2 1 for CSI-RS resource 1,2	
				'No CDM' for CSI-RS resource	
CSI-RS for	CDM Type			1,2	
beam refinement	Density (p)			3 for CSI-RS resource 1,2	
			Olata	120 kHz SCS: 160 for CSI-RS	
	CSI-RS periodicity		Slots	resource 1,2	
	CSI-RS offset		Slots	0 for CSI-RS resource 1,2	
	Repetition			ON	
	QCL info			TCI state #1	
	Type 1 QCI	SSB index		SSB #0	
	information	QCL Type		Туре С	
TCI state #0	Type 2	SSB index		SSB #0	
	QĊL				
	information	QCL Type		Туре D	
	Type 1	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS	
	QCL			for tracking' configuration	
TCI state #1	information	QCL Type		Туре А	
	Type 2	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS	
	QCL information			for tracking' configuration	
Number of HARQ		QCL Type		Type D	
HARQ ACK/NACK				8 Multiplexed	
Redundancy versi		lience		{0,2,3,1}	
reduindancy void	on coung coq			For FR2.120-1:	
				3  if mod  (i.5) = 0,	
				6 if $mod(i,5) = 2$	
K1 value				For FR2.120-2:	
(PDSCH-to-HARG	)-timina-indicat	or)		11  if mod(i,8) = 0,	
		/		7]if mod(i,8) = 4,	
			6]if mod(i,8) = 5, where i is slot index per radio		
				fame with values 0-79.	
Symbols for unuse	ed REs			OCNG as specified in A.5	
		ing and precoding		As specified in Annex B.4.1	
			CSI-RS or	slots which are not full DL.	
				cal to the TCI state applied for the	
PDCCH	I transmission.				
				d in Table 5.3.3-1 from TS 38.101-	
2 [3] for tested channel bandwidth and subcarrier spacing.					

## 8.2 Reporting of Channel Quality Indicator (CQI)

8.2.1 1RX requirements

TBD

- 8.2.2 2RX requirements
- 8.2.2.1 FDD

TBD

- 8.2.2.2 TDD
- 8.2.2.2.1 CQI reporting under AWGN conditions
- 8.2.2.2.1.1 2Rx TDD FR2 periodic wideband CQI reporting under AWGN performance for both SA and NSA
- 8.2.2.2.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

8.2.2.2.1.1.2 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.

## 8.2.2.2.1.1.3 Minimum requirement for periodic CQI reporting

The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 8.2.2.2.1.1.3-1, and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified by the following:

- a) the reported CQI value shall be in the range of  $\pm 1$  of the reported median more than 90% of the time;
- b) if the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by the less than or equal to 0.1.

	Parameter	Unit	Test 1 Test 2
Bandwidth	l'alameter	MHz	100
Subcarrier sp	acing	kHz	120
Duplex Mode	aong	KI IZ	TDD
TDD Slot Cor	figuration		FR2.120-2 Annex A.1.3
SNR <sub>BB</sub>	linguration	dB	8 9 14 15
Propagation of	hannol	uВ	8 9 14 15 AWGN
FIOPAGALION			2x2 with static channel
Antenna conf	iguration		
	-		specified in Annex B.1
Beamforming	Model		As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports ( <i>X</i> )		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the		
configuratio			8
n	PRB used for CSI-RS ( $k_0$ , $k_1$ )		
	First OFDM symbol in the PRB		13
	used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		
	CSI-RS	slot	8/1
	periodicity and offset		D
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	CDM Type		fd-CDM2
NZP CSI-	Density (ρ)		1
RS for CSI	First subcarrier index in the		6
acquisition	PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		<u> </u>
acquiencer	First OFDM symbol in the PRB		13
	used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )	13           slot         8/1	
	NZP CSI-RS-timeConfig	slot	8/1
	periodicity and offset	0101	
	CSI-IM resource Type		Periodic
CSI-IM	CSI-IM RE pattern		1
configuratio	CSI-IM Resource Mapping		(8, 13)
n	(ксы-ім,Ісы-ім)		(8, 18)
	CSI-IM timeConfig	slot	8/1
	periodicity and offset	5101	
ReportConfig	Туре		Periodic
CQI-table			Table 1
reportQuantity	ý		cri-RI-PMI-CQI
timeRestrictio	nForChannelMeasurements		Not configured
	nForInterferenceMeasurements		Not configured
cqi-FormatInc			Wideband
pmi-FormatIn			Wideband
Sub-band Siz		RB	8
csi-Reporting			11111111
	eriodicity and offset	slot	8/3
aperiodicTrigg	geringOffset		Not configured
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig-	1	· · ·
configuration	N1,CodebookConfig-N2)		Not configured
30.000	CodebookSubsetRestriction		010000
	RI Restriction		N/A
Physical char	nel for CSI report		PUCCH
. Hyoioai onai	CQI/RI/PMI delay	ms	8.375
Maximum nur	nber of HARQ transmission	1110	1
			As specified in Table
Measurement	t channel		As specified in Table A.4-1, TBS.1-2

Table 8.2.2.2.1.1.3-1	Test parameters
-----------------------	-----------------

The normative reference for this requirement is TS 38.101-4 [5] clause 8.2.2.2.1.1.

## 8.2.2.2.1.1.4 Test Description

### 8.2.2.2.1.1.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [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.

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, AWGN noise source and the UE antenna is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 8.1.2-1 and Table 8.2.2.2.1.1.3-1 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 38.521-2 [8].
- 4. Propagation conditions for 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 content are defined in clause 8.2.2.2.1.1.4.3.

## 8.2.2.2.1.1.4.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O. If no direction found mark the test as inconclusive.
- 2. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 8.2.2.2.1.1.3-1.
- 3. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 1 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 4. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.
- 5. If Median CQI is not equal to 1 or 15 and 1800 or more of the wideband CQI values are in the range (Median CQI 1)  $\leq$  Median CQI + 1) then continue with step 6, otherwise go to step 9.
- 6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio  $(NACK / ACK + NACK) \le 0.1$  then go to step 7, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 8 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK / ACK + NACK) > 0.1

then pass the UE for this test and go to step 10, otherwise go to step 9.

8. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 6 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK)  $\leq 0.1$ 

then pass the UE for this test and go to step 10, otherwise go to step 9.

- 9. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 8) for the other SNR point as appropriate. Otherwise fail the UE.
- 10. Repeat step 1 to 9 for Test2.

#### 8.2.2.2.1.1.4.3 Message Contents

Message contents are according to TS 38.508-1 [6] subclause 4.6.1 and 5.4.2 with the following exceptions:

## 8.2.2.2.1.1.4.3\_1 Message exceptions for SA

#### Table 8.2.2.2.1.1.4.3\_1-1: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-39			
Information Element	Value/remark	Comment	Condition
CSI-ReportConfig ::= SEQUENCE {			
reportConfigType CHOICE {		Periodic	
periodic SEQUENCE {			
reportSlotConfig	CSI- ReportPeriodicityAndOffs et	8/1	
}			
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE{			
Subbands9	11111111		
}			
}			
}			

## Table 8.2.2.2.1.1.4.3\_1-2: CodebookConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-25				
Information Element	Value/remark	Comment	Condition	
CodebookConfig ::= SEQUENCE {				
codebookType CHOICE {				
type1 SEQUENCE {				
subType CHOICE {				
typeI-SinglePanel SEQUENCE {				
nrOfAntennaPorts CHOICE {				
Two SEQUENCE {				
twoTX-codebookSubsetRestriction	010000			
}				
}				
}				
}				
}				
}				
}				

## Table 8.2.2.2.1.1.4.3\_1-3: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-157				
Information Element	Value/remark	Comment	Condition	
SchedulingRequestResourceConfig ::= SEQUENCE {				
periodicityAndOffset CHOICE {				
SI80	7			
}				
}				

## 8.2.2.2.1.1.4.3\_2 Message exceptions for NSA

Same as 8.2.2.2.1.1.4.3\_1.

## 8.2.2.2.1.1.5 Test Requirements

The pass/fail decision is as specified in the test procedure in clause 8.2.2.2.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

- 8.2.2.2.2 CQI reporting under fading conditions
- 8.2.2.2.2.1 2Rx TDD FR2 aperiodic wideband CQI reporting under fading performance for both SA and NSA
- 8.2.2.2.2.1.1 Test Purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 1% for the indicated transport format.

#### 8.2.2.2.1.2 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.

#### 8.2.2.2.1.3 Minimum requirement for aperiodic CQI reporting

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to

the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the CQI reporting under frequency non-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 8.2.2.2.1.3-1 and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified by the following:

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$  % of the time, where  $\alpha$ % is specified in Table 8.2.2.2.1.3-2;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ , where  $\gamma$  is specified in Table 8.2.2.2.1.3-2;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.01.

	Parameter	Unit	Test 1 Test 2
Bandwidth		MHz	100
Subcarrier sp	acing	kHz	120
Duplex Mode			TDD
TDD Slot Cor	ofiguration		FR2.120-2 Annex
			A.1.3
SNRBB		dB	6 7 12 13
Propagation of	channel		TDLA30-35
Antenna conf	iguration		2x2
	-		ULA High As specified in Annex
Beamforming	Model		B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuratio	First subcarrier index in the		0
n	PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		8
11	First OFDM symbol in the PRB		13
	used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		10
	CSI-RS	slot	8/1
	interval and offset		
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports (X)		2
	CDM Type		fd-CDM2
	Density (ρ)		1
NZP CSI-	First subcarrier index in the		6
RS for CSI	PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		-
acquisition	First OFDM symbol in the PRB		13
	used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )		
	NZP CSI-RS-timeConfig	slot	Not configured
	interval and offset aperiodicTriggeringOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		
CSI-IM	CSI-IM Resource Mapping		
configuratio	(kcsi-im,lcsi-im)		(8, 13)
n	CSI-IM timeConfig		
	interval and offset	slot	Not configured
ReportConfig	•		Aperiodic
CQI-table			Table 1
reportQuantit	V		cri-RI-PMI-CQI
	nForChannelMeasurements		Not configured
	nForInterferenceMeasurements		Not configured
cqi-FormatInd			Wideband
pmi-FormatIn			Wideband
Sub-band Siz		RB	8
csi-Reporting			111111111
	eriodicity and offset	slot	Not configured
	port Slot Offset		6
			1 in slots i, where
CSI request			mod(i, 8) = 1,
			otherwise it is equal to
. <u> </u>	0		0
reportTrigger	Size		1
			One State with one
			Associated Report
CSLAporiodia	cTriggerStateList		Configuration Associated Report
	InggerolateList		Configuration contains
			pointers to NZP CSI-
			RS and CSI-IM
Codebook	Codebook Type		typel-SinglePanel
configuration	Codebook Mode		1
garacon		1	

## Table 8.2.2.2.2.1.3-1: Test parameters

	(CodebookConfig- N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	1.375
Maximum number of HARQ transmission			1
Measurement channel			As specified in Table A.4-1, TBS.1-1

#### Table 8.2.2.2.2.1.3-2 Minimum requirements

	Test 1	Test 2
α[%]	2	2
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 8.2.2.2.1.

## 8.2.2.2.1.4 Test Description

#### 8.2.2.2.1.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [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.

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, the faders, AWGN noise source and the UE antenna is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 8.1.2-1 and Table 8.2.2.2.1.3-1 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 38.521-2 [8].
- 4. Propagation conditions for 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 content are defined in clause 8.2.2.2.2.1.4.3.

#### 8.2.2.2.1.4.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O. If no direction found mark the test as inconclusive.
- 2. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 8.2.2.2.1.5-1.

- 3. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 6000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 1 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.
- 4. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as Median CQI value.
- 5. If Median CQI value is not equal to 1 or 15 and 120 ( $\alpha$ %) or more of the wideband CQI values are outside the range (Median CQI 1)  $\leq$  Median CQI  $\leq$  (Median CQI + 1) then continue with step 6, otherwise go to step 8.
- 6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the Median CQI value from step 4 and shall not react to the UE's wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. Measure the average throughput according to Annex G.3.3 and G.3.4.

Declare the throughput as  $t_{median}$ .

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE's reported wideband CQI value. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000. Record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as t.

If the recorded BLER  $\ge 0.01$  and t /  $t_{median} \ge \gamma$  then pass the UE for this test and go to step 9.

- 8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 2 to 7) for the other SNR point as appropriate. Otherwise fail the UE.
- 9. Repeat step 2 to 8, with test conditions according to the table 8.2.2.2.2.1.5-1, for Test2 as appropriate.

8.2.2.2.1.4.3 Message Contents

Message contents are according to TS 38.508-1 [6] subclause 4.6.1 and 5.4.2 with the following exceptions:

8.2.2.2.2.1.4.3\_1 Message exceptions for SA

## Table 8.2.2.2.2.1.4.3\_1-1: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-39				
Information Element	Value/remark	Comment	Condition	
CSI-ReportConfig ::= SEQUENCE {				
reportConfigType CHOICE {		Aperiodic		
aperiodic SEQUENCE {				
reportSlotOffsetList	6			
}				
}				
reportFreqConfiguration SEQUENCE {				
csi-ReportingBand CHOICE{				
Subbands9	11111111			
}				
}				
}				

Derivation Path: TS 38.508-1 [6], Table 4.6.3-25			
Information Element	Value/remark	Comment	Condition
CodebookConfig ::= SEQUENCE {			
codebookType CHOICE {			
type1 SEQUENCE {			
subType CHOICE {			
typeI-SinglePanel SEQUENCE {			
nrOfAntennaPorts CHOICE {			
Two SEQUENCE {			
twoTX-codebookSubsetRestriction	000001		
}			
}			
}			
}			
}			
}			

## Table 8.2.2.2.2.1.4.3\_1-2: CodebookConfig

## Table 8.2.2.2.2.1.4.3\_1-3: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-157			
Information Element	Value/remark	Comment	Condition
SchedulingRequestResourceConfig ::= SEQUENCE {			
periodicityAndOffset CHOICE {			
SI80	7		
}			
}			

## 8.2.2.2.1.4.3\_2 Message exceptions for NSA

Same as in 8.2.2.2.1.4.3\_1.

## 8.2.2.2.2.1.5

## **Test Requirements**

	Parameter	Unit	Test 1 Test 2
Bandwidth		MHz	100
Subcarrier spacing		kHz	120
Duplex Mode	Duplex Mode		TDD
TDD Slot Configuration			FR2.120-2 Annex
TDD Slot Configuration			A.1.3
SNRBB		dB	6+ 7+ 12 13 TT TT +T +T T T T T
Propagation channel			TDLA30-35
Antenna configuration			2×2 ULA High
Beamforming Model			As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		8
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		13
	CSI-RS interval and offset	slot	8/1
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports (X)		2
	CDM Type		fd-CDM2
	Density (ρ)		1
NZP CSI-RS	First subcarrier index in the		6
for CSI acquisition	PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> ) First OFDM symbol in the PRB		13
	used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> ) NZP CSI-RS-timeConfig	-1-4	-
	interval and offset	slot	Not configured
	aperiodicTriggeringOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		1
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(8, 13)
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigT	уре		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
	ForChannelMeasurements		Not configured
	ForInterferenceMeasurements		Not configured
cqi-FormatInd			Wideband
pmi-FormatInd			Wideband
Sub-band Size		RB	8
csi-ReportingBand			11111111
CSI-Report periodicity and offset		slot	Not configured
Aperiodic Rep	ort Slot Offset		6
CSI request			1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0
reportTriggerS	Size	1	1
	TriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains

## Table 8.2.2.2.2.1.5-1 Test parameters

			pointers to NZP CSI- RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		Not configured
-	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel for CSI report			PUSCH
	CQI/RI/PMI delay	ms	1.375
Maximum number of HARQ transmission			1
Measurement channel			As specified in Table A.4-1, TBS.1-1
Note 1: TT = 0dB			

Table 8.2.2.2.2.1.5-2 Test requirements

	Test 1	Test 2
α[%]	2	2
γ	1.05 - TT	1.05 - TT
Note 1: TT = 0.01		

# 8.2.2.2.1\_1 2Rx TDD FR2 aperiodic CQI wideband reporting under fading performance for both SA and NSA – 256QAM (Rel-16 and forward)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Test point applicability is TBD for all bands in Table 8.1.1\_1-2.

## 8.2.2.2.2.1\_1.1 Test Purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 1% for the indicated transport format.

#### 8.2.2.2.1\_1.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting DL 256QAM.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and NR DL 256QAM.

#### 8.2.2.2.1\_1.3 Minimum requirement for aperiodic CQI reporting

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the CQI reporting under frequency non-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 8.2.2.2.1\_1.3-1 and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified by the following:

- a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time, where α% is specified in Table 8.2.2.2.1\_1.3-2;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ , where  $\gamma$  is specified in Table 8.2.2.2.1\_1.3-2;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.01.

Davada 194	Parameter	Unit	Test 3 Test 4
Bandwidth		MHz	50
Subcarrier spacing		kHz	120
Duplex Mode			TDD
TDD Slot Configuration			FR2.120-2 Annex
	5	JD	A.1.3
SNR <sub>BB</sub>	hannal	dB	7 8 20 21
Propagation of	channei		TDLA30-35 2x2
Antenna conf	iguration		ULA High
			As specified in Annex
Beamforming	Model		B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
ZP CSI-RS	Density (ρ)		1
configuratio	First subcarrier index in the		8
n	PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		0
	First OFDM symbol in the PRB		13
	used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		
	CSI-RS	slot	8/1
	interval and offset		
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports (X) CDM Type		2 fd-CDM2
NZP CSI-	Density (ρ) First subcarrier index in the		1
RS for CSI	PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		6
acquisition	First OFDM symbol in the PRB		
acquisition	used for CSI-RS (lo, l1)		13
	NZP CSI-RS-timeConfig		
	interval and offset	slot	Not configured
	aperiodicTriggeringOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		1
CSI-IM configuratio	CSI-IM Resource Mapping		(8, 13)
n	(ксы-ім,Ісы-ім)		(0, 13)
	CSI-IM timeConfig	slot	Not configured
	interval and offset	5101	Not conliguica
ReportConfig	Туре		Aperiodic
CQI-table			Table 2
reportQuantit			cri-RI-PMI-CQI
	nForChannelMeasurements		Not configured
	nForInterferenceMeasurements		Not configured
cqi-FormatInd			Wideband
pmi-FormatIn			Wideband
Sub-band Siz		RB	8
csi-Reporting		clo+	111111111 Not configured
	eriodicity and offset	slot	Not configured
Арепосіс ке	port Slot Offset		6 1 in slots i, where
			mod(i, 8) = 1,
CSI request			otherwise it is equal to
			0
reportTrigger	Size		1
			One State with one
			Associated Report
			Configuration
CSI-Aperiodic	cTriggerStateList		Associated Report
			Configuration contains
			pointers to NZP CSI-
			RS and CSI-IM
Codebook	Codebook Type Codebook Mode		typel-SinglePanel
configuration		1	1

## Table 8.2.2.2.2.1\_1.3-1: Test parameters

	(CodebookConfig- N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	1.375
Maximum number of HARQ transmission			1
Measurement channel			As specified in Table A.4-2, TBS.2-7

## Table 8.2.2.2.2.1\_1.3-2 Minimum requirements

	Test 3	Test 4
α [%]	2	2
γ	1.05	1.05

The normative reference for this requirement is TS 38.101-4 [5] clause 8.2.2.2.2.1.

### 8.2.2.2.1\_1.4 Test Description

Same test description as in clause 8.2.2.2.1.4 with the following exception:

- Table 8.2.2.2.2.1\_1.3-1 instead of 8.2.2.2.2.1.3-1
- Table 8.2.2.2.1\_1.4.1- instead of 8.2.2.2.2.1.4.3\_1-1
- Table 8.2.2.2.1\_1.5-1 instead of 8.2.2.2.2.1.5-1
- In test procedures, Test 3 and Test 4 are configured and tested.

## Table 8.2.2.2.2.1\_1.4.1-1: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-39			
Information Element	Value/remark	Comment	Condition
CSI-ReportConfig ::= SEQUENCE {			
reportConfigType CHOICE {		Aperiodic	
aperiodic SEQUENCE {			
reportSlotOffsetList	6		
}			
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE{			
Subbands9	11111111		
}			
}			
cqi-Table	table2		Test 3 and 4
}			

## 8.2.2.2.1\_1.5 Test Requirements

	Parameter	Unit	Test 3 Test 4
Bandwidth		MHz	50
Subcarrier spacing		kHz	120
Duplex Mode			TDD
TDD Slot Configuration			FR2.120-2 Annex A.1.3
SNRBB		dB	7+ 8+ 20 21 TT TT +T +T T T T T
Propagation c	hannel		TDLA30-35
Antenna confi	guration		2×2 ULA High
Beamforming Model			As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		8
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		13
	CSI-RS interval and offset	slot	8/1
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports (X)		2
	CDM Type		fd-CDM2
	Density (ρ)		1
NZP CSI-RS for CSI	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		6
acquisition	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		13
	NZP CSI-RS-timeConfig interval and offset	slot	Not configured
	aperiodicTriggeringOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		1
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(8, 13)
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfig			Aperiodic
CQI-table			Table 2
reportQuantity	,		cri-RI-PMI-CQI
	nForChannelMeasurements	İ	Not configured
	nForInterferenceMeasurements	İ	Not configured
cqi-FormatInd			Wideband
pmi-Formating			Wideband
Sub-band Size		RB	8
csi-Reporting			11111111
CSI-Report periodicity and offset		slot	Not configured
Aperiodic Report Slot Offset		3101	6
CSI request			1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0
reportTriggerS	Bize		1
	TriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains

## Table 8.2.2.2.2.1\_1.5-1 Test parameters

			pointers to NZP CSI- RS and CSI-IM
	Codebook Type		typeI-SinglePanel
	Codebook Mode		1
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		Not configured
-	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical chann	nel for CSI report		PUSCH
	CQI/RI/PMI delay	ms	1.375
Maximum number of HARQ transmission			1
Measurement channel			As specified in Table A.4-2, TBS.2-7
Note 1: TT =	= 0dB		

Table 8.2.2.2.2.1\_1.5-2 Test requirements

	Test 3	Test 4
α [%]	2	2
γ	1.05 - TT	1.05 - TT
Note 1: TT = 0.01		

## 8.2A Reporting of Channel Quality Indicator (CQI) for CA

## 8.2A.1 General

This clause includes the requirements for the reporting of channel quality indicator (CQI) with the UE configured for CA. The purpose is to verify that the CQI is correctly reported in accordance with the CQI definition given in TS 38.214 [12] for each CC with multiple cells configured for periodic reporting.

## 8.2A.2 1RX requirements

(Void)

## 8.2A.3 2RX requirements

## 8.2A.3.1 CQI reporting definition under AWGN conditions

## 8.2A.3.1.0 Minimum requirement for periodic CQI reporting

For the CA CQI reporting test defined in Table 8.2A.3.1.0-4, the test requirements and the test parameters are defined as below.

For each CC, the test parameters are specified in Table 8.2A.3.1.0-1.

For CA with 2 DL CC, for the SNR configuration specified in Table 8.2A.3.1.0-2, and using the downlink physical channels specified in Annex C.5.1 on each CC, the difference between the wideband CQI indices of PCell and SCell reported shall be such that

wideband  $CQI_{PCell}-wideband\ CQI_{SCell} \geq 2$ 

for more than 90% of the time.

For CA with 3 or more DL CC, for the SNR configuration specified in Table 8.2A.3.1.0-3, and using the downlink physical channels specified in Annex C.5.1 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, 3... reported shall be such that

wideband CQI<sub>PCell</sub> – wideband CQI<sub>SCell1</sub>  $\geq 2$ 

## wideband CQI\_{SCell1} - wideband CQI\_{SCell2, 3...} $\geq 2$

for more than 90% of the time.

	Parameter	Unit	Value
Subcarrier spacing		kHz	120
Duplex Mode			TDD
TDD Slot Configuration			FR2.120-2 Annex A.1.3
Propagation			AWGN
			1x2 with static channel
Antenna cont	riguration		specified in Annex B.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
ZP CSI-RS	Density (p)		1
configuratio	First subcarrier index in the		•
n	PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		8
	First OFDM symbol in the PRB		
	used for CSI-RS (lo, l1)		13
	CSI-RS periodicity and offset	slot	8/1
		5101	Periodic
	CSI-RS resource Type		1
	Number of CSI-RS ports (X)		No CDM
NZP CSI-	Density (ρ)		
RS for CSI	First subcarrier index in the		6
acquisition	PRB used for CSI-RS $(k_0, k_1)$		
·	First OFDM symbol in the PRB		13
	used for CSI-RS (l <sub>0</sub> , l <sub>1</sub> )		-
	NZP CSI-RS-timeConfig	slot	8/1
	periodicity and offset		
	CSI-IM resource Type		Periodic
CSI-IM	CSI-IM RE pattern		1
configuratio	CSI-IM Resource Mapping		(8, 13)
n	(ксы-ім,Ісы-ім)		(0, 10)
	CSI-IM timeConfig	slot	8/1
	periodicity and offset	0.01	
ReportConfig	Туре		Periodic
CQI-table			Table 1
reportQuantit			cri-RI-PMI-CQI
	onForChannelMeasurements		Not configured
timeRestrictio	onForInterferenceMeasurements		Not configured
cqi-FormatIn	dicator		Wideband
pmi-Formatlr	dicator		Wideband
			8 for 50MHz, 100MHz,
Sub-band Siz	ze	RB	16 for 200MHz,
			32 for 400MHz
csi-ReportingBand			11111111
CSI-Report periodicity and offset		slot	8/3
aperiodicTriggeringOffset			Not configured
Physical channel for CSI report			PUCCH
CQI/RI/PMI delay		ms	8.375
	mber of HARQ transmission		1
			Derived as per section
Measuremen	t channel		5.1.3.2 of TS 38.214 [12]

Table 8.2A.3.1.0-1: CA CQI reporting test parameters for each C	C
---	---

## Table 8.2A.3.1.0-2: SNR configurations for 2 DL CA

Parameter	PCell	SCell
SNR (dB)	10.0	4.0

Table 8.2A.3.1.0-3: SNR	configurations for 3 or more DL CA
-------------------------	------------------------------------

Parameter	PCell	SCell1	SCell2, 3
SNR (dB)	12.0	6.0	0.0

#### Table 8.2A.3.1.0-4: List of CA CQI reporting test

Test number CA duplex mode and SCS combination			
	1		TDD 120 kHz + TDD 120 kHz
	Note 1:		pplicability of requirements for different CA configurations and width combination sets is defined in 8.1.1.5.1.

The normative reference for this requirement is TS 38.101-4 [5], clause 8.2A.3.1.1.

## 8.2A.3.1.1 2Rx CQI reporting accuracy under AWGN conditions for CA (2DL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Test point applicability is TBD for all bands and  $BW_{agg} > 200$  MHz in Table 8.1.1\_1-2.

## 8.2A.3.1.1.1 Test Purpose

To verify that the CQI is correctly reported in accordance with the CQI definition given in TS 38.214 [12] for each CC with multiple cells configured for periodic reporting.

#### 8.2A.3.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL CA.

8.2A.3.1.1.3 Test description

8.2A.3.1.1.3.1 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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [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 FR2 operation, setup the LTE link according to Annex D

CA capability to be tested: test any one of the supported CA capabilities with largest aggregated CA bandwidth combination, as specified in 8.1.1.5.1.

CA configuration to be tested: For the selected CA capability, test any one of the supported CA configurations with largest aggregated CA bandwidth combination, as specified in 8.1.1.5.1.

- 1. Connection between SS, the AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 8.1.2-1, and Table 8.2A.3.1.0-1 to Table 6.2A.3.1.0-3 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 38.521-2 [8].

- 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* 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 8.2A.3.1.1.3.3.

## 8.2A.3.1.1.1.3.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O. If no direction found, mark the test as inconclusive.
- 2. Set the parameters of bandwidth, reference channel, propagation condition, antenna configuration and SNR configuration according to Table 8.2A.3.1.0-1 to Table 8.2A.3.1.0-4 as appropriate.
- 3. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.
- 4. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCC. For each CSI report calculate the respective difference CQI<sub>P-S</sub> = wideband CQI<sub>PCell</sub> wideband CQI<sub>SCell</sub>.
- 5. If more than 1800 values of CQI<sub>P-S</sub> are  $\geq 2$  pass the UE. Otherwise fail the UE.

8.2A.3.1.1.1.3.3 Message contents

## 8.2A.2.1.1.1.3.3\_1 Message exceptions for SA

#### Table 8.2A.2.1.1.1.3.3\_1-1: CSI-RS-ResourceMapping

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-2			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row2	0000 0010 0000	K0= 6, row2	
}			
density CHOICE {			
one	NULL		
}			
}			

#### Table 8.2A.2.1.1.1.3.3\_1-2: NZP CSI-ResourcePeriodicityAndOffset

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-2a			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slot8	3		
}			

#### Table 8.2A.2.1.1.1.3.3\_1-3: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-6			
Information Element	Value/remark	Comment	Condition
CSI-IM-Resource ::= SEQUENCE {			
periodicityAndOffset SEQUENCE {			
slot8	1		
}			
}			

Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-7	12	
Information Element	Value/remark	Condition
CSI-ReportConfig ::= SEQUENCE {		
subbandSize	8	For 50MHz and 100MHz CHBW.
	16	For 200MHz CHBW.
	32	For 400MHz CHBW.
}		

## Table 6.2A.2.1.1.1.3.3\_1-4: CSI-ReportConfig

## 8.2A.2.1.1.1.3.3\_2 Message exceptions for NSA

Same as specified in 8.2A.2.1.1.1.3.3\_2.

#### 8.2A.3.1.1.1.3.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 8.2A.3.1.1.1.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

## 8.2A.3.1.2 2Rx CQI reporting accuracy under AWGN conditions for CA (3DL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Test point applicability is TBD for all bands and BW<sub>agg</sub> > 200 MHz in Table 8.1.1\_1-2.

8.2A.3.1.2.1 Test Purpose

Same with 8.2A.3.1.1.1.

8.2A.3.1.2.2 Test applicability
---------------------------------

This test applies to all types of NR UE release 15 and forward that supports 3DL CA.

8.2A.3.1.2.3 Test description

8.2A.3.1.2.3.1 Initial conditions

Same with 8.2A.3.1.1.3.1.

8.2A.3.1.1.2.3.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O. If no direction found, mark the test as inconclusive.
- 2. Set the parameters of bandwidth, reference channel, propagation condition, antenna configuration and SNR configuration according to Table 8.2A.3.1.0-1 to Table 8.2A.3.1.0-4 as appropriate.
- 3. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.
- 4. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCCs. For each CSI report calculate the respective difference  $CQI_{P-S1}$  = wideband  $CQI_{PCell}$  wideband  $CQI_{SCell1}$  and the respective difference  $CQI_{S1-S2}$  = wideband  $CQI_{SCell1}$  wideband  $CQI_{SCell2}$ .
- 5. If more than 1800 values of CQI<sub>P-S1</sub> are  $\geq$  2 and more than 1800 values of CQI<sub>S1-S2</sub> are  $\geq$  2, pass the UE. Otherwise fail the UE.

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#### 8.2A.3.1.1.2.3.3 Message contents

Same with 8.2A.3.1.1.1.3.3.

8.2A.3.1.1.2.3.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 8.2A.3.1.1.2.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

## 8.2A.3.1.3 2Rx CQI reporting accuracy under AWGN conditions for CA (4DL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Test point applicability is TBD for all bands and  $BW_{agg} > 200$  MHz in Table 8.1.1\_1-2.

8.2A.3.1.3.1 Test Purpose

Same with 8.2A.3.1.1.1.

8.2A.3.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 4DL CA.

8.2A.3.1.3.3 Test description

8.2A.3.1.3.3.1 Initial conditions

Same with 8.2A.3.1.1.3.1.

#### 8.2A.3.1.1.3.3.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O. If no direction found, mark the test as inconclusive.
- 2. Set the parameters of bandwidth, reference channel, propagation condition, antenna configuration and SNR configuration according to Table 8.2A.3.1.0-1 to Table 8.2A.3.1.0-4 as appropriate.
- 3. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.
- 4. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCCs. For each CSI report calculate the respective difference  $CQI_{P-S1}$  = wideband  $CQI_{PCell}$  wideband  $CQI_{SCell1}$ , the respective difference  $CQI_{S1-S2}$  = wideband  $CQI_{SCell1}$  wideband  $CQI_{SCell2}$  and the respective difference  $CQI_{S1-S3}$  = wideband  $CQI_{SCell2}$ .
- 5. If more than 1800 values of CQI<sub>P-S1</sub> are  $\geq 2$ , more than 1800 values of CQI<sub>S1-S2</sub> are  $\geq 2$  and more than 1800 values of CQI<sub>S1-S3</sub> are  $\geq 2$ , pass the UE. Otherwise fail the UE.

#### 8.2A.3.1.1.3.3.3 Message contents

Same with 8.2A.3.1.1.1.3.3.

#### 8.2A.3.1.1.3.3.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 8.2A.3.1.1.3.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

## 8.3 Reporting of Precoding Matrix Indicator (PMI)

## 8.3.0 General

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission scheme 1 with 2TX and higher layer parameter *codebookType* set to 'typeI-SinglePanel' are specified in terms of the ratio

$$\gamma = \frac{t_{ue}}{t_{rnd}}$$

In the definition of  $\gamma$ , for 2TX PMI requirements,  $t_{ue}$  is 90 % of the maximum throughput obtained at  $SNR_{ue}$  using the precoders configured according to the UE reports, and  $t_{rnd}$  is the throughput measured at  $SNR_{ue}$  with random precoding.

- 8.3.1 1RX requirements (Void)
- 8.3.2 2RX requirements
- 8.3.2.1 FDD

TBD

- 8.3.2.2 TDD
- 8.3.2.2.1 2Rx TDD FR2 Single PMI with 2TX TypeI-SinglePanel codebook for both SA and NSA
- 8.3.2.2.1.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

## 8.3.2.2.1.2 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.

## 8.3.2.2.1.3 Minimum conformance requirements

For the parameters specified in Table 8.3.2.2.1.3-1, and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified in Table 8.3.2.2.1.3-2.

Pa	rameter	Unit	Test 1	Test 2
Bandwidth	ameter	MHz	100	100
Subcarrier spacir	og -	kHz	120	120
	ig	NI IZ	FR2.120-2 as	FR2.120-1 as
TDD DL-UL confi	TDD DL-UL configuration		specified in	specified in
	9		Annex A.1.3	Annex A.1.3
Propagation char	nnel		TDLA30-35	TDLA30-35
Antenna configur	ation		2 x 2 ULA Low	2 x 2 ULA Low
Beamforming Mo	del		As specified in Annex B.4.1	As specified in Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic
	Number of CSI-RS ports ( <i>X</i> )		4	4
	CDM Type		FD-CDM2	FD-CDM2
	Density (ρ)		1	1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 4, (8,-)	Row 4, (8,-)
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		(13,-)	(13,-)
	CSI-RS interval and offset	slot	8/1	5/1
	CSI-RS resource Type		Aperiodic	Aperiodic
	Number of CSI-RS ports (X)		2	2
	CDM Type		FD-CDM2	FD-CDM2
	Density (ρ)		1	1
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 3, (6,-)	Row 3, (6,-)
	First OFDM symbol in the PRB used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		(13,-)	(13,-)
	CSI-RS interval and offset	slot	Not configured	Not configured
	aperiodicTriggering Offset		0	0
	CSI-IM resource Type		Aperiodic	Aperiodic
	CSI-IM RE pattern		Pattern 1	Pattern 1
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,Icsi-im)		(8,13)	(8,13)
	CSI-IM timeConfig interval and offset	slot	Not configured	Not configured
ReportConfigType			Aperiodic	Aperiodic
CQI-table			Table 1	Table 1
reportQuantity			cri-RI-PMI-CQI	cri-RI-PMI-CQI
	orChannelMeasureme		Not configured	Not configured
timeRestrictionForInterferenceMeasur ements			Not configured	Not configured
cqi-FormatIndicat	tor		Wideband	Wideband

## Table 8.3.2.2.1.3-1: Test parameters (single layer)

pmi-FormatIndica	ator		Wideband	Wideband
Sub-band Size		RB	8	8
csi-ReportingBar	nd		111111111	111111111
CSI-Report interv		slot	Not configured	Not configured
Aperiodic Report			6	8
CSI request			1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0	1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTriggerSize	9		1	1
CSI-AperiodicTri	ggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM	One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
Codebook Type			typel- SinglePanel	typel- SinglePanel
	Codebook Mode		1	1
Codebook configuration	(CodebookConfig- N1,CodebookConfi g-N2)		N/A	N/A
	CodebookSubsetR estriction		001111	001111
	RI Restriction		N/A	N/A
Physical channel			PUSCH	PUSCH
CQI/RI/PMI delay		ms	1.375	1.75
Maximum numbe transmission	er of HARQ		4	4
Moneuromont channol			R.PDSCH.5- 7.1 TDD	
<ul> <li>Note 1: For random precoder selection, the precoder shall be updated in each slot (0.125 ms granularity).</li> <li>Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4)], this reported PMI</li> </ul>				ed in each slot slot#n based on
<ul> <li>cannot be applied at the gNB downlink before slot#(n+4)].</li> <li>Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.</li> </ul>				

Table 8.3.2.2.1.3-2: Minimum requ	uirement
-----------------------------------	----------

Parameter	Test 1	Test 2
γ	1.05	1.05

#### 8.3.2.2.1.4 Test description

#### 8.3.2.2.1.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [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 FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, the faders, AWGN noise source and the UE antenna is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 8.1.2-1 and Table 8.3.2.2.1.3-1 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 38.521-2 [8].
- 4. Propagation conditions for 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 content are defined in clause 8.3.2.2.1.4.3.

#### 8.3.2.2.1.4.2 Test procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O.If no direction found, mark the test as inconclusive.
- 2. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 8.3.2.2.1.3-1 as appropriate.
- 3. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with

aperiodic CSI request triggered. Establish  $t_{ue}$  and  $SNR_{ue}$  according to Annex G.3.2.

- 4. Set SNR to  $SNR_{ue}$ . The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure  $t_{rnd}$  according to Annex G.3.3.
- 5. Calculate  $\gamma = \frac{t_{ue}}{t_{md}}$ . If the ratio  $\geq \gamma$  which is specified in table 8.3.2.2.1.5-1, then the test is pass. Otherwise, the

test is fail.

6. Repeat steps from 3 to 5 for each subtest in Table 8.3.2.2.1.3-1 as appropriate.

#### 8.3.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

## 8.3.2.2.1.4.3\_1 Message exceptions for SA

## Table 8.3.2.2.1.4.3\_1-1: CSI-ResourceConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41			
Information Element	Value/remark	Comment	Condition
CSI-ResourceConfig ::= SEQUENCE {			
resourceType	Aperiodic		CSI-RS for
			CSI
			Acquisition
	Periodic		CSI-RS for
			Tracking or
			Beam
			Refinement
}			

## Table 8.3.2.2.1.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS for Tracking

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4	1.6.3-45		
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0001		
}			
nrofPorts	p1	1 for CSI-RS	
		resource 1,2,3,4	
firstOFDMSymbolInTimeDomain	4	$I_0 = 4$ for CSI-RS	
		resource 1 and 3	
	8	$I_0 = 8$ for CSI-RS	
		resource 2 and 4	
}			

## Table 8.3.2.2.1.4.3\_1-3: CSI-RS-ResourceMapping for NZP-CSI-RS for Acquisition

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4	4.6.3-45		
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row3	001000		
}			
nrofPorts	p2		
firstOFDMSymbolInTimeDomain	13		
}			

## Table 8.3.2.2.1.4.3\_1-4: CSI-RS-ResourceMapping for NZP-CSI-RS for Beam Refinement

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4	6.3-45		
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0001		
}			
nrofPorts	p1		
firstOFDMSymbolInTimeDomain	8	$I_0 = 8$ for CSI-RS	
		resource 1	
	9	$I_0 = 9$ for CSI-RS	
		resource 2	
}			

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45			
Information Element	Value/remark	Comment	Condition
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row4	100		
}			
nrofPorts	p4		
firstOFDMSymbolInTimeDomain	13		
}			

## Table 8.3.2.2.1.4.3\_1-5: CSI-RS-ResourceMapping for ZP-CSI-RS

## Table 8.3.2.2.1.4.3\_1-6: ZP CSI-ResourcePeriodicityAndOffset

Derivation Path: Table 4.6.3-43			
Information Element	Value/remark	Comment	Condition
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots8	1		Test 1
slots5	1		Test 2
}			

## Table 8.3.2.2.1.4.3\_1-7: CSI-IM-Resource

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Tab	le 4.6.3-34		
Information Element	Value/remark	Comment	Condition
csi-IM-ResourceElementPattern CHOICE {			
pattern1 SEQUENCE {			
subcarrierLocation-p1	s8		
symbolLocation-p1	13		
}			
}			

## Table 8.3.2.2.1.4.3\_1-8: CodebookConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-25			
Information Element	Value/remark	Comment	Condition
CodebookConfig ::= SEQUENCE {			
codebookType CHOICE {			
type1 SEQUENCE {			
subType CHOICE {			
typeI-SinglePanel SEQUENCE {			
nrOfAntennaPorts CHOICE {			
Two SEQUENCE {			
twoTX-codebookSubsetRestriction	001111		
}			
}			
TypeI-SinglePanel-ri-Restriction	1111111		
}			
}			
}			
}			
}			

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table	4.6.3-39		
Information Element	Value/remark	Comment	Condition
CSI-ReportConfig ::= SEQUENCE {			
reportConfigType CHOICE {			
aperiodic SEQUENCE {			
reportSlotOffsetList	6		Test 1
	8		Test 2
}			
}			
reportFreqConfiguration SEQUENCE {			
csi-ReportingBand CHOICE {			
subbands9	11111111		
}			
}			
subbandSize	value2		
}			

## Table 8.3.2.2.1.4.3\_1-9: CSI-ReportConfig

## 8.3.2.2.1.4.3\_2 Message exceptions for NSA

Same as 8.3.2.2.1.4.3\_1.

## 8.3.2.2.1.5 Test requirement

## Table 8.3.2.2.1.5-1: Test requirement (TDD)

Parameter	Test 1	Test 2
γ	1.04	1.04

## 8.4 Reporting of Rank Indicator (RI)

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

## 8.4.1 1RX requirements

(Void)

- 8.4.2 2RX requirements
- 8.4.2.1 FDD

(Void)

- 8.4.2.2 TDD
- 8.4.2.2.1 2Rx TDD FR2 RI reporting for both SA and NSA
- -8.4.2.2.1.1 Test Purpose

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

#### 8.4.2.2.1.2 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.

#### 8.4.2.2.1.3 Minimum requirement

The minimum performance requirement in Table 8.4.2.2.1.3-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 8.4.2.2.1.3-1, and using the downlink physical channels specified in Annex C.2.2, the minimum requirements are specified in Table 8.4.2.2.1.3-2.

			. ,	—	_
<b>D</b>	Parameter	Unit MHz	Test 1	Test 2	Test 3
Bandwidth			100	100	100
Subcarrier sp		kHz	120	120	120
Duplex Mode			TDD	TDD	TDD
	TDD Slot Configuration		FR2.120-2	FR2.120-2	FR2.120-2
SNR		dB	0	16	16
Propagation of			TDLA30-35	TDLA30-35	TDLA30-35
Antenna conf	iguration		ULA Low 2x2	ULA Low 2x2	XP High 2x2
Beamforming	Model		As defined in	As defined in	As defined in
Deamonning			Annex B.4.1	Annex B.4.1	Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		4	4	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
ZP CSI-RS	Density (ρ)		1	1	1
	First subcarrier index in the				$D_{avv}(1, (0, \cdot))$
configuratio	PRB used for CSI-RS (k <sub>0</sub> , k <sub>1</sub> )		Row 4, (8,-)	Row 4, (8,-)	Row 4, (8,-)
n	First OFDM symbol in the PRB		(10.)	(10.)	(12.)
	used for CSI-RS (I <sub>0</sub> , I <sub>1</sub> )		(13,-)	(13,-)	(13,-)
	CSI-RS		8/1	8/1	8/1
	interval and offset	slot			
	CSI-RS resource Type		Aperiodic	Aperiodic	Aperiodic
	Number of CSI-RS ports (X)		2	2	2
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
	Density (ρ)		1	1	1
NZP CSI-	First subcarrier index in the		1	1	I
RS for CSI			Row 3 (6,-)	Row 3 (6,-)	Row 3 (6,-)
	PRB used for CSI-RS ( $k_0$ , $k_1$ )				
acquisition	First OFDM symbol in the PRB		(13,-)	(13,-)	(13,-)
	used for CSI-RS (lo, l <sub>1</sub> )				
	NZP CSI-RS-timeConfig	slot	Not configured	Not	Not
	interval and offset			configured	configured
	aperiodicTriggeringOffset		0	0	0
	CSI-IM resource Type		Aperiodic	Aperiodic	Aperiodic
CSI-IM	CSI-IM RE pattern		Pattern 1	Pattern 1	Pattern 1
configuratio	CSI-IM Resource Mapping		(8,13)	(8,13)	(8,13)
n	(ксы-ім,Ісы-ім)				
	CSI-IM timeConfig	slot	Not configured	Not	Not
	interval and offset	5101		configured	configured
ReportConfig	Туре		Aperiodic	Aperiodic	Aperiodic
CQI-table			Table 1	Table 1	Table 1
roportQuantit			cri-RI-PMI-CQI	cri-RI-PMI-	cri-RI-PMI-
reportQuantit	У		CI-RI-PIVII-CQI	CQI	CQI
			and a sufficience of	not	not
timeRestrictio	onForChannelMeasurements		not configured	configured	configured
				not	not
umeRestrictio	onForInterferenceMeasurements		not configured	configured	configured
cqi-FormatInd	dicator		Wideband	Wideband	Wideband
pmi-Formatin			Wideband	Wideband	Wideband
Sub-band Siz		RB	8	8	8
csi-Reporting			111111111	111111111	111111111
		<u> </u>		Not	Not
CSI-Report ir	nterval and offset	slot	Not configured	configured	configured
Aperiodic Report Slot Offset			6	6	6
Apendulc Re			1 in slots i,	1 in slots i,	1 in slots i,
			,		
CSI request			where mod(i, $2) - 1$	where mod(i,	where mod(i, $2) - 1$
CSI request			8) = 1,	8) = 1,	8) = 1,
			otherwise it is	otherwise it is	otherwise it is
			equal to 0	equal to 0	equal to 0
reportTrigger	Size		1		
			One State with	One State	One State
			one Associated	with one	with one
CSI-Aperiodi	cTriggerStateList		Report	Associated	Associated
CSI-AperiodicTriggerStateList			Configuration	Report	Report
		1	Associated	Configuration	Configuration
			/1000010100	· · · · · · · · · · · · · · · · · ·	generation

# Table 8.4.2.2.1.3-1: RI Test (TDD)

			Configuration contains pointers to NZP CSI-RS and CSI-IM	Report Configuration contains pointers to NZP CSI-RS and CSI-IM	Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel- SinglePanel	typel- SinglePanel	typel- SinglePanel
	Codebook Mode		1	1	1
Codebook	(CodebookConfig- N1,CodebookConfig-N2)		N/A	N/A	N/A
configuration	CodebookSubsetRestriction		010000 for fixed rank 2, 010011 for following rank	000011 for fixed rank 1, 010011 for following rank	000011 for fixed rank 1, 010011 for following rank
	RI Restriction		N/A	N/A	N/A
Physical chan	nel for CSI report		PUSCH	PUSCH	PUSCH
CQI/RI/PMI delay		ms	1.375	1.375	1.375
Maximum number of HARQ transmission			1	1	1
RI Configuration			Fixed RI = 2 and follow RI	Fixed RI = 1 and follow RI	Fixed RI = 1 and follow RI
Note 1: Measurements channels are specified in Table A.4-1. TBS.1-1 is used for Rank 1 case. TBS.1-2 is used for Rank 2 case.					

Table 8.4.2.2.1.3-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3
<i>γ</i> 1	N/A	1.05	1.05
<i>γ</i> 2	1.0	N/A	N/A

The normative reference for this requirement is TS 38.101-4 [5] clause 8.4.2.2.

#### 8.4.2.2.1.4 Test Description

#### 8.4.2.2.1.4.1 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 subcarrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [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.

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, the faders, AWGN noise source and the UE antenna is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 8.1.2-1 and Table 8.4.2.2.1.3-1 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 38.521-2 [8].
- 4. Propagation conditions for 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 content are defined in clause 8.4.2.2.1.4.3.

#### 8.4.2.2.1.4.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O. If no direction found mark the test as inconclusive.
- Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 8.4.2.2.1.3-1 as appropriate. Measure the t<sub>fiv</sub> according to Annex G.3.3.
- 3. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 8.4.2.2.1.3-1. The SS sends downlink MAC padding bits on the DL RMC.
- 4. Propagation conditions are set according to Annex B.2.
- 5. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 8.4.2.2.1.3-1.
- 6. The UE shall transmit RRC Connection Reconfiguration Complete message.
- 7. Propagation conditions are set according to Table 8.4.2.2.1.3-1.
- The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure t<sub>reported</sub> according to Annex G.3.3.

If the ratio  $(t_{reported} / t_{fix})$  satisfies the requirement in Table 8.4.2.2.1.5-1, then pass the UE for this test and go to step 9. Otherwise, declare a FAIL verdict.

9. If all tests have not been done, then repeat the same procedure (steps 1 to 8) with test conditions according to the Table 8.4.2.2.1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.

#### 8.4.2.2.1.4.3 Message Contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

8.4.2.2.1.4.3\_1 Message exceptions for SA

#### Table 8.4.2.2.1.4.3\_1-1: SchedulingRequestResourceConfig

Derivation Path: TS 38.508-1 [6], Table 4.6.3-157					
Information Element	Value/remark	Comment	Condition		
SchedulingRequestResourceConfig ::= SEQUENCE {					
periodicityAndOffset CHOICE {					
SI80	7				
}					
}					

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Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41					
Information Element	Value/remark	Comment	Condition		
CSI-ResourceConfig ::= SEQUENCE {					
resourceType	Aperiodic		CSI-RS for CSI Acquisition, CSI-IM- Resource		
	Periodic		CSI-RS for Tracking or Beam Refinement		
}					

#### Table 8.4.2.2.1.4.3\_1-2: CSI-ResourceConfig

#### Table 8.4.2.2.1.4.3\_1-3: CodebookConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25					
Information Element	Value/remark	Comment	Condition		
nrOfAntennaPorts CHOICE {					
Two SEQUENCE {					
twoTX-CodebookSubsetRestriction	010000	Fixed rank 2	Test 1		
	000011	Fixed rank 1	Test 2, Test 3		
	010011	Following rank	Test 1, Test 2, Test 3		
}					
}					
typeI-SinglePaneI-ri-Restriction	1111111	Non restriction			

#### Table 8.4.2.2.1.4.3\_1-4: CSI-ReportConfig

Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39					
Information Element	Value/remark	Comment	Condition		
reportConfigType CHOICE {					
aperiodic SEQUENCE {					
reportSlotOffsetList	6				
}					
reportFreqConfiguration SEQUENCE {					
csi-ReportingBand CHOICE {					
subbands9	11111111				
}					
}					
subbandSize	value2				
}					

#### 8.4.2.2.1.4.3\_2 Message exceptions for NSA

Same as 8.4.2.2.1.4.3\_1.

#### 8.4.2.2.1.5 Test Requirements

#### Table 8.4.2.2.1.5-1: Test Requirement (TDD)

	Test 1	Test 2	Test 3
<i>y</i> 1	N/A	1.04	1.04
<i>γ</i> 2	0.99	N/A	N/A

# 9 Demodulation performance requirements for interworking

# 9.1 General

This clause covers the UE demodulation performance requirements for EN-DC, NE-DC, inter-band NR-DC between FR1 and FR2, and inter-band NR CA between FR1 and FR2.

For conformance testing involving FR2 test cases in this specification, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

# 9.1.1 Applicability of requirements

The following applicability rules are specified for demodulation performance requirements for interworking:

- For UEs supporting NR/5GC, EN-DC and NE-DC,
  - The performance requirements specified in Clause 5 will be verified only for NR/5GC except for the sustained downlink data rate test specified in Clause 5.5 and 5.5A.
  - The performance requirements specified in Clause 7 will be verified only for NR/5GC except for the sustained downlink data rate test specified in Clause 7.5.
  - The sustained downlink data rate tests specified in Clauses 5.5, 5.5A and 7.5 for NR/5GC and in Clause 9.4B for EN-DC and NE-DC are verified separately.
- The FR1 EN-DC test cases with the NR TDD DL-UL configurations which are not aligned with LTE's can be tested on the corresponding EN-DC band combinations where UE supports simultaneous transmission and reception.
- For UEs supporting NR FR1 CA and/or NR CA including FR1 and FR2, the requirements applicability is specified in Table 9.1.1-1.

# Table 9.1.1-1: Requirements applicability for UEs supporting NR FR2 CA and NR CA including FR1 and FR2

Supported scenarios	Requirements
NR FR2 CA	Clause 7.5A
NR CA including FR1 and FR2	Clause 9.4A.1
Both NR FR2 CA and NR CA including FR1 and FR2	Clause 7.5A

- For UEs supporting EN-DC including FR2 and/or EN-DC including FR1 and FR2, the requirements applicability is specified in Table 9.1.1-2.

# Table 9.1.1-2: Requirements applicability for UEs supporting EN-DC including FR2 and EN-DC including FR1 and FR2

Supported scenarios	SDR requirements	PDSCH requirements	PDCCH requirements
EN-DC including FR2	Clause 9.4B.1.2	Clause 9.2B.1.2	Clause 9.3B.1.2
EN-DC including FR1 and FR2	Clause 9.4B.1.3	Clause 9.2B.1.3	Clause 9.3B.1.3
Both EN-DC including FR2 and EN-DC including FR1 and FR2	Clause 9.4B.1.2	Clause 9.2B.1.2	Clause 9.3B.1.2

- For UEs supporting NR-DC including FR1 and FR2, if the FR2 requirements in Clause 7.2 and Clause 7.3 are tested, the test coverage can be considered fulfilled without executing requirements in Clause 9.2B.2 and Clause 9.3B.2.

- For UEs supporting NR-DC between FR1 and FR2, if requirements in Clause 9.4A.1 are tested under same or higher data rate as in Clause 9.4B.2, the test coverage can be considered fulfilled without executing the requirements in Clause 9.4B.2.
- For UEs supporting NE-DC and EN-DC, the test coverage of demodulation performance requirements can be considered fulfilled, if the demodulation requirements in Clause 5 and Clause 9.4B.1 are executed for UE under test in the standalone mode.
- For UEs supporting NE-DC and not supporting EN-DC, the test coverage of demodulation performance requirements can be considered fulfilled, if the demodulation requirements in Clause 5 and Clause 9.4B.3 are executed for UE under test.
- For UEs supporting NGEN-DC, the test coverage of demodulation performance requirements can be considered fulfilled, if the demodulation requirements in Clause 5 and Clause 9.4B.1 are executed for UE under test.

#### 9.1.1.1 Applicability of requirements for optional UE features

The applicability rule defined in Clause 5.1.1.3 shall be applied for performance requirements in Clauses 9.2B.1.1 and 9.4B.1.1.

The applicability rule defined in Clause 7.1.1.3 shall be applied for performance requirements in Clauses 9.2B.1.2, 9.4A.1, 9.4B.1.2 and 9.4B.1.3.

# 9.1.1.2 Applicability of requirements for mandatory UE features with capability signalling

The applicability rule defined in Clause 5.1.1.4 shall be applied for performance requirements in Clauses 9.2B.1.1 and 9.4B.1.1.

The applicability rule defined in Clause 7.1.1.4 shall be applied for performance requirements in Clauses 9.2B.1.2, 9.4A.1, 9.4B.1.2 and 9.4B.1.3.

# 9.1.2 E-UTRA Cell setup

This subclause provides the parameters for E-UTRA cell during the demodulation performance test for EN-DC unless otherwise stated. For EN-DC with multiple E-UTRA carriers or bands, randomly selected one carrier or band can be used as E-UTRA Pcell for the connection setup unless otherwise stated.

#### 9.1.2.1 FDD

The parameters specified in Table 9.1.2.1-1 and Table 9.1.2.1-2 are used to setup E-UTRA cell. One of test setup in Table 9.1.2.1-2 will be selected for the E-UTRA Cell depending on the maximum bandwidth of an E-UTRA carrier for all the EN-DC band combinations supported by the UE.

The measurement channels in Table 9.1.2.1-2 and OCNG pattern OP.1 FDD are specified in TS 36.521-1 [16]. The physical channel setup with downlink power allocation is according to Annex C.3.2 of TS 36.521-1 [16].

Parameter	Unit	Value
Cyclic prefix		Normal
Physical Cell ID		0
Number of PDCCH symbols	symbols	1
PHICH Ng (Note 1)		1
PHICH duration		Normal
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,0,1,2} for 64QAM
Propagation condition		Static propagation condition No external noise sources are applied
Transmission mode		1
Transmission time difference between E- UTRA cell and NR cell(s)	μs	0
Antenna configuration		All NR cells are in FR1: 1x2 Any NR cell is in FR2: 1 Tx <sup>Note 1</sup>
Codebook subset restriction		10
Symbols for all unused REs		OCNG in Annex A.5
		air, the UE Rx antenna configuration is not d has no impact on the test implementation.

Table 9.1.2.1-1: Common Test Parameters (FDD)

Table 9.1.2.1-2: Specific T	est Parameters	(FDD	[64QAM])
		(	[0+0,])

Test	Bandwidth	Downlink power allocation (dB)			
setup	(MHz)	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	
1	5	0	0	0	
2	10	0	0	0	
3	15	0	0	0	
4	20	0	0	0	

#### 9.1.2.2 TDD

The parameters specified in Table 9.1.2.2-1 and Table 9.1.2.2-2 are used to setup an E-UTRA cell. One of test setup in Table 9.1.2.2-2 will be selected for the E-UTRA Cell depending on the maximum bandwidth of an E-UTRA carrier for all the EN-DC band combinations supported by the UE.

The measurement channels in Table 9.1.2.2-2 and OCNG pattern OP.1 TDD are specified in TS 36.521-1 [16]. The physical channel setup with downlink power allocation is according to Annex C.3.2 of TS 36.521-1 [16].

Parameter	Unit	Value			
UL DL configuration		2 (Note1)			
Special subframe configuration		7			
Number of PDCCH symbols	symbols	1			
PHICH Ng (Note 3)		1			
PHICH duration		Normal			
Cyclic prefix		Normal			
Cell ID		0			
Maximum number of HARQ transmission		4			
Redundancy version coding sequence		{0,0,1,2} for 64QAM			
Propagation condition		Static propagation condition No external noise sources are applied			
Transmission mode		1			
Transmission time difference between E- UTRA cell and NR cell(s)	μs	0			
Antenna configuration		All NR cells are in FR1: 1x2 Any NR cell is in FR2: 1 Tx <sup>Note 2</sup>			
Codebook subset restriction		10			
Symbols for all unused REs		OCNG in Annex A.5			
<ul> <li>NOTE 1: The start of transmission of LTE frame is delayed by 2 LTE subframes with respect to the start of transmission of NR frame when TDD-TDD EN-DC configuration is configured during the test.</li> <li>NOTE 2: As the link can be provided over the air, the UE Rx antenna configuration is not</li> </ul>					
		d has no impact on the test implementation.			

Table 9.1.2.2-1: Common Test Parameters (TDD)

Table 9.1.2.2-2: Specific Test Paramet	ters (FDD 64QAM)

Test	Bandwidth		nlink p cation	
setup	(MHz)	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ
1	10	0	0	0
2	15	0	0	0
3	20	0	0	0

9.2 Void

- 9.2A PDSCH Demodulation for CA
- 9.2A.1 NR CA between FR1 and FR2

FFS

# 9.2B PDSCH Demodulation for DC

# 9.2B.1 EN-DC

# 9.2B.1.1 EN-DC within FR1

The NR PDSCH demodulation performance requirements and test case details for this test case are specified in Section 5.2.

During the test, only the PDSCH performance on the NR cell(s) shall be verified

# 9.2B.1.2 EN-DC including FR2 NR carrier only

The NR PDSCH demodulation performance requirements and test case details for this test case are specified in Section 7.2.

During the test, only the PDSCH performance on the NR cell(s) on FR2 carriers shall be verified.

# 9.2B.1.3 EN-DC including FR1 and FR2 NR carriers

The demodulation performance requirements are verified according to Section 9.2B.1.1 for EN-DC with FR1 NR carrier only and Section 9.2B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only demodulation performance requirements on the FR2 carriers are verified.

No demodulation requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

# 9.2B.2 NR DC between FR1 and FR2

FFS

- 9.3 Void
- 9.3A PDCCH Demodulation for CA
- 9.3A.1 NR CA between FR1 and FR2

FFS

- 9.3B PDCCH Demodulation for DC
- 9.3B.1 EN-DC

#### 9.3B.1.1 EN-DC within FR1

The NR PDCCH demodulation performance requirements and test case details for this test case are specified in Section 5.3.

During the test, only the PDCCH performance on the single NR cell shall be verified.

### 9.3B.1.2 EN-DC including FR2 NR carrier only

The NR PDCCH demodulation performance requirements and test case details for this test case are specified in Section 7.3.

During the test, only the PDCCH performance on the single NR cell shall be verified.

#### 9.3B.1.3 EN-DC including FR1 and FR2 NR carriers

The demodulation performance requirements are verified according to Section 9.3B.1.1 for EN-DC with FR1 NR carrier only and Section 9.3B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only demodulation performance requirements on the FR2 carriers are verified.

No demodulation requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

### 9.3B.2 NR DC between FR1 and FR2

FFS

- 9.4 Void
- 9.4A SDR test for CA

FFS

- 9.4B SDR test for DC
- 9.4B.1 EN-DC

#### 9.4B.1.1 Sustained downlink data rate performance for EN-DC within FR1

#### 9.4B.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

#### 9.4B.1.1.2 Test Applicability

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

#### 9.4B.1.1.3 Minimum conformance requirements

During the test, the PDSCH performance on both the NR cell(s) and LTE cell(s) shall be verified.

The TB success rate shall be higher than 85% when NR PDSCH is scheduled with MCS defined for the selected EN-DC bandwidth combination and with the downlink physical channel setup according to Annex C.3.1 and when E-UTRA PDSCH is scheduled with FRC defined for the selected EN-DC bandwidth combination and with the downlink physical channel setup according to Annex C.3.2 from TS 36.101 [X].

The TB success rate is defined as 100%\*NDL\_correct\_rx/ (NDL\_newtx + NDL\_retx), where NDL\_newtx is the number of newly transmitted DL transport blocks, NDL\_retx is the number of retransmitted DL transport blocks, and NDL\_correct\_rx is the number of correctly received DL transport blocks.

The common test parameters for NR cell are specified in Table 9.4B.1.1.3-1. The parameters specified in Table 9.4B.1.1.3-2 are applicable for tests on FDD NR cell and parameters specified in Table 9.4B.1.1.3-3 are applicable for tests on TDD NR cell.

Unless otherwise stated, no user data is scheduled on slot #0, 10 and 11 within 20 ms for SCS 15 kHz for NR cell.

Unless otherwise stated, no user data is scheduled on slot #0, 20 and 21 within 20 ms for SCS 30 kHz for NR cell.

	Parameter	Unit	Value
PDSCH transmission			Transmission scheme 1
EPRE ratio of PTRS	to PDSCH	dB	N/A
Channel bandwidth		MHz	Channel bandwidth from selected CA bandwidth combination
	Physical Cell ID		0
Common serving	SSB position in burst		First SSB in Slot #0
cell parameters	SSB periodicity	ms	20
	First DMRS position for Type A PDSCH mapping		2
Cross carrier schedu			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
configuration	Subcarrier spacing	kHz	15 or 30
	RB offset	RBs	0
DL BWP configuration #1	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
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH		Symbols #0
	Number of PRBs in CORESET		Table 9.4B.1.1.3-4
	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
PDCCH	DCI format		1_1
configuration	TCI State		TCI state #1
			For 2Tx: Single Panel Type I, Random precoder chosen from precoder index 0 and 2, selection updated per slot
	PDCCH & PDCCH DMRS Precoding configuration		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
	Mapping type		updated per slot Type A
	kO		updated per slot
	k0 PDSCH aggregation factor		updated per slot Type A 0 1
PDSCH	k0 PDSCH aggregation factor PRB bundling type		updated per slot Type A 0 1 Static
PDSCH configuration	k0 PDSCH aggregation factor PRB bundling type PRB bundling size		updated per slot Type A 0 1 Static WB
	k0 PDSCH aggregation factor PRB bundling type PRB bundling size Resource allocation type		updated per slot Type A 0 1 Static WB Type 0
	k0 PDSCH aggregation factor PRB bundling type PRB bundling size Resource allocation type VRB-to-PRB mapping type		updated per slot Type A 0 1 Static WB
	k0 PDSCH aggregation factor PRB bundling type PRB bundling size Resource allocation type VRB-to-PRB mapping type VRB-to-PRB mapping interleaver bundle size		updated per slot Type A 0 1 Static WB Type 0
	k0         PDSCH aggregation factor         PRB bundling type         PRB bundling size         Resource allocation type         VRB-to-PRB mapping type         VRB-to-PRB mapping interleaver bundle         size         DMRS Type		updated per slot Type A 0 1 Static WB Type 0 Non-interleaved
	k0 PDSCH aggregation factor PRB bundling type PRB bundling size Resource allocation type VRB-to-PRB mapping type VRB-to-PRB mapping interleaver bundle size		updated per slot Type A 0 1 Static WB Type 0 Non-interleaved N/A
configuration	k0         PDSCH aggregation factor         PRB bundling type         PRB bundling size         Resource allocation type         VRB-to-PRB mapping type         VRB-to-PRB mapping interleaver bundle         size         DMRS Type		updated per slot Type A 0 1 Static WB Type 0 Non-interleaved N/A Type 1 1 1
	k0         PDSCH aggregation factor         PRB bundling type         PRB bundling size         Resource allocation type         VRB-to-PRB mapping type         VRB-to-PRB mapping interleaver bundle size         DMRS Type         Number of additional DMRS		updated per slot           Type A           0           1           Static           WB           Type 0           Non-interleaved           N/A           Type 1           1           1           1           1           1           1           1           1           1           1000} for 1 Layer CCs           {1000, 1001} for 2 Layers CCs
configuration PDSCH DMRS	k0 PDSCH aggregation factor PRB bundling type PRB bundling size Resource allocation type VRB-to-PRB mapping type VRB-to-PRB mapping interleaver bundle size DMRS Type Number of additional DMRS Length		updated per slot Type A 0 1 Static WB Type 0 Non-interleaved N/A Type 1 1 {1000} for 1 Layer CCs

				1		
	Subcarrier inc CSI-RS	lexes in the PRB used for		$k_0 = 3$ for CSI-RS resource 1,2,3,4		
		Is in the PRB used for CSI-		$I_0 = 6$ for CSI-RS resource 1 and 3		
	RS			$I_0 = 10$ for CSI-RS resource 2 and 4		
	Number of CS	SI-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		
1				15 kHz SCS: 20 for CSI-RS resource		
	CSI-RS perio	dicity	Slots	1,2,3,4		
CSI-RS for tracking				30 kHz SCS: 40 for CSI-RS resource		
COPRO IOI TRACKING				1,2,3,4 15 kHz SCS:		
				10 for CSI-RS resource 1 and 2		
				11 for CSI-RS resource 3 and 4		
	CSI-RS offset		Slots			
				30 kHz SCS:		
				20 for CSI-RS resource 1 and 2		
				21 for CSI-RS resource 3 and 4		
	Frequency Oc	ccupation		Start PRB 0		
				Number of PRB = BWP size		
	QCL info			TCI state #0		
	Subcarrier inc CSI-RS	lexes in the PRB used for		k <sub>0</sub> = 4		
1		Is in the PRB used for CSI-				
	RS			$I_0 = 12$		
		SI-RS ports (X)		Same as number of transmit antenna		
	CDM Type			'FD-CDM2'		
NZP CSI-RS for	Density (p)			1		
CSI acquisition		diaite :		15 kHz SCS: 20		
	CSI-RS perio	dicity		30 kHz SCS: 40		
	CSI-RS offset			0		
	Frequency Oc	cupation		Start PRB 0		
				Number of PRB = BWP size		
	QCL info			TCI state #1		
	CSI-RS	lexes in the PRB used for		$k_0 = 0$		
		Is in the PRB used for CSI-		1 40		
	RS			$I_0 = 12$		
	Number of CS	SI-RS ports (X)		4		
ZP CSI-RS for CSI	CDM Type			'FD-CDM2'		
acquisition	Density (p)			1		
	CSI-RS perio	dicity		15 kHz SCS: 20		
	-	•		30 kHz SCS: 40		
	CSI-RS offset		+			
	Frequency Oc	ccupation		Start PRB 0 Number of PRB = BWP size		
	Type 1 QCL	SSB index		SSB #0		
	information	QCL Type		Type C		
TCI state #0	Type 2 QCL	SSB index		N/A		
	information	QCL Type		N/A		
			1	CSI-RS resource 1 from 'CSI-RS for		
	Type 1 QCL	CSI-RS resource		tracking' configuration		
TCI state #1	information	QCL Type		Type A		
	Type 2 QCL	CSI-RS resource	1	N/A		
	information	QCL Type		N/A		
Maximum number of	code block grou	ups for ACK/NACK feedback		1		
Maximum number of		ssion		4		
HARQ ACK/NACK b				Multiplexed		
Redundancy version	coding sequen	ce		{0,2,3,1}		
				Single Panel Type I, Random precoder		
		oonfiguration		selection updated per slot, with equal		
PDSCH & PDSCH D	INING Precoaing	comguration		probability of each applicable i1, i2 combination with PRB bundling		
				granularity		
Symbols for all unuse	ed REs		1	OCNG Annex A.5		
Propagation condition				Static propagation condition		
			1			

				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.					
Note 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 9.4B.1.1.3-2: Additional test parameters for NR FDD band

Parameter			Value
Duplex mode			FDD
PDSCH	Starting symbol (S)		1
configuration	Length (L)		13
Number of HARQ Processes			4
K1 value			2

#### Table 9.4B.1.1.3-3: Additional test parameters for NR TDD band

	Parameter	Unit	Value
Duplex mode			TDD
PDSCH	Starting symbol (S)		1
configuration	Length (L)		13
Number of HARQ	Processes		8
K1 value			Specific to each UL-DL pattern
			15 kHz SCS: FR1.15-1
TDD UL-DL pattern			30 kHz SCS: FR1.30-1
Note 1: PDSCH is	scheduled only on full DL slots		

### Table 9.4B.1.1.3-4: Number of PRBs in CORESET for NR cell

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

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

# Table 9.4B.1.1.3-5: MCS indexes for indicated UE capabilities for NR cell

Parameter	Unit	Value
Inter-TTI Distance		1
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1
Cross carrier scheduling		Not configured
Propagation condition		Static propagation condition No external noise sources are applied
$\hat{E}_{_{s}}$ at antenna port	dBm/15kHz	-85
Antenna configuration	2 layer CC	2x2 or 2x4
Antenna coningulation	4 layer CC	4x4
Codebook subset	2 layer CC	10
restriction	4 layer CC	1000
Downlink power	2 layer CC	$\rho_A = -3$ dB, $\rho_B = -3$ dB, $\sigma = 0$ dB
allocation	4 layer CC	$\rho_A = -6$ dB, $\rho_B = -6$ dB, $\sigma = 3$ dB

Table 9.4B.1.1.3-6: Additional test setup for E-UTRA CC

#### Table 9.4B.1.1.3-7: E-UTRA FRC for SDR test (FDD)

MIMO layer Bandwidth		Reference channel			
		64QAM	256QAM	1024QAM	
	5	R.PDSCH.4-1.1 FDD	R.PDSCH.4-3.1 FDD	R.PDSCH.4-5.1 FDD	
2 lover	10	R.PDSCH.4-1.2 FDD	R.PDSCH.4-3.2 FDD	R.PDSCH.4-5.2 FDD	
2 layer	15	R.PDSCH.4-1.3 FDD	R.PDSCH.4-3.3 FDD	R.PDSCH.4-5.3 FDD	
	20	R.PDSCH.4-1.4 FDD	R.PDSCH.4-3.4 FDD	R.PDSCH.4-5.4 FDD	
	5	R.PDSCH.4-2.1 FDD	R.PDSCH.4-4.1 FDD	R.PDSCH.4-6.1 FDD	
1 lovor	10	R.PDSCH.4-2.2 FDD	R.PDSCH.4-4.2 FDD	R.PDSCH.4-6.2 FDD	
4 layer	15	R.PDSCH.4-2.3 FDD	R.PDSCH.4-4.3 FDD	R.PDSCH.4-6.3 FDD	
	20	R.PDSCH.4-2.4 FDD	R.PDSCH.4-4.4 FDD	R.PDSCH.4-6.4 FDD	

Table 9.4B.1.1.3-8: E-UTRA FRC for SDR test (T	DD)
--	-----

MIMO layer Bandwidth		Reference channel			
willwid layer	Danuwium	64QAM	256QAM	1024QAM	
	10	R.PDSCH.6-1.1 TDD	R.PDSCH.6-3.1 TDD	R.PDSCH.6-5.1 TDD	
2 layer	15	R.PDSCH.6-1.2 TDD	R.PDSCH.6-3.2 TDD	R.PDSCH.6-5.2 TDD	
	20	R.PDSCH.6-1.3 TDD	R.PDSCH.6-3.3 TDD	R.PDSCH.6-5.3 TDD	
	10	R.PDSCH.6-2.1 TDD	R.PDSCH.6-4.1 TDD	R.PDSCH.6-6.1 TDD	
4 layer	15	R.PDSCH.6-2.2 TDD	R.PDSCH.6-4.2 TDD	R.PDSCH.6-6.2 TDD	
	20	R.PDSCH.6-2.3 TDD	R.PDSCH.6-4.3 TDD	R.PDSCH.6-6.3 TDD	

#### 9.4B.1.1.3.1 Procedure for test parameter selection

The test parameters are determined by the following procedure:

- Select one EN-DC bandwidth combination among all supported EN-DC configurations and set of per component carrier (CC) UE capabilities among all supported UE capabilities that provides the largest data rate [TS 38.306 [14, Section 4.1.2]].
  - Set of per NR CC UE capabilities include channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor TS 38.306 [14] Section 4.1.2]].
  - Set of per E-UTRA CC UE capabilities includes channel bandwidth, number of PDSCH MIMO layers and modulation format [TS 38.306 [14] Section 4.1.2]].
  - When there are multiple sets of EN-DC bandwidth combinations and UE capabilities with same largest data rate, select one among sets with the smallest aggregated channel bandwidth.

For each NR FR1 CC in EN-DC bandwidth combination, use Table 9.4B.1.1.3-5 to determine MCS based on test parameters and indicated UE capabilities.

For each E-UTRA CC in EN-DC bandwidth combination, use Table 9.4B.1.1.3-7 and Table 9.4B.1.1.3-8 to determine FRC 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.

data rate (in Mbps) = 
$$10^{-6} \cdot \sum_{j=1}^{J} \left( v_{Layers}^{(j)} \cdot Q_m^{(j)} \cdot f^{(j)} \cdot R_{max} \cdot \frac{N_{PRB}^{BW(j),\mu} \cdot 12}{T_s^{\mu}} \cdot (1 - OH^{(j)}) \right)$$

wherein

J is the number of aggregated component carriers in a band or band combination

 $R_{max} = 948/1024$ 

For the j-th CC,

 $v_{layers}^{(j)}$  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.

 $^{\mu}$  is the numerology (as defined in TS 38.211 [6])

 $T_s^{\mu}$  is the average OFDM symbol duration in a subframe for numerology  $\mu$ , i.e.  $T_s^{\mu} = \frac{10^{-3}}{14 \cdot 2^{\mu}}$ . Note that normal cyclic prefix is assumed.

 $N_{PRB}^{BW(j),\mu}$ is the maximum RB allocation in bandwidth  $BW^{(j)}$  with numerology  $\mu$ , 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.

For EUTRA in case of MR-DC, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.

Data rate (in Mbps) = 
$$10^{-3} \cdot \sum_{j=1}^{J} TBS_j$$

wherein

J is the number of aggregated EUTRA component carriers in MR-DC band combination

 $TBS_j$  is the total maximum number of DL-SCH transport block bits received within a 1ms TTI for j-th CC, as derived from TS36.213 [22] based on the UE supported maximum MIMO layers for the j-th carrier, and based on the modulation order and number of PRBs based on the bandwidth of the j-th carrier.

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.

For MR-DC, the approximate maximum data rate is computed as the sum of the approximate maximum data rates from NR and EUTRA

The normative reference for this requirement is TS 38.101-4 [5], clause 9.4B.1.1.

#### 9.4B.1.1.4 Test description

#### 9.4B.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 subcarrier spacing based on NR and E-UTRA operating bands specified in Table 5.3.5-1 of TS 38.521-1.

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

E-UTRA configurations before measurement are specified in at Table 9.4B.1.1.3-6.

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. 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].
- 3. Downlink signals for E-UTRA cell are initially set up according to TS 36.521-1 [16] Annex C.0 and uplink signals according to TS 36.521-1 [16] Annex H
- 4. Propagation conditions are set according to TS 36.521-1 [16] and TS 38.521-1 [7] Annex B.0 for E-UTRA CG and NR CG respectively.
- 5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG(s)* and *SCG*, Connected without release *On*, *Test Loop Function On with UE Test Loop Mode A with UL\_PDCP\_SDU\_SIZE = 0* for MCG DRB and SCG DRB according to TS 38.508-1 [6] clause 4.5.4. Message content are defined in clause 5.5.1.4.3.
- 6. SS sends a RRCConnectionReconfiguration message to change PDCP version of MCG DRB to NR PDCP.
- 7. SS shall transmit UECapabilityEnquiry message containing *UE-CapabilityRAT-Request* with *rat-Type* set to *eutra-nr* and *eutra*.
- 8. The UE shall transmit UECapabilityInformation message.
- 9. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-MRDC-Capability and UE-EUTRA-Capability*, and the procedure outlined in 9.4B.1.1.3.1 determine one EN-DC bandwidth combination that would provide the largest aggregated data rate.

10. Setup up the NR CG and E-UTRA CG using these parameters for the test.

11. Configure the NR CG TBsize, NR CG DL RMC, NR CG UL RMC from Annex A.3.2\_1 and Annex A.2.2 for UL as appropriate. Configure the E-UTRA CG TBsize, DL RMC and UL RMC from Table 9.4B.1.1.3-7, Table 9.4B.1.1.3-8 as appropriate.

9.4B.1.1.4.2 Test procedure

- 1. SS configures T-reordering timer to be infinity for both E-UTRA MCG DRB and NR SCG DRB.
- 2. SS sends a PDCP reestablishment via RRCConnectionReconfigurationmessage requesting for PDCP Status Report for both E-UTRA MCG DRB and NR SCG DRB.
- 3. SS sets the counters  $N_{DL_newtx} N_{DL_retx}$  per NR CG and E-UTRA CG to 0.
- 4. For each new DL HARQ transmission the SS generates sufficient NR 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 for both E-UTRA MCG DRB and NR SCG DRB. 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 per NR CG and E-UTRA CG. The SS increments then N<sub>DL\_newtx</sub> by one per CG.
- 5. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments N<sub>DL\_retx</sub> by one for that CG accordingly.
- 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 RRCConnectionReconfigurationmessage requesting for PDCP Status Report for both E-UTRA MCG and NR SCG DRB.
- 8. The SS calculates the TB success rate per NR CG and E-UTRA CG as A = 100% NDL\_correct\_rx \*/ (N<sub>DL\_newtx</sub> +  $N_{DL_retx}$ ).
- 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 Status Report.
- 10. The UE passes the test if A  $\geq$  85% TB success rates for both NR CG and E-UTRA CG 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.

#### 9.4B.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

Derivation Path: 38.509 clause 6.3.1			
Information Element	Value/remark	Comment	Condition
Protocol discriminator	1111		
Skip indicator	0000		
Message type	1000000		
UE test loop mode	00000000	UE test loop mode A	
UE test loop mode A LB setup			
Length of UE test loop mode A LB setup list in bytes	00001100	Length of two LB setup DRB (6 bytes)	
LB setup DRB[1]	0 0 0 0 0 0 0 0 0, 0 0 0 0 0 0 0 0 0, 0 0 0 0	UL PDCP SDU size = 0 Q4Q0 = MCG Data Radio Bearer identity number -1 for the radio bearer. See 38.509 clause 6.3.1	
LB setup DRB[2]	0 0 0 0 0 0 0 0 0, 0 0 0 0 0 0 0 0 0, 0 0 0 Q4 Q3 Q2 Q1 Q0	UL PDCP SDU size = 0 Q4Q0 = SCG 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 9.4B.1.1.4.3-0: CLOSE UE TEST LOOP (MCG and SCG DRB in the preamble)

#### Table 9.4B.1.1.4.3-1 to -7: Void

# Table 9.4B.1.1.4.3-8: RadioBearerConfig (Initial Conditions, Step 5)

Derivation Path: TS 38.508-1 [6], clause 4.6.3-132			
Information Element	Value/remark	Comment	Condition
RadioBearerConfig ::= SEQUENCE {			
drb-ToAddModList SEQUENCE (SIZE (1maxDRB))	1 entry		
OF DRB-ToAddMod {			
DRB-ToAddMod[1] SEQUENCE {		entry 1	
cnAssociation CHOICE {			
eps-BearerIdentity	Dedicated EPS bearer ID		
}			
drb-Identity	DRB-Identity of the SCG		
	DRB		
reestablishPDCP	Not Present		
pdcp-Config	PDCP-Config	Table	
		9.4B.1.1.4.3-8A	
}			
}			

# Table 9.4B.1.1.4.3-8A: 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		
}			

# Table 9.4B.1.1.4.3-9: RRCConnectionReconfiguration (Initial conditions, step6)

Derivation Path: TS 36.508 [7], Table 4.6.1-8 with cond	lition HO		
Information Element	Value/remark	Comment	Condition
RRCConnectionReconfiguration ::= SEQUENCE {			
criticalExtensions CHOICE {			
c1 CHOICE {			
rrcConnectionReconfiguration-r8 SEQUENCE {			
mobilityControlInfo	As per Table 4.6.5-1 of TS 36.508 [19]		
radioResourceConfigDedicated	RadioResourceConfigDe dicated-MCG-DRB-NR- PDCP	As per Table 9.4B.1.1.4.3-10	
nonCriticalExtension SEQUENCE {			
nonCriticalExtension SEQUENCE {			
nonCriticalExtension SEQUENCE {			
nonCriticalExtension SEQUENCE {			
nonCriticalExtension SEQUENCE {			
nonCriticalExtension SEQUENCE {			
nonCriticalExtension SEQUENCE {			
nonCriticalExtension SEQUENCE {			
nr-Config-r15	Not present		
nr-RadioBearerConfig1-r15	OCTET STRING containing RadioBearerConfig according to TS 38.508-1 [6], Table 4.6.3-132 with conditions MCG_NR_PDCP		
}			
}			
}			
}			
}			
}			
	+		
}	1		
}	1		
17			

Derivation Path: TS 36.508 [7], Table 4.6.3-19			
Information Element	Value/remark	Comment	Condition
RadioResourceConfigDedicated-MCG-DRB-NR-			
PDCP ::= SEQUENCE {			
drb-ToAddModList SEQUENCE (SIZE (1maxDRB))	1 entry		
OF DRB-ToAddMod {			
DRB-ToAddMod[1]	DRB-ToAddMod-MCG-	entry 1	
	DRB-NR-PDCP	As per Table	
		9.4B.1.1.4.3-1 <mark>1</mark>	
}			
drb-ToReleaseList SEQUENCE (SIZE (1maxDRB))	1 entry		
OF DRB-Identity {			
DRB-Identity[1]	Same as the DRB	entry 1	
	identity associated with		
	the default EPS bearer		
}			
physicalConfigDedicated	PhysicalConfigDedicated		
	-DEFAULT with condition		
	RBC-HO		
}			

Table 9.4B.1.1.4.3-10: RadioResourceConfigDedicated-MCG-DRB-NR-PDCP

#### Table 9.4B.1.1.4.3-11: DRB-ToAddMod-MCG-DRB-NR-PDCP

Derivation Path: TS 36.508 [19], Table 4.8.2.1.7-1			
Information Element	Value/remark	Comment	Condition
DRB-ToAddMod ::= SEQUENCE {			
eps-Bearerldentity	Same as the default EPS bearer Identity		
drb-Identity	Same as the DRB identity associated with the default EPS bearer		
pdcp-Config	Not present		
reestablishPDCP	Not present		
}			

### Table 9.4B.1.1.4.3-12: RadioBearerConfig (Test procedure, step 2 and step 7)

Derivation Path: TS 38.508-1 [6], clause 4.6.3-132			
Information Element	Value/remark	Comment	Condition
RadioBearerConfig ::= SEQUENCE {			
drb-ToAddModList SEQUENCE (SIZE (1maxDRB)) OF DRB-ToAddMod {	2 entries		
DRB-ToAddMod[1] SEQUENCE {		entry 1	
cnAssociation CHOICE {			
eps-BearerIdentity	Default EPS bearer ID		
}			
drb-Identity	DRB-Identity of the MCG DRB		
reestablishPDCP	true		
pdcp-Config	PDCP-Config		
}			
DRB-ToAddMod[2] SEQUENCE {		entry 2	
cnAssociation CHOICE {			
eps-BearerIdentity	Dedicated EPS bearer ID		
}			
drb-Identity	DRB-Identity of the SCG DRB		
reestablishPDCP	true		
pdcp-Config	PDCP-Config		
}			

#### 9.4B.1.1.5 Test requirement

The PDCP SDU success rate of greater than 85% shall be sustained during at least 300 frames.

# 9.4B.1.2 Sustained downlink data rate performance for EN-DC including FR2 NR carrier

Editor's Note: MU analysis is complete for up to 100 MHz ChBW.

#### 9.4B.1.2.1 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 conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

#### 9.4B.1.2.2 Test Applicability

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

#### 9.4B.1.2.3 Minimum conformance requirements

The test setup for E-UTRA Pcell is specified in Clause 9.1.2 and Table 9.4B.1.1.1-1. During the test, only the PDSCH performance on the NR cell(s) on FR2 carriers is verified.

The TB success rate shall be higher than 85% when NR PDSCH is scheduled with MCS defined for the selected EN-DC bandwidth combination and with the downlink physical channel setup according to Annex C.2.2.

The TB success rate of delivered PDCP SDU(s) by Layer2 is defined as TB success rate = 100%\*NDL\_correct\_rx/ (NDL\_newtx + NDL\_retx), where NDL\_newtx is the number of newly transmitted DL transport blocks, NDL\_retx is the number of retransmitted DL transport blocks, and DL\_correct\_rx is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the number of DL transport blocks per CG used for DC.

The test parameters are specified in Tables 9.4B.1.2.3-1, 9.4B.1.2.3-2.

Unless otherwise stated, no user data is scheduled on slot #0, 40 and 41 within 20 ms for SCS 60 kHz.

Unless otherwise stated, no user data is scheduled on slot #0, 80 and 81 within 20 ms for SCS 120 kHz.

	Parameter	Unit	Value
PDSCH transmissio	n scheme		Transmission scheme 1
PTRS epre-Ratio			0
Channel bandwidth		MHz	Channel bandwidth from selected CA
			bandwidth combination
	Physical Cell ID		0
Common serving	SSB position in burst		First SSB in Slot #0
cell parameters	SSB periodicity	ms	20
	First DMRS position for Type A PDSCH mapping		2
Cross carrier sched			Not configured
Active DL BWP inde	5		1
	Offset between Point A and the lowest		· · · · ·
Actual carrier	usable subcarrier on this carrier (Note 3)	RBs	0
configuration	Subcarrier spacing	kHz	60 or 120
	RB Offset		0
DL BWP configuration #1	Number of contiguous PRB		Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-2 [3] for tested channel bandwidth and subcarrier spacing
	Subcarrier spacing	kHz	60 or 120
	Cyclic prefix		Normal
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH		Symbols #0
	Number of PRBs in CORESET		Table 7.5A.1-2
	Number of PDCCH candidates and aggregation levels		1/8
PDCCH	CCE-to-REG mapping type		Non-interleaved
configuration	DCI format		1-1
	TCI State		TCI state #1
	PDCCH &PDCCH DMRS Precoding configuration		Single Panel Type I, Random per slo with equal probability of precoder index 0 and 2, and with REG bundling granularity for number of Tx larger than 1
	Mapping type		Туре А
	k0		0
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		WB
PDSCH	Resource allocation type		Туре 0
configuration	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		
	VRB-to-PRB mapping interleaver bundle size Starting symbol (S)		Non-interleaved N/A 1
	VRB-to-PRB mapping interleaver bundle size Starting symbol (S) Length (L)		Non-interleaved N/A 1 13
	VRB-to-PRB mapping interleaver bundle size Starting symbol (S) Length (L) DMRS Type		Non-interleaved       N/A       1       13       Type 1
	VRB-to-PRB mapping interleaver bundle size Starting symbol (S) Length (L) DMRS Type Number of additional DMRS		Non-interleaved       N/A       1       13       Type 1       1
PDSCH DMRS	VRB-to-PRB mapping interleaver bundle size Starting symbol (S) Length (L) DMRS Type		Non-interleaved           N/A           1           13           Type 1           1           1           1
	VRB-to-PRB mapping interleaver bundle size Starting symbol (S) Length (L) DMRS Type Number of additional DMRS		Non-interleaved       N/A       1       13       Type 1       1
	VRB-to-PRB mapping interleaver bundle size Starting symbol (S) Length (L) DMRS Type Number of additional DMRS Length		Non-interleaved           N/A           1           13           Type 1           1           1           1           1           13           Type 1           1           1           1           1           1           1           1           1           1           1           1           1           1           1           1           1
configuration	VRB-to-PRB mapping interleaver bundle size Starting symbol (S) Length (L) DMRS Type Number of additional DMRS Length Antenna ports indexes Number of PDSCH DMRS CDM group(s) without data		Non-interleaved           N/A           1           13           Type 1           1
configuration PTRS	VRB-to-PRB mapping interleaver bundle size Starting symbol (S) Length (L) DMRS Type Number of additional DMRS Length Antenna ports indexes Number of PDSCH DMRS CDM group(s)		Non-interleaved           N/A           1           13           Type 1           1           1           1           1           1           1           1           1           1           1           1           1000} for 1 Layer CCs           {1000, 1001} for 2 Layers CCs           1
PDSCH DMRS configuration PTRS configuration	VRB-to-PRB mapping interleaver bundle size         Starting symbol (S)         Length (L)         DMRS Type         Number of additional DMRS         Length         Antenna ports indexes         Number of PDSCH DMRS CDM group(s)         without data         Frequency density ( <i>K</i> <sub>PT-RS</sub> )         Time density ( <i>L</i> <sub>PT-RS</sub> )         Subcarrier indexes in the PRB used for		Non-interleaved           N/A           1           13           Type 1           1           1           1           13           Type 1           1           1           1           1           1           1000} for 1 Layer CCs           {1000, 1001} for 2 Layers CCs           1           2
configuration PTRS configuration CSI-RS for	VRB-to-PRB mapping interleaver bundle size         Starting symbol (S)         Length (L)         DMRS Type         Number of additional DMRS         Length         Antenna ports indexes         Number of PDSCH DMRS CDM group(s)         without data         Frequency density ( <i>K</i> <sub>PT-RS</sub> )         Time density ( <i>L</i> <sub>PT-RS</sub> )         Subcarrier indexes in the PRB used for CSI-RS         OFDM symbols in the PRB used for CSI-		Non-interleaved           N/A           1           13           Type 1           1           1           1           1           1           1000} for 1 Layer CCs           {1000, 1001} for 2 Layers CCs           1           2           1           k0 = 3 for CSI-RS resource 1,2,3,4           l0 = 6 for CSI-RS resource 1 and 3
configuration PTRS configuration	VRB-to-PRB mapping interleaver bundle size         Starting symbol (S)         Length (L)         DMRS Type         Number of additional DMRS         Length         Antenna ports indexes         Number of PDSCH DMRS CDM group(s)         without data         Frequency density ( <i>K</i> <sub>PT-RS</sub> )         Time density ( <i>L</i> <sub>PT-RS</sub> )         Subcarrier indexes in the PRB used for CSI-RS		Non-interleaved           N/A           1           13           Type 1           1           1           1           1           1           1           1           1           1           1000} for 1 Layer CCs           {1000, 1001} for 2 Layers CCs           1           2           1           k0 = 3 for CSI-RS resource 1,2,3,4

# Table 9.4B.1.2.3-1: Test parameters for FR2 TDD

				1,2,3,4
	Density (ρ)			3 for CSI-RS resource 1,2,3,4
				60 kHz SCS: 80 for CSI-RS resource
	CSI-RS periodicity		Slots	1,2,3,4
			Ciolo	120 kHz SCS: 160 for CSI-RS
				resource 1,2,3,4
				60 kHz SCS: 40 for CSI-RS resource 1 and 2
				41 for CSI-RS resource 3 and 4
	CSI-RS offset		Slots	
				120 kHz SCS:
				80 for CSI-RS resource 1 and 2
				81 for CSI-RS resource 3 and 4
	Frequency Occupation	tion		Start PRB 0 Number of PRB = BWP size
	QCL info			TCI state #0
		in the PRB used for		
	CSI-RS			k <sub>0</sub> = 4
	,	he PRB used for CSI-		lo = 13
	RS	x = x + z (M)		
	Number of CSI-RS	ports (X)		Same as number of transmit antenna 'FD-CDM2'
NZP CSI-RS for	CDM Type Density (ρ)			FD-CDM2
CSI acquisition				60 kHz SCS: 80
	CSI-RS periodicity		Slots	120 kHz SCS: 160
	CSI-RS offset			0
	Frequency Occupat	tion		Start PRB 0
				Number of PRB = BWP size
	QCL info	in the PRB used for		TCI state #1
	CSI-RS			$k_0 = 0$
	OFDM symbols in the PRB used for CSI-			lo = 12
	RS			
	Number of CSI-RS ports (X)			4
ZP CSI-RS for CSI acquisition	CDM Type Density (ρ)			'FD-CDM2'
acquisition				60 kHz SCS: 80
	CSI-RS periodicity		Slots	120 kHz SCS: 160
	CSI-RS offset			0
	Frequency Occupat	tion		Start PRB 0
		ex in the PRB used for		Number of PRB = BWP size
	CSI-RS	ex in the PRD used for		k <sub>0</sub> =0 for CSI-RS resource 1,2
	First OFDM symbol in the PRB used for			I <sub>0</sub> = 8 for CSI-RS resource 1
	CSI-RS	( ))		$l_0 = 9$ for CSI-RS resource 2
	Number of CSI-RS	ports (X)		1 for CSI-RS resource 1,2
CSI-RS for beam	CDM Type Density (ρ)			'No CDM' for CSI-RS resource 1,2 3 for CSI-RS resource 1,2
refinement				60 kHz SCS: 80 for CSI-RS resource
				1,2
	CSI-RS periodicity		Slots	120 kHz SCS: 160 for CSI-RS
				resource 1,2
	CSI-RS offset		Slots	0 for CSI-RS resource 1,2
	Repetition			ON TOLANA III
	QCL info	CCD index		TCI state #1
	Tyoe 1 QCL information	SSB index QCL Type		SSB #0 Type C
TCI state #0	Type 2 QCL	SSB index		SSB #0
	information	QCL Type		Type D
		2.		CSI-RS resource 1 from 'CSI-RS for
	Tyoe 1 QCL information	CSI-RS resource		tracking' configuration
TCI state #1		QCL Type		Туре А
	Tyoe 2 QCL	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for
	information			tracking' configuration
Movimum number	f and a black group - f			Type D
waximum number o	f code block groups f			1

feedback			
Number of HARQ Processes	10 for FR2.60-1 and 8 for FR2.120-1		
K1 value	Specific to each UL-DL pattern		
Maximum number of HARQ transmission	4		
HARQ ACK/NACK bundling	Multiplexed		
Redundancy version coding sequence	{0,2,3,1}		
TDD UL-DL pattern	60 kHz SCS: FR2.60-1 120 kHz SCS: FR2.120-1		
PDSCH & PDSCH DMRS Precoding configuration	Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity for Rank 2		
Symbols for all unused REs	OCNG Annex A.5		
Propagation condition	Static propagation condition No external noise sources are applied		
Antenna 1 layer CCs	1x2 or 1x4		
configuration 2 layers CCs	2x2 or 2x4		
Physical signals, channels mapping and precoding	As specified in Annex B.4.1		
<ul> <li>Note 1: PDSCH is scheduled only on full DL slots not containing SSB or TRS.</li> <li>Note 2: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission.</li> <li>Note 3: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [3] for tested channel bandwidth and subcarrier spacing.</li> </ul>			

Table 9.4B.1.2.3-2: Number of PRBs in CORESET

SCS (kHz)	50 MHz	100 MHz	200 MHz	400 MHz
60	66	132	264	N.A
120	30	66	132	264

Maximum number of PDSCH MIMO layers	Maximum modulation format	Scaling factor	MCS
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	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

•	•	01
MCS Index (Note 1)	SNR <sub>BB</sub> (dB) for maximum number of PDSCH MIMO Layers = 1	SNR <sub>BB</sub> (dB) for maximum number of PDSCH MIMO Layers = 2
13	6.2	9.0
14	7.2	9.9
15	8.2	10.9
16	8.7	11.6
17	10.1	13.2
18	10.7	13.7
19	11.7	14.7
20	12.7	15.6

13.6

14.8

15.6

16.9

18.3

19.3

20.5 23. MCS Index is based on MCS Table defined in

clause 5.1.3 of TS 38.214 [12] when 256QAM is not

16.5

17.6

18.6

19.7

21.2

<u>22.3</u> 23.3

#### Table 9.4B.1.2.3-4: SNR required to achieve 85% of peak throughput under AWGN conditions

The normative reference for this requirement is TS 38.101-4 [5], clause 9.4B.1.2.

enabled.

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22

<u>23</u> 24

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9.4B.1.2.3.1 Procedure for test parameter selection

The test parameters are determined by the following procedure:

Note 1:

- Step 1: Calculate the NR FR2 data rate for EN-DC bandwidth combinations, using a procedure from Clause 7.5A, for all supported EN-DC configurations and set of per NR component carrier (CC) UE capabilities among all supported UE capabilities:
  - Set of per NR CC UE capabilities includes a channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor as defined in clause 4.1.2 of TS 38.306 [14].
- Step 2: Calculate the E-UTRA data rate for EN-DC bandwidth combinations, using a procedure from clause 4.1.2 of TS 38.306 [14], for all supported EN-DC configurations and set of per E-UTRA component carrier (CC) UE capabilities among all supported UE capabilities:
  - Set of per E-UTRA CC UE capabilities includes a channel bandwidth, number of PDSCH MIMO layers and modulation format as defined in clause 4.1.2 of TS 38.306 [14].
- Step 3: Select the EN-DC bandwidth combination among all supported EN-DC configurations that achieves maximum total data rate in steps 1 and 2 among all UE capabilities:
  - When there are multiple sets of EN-DC bandwidth combinations and UE capabilities with the same largest data rate, select a single set with the smallest aggregated channel bandwidth.
- Step 4: For each NR FR2 CC in the selected EN-DC bandwidth combination, use MCS determined in step 1 for that EN-DC bandwidth combination 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.

data rate (in Mbps) = 
$$10^{-6} \cdot \sum_{j=1}^{J} \left( v_{Layers}^{(j)} \cdot Q_m^{(j)} \cdot f^{(j)} \cdot R_{max} \cdot \frac{N_{PRB}^{BW(j),\mu} \cdot 12}{T_s^{\mu}} \cdot (1 - OH^{(j)}) \right)$$

wherein

J is the number of aggregated component carriers in a band or band combination

 $R_{max} = 948/1024 \,$ 

For the j-th CC,

 $v_{Layers}^{(j)}$  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.

 $^{\mu}$  is the numerology (as defined in TS 38.211 [6])

 $T_s^{\mu}$  is the average OFDM symbol duration in a subframe for numerology  $\mu$ , i.e.  $T_s^{\mu} = \frac{10^{-3}}{14 \cdot 2^{\mu}}$ . Note that normal cyclic prefix is assumed.

 $N_{PRB}^{BW(j),\mu}$  is the maximum RB allocation in bandwidth  $BW^{(j)}$  with numerology  $\mu$ , 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.

For EUTRA in case of MR-DC, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.

Data rate (in Mbps) = 
$$10^{-3} \cdot \sum_{j=1}^{J} TBS_j$$

wherein

J is the number of aggregated EUTRA component carriers in MR-DC band combination

 $TBS_{j}$  is the total maximum number of DL-SCH transport block bits received within a 1ms TTI for j-th CC, as derived from TS36.213 [22] based on the UE supported maximum MIMO layers for the j-th carrier, and based on the modulation order and number of PRBs based on the bandwidth of the j-th carrier.

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.

For MR-DC, the approximate maximum data rate is computed as the sum of the approximate maximum data rates from NR and EUTRA

#### 9.4B.1.2.4 Test description

#### 9.4B.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 subcarrier 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 4.1.

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

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

- 1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.
- 2. The parameter settings for the NR cell are set up according to Table 7.2-1 and Table 7.2.2.2.1.0-2 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 38.521-2 [8].
- 4. Propagation conditions for NR cell are set according to Annex B.0.
- 5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Test Mode On*, (EN-DC, DC bearer *MCG* and *SCG*), *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 9.4B.1.2.4.3.
- 6. SS shall transmit UECapabilityEnquiry message containing UE-CapabilityRAT-Request with rat-Type set to eutra.
- 7. The UE shall transmit UECapabilityInformation message.
- 8. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-MRDC-Capability and UE-EUTRA-Capability*, and the procedure outlined in 9.4B.1.2.3.1 determine one EN-DC bandwidth combination that would provide the largest aggregated data rate.
- 9. Setup up the NR CG for these parameters for the test.

#### 9.4B.1.2.4.2 Test Procedure

- 1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.O. If no direction found, mark the test as inconclusive.
- 2. Based on the maximum SNR capability of the FR2 chamber, determine the max MCS index from table 9.4B.1.2.3-4 to be configured for this test.
- 3. Configure the NR CG TBsize, NR CG DL RMC, NR CG UL RMC from Annex A.3.2\_1 and Annex A.2.2 for UL as appropriate based on the MCS index chosen in step 2.
- 4. SS configures T-reordering timer to be infinity for NR SCG DRB.
- 5. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report for NR SCG DRB.
- 6. SS sets the counters  $N_{DL\_newtx} N_{DL\_retx}$  per NR CG to 0.
- 7. For each new DL HARQ transmission the SS generates sufficient NR 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 for NR SCG

DRB. 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 per NR CG. The SS increments then  $N_{DL_newtx}$  by one per CG.

- 8. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments N<sub>DL\_retx</sub> by one for that CG accordingly.
- 9. Steps 7 and 8 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.
- 10. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report for NR SCG DRB.
- 11. The SS calculates the TB success rate per NR CG as A = 100% NDL\_correct\_rx \*/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>).
- 12. 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 Status Report.
- 13. The UE passes the test if A  $\geq$  85% TB success rates for NR CG 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.
- 9.4B.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

Derivation Path: 38.509 clause 6.3.1			
Information Element	Value/remark	Comment	Condition
Protocol discriminator	1111		
Skip indicator	0000		
Message type	1000000		
UE test loop mode	00000000	UE test loop mode A	
UE test loop mode A LB setup			
Length of UE test loop mode A LB setup list in bytes	0000011	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, 0 0 0 Q4 Q3 Q2 Q1 Q0	UL PDCP SDU size = 0 Q4Q0 = Data Radio Bearer identity number for the default radio bearer. See 38.509 clause 6.3.1	
UE test loop mode B LB setup	Not present		

#### Table 9.4B.1.1.4.3-1: PDCCH-ControlResourceSet-spCellConfigDedicated

Derivation Path: TS 38.508-1 [6], Table 4.6.3-28			
Information Element	Value/remark	Comment	Condition
ControlResourceSet ::= SEQUENCE {			
frequencyDomainResources	CORESET value according to Table 9.4B.1.2.3-2 as applicable		
}			
}			

Derivation Path: TS 38.508-1 [6], Table 4.6.3-162					
Information Element	Value/remark	Comment	Condition		
SearchSpace ::= SEQUENCE {					
monitoringSymbolsWithinSlot	1000000000000	Symbols 0			
nrofCandidates SEQUENCE {					
aggregationLevel1	n0				
aggregationLevel2	n0				
aggregationLevel4	n0				
aggregationLevel8	n1	AL8			
aggregationLevel16	n0				
}					
}					

#### Table 9.4B.1.1.4.3-2: PDCCH Search Space

#### Table 9.4B.1.1.4.3-3: RadioBearerConfig

Derivation Path: TS 38.508 [6], clause 4.6.3-132			
Information Element	Value/remark	Comment	Condition
RadioBearerConfig ::= SEQUENCE {			
drb-ToAddModList SEQUENCE (SIZE (1maxDRB))	1 entry		EN-
OF SEQUENCE {			DC_DRB
cnAssociation CHOICE {			
eps-BearerIdentity	6		
}			
drb-Identity	DRB-Identity using condition DRB2		
reestablishPDCP	true		EN- DC_DRB AND Re- establish_P DCP
pdcp-Config	PDCP-Config		
}			

#### Table 9.4B.1.1.4.3-4: PDCP-Config

Derivation Path: TS 38.508 [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		
}			

#### 9.4B.1.2.5 Test requirement

The PDCP SDU success rate of greater than 85% shall be sustained during at least 300 frames.

# 9.4B.2

# 9.4B.3 NE-DC

#### 9.4B.3.1 Sustained downlink data rate performance for NE-DC within FR1

The sustained downlink data rate performance for NR CC and E-UTRA CC along with test case details for this test case are specified in clause 9.4B.1.1.

# 10 CSI reporting requirements for interworking

# 10.1 General

This clause specifies CSI performance requirements for EN-DC, NE-DC, inter-band NR-DC between FR1 and FR2, and inter-band NR CA between FR1 and FR2.

The definition of frequency ranges (FR1 and FR2) are specified in table 5.1-1 of TS 38.101-3 [4].

For conformance testing involving FR2 test cases in this specification, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

# 10.1.1 Applicability of requirements

The following applicability rules are specified for demodulation performance requirements for interworking:

- For UEs supporting NR/5GC, EN-DC and NE-DC,
  - The performance requirements specified in Clause 6 will be verified only for NR/5GC mode.
  - The performance requirements specified in Clause 8 will be verified only for NR/5GC mode.
- The FR1 EN-DC test cases with the NR TDD DL-UL configurations which are not aligned with LTE's can be tested on the corresponding EN-DC band combinations where UE supports simultaneous transmission and reception.
- For UEs supporting NR-DC including FR1 and FR2, if the FR2 requirements in Clause 8.2, Clause 8.3 and Clause 8.4 are tested, the test coverage can be considered fulfilled without executing requirements in Clause 10.2B.2, Clause 10.3B.2 and Clause 10.4B.2.
- For UEs supporting NE-DC, the test coverage of CSI reporting requirements can be considered fulfilled, if the CSI reporting requirements in Clause 6 are executed for UE under test in the standalone mode.
- For UEs supporting NGEN-DC, the test coverage of CSI reporting requirements can be considered fulfilled, if the CSI reporting requirements in Clause 6 are executed for UE under test.
- For UEs supporting EN-DC including FR2 and/or EN-DC including FR1 and FR2, the requirements applicability is specified in Table 10.1.1-1.

# Table 10.1.1-1: Requirements applicability for UEs supporting EN-DC including FR2 and/or EN-DC including FR1 and FR2

Supported scenarios	CQI requirements	PMI requirements	RI requirements	
EN-DC including FR2	Clause 10.2B.1.2	Clause 10.3B.1.2	Clause 10.4B.1.2	
EN-DC including FR1 and FR2	Clause 10.2B.1.3	Clause 10.3B.1.3	Clause 10.4B.1.3	
Both EN-DC including FR2 and EN-DC including FR1 and FR2	Clause 10.2B.1.2	Clause 10.3B.1.2	Clause 10.4B.1.2	

### 10.1.1.1 Applicability of requirements for optional UE features

10.1.1.2 Applicability of requirements for mandatory UE features with capability signalling

The applicability rule defined in Clause 6.1.1.4 shall be applied for performance requirements in Clauses 10.2B.1.1, 10.3B.1.1 and 10.4B.1.1.

The applicability rule defined in Clause 8.1.1.4 shall be applied for performance requirements in Clauses 10.2B.1.2, 10.3B.1.2 and 10.4B.1.2.

10.2 Void

# 10.2A Reporting of Channel Quality Indicator (CQI) for CA

# 10.2B Reporting of Channel Quality Indicator (CQI) for DC

10.2B.1 EN-DC

### 10.2B.1.1 EN-DC within FR1

The NR CQI requirements and test case details for this test case are specified in Section 6.2.

During the test, only the CQI requirements on the NR cell shall be verified.

### 10.2B.1.2 EN-DC including FR2 NR carrier

The NR CQI requirements and test case details for this test case are specified in Section 8.2.

During the test, only the CQI performance on the NR cell(s) on FR2 carriers shall be verified.

### 10.2B.1.3 EN-DC including FR1 and FR2 NR carriers

The CSI performance requirements are verified according to section 10.2B.1.1 for EN-DC with FR1 NR carrier only and section 10.2B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only the CSI performance requirements on the FR2 carriers are verified.

No CSI requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

# 10.2B.2 NR DC between FR1 and FR2

FFS

# 10.3A Reporting of Precoding Matrix Indicator (PMI) for CA

FFS

# 10.3B Reporting of Precoding Matrix Indicator (PMI) for DC

# 10.3B.1 EN-DC

#### 10.3B.1.1 EN-DC within FR1

The NR PMI requirements and test case details for this test case are specified in Section 6.3.

During the test, only the PMI requirements on the NR cell shall be verified.

#### 10.3B.1.2 EN-DC including FR2 NR carrier

The NR PMI requirements and test case details for this test case are specified in Section 8.3.

During the test, only the PMI performance on the NR cell(s) on FR2 carriers shall be verified.

#### 10.3B.1.3 EN-DC including FR1 and FR2 NR carriers

The PMI performance requirements are verified according to section 10.3B.1.1 for EN-DC with FR1 NR carrier only and section 10.3B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only the PMI performance requirements on the FR2 carriers are verified.

No PMI requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

# 10.3B.2 NR DC between FR1 and FR2

FFS

# 10.4A Reporting of Rank Indicator (RI) for CA

FFS

# 10.4B Reporting of Rank Indicator (RI) for DC

# 10.4B.1 EN-DC

#### 10.4B.1.1 EN-DC within FR1

The NR RI requirements and test case details for this test case are specified in Section 6.4.

During the test, only the RI requirements on the NR cell shall be verified.

#### 10.4B.1.2 EN-DC including FR2 NR carrier

The NR RI requirements and test case details for this test case are specified in Section 8.4.

During the test, only the RI performance on the NR cell(s) on FR2 carriers shall be verified.

#### 10.4B.1.3 EN-DC including FR1 and FR2 NR carriers

The RI performance requirements are verified according to section 10.4B.1.1 for EN-DC with FR1 NR carrier only and section 10.4B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only the RI performance requirements on the FR2 carriers are verified.

No RI requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

# 10.4B.2 NR DC between FR1 and FR2

FFS

# 11 V2X requirements

This clause contains the performance requirements for the sidelink physical channels specified for V2X Sidelink Communication.

# 11.1 Demodulation performance requirements (Conducted requirements)

### 11.1.1 General

#### 11.1.1.1 Applicability of requirements

#### 11.1.1.1.1 General

The minimum performance requirements are applicable to all V2X operating bands defined in TS 38.101-1[2] Clause 5.2E.

The minimum performance requirements in Clause 11.1 are mandatory for UE supporting NR SL operation (*sl-Reception-r16*), except test cases listed in Clause 11.1.1.2.

# 11.1.1.1.2 Applicability of requirements for mandatory UE V2X features with capability signalling

The performance requirements in Table 11.1.1.1.2-1 shall apply for V2X UEs which support mandatory UE features with capability signalling only.

UE feature/capability [14]		Test type	Test list	Applicability notes
Support of synchronization	FR1	PSSCH	Clause 11.1.2.1.1	
sources for NR sidelink (sync-			Clause 11.1.6.1.1	
Sidelink-r16)			Clause 11.1.7.1.1	
		PSCCH	Clause 11.1.3.1.1	
			Clause 11.1.8.1.1	
		PSBCH	Clause 11.1.4.1.1	
		PSFCH	Clause 11.1.5.1.1	
			Clause 11.1.9.1.1	
Supports of PSFCH format 0	FR1	PSSCH	Clause 11.1.2.1.1	
(psfch-FormatZeroSidelink-			Clause 11.1.6.1.1	
r16)			Clause 11.1.7.1.1	
		PSCCH	Clause 11.1.3.1.1	
			Clause 11.1.8.1.1	
		PSFCH	Clause 11.1.5.1.1	
			Clause 11.1.9.1.1	

### 11.1.1.2 Common test parameters

Parameters specified in Table 11.1.1.2-1 are applied for all test cases in this clause unless otherwise stated.

	Parameter	Unit	Value			
Carrier	Offset between Point A and the lowest usable subcarrier on this carrier (Note 1)	RBs	0			
configuration	Subcarrier spacing	kHz	30			
	Cyclic prefix		Normal			
	RB offset	RBs	0			
SL BWP configuration #1	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			
PT-RS configuration			PT-RS is not configured			
	PSCCH Time resource	Symbols	2			
	PSCCH Frequency resource	PRBs	10			
	PSFCH number of cyclic shift pairs		n1			
	PSFCH hopping ID		0			
	PSFCH candidate resource type		allocSubCH			
Resource pool	Set of PRBs for PSFCH transmission		ones(1,100) for 40 MHz and ones(1,50) for 20 MHz			
configuration	PSSCH RSRP threshold		66 (infinity dBm)			
	Synchronization reference		GNSS			
	Subchannel size	PRBs	10			
	Number of sub-channels		5 for 20 MHz and 10 for 40 MHz			
	Start PRB for first sub-channel		0			
	Time resource bitmap		ones(1, 160)			
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.						

# Table 11.1.1.2-1: Common test parameters

The normative reference for this requirement is TS 38.101-4 [5] clause 11.1.1.2.

# 11.1.2 PSSCH demodulation requirements

# 11.1.2.1 2Rx requirements

# 11.1.2.1.1 2Rx FR1 PSSCH performance

# 11.1.2.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.2.1.1.0-2 with the test parameters specified in Table 11.1.2.1.1.0-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and sidelink UE 1 transmits PSCCH and PSSCH.

Parameter		Unit		Value		
		Unit	Test 1	Test 2	Test 3	
Active cel	l(s)			None		
	Sidelink transmissions		F	SCCH + PSS	СН	
	PSSCH DMRS pattern (Note 1)		{3,4}	{2,3}	{2,2}	
Sidelink	Index of sub-channel allocation		[0,1]	[0,1]	[0]	
UE 1	Timing offset (Note 2)	μS	CP/2-12*64*Tc			
UEI	Frequency offset (Note 3)	Hz	+600			
	Synchronization		GNSS or GNSS-equivalent			
	Antenna configuration		1x2 Low			
PSFCH re	esource period	Slot	4	4	4	
MinTime	BapPSFCH	Slot	3	3	3	
Note 1:	ote 1: {x, y}: x and y means the number of DMRS symbols for slot with PSFCH transmission and					
	without PSFCH transmission, respectively.					
Note 2:	Note 2: Time offset of transmitted Sidelink UE signal with respect to GNSS referring timing.					
Note 3:	Frequency offset of transmitted Sidelink U	JE signal wit	th respect to G	NSS reference	frequency.	

# Table 11.1.2.1.1.0-1: Test parameters

Reference	Bandwidth (MHz)/	Modulation format	Propagation	Referen	ce value
	Out a series	and a sile nate	a an diti an	Deecu	

Table 11.1.2.1.1.0-2: Minimum performance

	Reference	(MHz)/	Modulation format	Propagation	Reference value	
Test num.	channel	Subcarrier spacing(kHz)	and code rate	condition	PSSCH BLER (%)	SNR(dB) of PSSCH
1	R.PSSCH.2-1.1	20 / 30	QPSK, 0.30	TDLA30-2700		3.4
2	R.PSSCH.2-1.2	20 / 30	16QAM, 0.37	TDLA30-1400	10%	8.8
3	R.PSSCH.2-1.3	20 / 30	64QAM, 0.43	TDLA30-180		14.8

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.2.1.1.

#### 11.1.2.1.1\_1 2Rx FR1 PSSCH performance - single active PSSCH link

11.1.2.1.1\_1.1 Test purpose

The purpose is to verify the PSSCH for V2X demodulation performance with a single active PSSCH link.

11.1.2.1\_1.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.2-1.

- 11.1.2.1\_1.1.3 Test description
- 11.1.2.1\_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 subcarrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.2.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.2.1.1.0-2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

- Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).
- 2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.2.1\_1.1.3.3.
- 3. Sidelink physical channels and signals are initially set up according to Table 11.1.2-1, Table 11.1.2.1.1.0-1 and Annex A.6 as appropriate.
- 4. Propagation conditions are set according to Annex B.0.
- 5. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the receiving UE. Message contents are defined in clause 11.1.2.1.1\_1.3.3.
- 6. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

11.1.2.1.1\_1.3.2 Test procedure

- 1. Sidelink UE1 transmits PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.2.1.1.0-1. The sidelink UE1 transmits MAC padding bits on the sidelink RMC.
- 2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.2.1.4-1 as appropriate.
- 3. Measure the average PSSCH BLER according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. If the measured average PSSCH BLER is less than the reference value in Table 11.1.2.1.4-1 pass the UE. Otherwise fail the UE.
- 4. Repeat steps from 1 to 3 for each subtest in Table 11.1.2.1.1\_1.4-1 as appropriate.

#### 11.1.2.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3 with the following exceptions.

Derivation Path: TS 38.508-1 [6] Table	Derivation Path: TS 38.508-1 [6] Table 4.3.6.2.1.1-1					
Parameter	Value	Value in binary	Condition			
DMRS pattern	indicates the 2nd entry in sl- PSSCH-DMRS-TimePatternList- r16 if mod (i, 4), else indicates the 3rd entry in sl-PSSCH-DMRS- TimePatternList-r16.	"01"B if mod (i, 4) = 0 "10"B if mod (i, 4) ≠ 0	Test 1			
	where i is the logical slot index belong to resource pool per 1024 radio frame as specified in 38.214 [12] clause 8					
	indicates the 1st entry in sl- PSSCH-DMRS-TimePatternList- r16 if mod (i, 4), else indicates the 2nd entry in sl-PSSCH-DMRS- TimePatternList-r16.	"00"B if mod (i, 4) = 0 "01"B if mod (i, 4) ≠ 0	Test 2			
	indicates the 1st entry in sl- PSSCH-DMRS-TimePatternList- r16	"00"B	Test 3			

# Table 11.1.2.1.1\_1.3.3-1: Physical layer parameters for SCI format 1-A

Derivation Path: TS 38.508-1 [6] Table 5.4.3-1			
Information Element	Value/remark	Comment	Condition
SL-ResourcePool-r16 ::= SEQUENCE {			
sI-PSSCH-Config-r16 CHOICE {			
setup SEQUENCE {			
sI-PSSCH-DMRS-TimePatternList-r16	3 entries		
SEQUENCE (SIZE (13)) OF INTEGER (24) {			
INTEGER[1]	2	entry 1	
INTEGER[2]	3	entry 2	
INTEGER[3]	4	entry 3	
}			
}			

# Table 11.1.2.1.1\_1.3.3-2: SL-ResourcePool

# 11.1.2.1.4 Test Requirements

For the parameters specified in Table 11.1.2.1.0-1 and SNR specified in Table 11.1.2.1.1\_1.4-1, the average PSSCH BLER obtained in step 3 shall be below the reference value specified in Table 11.1.2.1.1\_1.4-1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

-	Reference	Bandwidth (MHz)/			Reference value	
Test num.	channel	Subcarrier spacing(kHz)	and code rate	Propagation condition	PSSCH BLER (%)	SNR(dB) of PSSCH
1	R.PSSCH.2-1.1	20 / 30	QPSK, 0.30	TDLA30-2700		4.2
2	R.PSSCH.2-1.2	20 / 30	16QAM, 0.37	TDLA30-1400	10%	9.6
3	R.PSSCH.2-1.3	20 / 30	64QAM, 0.43	TDLA30-180		15.6

#### Table 11.1.2.1.1\_1.4-1: Test performance

# 11.1.3 PSCCH demodulation requirements

# 11.1.3.1 2Rx requirements

# 11.1.3.1.1 2Rx FR1 PSCCH performance

# 11.1.3.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.3.1.1.0-2 with the test parameters specified in Table 11.1.3.1.1.0-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and sidelink UE 1 transmits PSCCH and PSSCH.

Parameter		Unit	Test 1			
Active cell(s)			None			
	Sidelink Transmissions		PSCCH+PSSCH			
	Timing offset (Note 1)	μS	CP/2-12*64*Tc			
Sidelink UE 1	Frequency offset (Note 2)	Hz	+600			
	Synchronization		GNSS or GNSS-equivalent			
	Antenna configuration		1x2 Low			
	PSSCH RMC		R.PSSCH.2-1.1			
NOTE 1: Time	offset of transmitted Sidelink UE	signal wit	n respect to GNSS reference timing.			
NOTE 2: Frequ	NOTE 2: Frequency offset of transmitted Sidelink UE signal with respect to GNSS reference frequency.					
NOTE 3: OCC	index i for PSCCH DMRS is ran	domly sele	cted from {0, 1, 2} for each PSCCH transmission.			

# Table 11.1.3.1.1.0-1: Test parameters

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	PSCCH	Bandwidth		Reference	e value
Test number	Reference channel	(MHz) / Subcarrier spacing (kHz)	Propagation condition	Probability of missed PSCCH (%)	SNR (dB) of PSCCH
1	R.PSCCH.2-1.1	20 / 30	TDLA30-1400	1	4.7

#### Table 11.1.3.1.1.0-2: Minimum performance

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.3.1.1.

#### 11.1.3.1.1\_1 2Rx FR1 PSCCH performance - single active PSSCH link

#### 11.1.3.1.1\_1.1 Test purpose

The purpose is to verify the PSCCH for V2X demodulation performance with a single active PSSCH link.

#### 11.1.3.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

#### 11.1.3.1.1\_1.3 Test description

#### 11.1.3.1.1\_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 subcarrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.3.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.3.1.1.0-2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

- 1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).
- 2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.3.1.1\_1.3.3.
- 3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.3.1.1.0-1 and Annex A.6 as appropriate.
- 4. Propagation conditions are set according to Annex B.0.
- 5. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the received UE. Message contents are defined in clause 11.1.3.1.1\_1.3.3.
- 6. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

#### 11.1.3.1.1\_1.3.2 Test procedure

- 1. Sidelink UE1 transmits PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.3.1.1.0-1. The sidelink UE1 transmits MAC padding bits on the sidelink RMC.
- 2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.3.1.1\_1.4-1 as appropriate.
- 3. Measure the probability of PSCCH miss-detection according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. If the measured probability of PSCCH miss-detection is less than the reference value in Table 11.1.3.1.1\_1.4-1 pass the UE. Otherwise fail the UE.
- 4. Repeat steps from 1 to 3 for each subtest in Table 11.1.3.1.1\_1.4-1 as appropriate.

# 11.1.3.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3.

# 11.1.3.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.3.1.0-1 and SNR specified in Table 11.1.3.1.4-1, the average PSSCH BLER obtained in step 3 shall be below the reference value specified in Table 11.1.3.1.4-1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

# Table 11.1.3.1.4-1: Test performance requirements

	PSCCH Bandwidth			Reference value		
Test number	Reference channel	(MHz) / Subcarrier spacing (kHz)	Propagation condition	Probability of missed PSCCH (%)	SNR (dB) of PSCCH	
1	R.PSCCH.2-1.1	20 / 30	TDLA30-1400	1	5.5	

# 11.1.4 PSBCH demodulation requirements

# 11.1.4.1 2Rx requirements

# 11.1.4.1.1 2Rx FR1 PSBCH performance

# 11.1.4.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.4.1.1.0-2 with the test parameters specified in Table 11.1.4.1.1.0-1. The Sidelink UE 1 transmits PSBCH to UE and the UE is synchronized to SLSS of Sidelink UE 1.

RAN4 has recommended that these requirements do not need to be tested.

Table	11.1.	4.1.1.	0-1:	Test	parameters
-------	-------	--------	------	------	------------

	Parameter	Unit	Test 1		
Active cell(s)			None		
	Sidelink Transmissions		SLSS+PSBCH (Note 3)		
	slssid		0		
Sidelink UE 1	Time offset (Note 1)	μS	0		
	Frequency offset (Note 2)	Hz	0		
	Synchronization source		GNSS		
	Antenna configuration		1x2 Low		
	Note 1: Time offset of transmitted Sidelink UE 1 signal with respect to GNSS reference timing.				
Note 2: Frequency offset of transmitted Sidelink UE 1 signal with respect to GNSS reference frequency.					
Note 3: PSBCH	transmits together with correspon	nding SLSS in	the same slot.		

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	Bandwidth (MHz)			Reference value		
Test number	/ Subcarrier spacing (kHz)	PSBCH Reference channel	Propagation condition	Probability of missed PSBCH (%)	SNR (dB)	
1	20 / 30	R.PSBCH.2-1	TDLA30-180	1	0.1	

#### Table 11.1.4.1.1.0-2: Minimum performance

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.4.1.1.

# 11.1.5 PSFCH demodulation requirements

- 11.1.5.1 2Rx requirements
- 11.1.5.1.1 2Rx FR1 PSFCH performance
- 11.1.5.1.1.0 Minimum requirements
- 11.1.5.1.1.0.1 NACK missed detection requirements

The minimum requirements are specified in Table 11.1.5.1.1.0.1-2 with the test parameters specified in Table 11.1.5.1.0.1-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and sidelink UE 1 receives PSCCH and PSSCH sent by the UE under test and transmits PSFCH.

	Parameter	unit	Test 1			
Allocated	I resource blocks	RB	1			
The num	ber of PSFCH symbols (Note 1)	symbol	2			
Number	of information bits	bit	1			
Synchror	nization source		GNSS			
Timing of	ffset (Note 2)	μs	CP/2-12*64*Tc			
Frequency offset (Note 3) Hz 600						
PSFCH resource period Slots 1						
Antenna configuration 1x2 Low						
Note 1	Note 1 First symbol is included. First symbol is used for AGC and not used for demodulation.					
Note 2 Time offset of transmitted Sidelink UE signal with respect to GNSS referring timing.						
Note 3 Frequency offset of transmitted Sidelink UE signal with respect to GNSS reference frequency.						

#### Table 11.1.5.1.1.0.1-1: Test parameters

Teat	Bondwidth (MU=) /	Drenegation	Reference value		
Test num.	Bandwidth (MHz) / Subcarrier spacing (kHz)	Propagation condition	NACK missed detection probability (%)	SNR (dB)	
1	20 / 30	TDLA30-180	1	9.5	

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.5.1.1.1.

11.1.5.1.1.0.2 DTX to NACK requirements

The DTX to NACK probability, i.e. the probability that NACK is detected when nothing was sent:

Prob(PSFCH DTX  $\rightarrow$  NACK bits) =  $\frac{\#(\text{false NACK bits})}{\#(\text{PSFCH DTX})*\#(\text{NACK bits})}$ 

where:

- #(false NACK bits) denotes the number of detected NACK bits.
- #(NACK bits) denotes the number of encoded bits per slot
- #(PSFCH DTX) denotes the number of DTX occasions

The DTX to NACK probability shall not exceed 1% with the test parameters are configured in Table 11.1.5.1.1.0.1-1.

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.5.1.1.2.

#### 11.1.5.1.1\_1 2Rx FR1 PSCCH performance - single active PSSCH link

11.1.5.1.1\_1.1 Test purpose

The purpose is to verify the PSFCH for V2X demodulation performance with a single active PSSCH link.

#### 11.1.5.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

- 11.1.5.1.1\_1.3 Test description
- 11.1.5.1.1\_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 subcarrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

Test Environment: Low, 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 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.5.1.1.0.1-2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

- 1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).
- 2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.5.1.1\_1.3.3.
- 3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.5.1.1.0.1-1 and Annex A.6 as appropriate.
- 4. Propagation conditions are set according to Annex B.0.
- 5. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the transmitting UE and operates in NACK-only HARQ groupcast mode. Message contents are defined in clause 11.1.5.1.1\_1.3.3.
- 6. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

#### 11.1.5.1.1\_1.3.2 Test procedure

- 1. The UE under test transmits PSCCH/PSSCH in every PSCCH/PSSCH duration for NR sidelink communication according to *SL-PreconfigurationNR*. The Sidelink UE1 receives the PSSCH sent by the UE under test. For every PSSCH received, the Sidelink UE1 sends NACK on PSFCH if the corresponding PSFCH falls in even slot and sends nothing if the corresponding PSFCH falls in odd slot.
- 2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.5.1.1\_1.4-1 as appropriate.
- 3. Measure probability of NACK miss-detection and DTX to NACK probability according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. Pass the UE if the measured probability of PSFCH miss-detection is less than the reference value in Table 11.1.5.1.1\_1.4-1 and the measured DTX to NACK probability is not exceed the reference value in clause 11.1.5.1.1.0.2. Otherwise fail the UE.
- 4. Repeat steps from 1 to 3 for each subtest in Table 11.1.5.1.1\_1.4-1 as appropriate.

# 11.1.5.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3 with the following exceptions.

Derivation Path: TS 38.508-1 [6] Table 5.4.3-1			
Information Element	Value/remark	Comment	Condition
SL-ResourcePool-r16 ::= SEQUENCE {			
sI-PSFCH-Config-r16 CHOICE {			
setup SEQUENCE {			
sI-PSFCH-Period-r16	sl1		
}			
}			
}			

#### 11.1.5.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.5.1.0-1 and SNR specified in Table 11.1.5.1.1\_1.4-1, the NACK missed detection probability obtained in step 3 shall be below the reference value specified in Table 11.1.5.1.1\_1.4-1.

For the parameters specified in Table 11.1.5.1.1.0.1-1, the DTX to NACK probability shall not exceed 1%.

Test	Bandwidth (MHz) /	Bronggation	Reference value		
num.	Subcarrier spacing (kHz)	Propagation condition	NACK missed detection probability (%)	SNR (dB)	
1	20 / 30	TDLA30-180	1	10.3	

# 11.1.6 Power imbalance performance with two links

11.1.6.1 2Rx requirements

# 11.1.6.1.1 2Rx FR1 Power imbalance performance

#### 11.1.6.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.6.1.1.0-2 with the test parameters specified in Table 11.1.6.1.1.0-1. In this test scenario, The Sidelink UE 1 and 2 are synchronized to GNSS or GNSS-equivalent synchronization reference.

	Parameter	Unit	Test 1
Active cell(s)	Active cell(s)		None
Active Sidelink UE(s)			Sidelink UE 1, Sidelink UE 2
	Sidelink Transmissions		PSCCH + PSSCH
	PSSCH DMRS pattern(Note 1)		{2,3}
	Sub-channel allocation		Sub-channel 0
Sidelink UE 1	Time offset (Note 2)	μS	0
	Frequency offset (Note 3)	Hz	0
	Antenna configuration		1x2 Low
	PSFCH periodicity	Slots	4
	MinTimeGapPSFCH	Slots	3
	Sidelink Transmissions		PSCCH + PSSCH
	PSSCH DMRS pattern(Note 1)		{2,3}
	Sub-channel allocation		Sub-channel 3
Sidelink UE 2	Time offset (Note 2)	μs	0
SIDEIIIIK UE Z	Frequency offset (Note 3)	Hz	0
	Antenna configuration		1x2 Low
	PSFCH periodicity	Slots	4
	MinTimeGapPSFCH	Slots	3
Note 1: {x, y}: x	and y means the number of DMI	RS symbols	for slot with PSFCH transmission and without
	transmission, respectively.		
	set of transmitted Sidelink UE signa		
Note 3: Frequen	cy offset of transmitted Sidelink UE	signal with	respect to GNSS reference frequency.

#### Table 11.1.6.1.1.0-1: Test parameters

Table 11.1.6.1.1.0-2:	Minimum	performance
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	Bandwidth		PSSCH	Modulation		Reference value	
Test number	(MHz)/ Subcarrier spacing(kHz)	Sidelink UE	Reference channel	format and code rate	Propagation condition	PSSCH BLER (%)	SNR (dB) of PSSCH
1	1 20/30	1	R.PSSCH.2-1.4	QPSK, 0.30	AWGN	(Note 1)	30.35
1		2	R.PSSCH.2-1.4	QPSK, 0.30	AWGN	10	4.8
Note 1:	Note 1: There is no BLER requirement for Sidelink UE 1.						

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.6.1.1.

11.1.6.1.1\_1 2Rx FR1 Power imbalance performance - two active PSSCH link

# 11.1.6.1.1\_1.1 Test purpose

The purpose is to verify the demodulation performance when receiving PSSCH transmissions from two Sidelink UEs with power imbalance in one slot.

#### 11.1.6.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

11.1.6.1.1\_1.3 Test description

# 11.1.6.1.1\_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 subcarrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.6.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.6.1.1.0 as defined in TS 38.508-1 [6] clause 4.3.1.8.

- 1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).
- 2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.6.1.1\_1.3.3.
- 3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.6.1.1.0-1 and Annex A.6 as appropriate.
- 4. Propagation conditions are set according to Annex B.0.
- 5. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the receiving UE. Message contents are defined in clause 11.1.6.1.1\_1.3.3.
- 6. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

# 11.1.6.1.1\_1.3.2 Test procedure

- 1. Sidelink UE1 and Sidelink UE2 transmit PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.6.1.1.0-1. Both sidelink UE1 and sidelink UE2 transmit MAC padding bits on their sidelink RMC respectively.
- 2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.6.1.1\_1.4-1 as appropriate.
- 3. Measure the average PSSCH BLER of sidelink UE2 according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. If the measured average PSSCH BLER of sidelink UE2 is less than the reference value in Table 11.1.6.1.1\_1.4-1 pass the UE. Otherwise fail the UE.
- 4. Repeat steps from 1 to 3 for each subtest in Table 11.1.6.1..1\_14-1 as appropriate.

#### 11.1.6.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4 with the following exceptions.

#### Table 11.1.6.1.1\_1.3.3-1: Physical layer parameters for SCI format 1-A

Derivation Path: TS 38.508-1 [6] Table 4.3.6.2.1.1-1							
Parameter	Value	Value in binary	Condition				
DMRS pattern	indicates the 1st entry in sl- PSSCH-DMRS-TimePatternList- r16 if mod (i, 4), else indicates the 2nd entry in sl-PSSCH-DMRS- TimePatternList-r16. where i is the logical slot index belong to resource pool per 1024 radio frame as specified in 38.214 [12] clause 8	"0"B if mod (i, 4) = 0 "1"B if mod (i, 4) ≠ 0					

Derivation Path: TS 38.508-1 [6] Table 5.4.3-1			
Information Element	Value/remark	Comment	Condition
SL-ResourcePool-r16 ::= SEQUENCE {			
sI-PSSCH-Config-r16 CHOICE {			
setup SEQUENCE {			
sI-PSSCH-DMRS-TimePatternList-r16	2 entries		
SEQUENCE (SIZE (13)) OF INTEGER (24) {			
INTEGER[1]	2	entry 1	
INTEGER[2]	3	entry 2	
}			
}			

# Table 11.1.6.1.1\_1.3.3-2: SL-ResourcePool

# 11.1.6.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.6.1.1.0-1 and SNR specified in Table 11.1.6.1.1.4-1, the average PSSCH BLER of sidelink UE2 obtained in step 3 shall be below the reference value specified in Table 11.1.6.1.1\_1.4-1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

Table 11.1.6.1.1	_1.4-1: Test	performance
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	Bandwidth		PSSCH	Modulation		Reference	ce value
Test number	(MHz)/ Subcarrier spacing(kHz)	Sidelink UE	Reference channel	format and code rate	Propagation condition	PSSCH BLER (%)	SNR (dB) of PSSCH
1	20 / 30	1	R.PSSCH.2-1.4	QPSK, 0.30	AWGN	(Note 1)	30.35
1	20730	2	R.PSSCH.2-1.4	QPSK, 0.30	AWGN	10	5.4
Note 1: There is no BLER requirement for Sidelink UE 1.							

# 11.1.7 HARQ buffer soft combining

# 11.1.7.1 2Rx requirements

# 11.1.7.1.1 2Rx FR1 HARQ buffer soft combining performance

# 11.1.7.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.7.1.1.0-2 with the test parameters specified in Table 11.1.7.1.1.0-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and all sidelink UE i ( $0 \le i \le n$ ) transmit PSCCH and PSSCH.

	Parameter	Unit	Test 1
Active cell(s)			None
Active Sidelink	UE(s)		Sidelink UE i, $0 \le i < n$ (Note 1,2)
	Sidelink Transmissions		PSCCH + PSSCH
	PSSCH DMRS pattern		{2}
	Time gap between initial	Slots	[ <i>n</i> (Note 3)]
	transmission and retransmission	01013	[// (Note 5)]
Sidelink UE i,	Timing offset (Note 4)	μS	0
0 ≤ i < <i>n</i>	Frequency offset (Note 5)	Hz	0
	Synchronization source		GNSS or GNSS-equivalent
	Antenna configuration		1x2 Low
	Redundancy version coding		{0,2}
	sequence		ر0,2}

# Table 11.1.7.1.1.0-1: Test parameters

PSFCH r	esource period	Slots	1		
Note 1:	Note 1: <i>n</i> is the number of HARQ process UE can support (based on IE harq-RxProcessSidelink)				
Note 2:	When $n = 16$ or 24, sidelink UEs transmit	one by one	e circularly for every slot;		
	When n=32, the first 31 UEs transmit sign	hal one by o	one circularly for every slot and in the first		
	subchannel, and the 32nd UE transmits s	ignal in the	first slot but in the second subchannel;		
	When n=48, the first 31 UEs transmit sign	hal one by o	one circularly for every slot and in the first		
	subchannel, the next 17 UEs transmit sig	nal in the s	ame slot as the first 17 UEs but in the second		
	subchannel;				
	When n=64, first 31 UEs transmit signal of	one by one	circularly for every slot and in the first subchannel,		
			/ for every slot and in the second subchannel, the last		
	2 UEs transmit signal in the same slot as	the first 2 l	JEs in the third subchannel		
Note 3:	k = n if $n < 32$ , otherwise $k = 31$				
Note 4:					
Note 5:	Frequency offset of transmitted Sidelink L	JE signal w	vith respect to GNSS reference frequency.		

Table 11.1.7.1.1.0: Minimum performance

ſ	Test	Bandwidth (MHz) /	PSSCH Reference	Brongation	Referen	ce value
	num.	Subcarrier spacing(kHz)	channel	Propagation condition	PSSCH BLER (%)	SNR (dB) of PSSCH
	1	20 / 30	R.PSSCH.2-1.5	AWGN	5	10.9

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.7.1.1

11.1.7.1.1\_1 2Rx FR1 HARQ buffer soft combining performance - maximum number of HARQ processes11.1.7.1.1\_1.1 Test purpose

The purpose is to verify the maximum number of HARQ processes per TTI supported by the V2X UE.

# 11.1.7.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

# 11.1.7.1.1\_1.3 Test description

# 11.1.7.1.1\_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 subcarrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.7.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.7.1.1.0-2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

- 1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).
- 2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.7.1.1\_1.3.3.

- 3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.7.1.1.0-1 and Annex A.6 as appropriate.
- 4. Propagation conditions are set according to Annex B.0.
- 5. Determine the number of sidelink UEs, i.e. N, as:
  - N = 16 if pc\_harq\_RxProcessSidelink\_n16 = true
  - N = 24 if pc\_harq\_RxProcessSidelink\_n24 = true
  - N = 32 if pc\_harq\_RxProcessSidelink\_n32 = true
  - N = 48 if pc\_harq\_RxProcessSidelink\_n48 = true
  - N = 64 if pc\_harq\_RxProcessSidelink\_n64 = true
- 6. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the received UE. Message contents are defined in clause 11.1.7.1.1\_1.3.3.
- 7. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

11.1.7.1.1\_1.3.2 Test procedure

- 1. Sidelink UE i,  $0 \le i < N$ , transmits PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.7.1.1.0-1. The sidelink UE i,  $0 \le i < N$  transmits MAC padding bits on the sidelink RMC.
- 2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.7.1.1\_1.4-1 as appropriate.
- 3. Measure the average PSSCH BLER according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. If the measured average PSSCH BLER is less than the reference value in Table 11.1.7.1.1\_1.4-1 pass the UE. Otherwise fail the UE.
- 4. Repeat steps from 1 to 3 for each subtest in Table 11.1.7.1.1\_1.4-1 as appropriate.

#### 11.1.7.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4 with the following exceptions.

# Table 11.1.7.1.1\_1.3.3-1: Physical layer parameters for SCI format 1-A

Derivation Path: TS 38.508-1 [6] Table 4.3.6.2.1.1-1				
Parameter Value Value in binary Condition				
DMRS pattern	Not present	-		

Derivation Path: TS 38.508-1 [6] Table 5.4.3-1			
Information Element	Value/remark	Comment	Condition
SL-ResourcePool-r16 ::= SEQUENCE {			
sI-PSSCH-Config-r16 CHOICE {			
setup SEQUENCE {			
sI-PSSCH-DMRS-TimePatternList-r16	1 entry		
SEQUENCE (SIZE (13)) OF INTEGER (24) {			
INTEGER[1]	2	entry 1	
}			
}			
}			
}			

#### Table 11.1.7.1.1\_1.3.3-2: SL-ResourcePool

#### 11.1.7.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.7.1.0-1 and SNR specified in Table 11.1.7.1.1\_1.4-1, the average PSSCH BLER obtained in step 3 shall be below the reference value specified in Table 11.1.7.1.1\_1.4-1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

Table 11.1.7.1.1_	1.4-1: Test	performance
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Test	Bandwidth (MHz) /	PSSCH Reference	Propagation	Referen	ce value
num	Subcarrier spacing(kHz)	channel	Propagation condition	PSSCH BLER (%)	SNR (dB) of PSSCH
1	20 / 30	R.PSSCH.2-1.5	AWGN	5	11.5

# 11.1.8 PSCCH decoding capability test

11.1.8.1 2Rx requirements

# 11.1.8.1.1 2Rx FR1 PSCCH decoding capability

#### 11.1.8.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.8.1.1.0-2 with the test parameters specified in Table 11.1.8.1.1.0-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and sidelink UE 1 transmits PSCCH and PSSCH and the test procedure is specified as follows:

- 10 UEs transmit PSCCHs and corresponding PSSCHs to the tested UE per slot with each UE occupying one subchannel.
- x UEs transmit PSCCHs and corresponding PSSCHs with high priority level on x subchannels that are randomly selected from 10 subchannels per slot and 10-x UEs transmit PSCCHs and corresponding PSSCHs with low priority level on the remaining subchannels. The indication of priority level specified in Clause 5.4.3.3 of TS 23.287 [23] and Clause 5.22.1.3.1 of TS 38.321 [24] is included in PSCCH.

Where x equals to:

- The number of PSFCH(s) resources that the tested UE can transmit in a slot (i.e. IE *psfch-TxNumber* specified in clause 4.2.16.1.6 of TS 38.306 [14]) if the number of PSFCH(s) resources that the tested UE can transmit in a slot is less than 10
- 10, otherwise.

The probability of PSCCH miss detection is calculated as follows:

 $Prob(PSCCH miss detection) = \frac{\#(missing ACK/NACK)}{\#(Tx high priority PSCCH/PSSCH)}$ 

Where:

- #(Tx high priority PSCCH/PSSCH) denotes the total number of transmitted PSCCH/PSSCH with high priority level.
- #(missing ACK/NACK) denotes the total number of missing ACK/NACK with high priority.

Table	11.1.8	3.1.1.0-1:	Test parameters	5
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Parameter			Value
Member ID (Note	1)		0
Sidelink UE i, 0 ≤ i ≤ 9 (Note 5)	Sidelink Transmissions		PSCCH + PSSCH
	Timing offset (Note 2)	μS	0
0 2 1 2 9 (NOLE 5)	Frequency offset (Note 3)	Hz	0

	Synchronization source			GNSS		
		Propagation Channel			Static propagation condition without external noise	
		Antenna configuration			1x2 Low	
		PSSCH RMC			R.PSSCH.2-1.1	
		PSCCH RMC (Note 4)			R.PSCCH.2-1.1	
		Source ID			0	
		PSFCH periodicity		Slots	1	
		MinTimeGapPSFCH		Slots	2	
	RB index			10*i		
		PSFCH Resource (Note 6)	CS pair index		0	
Note 1: Note 2:	Time of	Member ID is an identifier uniquely identifying a member. Time offset of transmitted Sidelink UE signal with respect to GNSS reference timing.				
Note 3:	Freque	ncy offset of transmitted Sidelin	k UE signal with re	espect to	OGNSS reference frequency.	
Note 4:		C index for PSCCH DMRS is randomly selected betwee			1, 2} for each PSCCH	
		nission as per in Clause 8.4.1.3.2 of TS 38.211 [9].				
Note 5:		n UE occupies one sub-channel so that all sub-channels are filled.				
Note 6:		TS 38.213 [11].				

Table 11.1.8.1.1.0-2: Minimum performance

Test Number	Bandwidth (MHz) / Subcarrier spacing(kHz)	PSCCH Reference channel	Propagation Channel	Reference value Probability of missed PSCCH (%)
1	40 / 30	R.PSCCH.2-1.1	Static propagation condition without external noise	1

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.8.1.1.

# 11.1.8.1.1\_1 2Rx FR1 PSCCH decoding capability - maximum number of received PSCCHs

#### 11.1.8.1.1\_1.1 Test purpose

The purpose is to verify the maximum number of received PSCCHs per TTI supported by the V2X UE.

#### 11.1.8.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

11.1.8.1.1\_1.3 Test description

# 11.1.8.1.1\_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 subcarrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.8.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.8.1.1.0-2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

- 1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).
- 2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.8.1.1\_1.3.3.
- 3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.8.1.1.0-1 and Annex A.6 as appropriate.
- 4. Propagation conditions are set according to Annex B.0.
- 5. Determine the number of sidelink UE transmitting PSSCH with high priority, i.e. x, as follows:
  - x = 4 if pc\_psfch\_TxNumber\_n4 = true;
  - x = 8 if pc\_psfch\_TxNumber\_n8 = true;
  - x = 10 if pc\_psfch\_TxNumber\_n16 = true.
- 6. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the received UE. Message contents are defined in clause 11.1.8.1.1\_1.3.3.
- 7. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

## 11.1.8.1.1\_1.3.2 Test procedure

- Sidelink UE 0~9 transmit PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.8.1.0-1. The SS randomly chooses x sidelink UEs among sidelink UE 0~9 to transmit PSSCHs with high priority and let the remaining 10-x sidelink UEs transmit PSSCH with low priority level. The sidelink UE 0~9 transmit MAC padding bits on the sidelink RMC.
- 2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.8.1.1\_1.4-1 as appropriate.
- 3. Measure the probability of missed PSCCH according to clause 11.1.8.1.1.0 for a duration sufficient to achieve statistical significance as given in Annex G.5. If the measured probability of PSCCH miss-detection is less than the reference value in Table 11.1.8.1.1\_1.4-1 pass the UE. Otherwise fail the UE.
- 4. Repeat steps from 1 to 3 for each subtest in Table 11.1.8.1.1\_1.4-1 as appropriate.

#### 11.1.8.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3 with the following exceptions.

#### Table 11.1.8.1.1\_1.3.3-1: SL-ResourcePool

Derivation Path: TS 38.508-1 [6] Table 5.4.3-1			
Information Element	Value/remark	Comment	Condition
SL-ResourcePool-r16 ::= SEQUENCE {			
sI-PSFCH-Config-r16 CHOICE {			
setup SEQUENCE {			
sl-PSFCH-Period-r16	sl1		
sl-MinTimeGapPSFCH-r16	sl2		
}			
}			
}			

# 11.1.8.1\_1.1.4 Test Requirements

For the parameters specified in Table 11.1.8.1.1.0-1 and SNR specified in Table 11.1.8.1.1\_1.4-1, the average PSSCH BLER obtained in step 3 shall be below the reference value specified in Table 11.1.8.1.1\_1.4-1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

#### Table 11.1.8.1.1\_1.4-1: Test performance requirements

Tes Num	Bandwidth (MHz) / Subcarrier spacing(kHz)	PSCCH Reference channel	Propagation Channel	Reference value Probability of missed PSCCH (%)
1	40 / 30	R.PSCCH.2-1.1	Static propagation condition without external noise	1

# 11.1.9 PSFCH decoding capability Test

- 11.1.9.1 2Rx requirements
- 11.1.9.1.1 2Rx FR1 PSFCH decoding capability
- 11.1.9.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.9.1.1.0-2 with the test parameters specified in Table 11.1.9.1.1.0-1. In each slot, a group of UEs transmits PSFCHs to the tested UE.

F	Parameter		Test 1	
HARQ-ACK informat	ion		ACK or NACK	
Source ID of tested l	JE		0	
	Sidelink transmissions for		PSFCH	
	Timing offset (Note 1)	μS	0	
	Frequency offset (Note 2)	Hz	0	
	Synchronization source		GNSS or GNSS-equivalent	
	Propagation Channel		Static propagation condition	
Sidelink UE i,	Fropagation Charmer		No external noise sources are applied	
$0 \le i \le N-1$ (Note 3)	Antenna configuration	on 1x2 Low		
	Member ID(Note 4)		i	
			N UEs transmit PSFCHs one by one on each RB	
	PSFCH resource		with CS pair index 0. i.e. UE 0 transmits PSFCH	
	allocation(Note 5)		on RB 0, UE 1 transmits PSFCH on RB 1,, UE	
			(N-1) transmits PSFCH on RB N-1	
	PSFCH periodicity	Slots	1	
Note 1: Time offse	et of transmitted Sidelink UE sig	inal with respe	ect to GNSS reference timing.	
			respect to GNSS reference frequency.	
Note 3: N equals to the number of PSFCH(s) resources that UE can receive in a slot as specified in Clause				
	of TS 38.306[14] ( IE <i>psfch-Rx</i>			
	D is an identifier uniquely identi			
Note 5: All PSFCH	Hs in a slot are corresponding to	one PSSCH	that occupies all sub channels.	

#### Table 11.1.9.1.1.0-1: Test parameters

	Bandwidth (MHz) /		Reference value	
Test Number	Subcarrier spacing(kHz)	Propagation Channel	Probability of success detection slot with ACK only	Probability of success detection slot with NACK or DTX

	1	40 / 30	Static propagation condition without external noise	99	99	
ĺ	Note 1: The probability of success detection slot with ACK only is the probability that the corresponding PSSCH is					
	n	not retransmitted when Option A is selected.				
	Note 2: T	The probability of success detection slot with NACK or DTX is the probability that the corresponding				
	P	PSSCH is retransmitted when Option B or option C is selected.				

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.9.1.1.1.

# 11.1.9.1.1\_1 2Rx FR1 PSFCH decoding capability - maximum number of received PSFCHs

# 11.1.9.1\_1.1.1 Test purpose

The purpose is to verify the maximum number of PSFCHs received by UE per slot in group cast scenario by using ACK/NACK feedback mode.

# 11.1.9.1\_1.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

# 11.1.9.1\_1.1.3 Test description

# 11.1.9.1\_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 subcarrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.9.1.1.0-2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

- 1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).
- 2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.9.1\_1.1.3.3.
- 3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.9.1.1.0-1 and Annex A.6 as appropriate.
- 4. Propagation conditions are set according to Annex B.0.
- 5. Determine the number of sidelink UEs, i.e. N, as follows:
  - N = 5 if pc\_psfch\_RxNumber\_n5 = true;
  - N = 15 if pc\_psfch\_RxNumber\_n15 = true;
  - N = 25 if pc\_psfch\_RxNumber\_n25 = true;

- N = 32 if pc\_psfch\_RxNumber\_n32 = true;
- N = 35 if pc\_psfch\_RxNumber\_n35 = true;
- N = 45 if pc\_psfch\_RxNumber\_n45 = true;
- N = 50 if pc\_psfch\_RxNumber\_n50 = true;
- N = 64 if pc\_psfch\_RxNumber\_n64 = true;
- 6. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the transmitting UE and operates in ACK/NACK HARQ groupcast mode. Message contents are defined in clause 11.1.9.1\_1.1.3.3.
- 7. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

# 11.1.9.1\_1.1.3.2 Test procedure

- The UE under test transmits PSCCH/PSSCH in every PSCCH/PSSCH duration for NR sidelink communication according to *SL-PreconfigurationNR*. The Sidelink UEs receive the PSSCH sent by the UE under test and send PSFCH. Information transmitted in each PSFCH is randomly selected from Option A, Option B and Option C with probability of 50%, 25% and 25% respectively. Transmitted PSFCHs are related to one PSSCH which is transmitted by tested UE and occupies all the subchannels.
  - Option A: All the UEs in the group transmit ACKs
  - Option B: One UE transmits NACK and the rest of UEs transmit ACKs. The PSFCH resource index with NACK is random per slot
  - Option C: One UE transmits nothing (i.e. DTX) and the rest of UEs transmit ACKs. The PSFCH resource index of the DTX is random per slot.
- 2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.9.1\_1.1.4-1 as appropriate.
- 3. Measure probability of success detection slot with ACK only, and probability of success detection slot with NACK or DTX according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. Pass the UE if the measured probability of success detection slot with ACK only, and probability of success detection slot with NACK or DTX are no less than the reference value in Table 11.1.9.1.1\_1.4-1. Otherwise fail the UE.
- 4. Repeat steps from 1 to 3 for each subtest in Table 11.1.9.1.1\_1.4-1 as appropriate.

#### 11.1.9.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3 with the following exceptions.

#### Table 11.1.9.1.1\_1.3.3-1: *SL-ResourcePool*

Derivation Path: TS 38.508-1 [6] Table 5.4.3-1			
Information Element	Value/remark	Comment	Condition
SL-ResourcePool-r16 ::= SEQUENCE {			
sI-PSFCH-Config-r16 CHOICE {			
setup SEQUENCE {			
sl-PSFCH-Period-r16	sl1		
}			
}			
}			

# 11.1.9.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.9.1.0-1 and SNR specified in Table 11.1.9.1.1\_1.4-1, the probability of success detection slot with ACK only, and probability of success detection slot with NACK or DTX obtained in step 3 shall be no less the reference value specified in Table 11.1.9.1.1\_1.4-1.

# Table 11.1.9.1.1\_1.4-1: Test performance requirements

	Bandwidth (MHz) /		Referei	nce value	
Test Number	Subcarrier spacing(kHz)	Propagation Channel	Probability of success detection slot with ACK only	Probability of success detection slot with NACK or DTX	
1	40 / 30	Static propagation condition without external noise	99	99	
	Note 1: The probability of success detection slot with ACK only is the probability that the corresponding PSSCH is not retransmitted when Option A is selected.				
		s detection slot with NACK or I when Option B or option C is se		the corresponding	