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Contents

Foreword

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1 Scope

The present document is the technical report on the "Relays for LTE" work item [2]. The overall objective of the WI is to specify Relays for LTE in Rel-10 timeframe.

This document is intended to gather the relevant background information in order to address Relay Node (RN) requirements as well as propose suitable updates to the specifications under the responsibility of RAN4. RAN4 have agreed to focus on fixed RN.

2 References

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

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

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] RP-091434, "Relays for LTE", Vodafone

[3] TR 36.814, "Further Advancements for E-UTRA Physical Layer Aspects (Release 9)", V9.0.0.

[4] TR 25.942, "Radio Frequency (RF) System Scenarios (Release 9)", V9.0.0

[5] TR 36.942, "Radio Frequency (RF) System Scenarios (Release 9)", V9.2.0

[6] TR 36.101, "User Equipment (UE) radio transmission and reception (Release 9)", V9.2.0

[7] TS 36.104, "Base Station (BS) radio transmission and reception; (Release 9)", V 9.2.0

[8] TR 36.804, "Base Station (BS) radio transmission and reception; (Release 8)", V.1.2.0

[9] TR 36.826, "Relay radio transmission and reception; (Release 10)", V.0.12.0

[10] TS 36.521-1, "User Equipment (UE) conformance specification Radio transmission and reception Part 1: Conformance Testing; (Release 10)", V10.0.0

[11] TS 36.508, "Common test environments for User Equipment (UE) conformance testing (Release 10)", V10.0.0

[12] TR.36.141, "Base Station (BS) conformance testing".

3 Definitions, symbols and abbreviations

3.1 Definitions

Void

3.2 Symbols

Void

3.3 Abbreviations

Void

4 General assumptions

4.1 Relay classification

The Relay classes are defined based on the RF scenarios expected for the Relay access deployment, defined in terms of the Minimum Coupling Loss (MCL) between Relay and UE. The following definitions are used:

- High-CL Relay are characterised by requirements derived from outdoor Relay scenarios with a Relay to UE minimum coupling loss equals to 59 dB.
- Low-CL Relay are characterised by requirements derived from indoor Relay scenarios with a Relay to UE minimum coupling loss equals to 45 dB.

4.2 Power classes

Two power classes are defined as the maximum output power for relay access link as in Table 4.2-1.

Table 4.2-1 Relay access link power class

Power class	Pmax [dBm]
Power class 1	24
Power class 2	30

Single power class is defined for the maximum output power for relay backhaul link as in Table 4.2-2

Table 4.2-2 Relay backhaul link power class

Power class	Pmax [dBm]
Power class 1	24

It should be noted that the specified power class is the maximum output power and does not specify the power that a relay must transmit at.

4.3 Operating Bands

For in-band Relay backhaul and access link shouldoperate in the same operating band.

4.4 Channel bandwidth

Requirements in present document are specified for the channel bandwidths listed in Table 4.4-1.

Table 4.4-1 Transmission bandwidth configuration NRB in E-UTRA channel bandwidths

Channel bandwidth $BW_{Channel}$ [MHz]	1.4	3	5	10	15	20
Transmission bandwidth configuration N_{RB}	6	15	25	50	75	100

For access link, relay should declare the supported bandwidth(s) as a BS does, and for backhaul link, relay should support all the bandwidths listed in TS 36.101 Table 5.6.1-1. Note that NOTE 1 in TS 36.101 Table 5.6.1-1 does not apply for relay.

5 Methodology

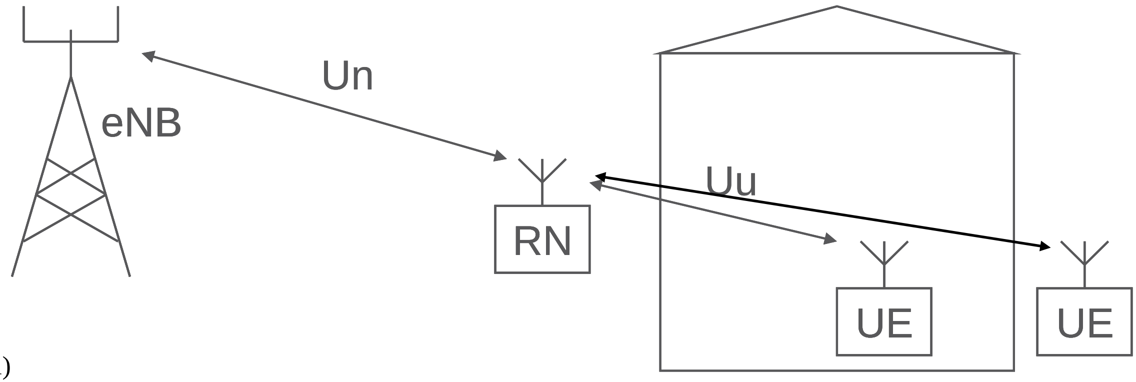
<Text will be added>

6 System scenarios

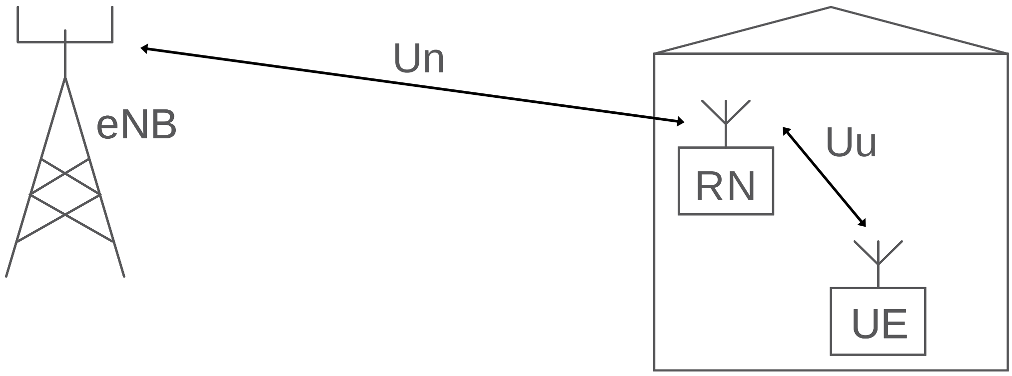
The main use scenario for relays studied in this TR is illustrated in Figure 6-1. The network consists of both eNodeBs and relay nodes (RN). The network is deployed in a urban environment and the main purposes for the relays are to provide

a) coverage extension

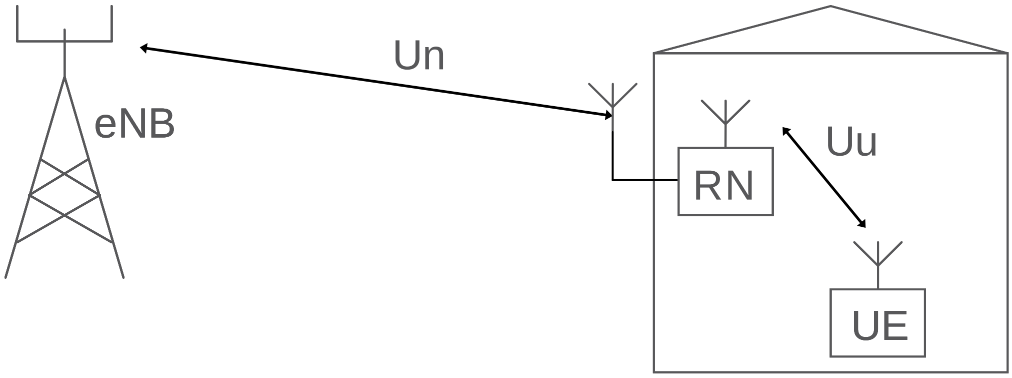
b) indoor coverage and increased data rates in areas with poor performance.



a)



b)



c)

Figure 6-1 Example of a relay deployment scenario: a) outdoor relay; b) indoor relay c) truwall relay

The Macro network is a typical network using three-sector site planning over a single carrier. Support for carrier aggregation with relay nodes is FFS.

The relay nodes are owned and operated by an operator. The relays are located either indoors or outdoors and there are a few relays per eNodeB. The deployment of the relays is planned to provide coverage and/or enhance throughput in specific areas.. MIMO can be used both in the access and the backhaul link.

As the primary function of relay node is for the coverage-improvement, both outdoor and indoor scenarios should be considered. The outdoor relay could be used for cell-edge coverage through throughput enhancement for cell edge users and/or coverage extension, and the indoor relay is used for solving indoor dead spot and hot spot scenarios. The probability that a UE is located indoors is 80%. In each Macro cell there are several relay nodes controlled by the same operator Table 6.1 summarize some basic characteristics for further study.

Table 6-1 Possible Parameter Definitions for Relay node Deployments

Parameter	Relay node (General)
Relay antenna height	Outdoor relay: 5m Indoor relay: [2.5m]
Minimum distance between relay node and eNBs	>=35m
Minimum distance between UE and relay node	Outdoor relay> 10m
	Indoor relay >= 3m
Relays per macro cell	1 to 5
Penetration loss (relay to UE)	Relay with outdoor coverage antenna to UE: 20 dB
	Relay with indoor coverage antenna to UE: 0 dB
Parameter	**Access link**
Antenna Configuration (Relay-UE link)	Omni-directional, 2 tx , 2 rx antenna ports, or 4 tx , 4 rx antenna ports
Parameter	**Backhaul link**
Antenna Configuration (Macro-Relay link)	Directional 2 tx , 2 rx antenna ports, or 4 tx , 4 rx antenna ports
Antenna Configuration (Macro-Relay link)	Directional 2 tx , 2 rx antenna ports, or 4 tx , 4 rx antenna ports

6.1 Coexistence simulation cases

In this subclause the simulation cases for coexistence studies are outlined.

Systems using relays is different from previously performed coexistence studies in the sense that there are different kinds of nodes that cause interference and that are impacted. In Table 6.1-1 the aggressor links and victim links are listed.

Both the aggressor and the victim networks contain eNB, RN and UE nodes.

Table 6.1-1 Coexistence simulation cases

Case	Aggressors	Victim Link	Relay Deployment	RN antenna configuration	Propagaion Model	RN Max Power	Power control
A1	eNB and RN access side	eNB -> UE	6.2.1 Case 1 D_R=1.5R	6.4b Outdoor relay G_{BH} = 15 dBi	Case 1 with site planning NLOS	$P_{AC,max}$=30 dBm $P_{BH.max}$=30 dBm	N/A
A2-1	UE and RN backhaul side	UE -> eNB					PC1 (6.6.1)
A2-2	UE and RN backhaul side	UE -> eNB					PC2 (6.6.1)
A3	eNB	eNB -> RN eNB -> UE					N/A
A4-1	UE	UE-> RN UE->eNB					PC1 (6.6.1)
A4-2	UE	UE-> RN UE->eNB					PC2 (6.6.1)

Case	Aggressors	Victim Link	Relay Deployment	RN antenna configuration	Propagaion Model	RN Max Power	Power control
B1	eNB and RN access side	eNB -> UE	6.2.4 Case 1 D_R=1.5R	6.4b Truwall relay G_{BH} = 15 dBi	Case 1 with site planning NLOS	$P_{AC,max}$=24 dBm $P_{BH.max}$=[24,30] dBm <Additional uplink simulation cases are FFS for covering both 24 and 30 dBm >	N/A
B2-1	UE and RN backhaul side	UE -> eNB					PC1 (6.6.3)
B2-2	UE and RN backhaul side	UE -> eNB					PC2 (6.6.3)
B3	eNB	eNB -> RN eNB -> UE					N/A
B4-1	UE	UE-> RN UE->eNB					PC1 (6.6.3)
B4-2	UE	UE-> RN UE->eNB					PC2 (6.6.3)

Case	Aggressors	Victim Link	Relay Deployment	RN antenna configuration	Propagaion Model	RN Max Power	Power control
C1	eNB and RN access side	eNB -> UE	6.2.1 Case 3 D_R=1.5R	6.4b Outdoor relay G_{BH} = 15 dBi	Case 3 with site planning NLOS	$P_{AC,max}$=30 dBm $P_{BH.max}$=30 dBm	N/A
C2-1	UE and RN backhaul side	UE -> eNB					PC1 (6.6.1)
C2-2	UE and RN backhaul side	UE -> eNB					PC2 (6.6.1)
C3	eNB	eNB -> RN eNB -> UE					N/A
C4-1	UE	UE-> RN UE->eNB					PC1 (6.6.1)
C4-2	UE	UE-> RN UE->eNB					PC2 (6.6.1)

Case	Aggressors	Victim Link	Relay Deployment	RN antenna configuration	Propagaion Model	RN Max Power	Power control
D1	eNB and RN access side	eNB -> UE	6.2.4 Case 3 D_R=1.5R	6.4b Truwall relay G_{BH} = 15 dBi	Case 3 with site planning NLOS	$P_{AC,max}$=24 dBm $P_{BH.max}$=[24,30] dBm < Additional uplink simulation cases are FFS for covering both 24 and 30 dBm >	N/A
D2-1	UE and RN backhaul side	UE -> eNB					PC1 (6.6.3)
D2-2	UE and RN backhaul side	UE -> eNB					PC2 (6.6.3)
D3	eNB	eNB -> RN eNB -> UE					N/A
D4-1	UE	UE-> RN UE->eNB					PC1 (6.6.3)
D4-2	UE	UE-> RN UE->eNB					PC2 (6.6.3)

Table 6.1-1 Coexistence simulation cases

Case	Aggressors	Victim Link	Relay Deployment	RN antenna configuration	Propagaion Model	RN Max Power	Power control
E1	eNB and RN access side	eNB -> UE	6.2.2 Case 1	6.4b Outdoor relay G_{BH} = 15 dBi	Case 1 with site planning NLOS	$P_{AC,max}$=30 dBm $P_{BH.max}$=30 dBm	N/A
E2-1	UE and RN backhaul side	UE -> eNB					PC1 (6.6.1)
E2-2	UE and RN backhaul side	UE -> eNB					PC2 (6.6.1)
E3	eNB	eNB -> RN eNB -> UE					N/A
E4-1	UE	UE-> RN UE->eNB					PC1 (6.6.1)
E4-2	UE	UE-> RN UE->eNB					PC2 (6.6.1)

Case	Aggressors	Victim Link	Relay Deployment	RN antenna configuration	Propagaion Model	RN Max Power	Power control
F1	eNB and RN access side	eNB -> UE	6.2.5 Case 1	6.4b Truwall relay G_{BH} = 15 dBi	Case 1 with site planning NLOS	$P_{AC,max}$=24 dBm $P_{BH.max}$=[24,30] dBm < Additional uplink simulation cases are FFS for covering both 24 and 30 dBm >	N/A
F2-1	UE and RN backhaul side	UE -> eNB					PC1 (6.6.3)
F2-2	UE and RN backhaul side	UE -> eNB					PC2 (6.6.3)
F3	eNB	eNB -> RN eNB -> UE					N/A
F4-1	UE	UE-> RN UE->eNB					PC1 (6.6.3)
F4-2	UE	UE-> RN UE->eNB					PC2 (6.6.3)

Case	Aggressors	Victim Link	Relay Deployment	RN antenna configuration	Propagaion Model	RN Max Power	Power control
G1	eNB and RN access side	eNB -> UE	6.2.2 Case 3	6.4b Outdoor relay G_{BH} = 15 dBi	Case 3 with site planning NLOS	$P_{AC,max}$=30 dBm $P_{BH.max}$=30 dBm	N/A
G2-1	UE and RN backhaul side	UE -> eNB					PC1 (6.6.1)
G2-2	UE and RN backhaul side	UE -> eNB					PC2 (6.6.1)
G3	eNB	eNB -> RN eNB -> UE					N/A
G4-1	UE	UE-> RN UE->eNB					PC1 (6.6.1)
G4-2	UE	UE-> RN UE->eNB					PC2 (6.6.1)

Case	Aggressors	Victim Link	Relay Deployment	RN antenna configuration	Propagaion Model	RN Max Power	Power control
H1	eNB and RN access side	eNB -> UE	6.2.5 Case 3	6.4b Truwall relay G_{BH} = 15 dBi	Case 3 with site planning NLOS	$P_{AC,max}$=24 dBm $P_{BH.max}$=[24,30] dBm < Additional uplink simulation cases are FFS for covering both 24 and 30 dBm >	N/A
H2-1	UE and RN backhaul side	UE -> eNB					PC1 (6.6.3)
H2-2	UE and RN backhaul side	UE -> eNB					PC2 (6.6.3)
H3	eNB	eNB -> RN eNB -> UE					N/A
H4-1	UE	UE-> RN UE->eNB					PC1 (6.6.3)
H4-2	UE	UE-> RN UE->eNB					PC2 (6.6.3)

<The Exact Set of simulations is FFS and needs further agreements>

<The main focus is on operator deployed scenarios, user deployed relays are FFS>

<The set of simulations for indoor relays is FFS>

<It may be possible to use the simulations for other setups In particular, it is FFS if the uplink outdoor relay simulations with $P_{BH,max}$ = 30 dBm may be used for a Truwall relay with the same backhaul link power>

6.2 System layout

This section describes the deployment used for eNodeB and RN. In all deployments there will be a fixed number [1, 4] of relay nodes per cell.

Table 6.2-1 Possible Parameter Definitions for Macro Network

Parameter	Macro Network
Environment	Macro cell, Urban (Case1) Rural area (Case3)
Macro Cellular layout	Hexagonal grid, 19 cell sites, 57 sectors with BTS in the corner of the cell
Macro Cell ISD	a) Case 1 with an ISD of 500 meters b) Case 3 with and ISD of 1.732 km

6.2.1 Uncoordinated macro cellular deployment, RN at cell edge

6.2.1.1 Network layout

Simulations are performed in the "Uncoordinated macro cellular deployment" described in section 4.4.2.1 of [5].

The RNs are located at [0.5, 1, 1.5] R (cell radius) from the eNodeB. The RN are evenly spread over a total angle of +/-30 degrees.

The exact distance to use is FFS and needs to be agreed in further meetings. Initially a number of parameters are used.

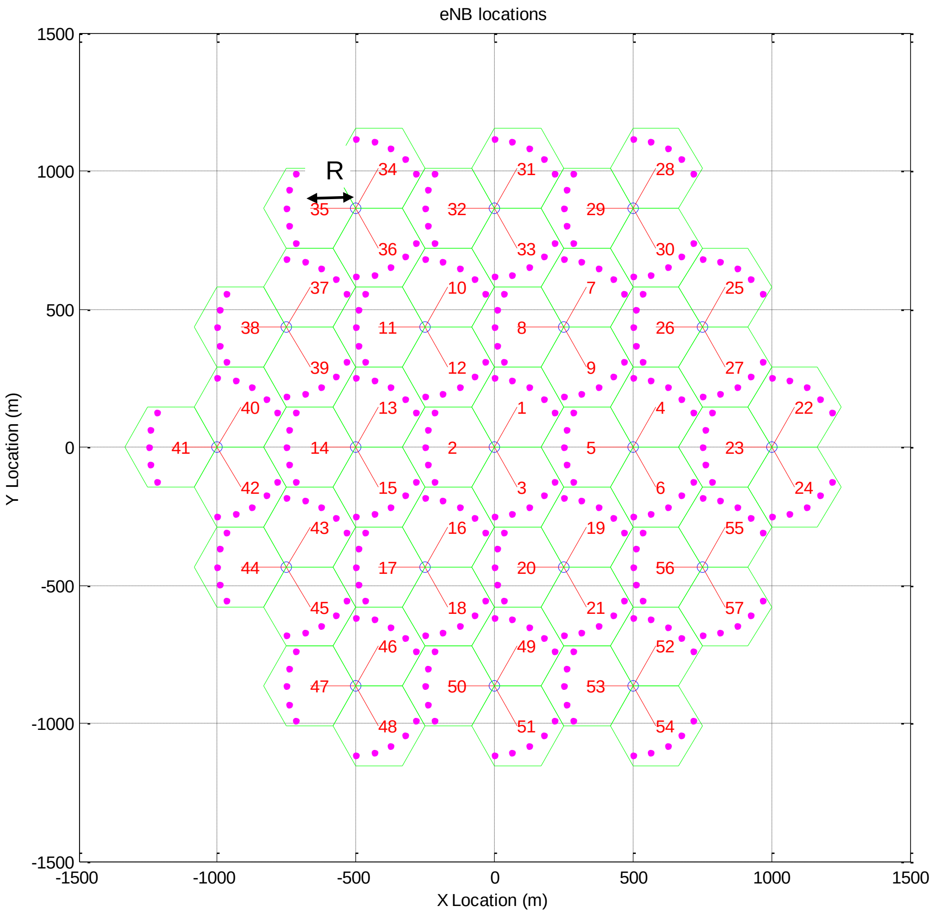


Figure 6.2.1.1-1 Example of RN deployment. 5 RN per eNB. NOTE: Victim eNB not shown currently

6.2.1.2 UE location

UEs are located uniformly over the service area with [30] UEs per BS sector, i.e. per unit area of ISD^2 * sqrt(3)/6 .

On average 30 UE are placed inside each macro cell.

UEs are located indoors with a probability of 80%.

Uniform UE distribution shall be the baseline.

Other UE distribution methods may also be used in order to accelerate the simulation, such as the method in TR 36.814 Table A.2.1.1.2-5.

6.2.2 Uncoordinated macro cellular deployment, RN at regular grid

This deployment scenario uses the same assumptions as the deployment scenario in 6.2.1 with the exception that the RN are placed on a regular square grid. 4 relay nodes are assumed to be symmetrically placed about the cell center with an inter-relay node distance of 0.9 times the cell radius. An illustration of the regular grid is shown in figure 6.2.2-1.

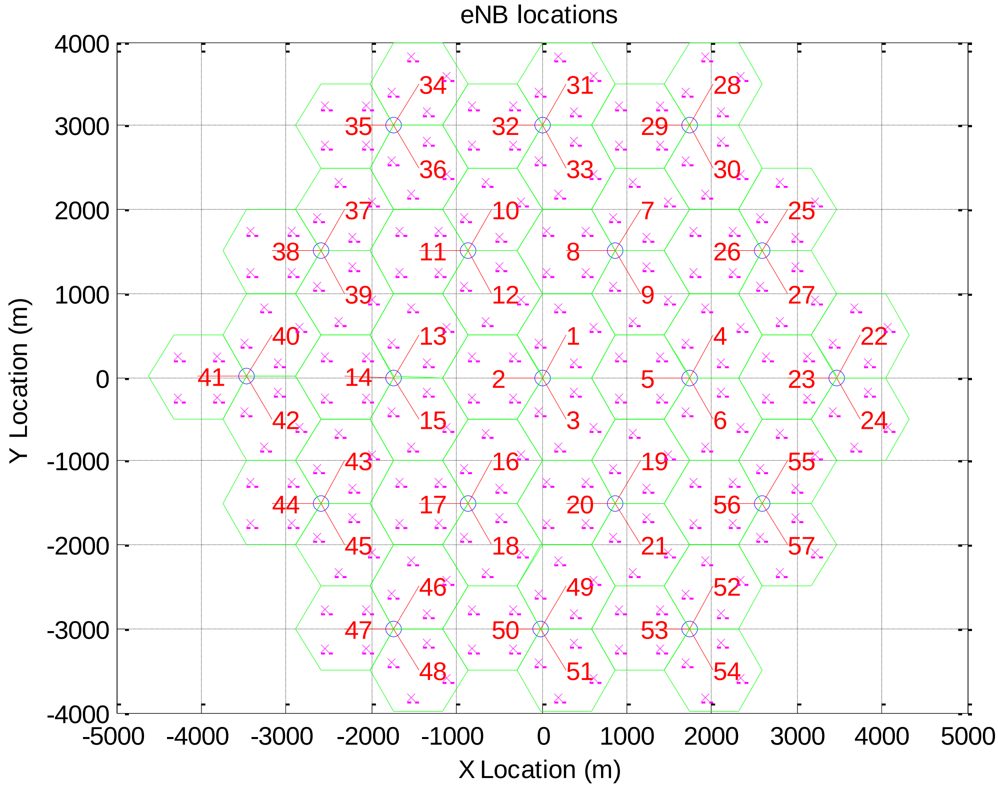


Figure 6.2.2-1 Example of regular RN grid deployment. 4 RN per eNB. NOTE: Victim eNB not shown currently

6.2.3 Manhattan grid deployment

Use of Manhattan grid is FFS.

6.2.4 Thruwall scenario

6.2.4.1 Network layout

Figure 6.2.4.1-1 shows the thruwall relay scenario. Assume there are 5 in-building coverage areas randomly located within the donor cell.

In-building coverage areas will be modelled as a 50 meter by 50 meter square area

In-building coverage areas will be served by one dedicated relay node that can be modelled as a thruwall relay positioned on the wall closest to the eNB along the boresite between the eNB and the center of the coverage area.The antennas are located on this position on either side of the wall. . No penetration loss is assumed for the Un backhaul link

The building wall closest to the eNB is perpendicular to a line between the BS and the center of the building. The building cannot be located on the border of the cell, i.e. the entire building has to be inside one cell.

Modelling of floor loss if FFS.

Indoor propagation will be modelled using a 5x5 grid of 10 m by 10 m apartments in a 50 m by 50 m cluster, and employing the pathloss models of Table A.2.1.1.2-3 in [3].

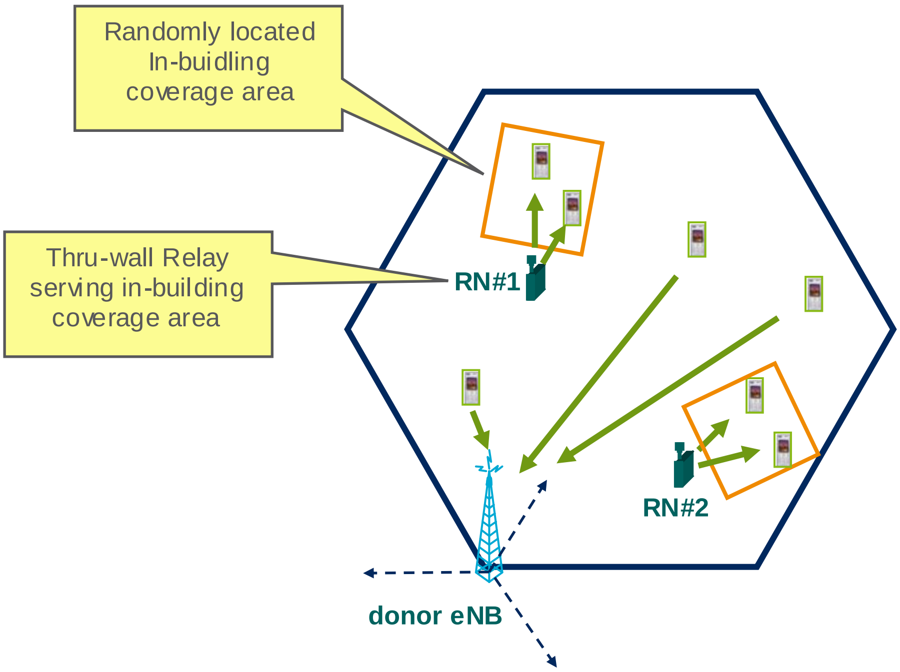


Figure 6.2.4.1-1 Illustration of indoor cluster modeling for relay co-existence studies

6.2.4.2 UE Locations

Each in-building coverage area will have a cluster of 4 indoor UEs randomly dropped within the in-building coverage area.

The building coverage consists of a 5x5 cluster of apartments, each of size 10mx10m. Only one UE can be located in each apartment. Figure 6.2.4.2-1 illustrates the 5x5 Grid model:

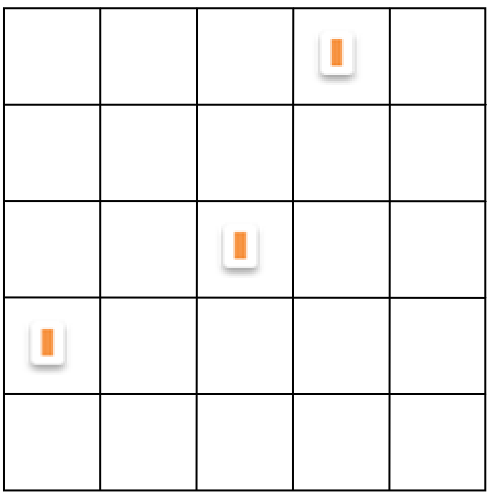


Figure 6.2.4.2-1: 5x5 Indoor Grid Model

In addition 10 outdoor UEs will be randomly dropped in the donor cell and will be served by either the eNB or one of the truwall relays.

6.2.5 Thruwall scenario with regular building layout

For the thru-wall scenario with regular building layout the following assumptions apply:

Buildings with a size of 50x50 m are located on a regular grid. The regular grid is the same as in subclause 6.2.2. Building orientation and antenna locations is the same as in subclause 6.2.4.

UE locations inside the building is the same as described in subclause 6.2.4.2.In addition 10 outdoor UEs will be randomly dropped in the donor cell.

6.3 Cell selection

UEs are connected to the BS if: $RSRP_{BS} > RSRP_{RN} + \Delta_{RSPR}$ and to the RN otherwise.

Δ_{RSPR} is a tuning parameter to balance the load between RN and BS by ensuring that UL and DL links are approximately equal. Δ_{RSPR} is set to [5] dB.

6.4 Antenna patterns and directions

Table 6.4-1 RN antenna configurations

	6.4a	6.4b [High Priority]	6.4c [Can be excluded]	6.4d
UE Antenna	According to 6.4.1	According to 6.4.1	According to 6.4.1	According to 6.4.1
eNB Antenna	According to 6.4.2	According to 6.4.2	According to 6.4.2	According to 6.4.2
RN Access Link Antenna Type	Omnirectional	Omnirectional	Directional	Directional
RN Access Link Antenna Gain	5 dBi	5 dBi	TBD	[TBD] dBi [65] deg
RN Access Link Antenna Height	Outdoor relay: 5 m Indoor relay: [2.5 m]	Outdoor relay: 5 m Indoor relay: [2.5 m] Truwall: [2.5 m]	TBD	20 m
RN Backhaul Link Antenna Type	Omnirectional	Directional	Omnirectional	Directional
RN Backhaul Link Antenna Gain	5 dBi	[7, 15] dBi [65] deg	5 dBi	[15,20] dBi [65] deg
RN Backhaul Link Antenna Height	Outdoor relay: 5 m Indoor relay: [2.5 m]	Outdoor relay: 5 m Indoor relay: [2.5 m] Truwall: [5 m]	5 m	20 m

Study area: How would the case with omnidirectional backhaul work. Do we need a separate ACLR/ACS spec/class?

6.4.1 UE antenna

The UE antenna is modelled as an omnidirectional antenna with 0 dBi gain. Antenna height is [1.5] m.

6.4.2 eNB antenna

The model for the eNB antenna is the same used in [5]. The eNB antenna has the following horizontal pattern:

$$A(\theta) = -\min\left[12\left(\frac{\theta}{\theta_{3dB}}\right)^2, \ A_m\right] \quad \text{where} \quad -180 \le \theta \le 180$$

θ_{3dB} is the 3dB beam width which corresponds to 65 degrees, and $A_m = 20dB$ is the maximum attenuation.

The antenna height is 30 m and the gain is 15dBi including feeder losses corresponding to the urban scenario for 2GHz in [5].

6.4.3 RN antennas

The RN antenna parameters are given in table 6.4-1.

The gain in table 6.4-1 for an omnidirectional antenna includes feeder losses.

For a directional antenna the beamwidth and gain is stated in table 6.4-1. The antenna pattern is given by:

$$A(\theta) = -\min\left[12\left(\frac{\theta}{\theta_{3dB}}\right)^2,\ A_m\right] \quad \text{where} \quad -180 \le \theta \le 180$$

θ_{3dB} is the 3dB beam width and and $A_m = 20dB$ is the maximum attenuation.

6.5 Propagation Models and MCL

In this section, the carrier frequency is assumed to be 2GHz carrier frequency, and R is in km.

6.5.1 Case 1: ISD of 500 meters

This subsection lists the propagation models and MCL values to be used for the links in a system with a Case 1 ISD of 500 meters

6.5.1.1 Macro-UE link

LOS scenario: $PL_{LOS}(R)$= 103.4+24.2log10(R)

NLOS scenario: $PL_{NLOS}(R)$= 131.1+42.8log10(R)

LOS Probability function: Prob(R)=min(0.018/R,1)*(1-exp(-R/0.063))+exp(-R/0.063)

MCL is: 70 dB [5]

Lognormal shadowing standard deviation: 10 dB

In case of an indoor UE, an additional wall penetration loss of [18] dB has to be considered.

6.5.1.2 Macro-Relay link

Without site planning

LOS scenario: PL_{LOS} (R)=100.7+23.5log10(R)

NLOS scenario: PL_{NLOS} (R)= 125.2+36.3log10(R)

LOS Probability function: Prob(R)=min(0.018/R,1)*(1-exp(-R/0.072))+exp(-R/0.072)

In case of an indoor Relay, an additional wall penetration loss of [18] dB has to be considered.

With site planning

As the RNs are controlled by the operators, they can do site planning such that the LOS probability between donor-eNB and RNs are maximized in order to increase the throughput/coverage for the backhaul link. Even if the link between the donor-eNB and RN is NLOS, the operators can still do site planning in order to improve the shadowing of the propagation channel. Below are the adjustments on LOS probability and lognormal shadowing when site planning is conducted by the operators [3]:

For LOS: PL_{LOS} (R)

For NLOS: PL_{NLOS} (R)-B, where B=5dB, for donor macro (from each of its sectors) to relay, otherwise, for non-donor cell and non optimized deployment B=0dB.

LOS Probability function: [1-(1- Prob(R))^N,] where N=3, for donor macro (from each of its sectors) to relay, otherwise, for non-donor cell and non optimized deployment N=1.

Free Space scenario: PL_{FS}(R)= 98.4+20log10(R).

<Note that the free space scenario is particularly interesting for receiver blocking, where there is a free space path between the relay and the interfered eNB and a NLOS path between the relay and the serving eNB.>

MCL is: (70 dB – G_{BH}) dB, where G_{BH} is the relay backhaul antenna gain.

Note that the MCL values given in this section are used for relay coexistence study only.

Lognormal shadowing standard deviation: 6 dB

6.5.1.3 Outdoor Relay access antenna-UE link

LOS scenario: PL_{LOS} (R)=103.8+20.9log10(R)

NLOS scenario: PL_{NLOS} (R)=145.4+37.5log10(R)

LOS Probability function: Prob(R)=0.5-min(0.5,5exp(-0.156/R))+min(0.5, 5exp(-R/0.03))

MCL is: (64 – G_{AC}) dB for outdoor deployments of the access antenna [4] , where G_{AC} is the relay access antenna gain.

Lognormal shadowing standard deviation: 10 dB

In case of an outdoor Relay and an indoor UE, an additional wall penetration loss of [18] dB has to be considered.

6.5.1.4 Indoor Relay access antenna – UE link

Indoor relay access antennas are assumed to be deployed in apartment clusters outlined in subclause 6.2.4.2.

Relay to UEs inside the same cluster: L= 127+30log10(R)

Relay to UEs in different clusters: L= 128.1+37.6log10(R)

Note that the number of floors in the path is assumed to be 0.

MCL is: (50 – G_{AC}) dB for indoor deployments of the access antenna [4], where G_{AC} is the relay access antenna gain.

Lognormal shadowing standard deviation: 10 dB for link between relay and relay UE, and 8dB for other links

The penetration loss of the wall separating apartments is 5dB.6.5.1.5 Correlation for shadowing

For the same type of link (i.e. Macro-Relay link, Relay-UE link, and Macro-UE link respectively), a shadowing correlation factor of 0.5 for the shadowing between sites (regardless aggressing or victim system) and of 1 between sectors of the same site shall be used. Furthermore, no correlation is assumed for shadowing between different types of link (i.e. Macro-Relay and Relay-UE, Macro-Relay and Macro-UE, Relay-UE and Macro-UE).

6.5.2 Case 3: ISD of 1.732 km

This subsection lists the propagation models and MCL values to be used for the links in a system with a Case 3 ISD of 1.732 km

6.5.2.1 Macro-UE link

LOS scenario: PL_{LOS} (R)= 103.4+24.2log10(R)

NLOS scenario: PL_{NLOS} (R)= 131.1+42.8log10(R)

LOS Probability function: Prob(R)=exp(-(R-0.01)/1.0)

MCL is: 80 dB [5]

Lognormal shadowing standard deviation: 10 dB

In case of an indoor UE, an additional wall penetration loss of [18] dB has to be considered.

6.5.2.2 Macro-Relay link

Without site planning

LOS scenario: PL_{LOS} (R)=100.7+23.5log10(R)

NLOS scenario: PL_{NLOS} (R)= 125.2+36.3log10(R)

LOS Probability function: Prob(R)=exp(-(R-0.01)/1.15)

In case of an indoor Relay, an additional wall penetration loss of [18] dB has to be considered.

With site planning

As the RNs are controlled by the operators, they can do site planning such that the LOS probability between donor-eNB and RNs are maximized in order to increase the throughput/coverage for the backhaul link. Even if the link between the donor-eNB and RN is NLOS, the operators can still do site planning in order to improve the shadowing of the propagation channel. Below are the adjustments on LOS probability and lognormal shadowing when site planning is conducted by the operators [3]:

For LOS: PL_{LOS} (R)

For NLOS: PL_{NLOS} (R)-B, where B=5dB, for donor macro (from each of its sectors) to relay, otherwise, for non-donor cell and non optimized deployment B=0dB.

LOS Probability function: [1-(1- Prob(R))^N,] where N=3, for donor macro (from each of its sectors) to relay, otherwise, for non-donor cell and non optimized deployment N=1.

Free Space scenario: PL_{FS}(R)= 98.4+20log10(R)

<Note that the free space scenario is particularly interesting for receiver blocking, where there is a free space path between the relay and the interfered eNB and a NLOS path between the relay and the serving eNB.>

MCL is: (80 – G_{BH}) dB , where G_{BH} is the relay backhaul antenna gain.

Note that the MCL values given in this section are used for relay coexistence study only.

Lognormal shadowing standard deviation: 6 dB

6.5.2.3 Outdoor Relay access antenna-UE link

LOS scenario: PL_{LOS} (R)=103.8+20.9log10(R)

NLOS scenario: PL_{NLOS} (R)=145.4+37.5log10(R)

LOS Probability function: Prob(R)=0.5-min(0.5,3exp(-0.3/R))+min(0.5, 3exp(-R/0.095))

MCL is: (64 – G_{AC}) dB [4] , where G_{AC} is the relay access antenna gain.

Lognormal shadowing standard deviation: 10 dB

In case of an outdoor Relay and an indoor UE, an additional wall penetration loss of [18] dB has to be considered.

In case of both indoor Relay and UE in NLOS, an additional wall penetration loss of [7] dB has to be considered.

6.5.2.4 Indoor Relay access antenna – UE link

The same propagation model as in subclause 6.5.1.4 applies.

6.5.2.5 Correlation for shadowing

For the same type of link (i.e. Macro-Relay link, Relay-UE link, and Macro-UE link respectively), a shadowing correlation factor of 0.5 for the shadowing between sites (regardless aggressing or victim system) and of 1 between sectors of the same site shall be used. Furthermore, no correlation is assumed for shadowing between different types of link (i.e. Macro-Relay and Relay-UE, Macro-Relay and Macro-UE, Relay-UE and Macro-UE).

6.6 Power control

The Rel 8 power control algorithm is employed for the backhaul uplink from the RN to the eNB as well as for the access uplink from the UE to the RN. As defined in TS36.942, section 5.1.1.6 [5], the following power control equation should be used for the initial uplink co-existence simulations with RNs:

$$P_t = P_{\max} \times \min\left\{1, \max\left[R_{\min}, \left(\frac{PL}{PL_{x-ile}}\right)^{\gamma}\right]\right\}$$

where Pmax is the maximum transmit power, Rmin is the minimum power reduction ratio to prevent UEs or RNs with good channels to transmit at very low power level, PL is the path loss for the UE or RN and PLx-ile is the x-percentile path loss (plus shadowing) value. With this power control equation, the x percent of UEs or RNs that have the highest pathloss will transmit at Pmax. Finally, $0<\gamma<=1$ is the balancing factor for UEs or RNs with a bad channel and UEs or RNs with a good channel. Values for Pmax and are given in table 6.6-1.

The eNB and RN in the access link is always transmitting at maximum power.

Table 6.6-1: Transmit power ranges for the links

Node / Link	Minumum power P_{min} [dBm]	Maximum Power P_{max} [dBm]
eNodeB	N/A	46
RN backhaul	[-54]	[24,30]
RN access	N/A	[24,30]
UE	-40	23

6.6.1 Power Control for Outdoor Relay

For "outdoor Relay" scenario, both parameter sets 1 and 2 as defined for power control in table 6.6.1-1, 6.6.1-2 and 6.6.1-3 should be considered for use in both the backhaul and access uplinks. All RNs and UEs use the same power control set both in the aggressor and victim network.

Table 6.6.1-1: Power control algorithm parameter for UE

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	109	110	112	115
Set 2	0,8	TBD	TBD	129	133

Table 6.6.1-2: Power control algorithm parameter for RN backhaul link (P_{max}=24dBm)

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	[105]	[106]	[108]	[111]
Set 2	0,8	TBD	TBD	[124]	[128]

Table 6.6.1-3: Power control algorithm parameter for RN backhaul link (P_{max}=30dBm)

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	[111]	[112]	[114]	[117]
Set 2	0,8	TBD	TBD	[132]	[136]

6.6.2 Power Control for Indoor Relay

For "Indoor Relay" scenario, both parameter sets 1 and 2 as defined for power control in Table 6.6.2-1 – 6.6.2-4 should be considered for use in both the backhaul and access uplinks.

Table 6.6.2-1: UL power control for UE->eNB link

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	109	110	112	115
Set 2	0,8	[TBD]	TBD	129	133

Table 6.6.2-2: UL power control for inside UE->RN link

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	116	117	119	122
Set 2	0,8	[TBD]	TBD	136	140

Table 6.6.2-3: Power control algorithm parameter for RN backhaul link (P_{max}=24dBm)

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	112	113	115	118
Set 2	0,8	TBD	TBD	130	133

Table 6.6.2-4: Power control algorithm parameter for RN backhaul link (P_{max}=30dBm)

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	118	119	121	124
Set 2	0,8	TBD	TBD	138	141

6.6.3 Power Control for Thruwall Relay

For "Truwall Relay" scenario, both parameter sets 1 and 2 as defined for power control in table 6.6.3-1—6.6.3-4 should be considered for use in both the backhaul and access uplinks.

Table 6.6.3-1: UL power control for UE->eNB link

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	109	110	112	115
Set 2	0,8	[TBD]	TBD	129	133

Table 6.6.3-2: UL power control for inside UE->RN link

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	116	117	119	122
Set 2	0,8	[TBD]	TBD	136	140

Table 6.6.3-3: Power control algorithm parameter for RN backhaul link (P_{max}=24dBm)

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	104	105	107	110
Set 2	0,8	TBD	TBD	122	126

Table 6.6.3-4: Power control algorithm parameter for RN backhaul link (P_{max}=30dBm)

Parameter set	Gamma	PLx-ile			
		20 MHz bandwidth	15 MHz bandwidth	10 MHz bandwidth	5 MHz bandwidth
Set 1	1	110	111	113	116
Set 2	0,8	TBD	TBD	130	134

6.7 Interference

The amount of interference caused by a system in the adjacent channel is defined by the Adjacent Channel Leakage power Ratio (ACLR) of the aggressor system and the Adjacent Channel Selectivity (ACS) of the victim system. Together with ACS, the ACLR defines the Adjacent Channel Interference Ratio (ACIR) as

$$ACIR = \frac{1}{\frac{1}{ACLR} + \frac{1}{ACS}}$$

This relation and its application rely on identical assumed reference bandwidths in the ACLR and ACS definitions. If aggressor and victim have different reference bandwidths, both ACLR and ACS definitions have to account for exactly those bandwidths. This becomes more complex when there are different systems involved or the bandwidth of a system is flexible as in E-UTRA.

For coexistence purposes the same channel bandwidth is selected for both the aggressor and victim system. The selected bandwidth is 10 MHz.

A RB can be simultaneously used in the RN access link and the donor eNB.

6.7.1 Downlink

The eNB and the RN access link are assumed to be able to transmit at the full bandwidth. Thus the ACIR is the same for all allocations.

The PSD of the transmitter is constant for all RB. The interference in the adjacent channel is assumed to be flat, i.e to have constant PSD.

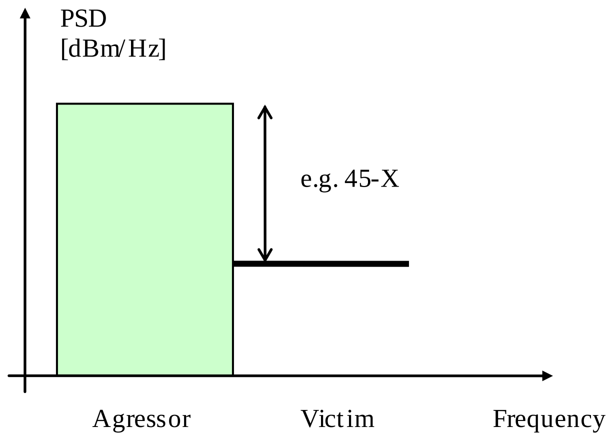


Figure 6.7.1-1 Adjacent channel interference for downlink.

The UE ACS is specified as 33 dB in 36.101 [6] and the eNB ACLR is 45 dB [7].. The UE ACS is specified as 33 dB in 36.101 [6]. The ACIR values to be used for downlinks are listed in Table 6.7-1. The Y in the table below is obtained by combining the ACLR of the RN in the aggressor network and the ACS of the RN in the victim network.

Table 6.7-1 ACIR Downlink

Transmitter	Receiver	
	RN	UE
eNB	45-X	33
RN	f(X,Y)	33-Y

[Note: $45 - X = -10\log(RN\_DL\_ACS^{-1} + 10^{-45/10})$

$33 – Y = -10\log(RN\_DL\_ACLR^{-1}+ 10^{-33/10})$

$f(X,Y) = -10\log(RN\_DL\_ACLR^{-1} + Relay\_DL\_ACS^{-1})$]

6.7.2 Uplink

In the uplink the transmissions are split into 1/3 of the channel BW. The ACLR of the UE is 30 dB [6] and the ACS of the BS is 46 dB [8]. For transmissions in adjacent blocks the value in Table 6.7-2 marked "adjacent" apply, otherwise the other value applies.

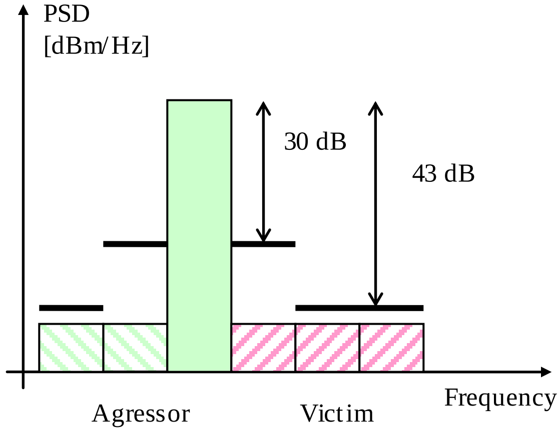


Figure 6.7.1-2 Adjacent channel interference for UE to eNB uplink interference.

Table 6.7-2 ACIR Uplink

Transmitter	Receiver	
	eNB	RN
RN	46-A (adjacent) or 46-A'	F(A,B) (adjacent) or F(A',B')
UE	30 (adjacent) 43	30-B (adjacent) 43-B'

[Note: similar eqns as above, where A depends on RN_UL_ACLR and B depends on RN_UL_ACS]

6.8 Traffic assumptions

To simplify simulations relays in the same system are either transmitting or receiving in a snapshot. I.e. one relay cannot transmit while another relay receives if the relays belong to the same system.

The case with relays in both the victim and aggressor system is FFS. Thus whether two relays that belong to different systems can transmit and receive simultaneously is FFS.

6.8.1 Simulation case 1

Aggressor: eNB and RN access side, Victim link: eNB -> UE

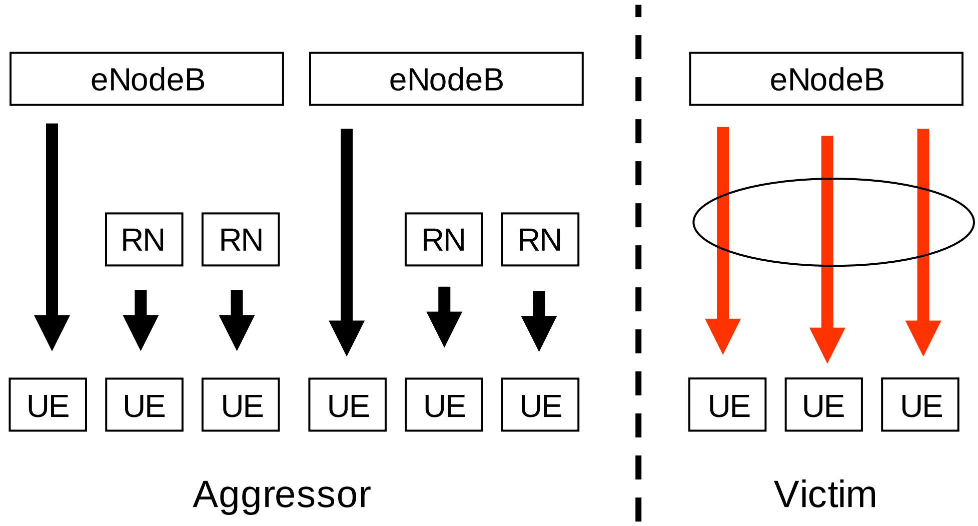


Figure 6.8.1-1 Simulation case 1, eNB and RN in the aggressor system are transmitting.

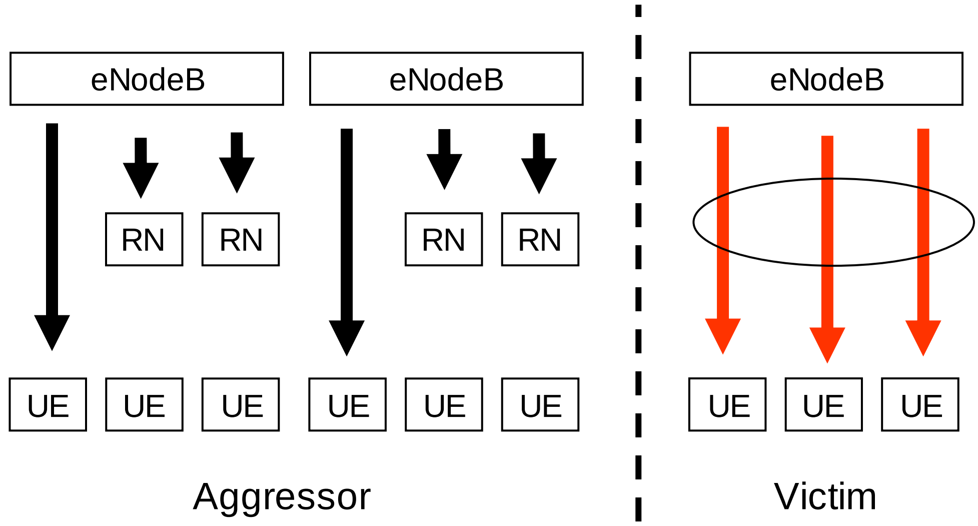


Figure 6.8.1-2 Simulation case 1, eNBs in the aggressor system are transmitting.

In 50% of the snapshots:

- All eNB in the aggressor system are transmitting. All eNB in the aggressor system are transmitting at full BW
- All the RN in the aggressor system are transmitting. All RN in the aggressor system are transmitting full BW.
- All eNB in the victim system are transmitting.

In 50% of the snapshots

- All eNB in the aggressor system are transmitting. All eNB in the aggressor system are transmitting at full BW
- All eNB in the victim system are transmitting.

Throughput loss is measured in all eNB-UE links in the victim system.

6.8.2 Simulation case 2

Aggressor: UE and RN backhaul side, Victim link: UE -> eNB

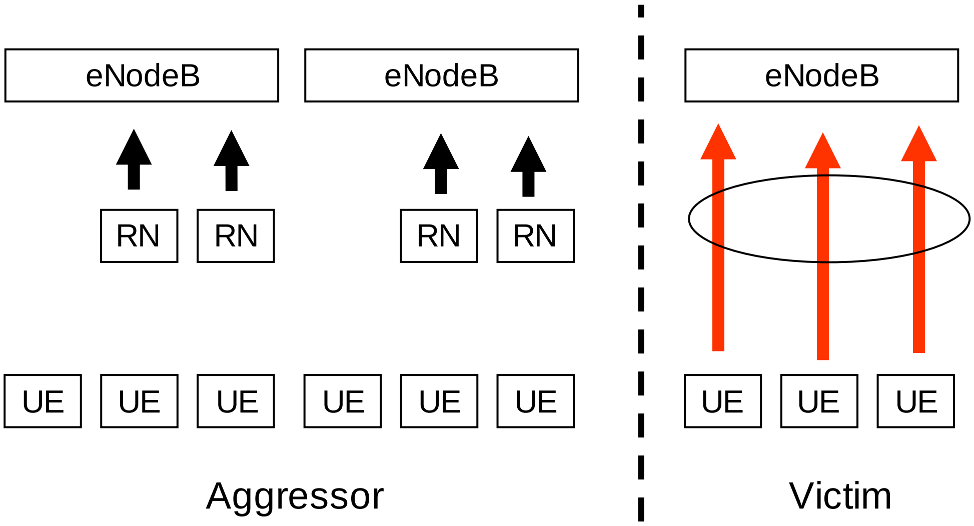


Figure 6.8.2-1 Simulation case 2. RN in the aggressor system are transmitting.

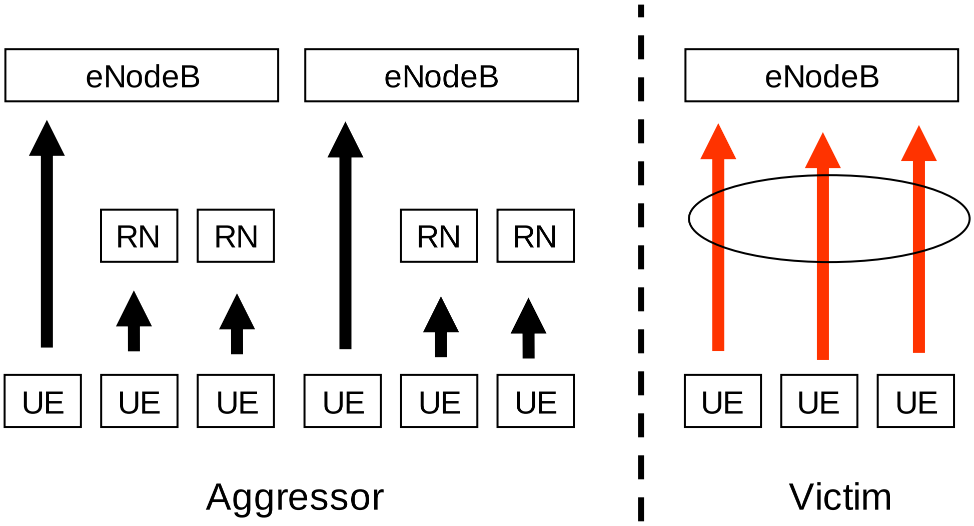


Figure 6.8.2-2 Simulation case 2. UE in the aggressor system are transmitting.

In 50% of the snapshots:

- In each donor cell in the aggressor system there are 3 actively transmitting RN. The 3 RN are selected randomly from all the available RN in the donor cell.

In 50% of the snapshots:

- In each donor cell in the aggressor system there are 3 actively transmitting UE. If there are more than 3 UEs in the donor cell, 3 UEs are randomly selected that actively transmit.

- In each relay cell in the aggressor system there are 1~3 actively transmitting UE. If there are more than 3 UEs in the relay cell, 3 UEs are randomly selected that actively transmit. Regardless of the activated UE number in the relay cell, each UE occupies 1/3 of total BW. To simulate the worst case, the RBs should be assigned to the 1/3 bandwidth closest to the victim system.

In each cell in the victim system there are 3 UEs actively transmitting. If there are more than 3 UEs in the cell in the victim system, 3 UEs are randomly selected that actively transmit.

The throughput loss is measured in all the UE-eNB links in the victim system.

6.8.3 Simulation case 3

Aggressor: eNB Victim link: eNB -> RN

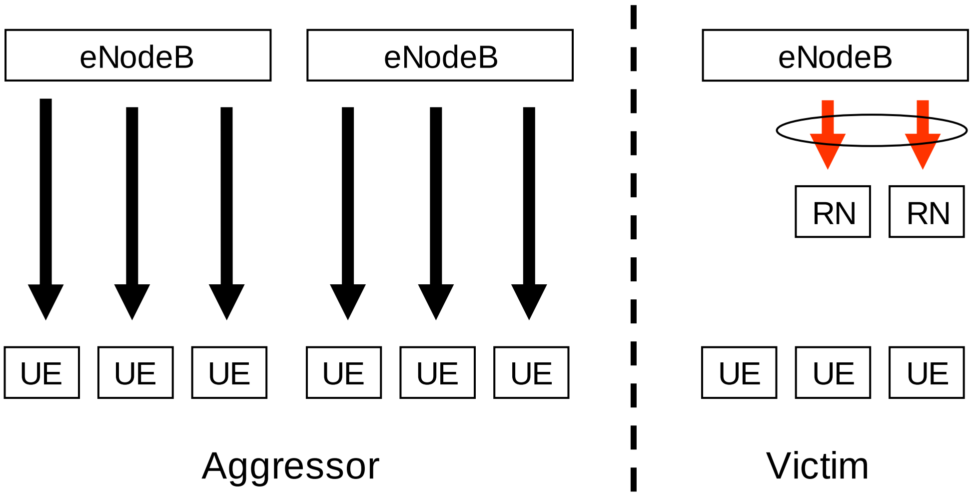


Figure 6.8.3-1 Simulation case 3. eNBs in the aggressor system are transmitting

All eNB in the aggressor system are transmitting. All eNB in the aggressor system are transmitting at full BW

All eNB in the victim system are transmitting. All eNB in the victim system are transmitting at full BW

All RN in the victim system are receiving.

The throughput loss is measured in all the eNB-RN links in the victim system.

6.8.4 Simulation case 4

Aggressor: UE, Victim link: UE-> RN

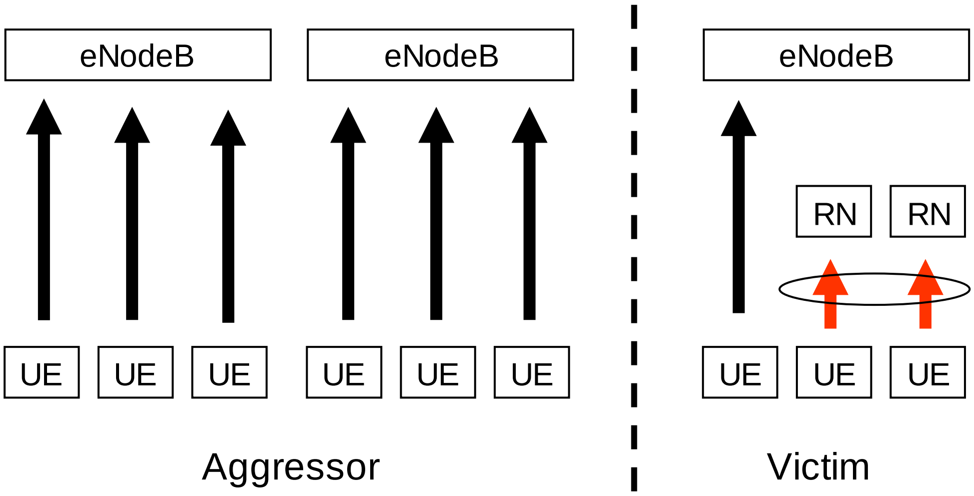


Figure 6.8.4-1 Simulation case 4. UE in the aggressor system are transmitting

In each cell in the aggressor system there are 3 UE transmitting. If there are more than 3 UEs in the cell, 3 UEs are randomly selected that actively transmit.

In the victim system there are 3 UE transmitting in each donor cell. If there are more than 3 UEs in the donor cell, 3 UEs are randomly selected that actively transmit.

In each relay cell there are 1~3 UE transmitting. If there are more than 3 UEs in the relay cell, 3 UEs are randomly selected that actively transmit. Regardless of the activated UE number in the relay cell, each UE just occupies 1/3 of total BW. To simulate the worst scenario, the 1/3 bandwidths are randomly assigned to the UE(s).

The throughput loss is measured in all the UE-RN links in the victim system.

6.9 Performance measures

The standard shifted truncated Shannon limits defined in Annex A.2 of TS36.942 [5] are employed as the benchmark against which the co-existence performance of relay nodes is to be evaluated.

The following equations approximate the throughput over a channel with a given SNR, when using link adaptation:

$$Throughput, Thr, bps/Hz = \left| \begin{array}{ll} \mathrm{Thr} = 0 & \mathrm{for\ SNIR} < \mathrm{SNIR}_{\mathrm{MIN}} \\ \mathrm{Thr} = \alpha.\mathrm{S(SNIR)} & \mathrm{for\ SNIR}_{\mathrm{min}} < \mathrm{SNIR} < \mathrm{SNIR}_{\mathrm{MAX}} \\ \mathrm{Thr} = \mathrm{Thr}_{\mathrm{MAX}} & \mathrm{for\ SNIR} > \mathrm{SNIR}_{\mathrm{MAX}} \end{array} \right.$$

Where: S(SNIR) is the Shannon bound: S(SNIR) = log2(1+SNIR) bps/Hz

α Attenuation factor, representing implementation losses

SNR_{MIN} Minimum SNIR of the codeset, dB

Thr_{MAX} Maximum throughput of the codeset, bps/Hz

$SNIR_{MAX}$ SNIR at which max throughput is reached S-1(ThrMAX), dB

The parameters α, SNRMIN and THRMAX can be chosen to represent different modem implementations and link conditions. The parameters Table 6.9.1 represent a baseline case, which assumes:

- 1:2 antenna configurations
- Typical Urban fast fading channel model (10kmph DL, 3kmph UL)
- Link Adaptation
- Channel prediction
- HARQ

Table 6.9-1 Parameters describing baseline Link Level performance for E-UTRA Co-existence simulations

Parameter	DL	UL	Notes
A, attenuation	0.6	0.4	Represents implementation losses
SNIRMIN, dB	10	10	Based on QPSK, 1/8 rate (DL) & 1/5 rate (UL)
$Thru_{MAX}$, bps/Hz	4.4	2.0	Based on 64QAM 4/5 (DL) & 16QAM 3/4 (UL)

Table 6.9-1 illustrates the parameters for the baseline E-UTRA DL and UL. Table 6.9-2 shows the resulting look up table, which is plotted in Figure 6.9-1. Table 6.9-2 gives throughput in terms of spectral efficiency (bps per Hz).

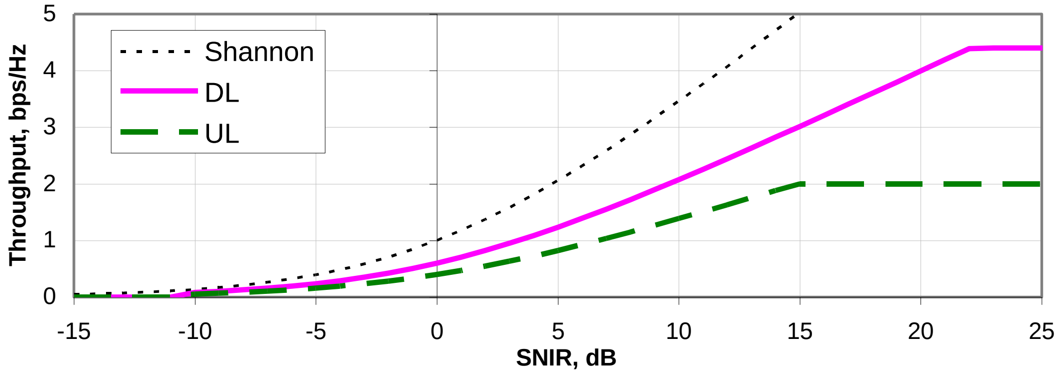


Figure 6.9-1 Throughput vs SNR for Baseline E-UTRA Coexistence Studies

Table 6.9-2 Look-Up-Table of UL and DL Throughput vs. SNIR for Baseline E-UTRA Coexistence Studies

SNIR [dB]	Throughput [bps/Hz]	
	DL	UL
-11	0	0
-10	0.08	0.06
-9	0.10	0.07
-8	0.13	0.08
-7	0.16	0.10
-6	0.19	0.13
-5	0.24	0.16
-4	0.29	0.19
-3	0.35	0.23
-2	0.42	0.28
-1	0.51	0.34
0	0.60	0.40
1	0.71	0.47
2	0.82	0.55
3	0.95	0.63
4	1.09	0.72
5	1.23	0.82
6	1.39	0.93
7	1.55	1.04
8	1.72	1.15
9	1.90	1.26
10	2.08	1.38
11	2.26	1.51
12	2.44	1.63
13	2.63	1.76
14	2.82	1.88
15	3.02	2.00
16	3.21	2.00
17	3.41	2.00
18	3.60	2.00
19	3.80	2.00
20	3.99	2.00
21	4.19	2.00
22	4.39	2.00
23	4.40	2.00

7 Results

7.1 Coexistence results

For coexistence studies 48 cases have been defines as outlined in subclause 6.1. A complete set of results from the coexistence studies can be found in [x]. Since there are so many data points a complete set is not shown in this report, the acir value for 5% loss in the average and the 5th percentile throughput are shown in table 7.1-1 and 7.1-2. Note that the data used is from RAN4-58, RAN4-58AH and RAN4-59 only since the simulation assumptions were updated before that and thus the data prior to RAN4-58 is not consisten with the data from later meetings.

Table 7.1-1 Required ACIR [dB] for <5% loss on average throughput

Case		A	B	C	D	E	F	G	H
		Outdoor	Thruwall	Outdoor	Thruwall	Outdoor	Thruwall	Outdoor	Thruwall
1	DL	<20	<20	**22.1**	<20	<20	<20	22.5	<20
2-1	UL PC1	32.0	**>50**	35.7	39.3	29.7	>50	30.2	42.9
2-2	UL PC2	28.5	36.9	25.5	32.9	<20	34.4	20.9	28.3
3	DL	**24.2**	<20	22.0	<20	<20	<20	<20	<20
4-1	UL PC1	**24.2**	<20	21.8	<20	24.0	<20	<20	<20
4-2	UL PC2	21.6	<20	<20	<20	<20	<20	<20	<20

Table 7.1-1 Required ACIR [dB] for <5% loss on 5th percentile throughput

Case		A	B	C	D	E	F	G	H
		Outdoor	Thruwall	Outdoor	Thruwall	Outdoor	Thruwall	Outdoor	Thruwall
1	DL	31.9	<20	>50	44.2	33.2	<20	>50	<20
2-1	UL PC1	33.4	**>50**	40	38.1	26.6	**>50**	38.9	26.2
2-2	UL PC2	32.1	34.4	36.9	34.8	24.6	29.8	33.5	20.4
3	DL	33.5	24.9	33.5	29.1	24.8	25.3	26.9	27.4
4-1	UL PC1	32.2	28	33.6	<20	32.7	28	31.2	<20
4-2	UL PC2	27.1	<20	27.2	<20	26.2	<20	28.4	<20

The results for some of the cases that require a high ACIR are plotted in more detail in the figures below. We have selected two case where the relay is the aggressor for the uplink the throughwall case seems to be the most difficult (Case B2-1) and for the DL the outdoor case Case C1 seems to be have largest impact. When the relay is the victim the DL case outdoor A3 and uplink outdoor case A4-1 seems to be most difficult.

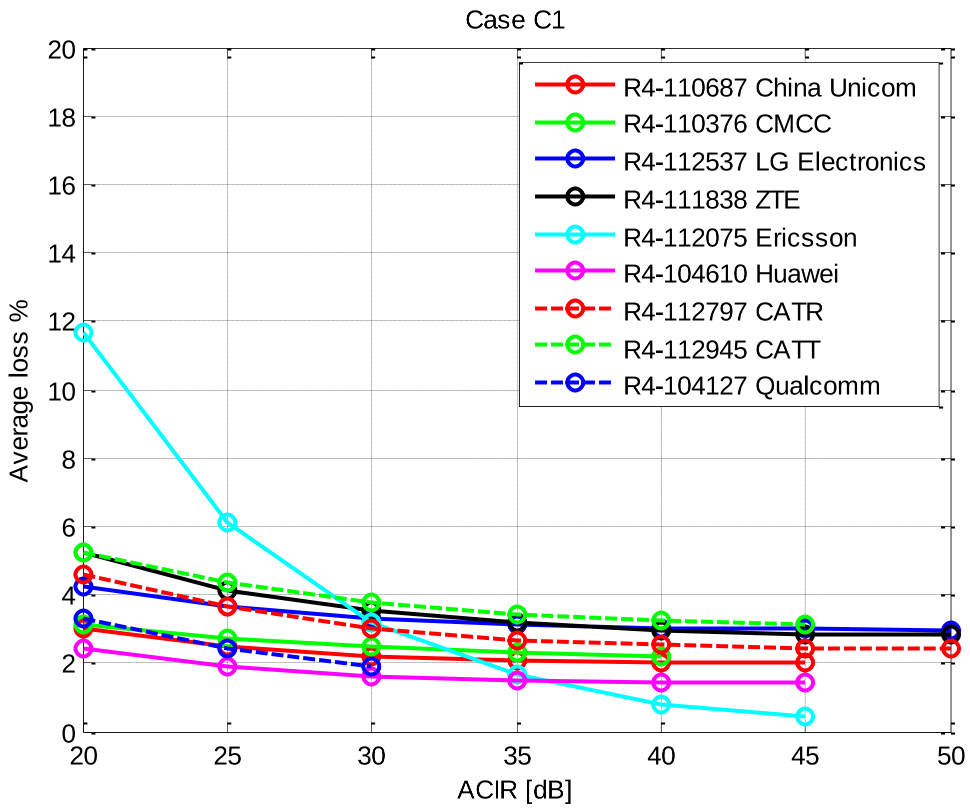


Figure 7.1-1 Case C1, Average loss

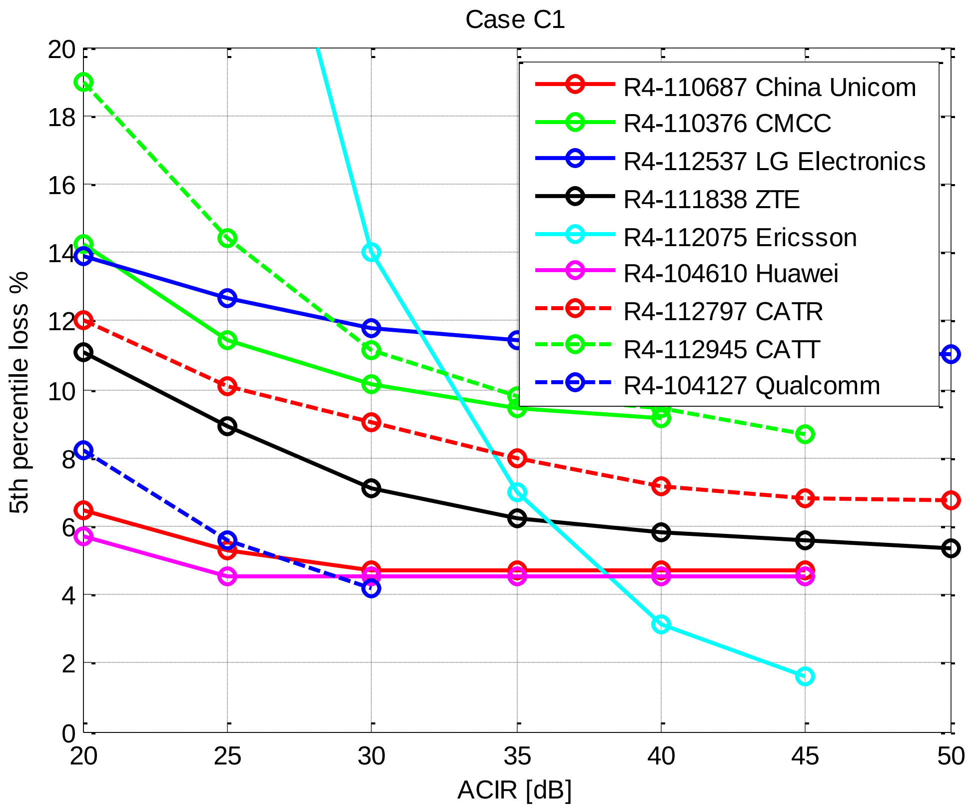


Figure 7.1-2 Case C1, 5th percentile loss

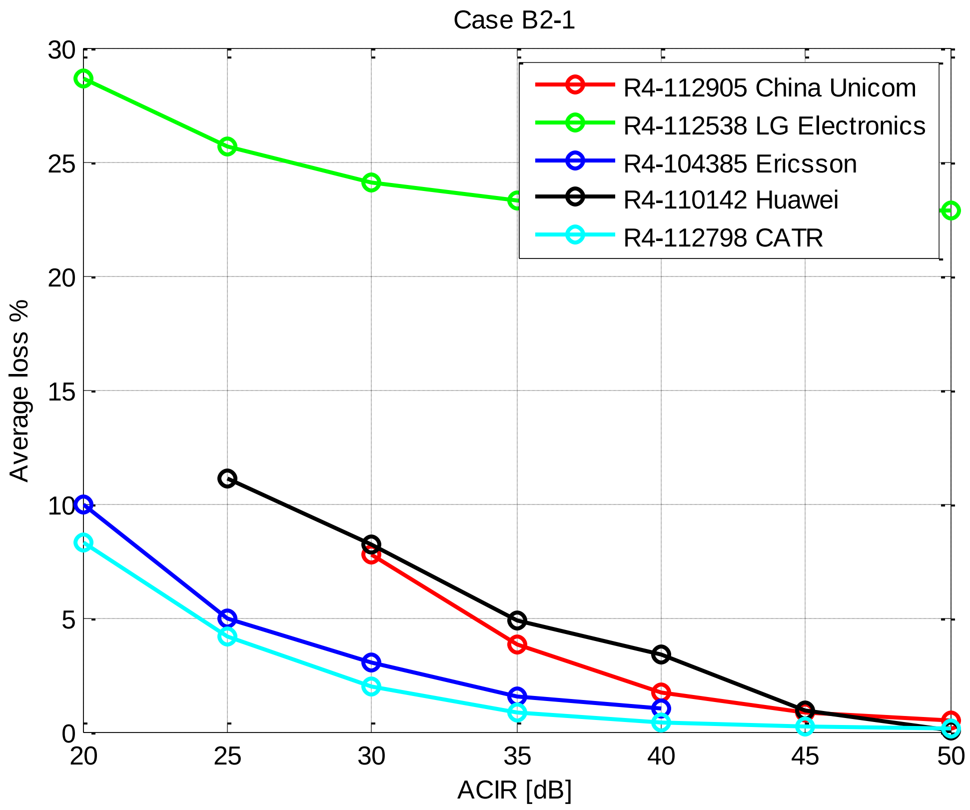


Figure 7.1-3 Case B2-1, Average loss

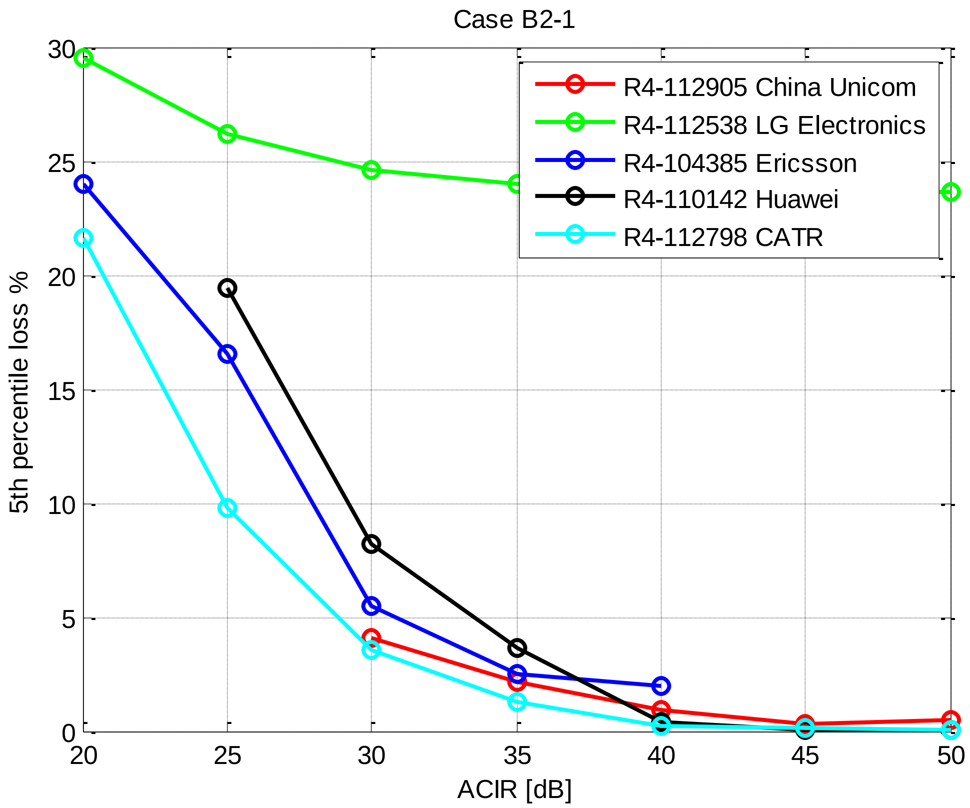


Figure 7.1-4 Case B2-1, 5th percentile loss

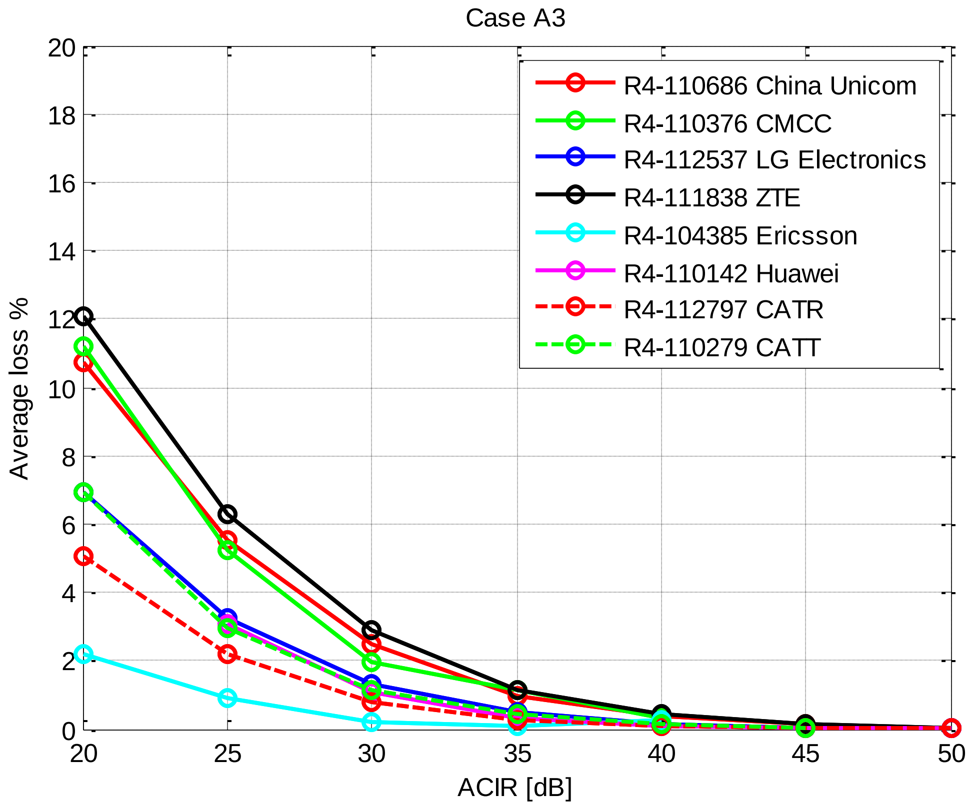


Figure 7.1-5 Case A3, Average loss

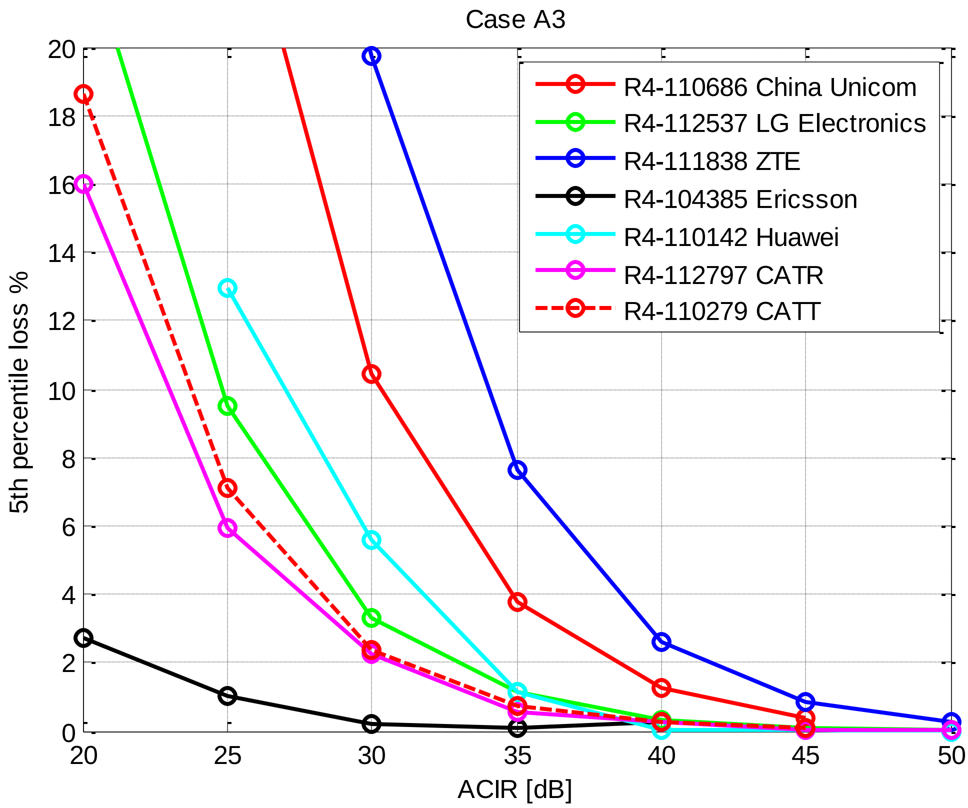


Figure 7.1-6 Case A3, 5th percentile loss

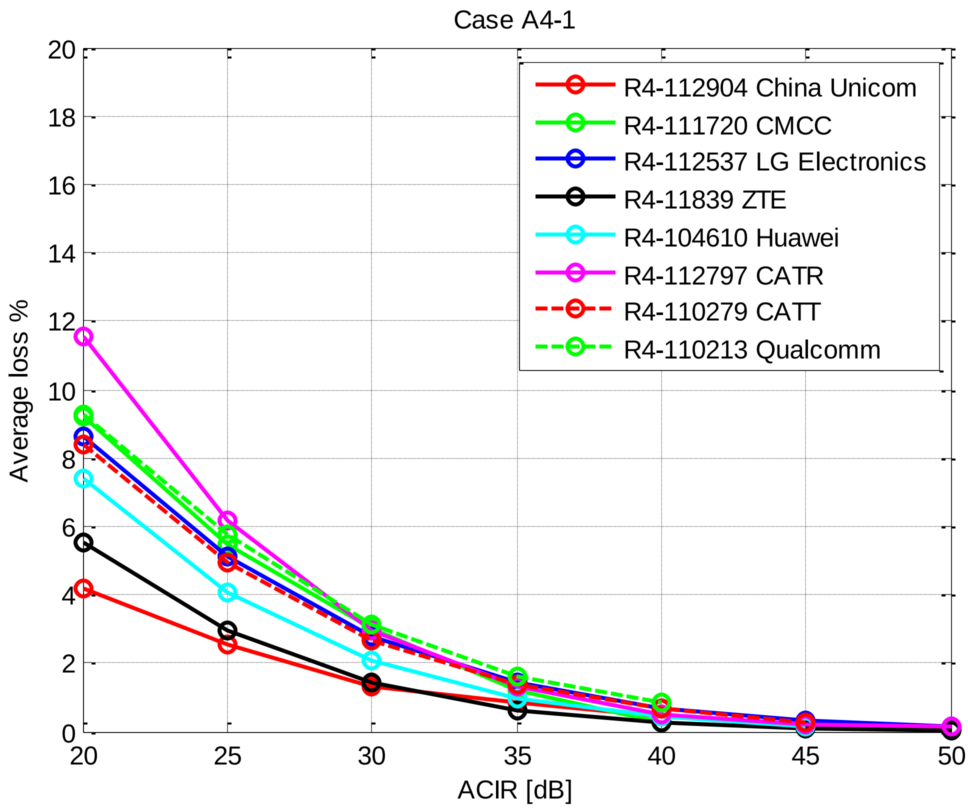


Figure 7.1-7 Case A4-1, Average loss

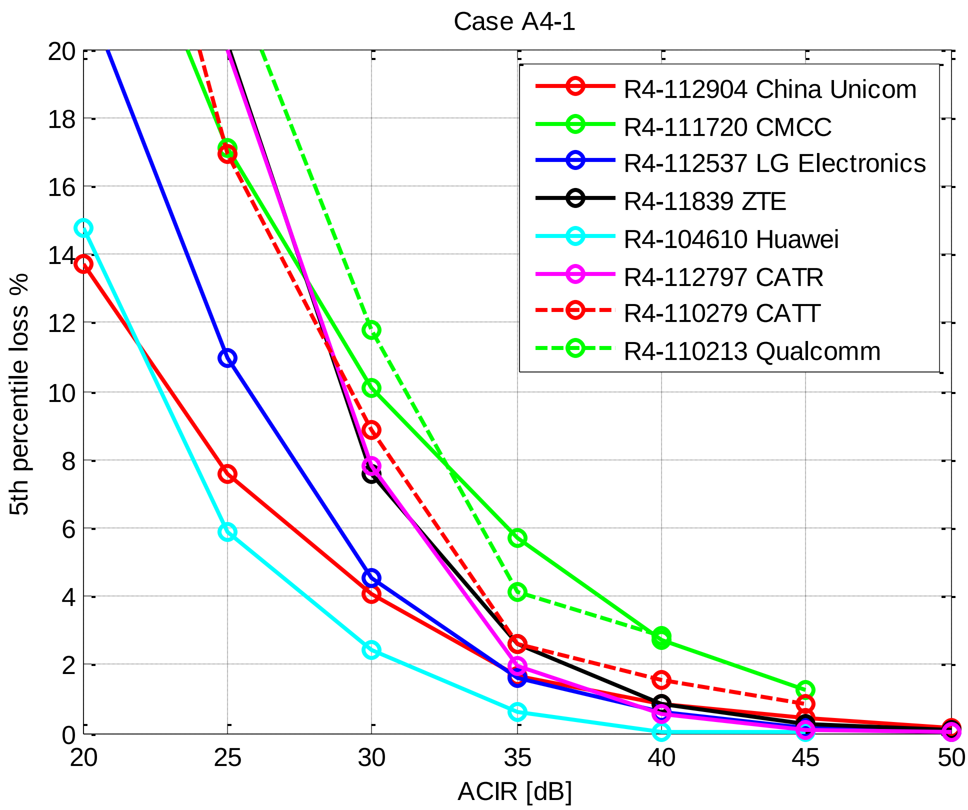


Figure 7.1-8 Case A4-1, 5th percentile loss

8 Backhaul link requirements

8.1 Transmitter

8.1.1 General

Unless otherwise stated, the requirements in sub-section 8.1 are expressed for Relay backhaul link with a single or multiple transmit antenna(s).

Unless otherwise stated, the transmitter characteristics are specified at the Relay antenna connector (test port A) with a full complement of transceivers for the configuration in normal operating conditions. If any external apparatus such as a TX amplifier, a filter or the combination of such devices is used, requirements apply at the far end antenna connector (port B).

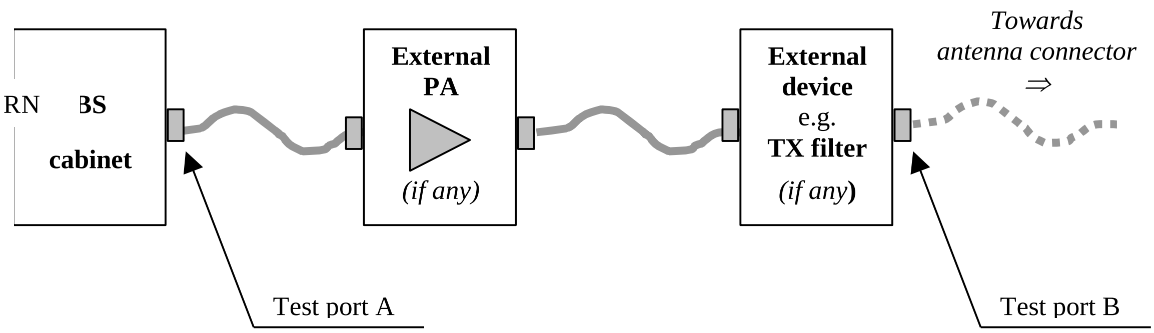


Figure 8.1.1-1: Transmitter test ports

8.1.2 Output power

The following Relay rated output power defines the mean power level that the manufacturer has declared to be available at the antenna connector during the transmitter ON period for any transmission bandwidth within the channel bandwidth for Relay backhaul. The period of measurement shall be at least one sub frame (1ms)

Table 8.1.2-1: Relay rated output power

Relay power class	rated output power
Class1	<+ 24 dBm (for one transmit antenna port) <+ 21 dBm (for two transmit antenna ports) <+ 18 dBm (for four transmit antenna ports)

For coexistence with a victim base station a minimum MCL should be met in all scenarios. This is particularly relevant for use cases where Relays are placed wall mounted or in rooftops. The value for this MCL is FFS.

8.1.2.1 Minimum requirement

In normal conditions, the base station maximum output power shall remain within +2 dB and -2 dB of the rated output power declared by the manufacturer.

In extreme conditions, the base station maximum output power shall remain within +2.5 dB and -2.5 dB of the rated output power declared by the manufacturer.

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

8.1.2.2 Configured transmitted Power for backhaul link

The Relay backhaul link is allowed to set its configured maximum output power P_{CMAX}. The configured maximum output power P_{CMAX} is set within the following bounds:

- P_{CMAX} = MIN { P_{EMAX}, PRAT }
- P_{EMAX} is the value given to IE *P-Max*, defined in TS36.331
- PRAT is the Relay rated output power specified in table 8.1.2.1-1 without taking into account the tolerance specified in the table 8.1.2.1-1

The measured configured maximum output power P_{UMAX} shall be within the following bounds:

$$P_{CMAX} - T(P_{CMAX}) \leq P_{UMAX} \leq P_{CMAX} + T(P_{CMAX})$$

Where $T(P_{CMAX})$ is defined by the tolerance table below and applies to P_{CMAX_L} and P_{CMAX_H} separately. If the P_{EMAX} is specially informed/declared that it would be settled as fixed level, the tolerance $T(P_{CMAX})$ should be aligned with the corresponding requirement for rated output power for Relay backhaul link and the test could focus on the specific range. If the informed/declared P_{EMAX} is equal to PRAT, P_{CMAX} could be tested together with PRAT.

Table 8.1.2.2-1: P_{CMAX} tolerance

P_{CMAX} (dBm)	Tolerance $T(P_{CMAX})$ (dB)
PRAT-3 ≤ P_{CMAX} ≤PRAT	2.0
PRAT-4 ≤ P_{CMAX} < PRAT-3	[2.5]
PRAT-5 ≤ P_{CMAX} < PRAT-4	[3.0]
PRAT-6 ≤ P_{CMAX} < PRAT-5	[3.5]
PRAT-13 ≤ P_{CMAX} < PRAT-6	[4.0]
[-50] ≤ P_{CMAX} < PRAT-13	[6.0]

8.1.3 Output power dynamics

8.1.3.1 Minimum output power

The minimum controlled output power of the RN is defined as the broadband transmit power of the RN, i.e. the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value. The minimum output power is defined as the mean power in one sub-frame (1ms). The minimum output power shall not exceed the values of -50dBm. For relay backhaul link with multiple transmit antenna connectors, the requirement is FFS.

8.1.3.2 Transmit OFF power

Transmit OFF power is defined as the mean power when the transmitter is OFF. The transmitter is considered to be OFF when the Relay backhaul is not allowed to transmit or during periods when the Relay is not transmitting a sub-frame. During DTX and measurements gaps, the Relay backhaul is not considered to be OFF.

8.1.3.2.1 Minimum requirement

The transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 8.1.3.2.1-1.

Table 8.1.3.2.1-1: Transmit OFF power

	Channel bandwidth / Transmit OFF power / measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Transmit OFF power	-66 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

8.1.3.3 ON/OFF time mask

With the exception of requirements for PRACH all the other requirements defined in subclause 6.3.4 of TS36.101 shall be applied for Relay backhaul link as transmitter ON/OFF time mask. The off power for Relay backhaul link is defined in section 8.1.3.2.

For relay backhaul link with multiple transmit antenna connectors, the requirement defined in subclause 6.3.4B of TS36.101 shall be applied, besides the requirements for PRACH.

8.1.3.4 Power Control

Power control requirements defined in TS36.101 Section 6.3.5 could be reused for Relay backhaul side with some modifications. One modification is that since there is no PRACH for Relay backhaul side, the Absolute Power Tolerance and Relative Power Tolerance requirement for PRACH is not needed for Relay backhaul. The other modification is that the relaxation of 1.5dB on lower limit of UE Absolute Power Tolerance and Relative Power Tolerance minimum requirements for specific transmission bandwidth and operating bands defined in TS36.101 Table 6.2.2-1 (Note 2) is not needed for Relay backhaul side.

8.1.4 Transmit signal quality

8.1.4.1 Frequency error

The modulated carrier frequency of Relay Node backhaul link shall be accurate to within ±0.1 PPM observed over a period of one time slot (0.5 ms) compared to [the carrier frequency received from the Donor eNode B]. Although the reference frequency source of backhaul and access link could be the same and the same frequency error requirements could be applied for both the access link and the backhaul link, it is adequate to keep this requirement of RN backhaul link aligned with that of UE.

8.1.4.2 EVM

The EVM requirements in TS36.101 subclause 6.5.2.1 should be applied to relay backhaul link.

8.1.4.3 Time alignment between transmitter branches

Time alignment error requirements defined in TS36.101 Section 6.8.1 apply for Relay backhaul link.

8.1.5 Unwanted emissions

8.1.5.1 Adjacent Channel Leakage power Ratio (ACLR)

ACIR defines the protection against adjacent channel interference. In the backhaul uplink, ACIR is determined by relay ACLR and BS ACS, in which BS ACS is assumed to be 46dB. According to the Relay coexistence simulation results, ACLR requirements for Relay backhaul transmitter shall be 45dB. The E-UTRA BS ACLR requirements defined in TS36.104 [7] are applied to the transmitter of Relay node backhaul link.

8.1.5.2 Operating Band Unwanted Emission

The operating band unwanted emission of local area BS for both category A and B in TS36.104 is reused.

8.1.5.3 Spurious Emission

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements in line with SM.329 and E-UTRA operating band requirement to address BS and UE co-existence.

In both BS and UE specs the spurious requirements are defined for both UL and DL protection and for TS36.104 the co-location requirements are included as BSs are likely to be deployed in the same site. Here we compare the requirements for BS and UE one by one.

Mandatory requirements/Minimum Requirements

The Mandatory requirements are specified for Cat. A and Cat. B BS in TS36.104 Section 6.6.3.1 and the minimum requirements for UE for UE is specified in TS36.101 Section 6.6.3.1. It's observed that the minimum requirements for UE are the same as Cat. B requirements. As the Cat. A and B requirements are developed for different area and here the mandatory requirements in TS36.104 are proposed for relay BH link.

Co-existence Requirements

The co-existence requirements are specified for UL and DL bands separately for both BS and UE. By comparison for both UL and DL the LA BS requirements are more stringent and thus they are proposed for relay BH.

Co-location Requirements

Relay station is proposed to improve the coverage and is very likely to be deployed with other BS. The LA BS co-location requirements should be implemented for relay BH.

The LA requirements including mandatory requirements, co-existence requirements and co-location requirements in TS36.104 section 6.6.4 should be implemented by relay backhaul link.

8.1.6 Transmit intermodulation

The requirement defined section 6.7 in TS36.104 shall be applied to Relay backhaul link transmitter.

8.2 Receiver

8.2.1 General

Unless otherwise stated the receiver characteristics are specified at the antenna connector(s) of the Relay backhaul link (test port A in figure8.2-1) with a full complement of transceivers for the configuration in normal operating conditions. If any external apparatus such as a RX amplifier, a filter or the combination of such devices is used, requirements apply at the far end antenna connector (port B in figure 8.2-1). For Relays with more than one backhaul receiver antenna connector, identical interfering signals shall be applied to each receiver antenna port if more than one of these is used (diversity).

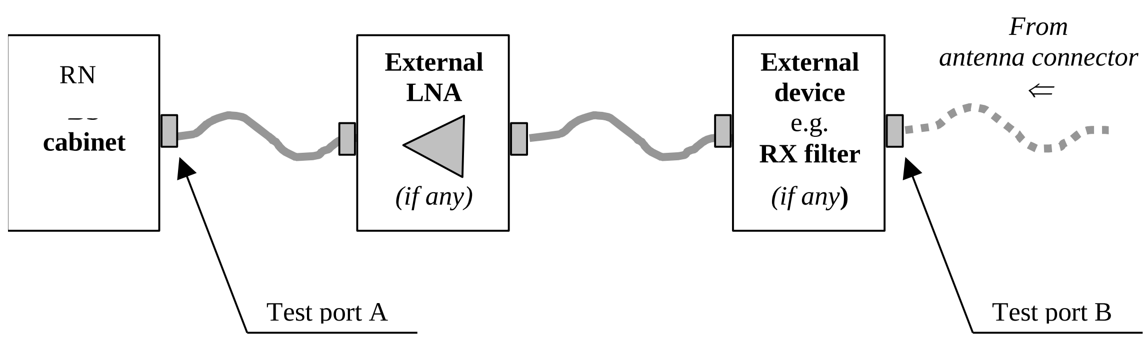


Figure 8.2.1-1: Receiver test ports

The levels of the test signal applied to each of the antenna connectors shall be as defined in the respective sub-sections below.

The requirements in following section assume that the receiver is equipped with two Rx port as a baseline. Requirements for 4 ports are FFS. With the exception of receiver spurious emission all requirements shall be verified by using both (all) antenna ports simultaneously.

8.2.2 Reference sensitivity

The reference sensitivity requirement for the backhaul should not depend on operating band.

The reference sensitivity should be defined in a similar way as in TS 36.101 subclause 7.3.1.. I.e. the throughput should be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 8.2.2-1

Whether the transmitter should be turned on or not during tests is FFS.

Table 8.2.2-1 Backhaul antenna connector reference sensitivity

E-UTRA channel bandwidth [MHz]	Reference sensitivity power level, PREFSENS [dBm]
	PRAT=24 dBm
1.4	[-105.7]
3	[-102.7]
5	[-101]
10	[-98]
15	[[-96.2]
20	[-95]

8.2.3 Maximum input level

The requirements for maximum input level in TS 36.101 subclause 7.4 should be applied to relay backhaul link. Note that only the reference measurement channel for UE category 3-5 in TS 36.101 Annex A.3.2 should be adopted for Relay.

8.2.4 Adjacent Channel Selectivity (ACS)

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

According to the coexistence results 46dB ACS is enough for relay BH link to make sure the performance loss is under 5%.

According to blocking simulation results the wanted signal is proposed to be -67.5dBm ($P_{REFSENS}$ +33.5dB) and as ACS is specified in the similar way the same wanted signal level is proposed. The relay backhaul link works in the UL band which is same with a UE, the interferer signal level is propose to be -25dBm which is the UE maximum input power.

As the relay might be deployed in the cell edge and the received signal power could be low, a low wanted signal power ACS requirements are also required. The wanted signal power is set to the same as TS36.101 ACS requirement and the interferer level is scaled to keep same ACS requirements with large wanted signal power.

Table 8.2.4-1: Adjacent Channel Selectivity for relay backhaul link (large wanted signal power)

E-UTRA channel bandwidth [MHz]	Wanted signal mean power [dBm]	Interfering signal mean power [dBm]	Interfering signal centre frequency offset from the channel edge of the wanted signal [MHz]	Type of interfering signal
1.4	$P_{REFSENS}$ + 40.5dB*	-25	0.7025	1.4MHz E-UTRA signal
3	$P_{REFSENS}$ + 35.5dB*	-25	1.5075	3MHz E-UTRA signal
5	$P_{REFSENS}$ + 33.5dB*	-25	2.5025	5MHz E-UTRA signal
10	$P_{REFSENS}$ + 33.5dB*	-25	2.5075	5MHz E-UTRA signal
15	$P_{REFSENS}$ + 33.5dB*	-25	2.5125	5MHz E-UTRA signal
20	$P_{REFSENS}$ + 33.5dB*	-25	2.5025	5MHz E-UTRA signal
Note*: $P_{REFSENS}$ depends on the channel bandwidth as specified in Table 8.2.2-1.				

Table 8.2.4-2: Adjacent Channel Selectivity for relay backhaul link (low wanted signal power)

E-UTRA channel bandwidth [MHz]	Wanted signal mean power [dBm]	Interfering signal mean power [dBm]	Interfering signal centre frequency offset from the channel edge of the wanted signal [MHz]	Type of interfering signal
1.4	$P_{REFSENS}$ + 21 dB*	-44.5	0.7025	1.4MHz E-UTRA signal
3	$P_{REFSENS}$ + 16 dB*	-44.5	1.5075	3MHz E-UTRA signal
5	$P_{REFSENS}$ + 14 dB*	-44.5	2.5025	5MHz E-UTRA signal
10	$P_{REFSENS}$ + 14 dB*	-44.5	2.5075	5MHz E-UTRA signal
15	$P_{REFSENS}$ + 14 dB*	-44.5	2.5125	5MHz E-UTRA signal
20	$P_{REFSENS}$ + 14 dB*	-44.5	2.5025	5MHz E-UTRA signal
Note*: $P_{REFSENS}$ depends on the channel bandwidth as specified in Table 8.2.2-1.				

ACS requirement for Relay backhaul link is FFS.

8.2.5 Blocking characteristics

The general blocking requirement should be defined in a similar way as in TS 36.104 subclause 7.6.1. The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to Relay antenna input using the parameters in Table 8.2.5-1.

Table 8.2.5-1: Blocking performance requirement for Relay

Operating Band	Centre Frequency of Interfering Signal [MHz]			Interfering Signal mean power [dBm]	Wanted Signal mean power [dBm]	Interfering signal centre frequency minimum frequency offset from the channel edge of the wanted signal [MHz]	Type of Interfering Signal
1-7, 9-11, 13-14, 18,19, 21, 23, 24, 33-43	(F_{UL_low} -20)	to	(F_{UL_high} +20)	-15	$P_{REFSENS}$ +33.5dB*	See table 8.2.5-2	See table 8.2.5-2
	1 (F_{UL_high} +20)	to to	(F_{UL_low} -20) 12750	-15	$P_{REFSENS}$ +6dB*	-	CW carrier
8	(F_{UL_low} -20)	to	(F_{UL_high} +10)	-15	$P_{REFSENS}$ +33.5dB*	See table 8.2.5-2	See table 8.2.5-2
	1 (F_{UL_high} +10)	to to	(F_{UL_low} -20) 12750	-15	$P_{REFSENS}$ +6dB*	-	CW carrier
12	(F_{UL_low} -20)	to	(F_{UL_high} +13)	-15	$P_{REFSENS}$ +33.5dB*	See table 8.2.5-2	See table 8.2.5-2
	1 (F_{UL_high} +13)	to to	(F_{UL_low} -20) 12750	-15	$P_{REFSENS}$ +6dB*	-	CW carrier
17	(F_{UL_low} -20)	to	(F_{UL_high} +18)	-15	$P_{REFSENS}$ +33.5dB*	See table 8.2.5-2	See table 8.2.5-2
	1 (F_{UL_high} +18)	to to	(F_{UL_low} -20) 12750	-15	$P_{REFSENS}$ +6dB*	-	CW carrier
20	(F_{UL_low} -11)	to	(F_{UL_high} +20)	-15	$P_{REFSENS}$ +33.5dB*	See table 8.2.5-2	See table 8.2.5-2
	1 (F_{UL_high} +20)	to to	(F_{UL_low} -11) 12750	-15	$P_{REFSENS}$ +6dB*	-	CW carrier
25	(F_{UL_low} -20)	to	(F_{UL_high} +15)	-15	$P_{REFSENS}$ +33.5dB*	See table 8.2.5-2	See table 8.2.5-2
	1 (F_{UL_high} +15)	to to	(F_{UL_low} -20) 12750	-15	$P_{REFSENS}$ +6dB*	-	CW carrier
Note*: $P_{REFSENS}$ depends on the channel bandwidth as specified in Table 8.2.2-1							

Table 8.2.5-2: Interfering signals for blocking performance requirement

E-UTRA channel BW of the lowest (highest) carrier received [MHz]	Interfering signal centre frequency minimum offset to the lower (higher) edge [MHz]	Type of interfering signal
1.4	±2.1	1.4MHz E-UTRA signal
3	±4.5	3MHz E-UTRA signal
5	±7.5	5MHz E-UTRA signal
10	±7.5	5MHz E-UTRA signal
15	±7.5	5MHz E-UTRA signal
20	±7.5	5MHz E-UTRA signal

The co-location blocking requirement for local area BS in TS 36.104 can be reused for Relay backhaul link.

8.2.6 Receiver spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the relay backhaul link antenna connector.

The requirements in TS36.101 section 7.9 should be applied for relay backhaul link.

8.2.7 Receiver intermodulation

The receiver IM is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

In TS36.101 wide band IM is specified for UE receiver and the metric is reused for relay backhaul link. As the relay BH REFSENS is 1 dB better than UE the interference level is proposed to be 1dB smaller correspondingly to keep the relative performance unchanged. Meanwhile the relay BH link has different antenna gain as UE and the interferer single should be 5dB higher than UE requirements. As a result the requirements should be - 42dBm.

Power in Transmission Bandwidth Configuration chooses different value for wide band due to some implementation reason and relay station should choose one value (6dB) for 5MHz and above.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in TS36.101 Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 8.2.7-1 for the specified wanted signal mean power in the presence of two interfering signals

Table 8.2.7-1: Wide band intermodulation for relay backhaul link

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		12	8	6	6	6	-6
$P_{Interferer\ 1}$ (CW)	dBm	-42					
$P_{Interferer\ 2}$ (Modulated)	dBm	-42					
$BW_{Interferer\ 2}$		1.4	3	5			
$F_{Interferer\ 1}$ (Offset)	MHz	-BW/2 - 2.1 / +BW/2 + 2.1	-BW/2 - 2.1 / +BW/2 + 2.1	-BW/2 - 7.5 / +BW/2 + 7.5			
$F_{Interferer\ 2}$ (Offset)	MHz	$2^*F_{Interferer\ 1}$					
Note 1: Reference measurement channel is specified in TS36.101 Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1. Note 2: The modulated interferer consists of the Reference measurement channel specified in TS36.101 Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1The interfering modulated signal is 5MHz E-UTRA signal as described in Annex D for channel bandwidth ≥5MHz							

8.3 Performance

8.3.1 Performance requirements for R-PDCCH

For R-PDCCH, formats with and without cross-interleaving, resource mapping with LVRB and DVRB, normal and reduced DMRS, are all supported in Rel-10. The performance requirements for all these R-PDCCH cases shall be defined based on DL grant.

The performance requirements for R-PDCCH with no cross-interleaving and LVRB resource mapping shall be prioritized.

8.3.1.1 R-PDCCH format without cross-interleaving

8.3.1.1.1 FDD

For single-layer transmission on antenna port 7, the requirements are specified in Table 8.3.1.1.1-2, with parameters in Table 8.3.1.1.1-1.

Table 8.3.1.1.1-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 1	Test 2
Cyclic prefix			Normal	
Cell ID			0	
Un subframe type in DeNB			Normal subframe	
SubframeConfigurationFDD			10110101	
Number of OFDM symbols for PDCCH		OFDM symbols	2	
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)	
Downlink power allocation	R-PDCCH_RA OCNG_RA	dB	0	
	R-PDCCH_RB OCNG_RB	dB	0	
Cell-specific reference symbols			Antenna port 0	Antenna port 0,1
CSI reference signal configuration			1	
Number of CSI reference signals configured			1	4
CSI reference signal subframe configuration			I_{CSI-RS} = 37	
N_{oc} at antenna port		dBm/15kHz	-98	
Number of allocated resource blocks		PRB	2	4
Unused REs and PRBs			OCNG (Note 2)	
Simultaneous transmission (Note 3)			No	
Beamforming Model			No precoding	a precoder vector $W(i)$ of size 4×1 is randomly selected with the number of layers $\upsilon=1$ from Table 6.3.4.2.3-2 in TS 36.211 as beamforming weights
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms	
Note 1: as specified in Table 5.4-1 in TS 36.216 Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs or other OCGN REs shall be uncorrelated pseudo random data, which is QPSK modulated. Note 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused. Note 4: $n_{\mathrm{SCID}}=0$				

Table 8.3.1.1.1-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10MHz	R.1 FDD	1OP.1 FDD	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	2.1
2	10 MHz	R.2 FDDTBD	1OP.1 FDD	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	11.5

8.3.1.1.2 TDD

For single-layer transmission on antenna port 7, the requirements are specified in Table 8.3.1.1.2-2, with parameters in Table 8.3.1.1.2-1.

Table 8.3.1.1.2-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 1	Test 2
Cyclic prefix			Normal	
Cell ID			0	
Un subframe type in DeNB			Normal subframe	
Uplink downlink configuration			1	
SubframeConfigurationTDD			4	
Number of OFDM symbols for PDCCH		OFDM symbols	2	
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)	
Downlink power allocation	R-PDCCH_RA OCNG_RA	dB	0	
	R-PDCCH_RB OCNG_RB	dB	0	
Cell-specific reference symbols			Antenna port 0	Antenna port 0,1
CSI reference signal configuration			1	
Number of CSI reference signals configured			1	4
CSI reference signal subframe configuration			I_{CSI-RS} = 35	
N_{oc} at antenna port		dBm/15kHz	-98	
Number of allocated resource blocks		PRB	2	4
Unused REs and PRBs			OCNG (Note 2)	
Simultaneous transmission (Note 3)			No	
Beamforming Model			No precoding	a precoder vector $W(i)$ of size 4×1 is randomly selected with the number of layers $\upsilon=1$ from Table 6.3.4.2.3-2 in TS 36.211 as beamforming weights
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms	

Note 1: as specified in Table 5.4-1 in TS 36.216
Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs or other OCNG REs shall be uncorrelated pseudo random data, which is QPSK modulated.
Note 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused.
Note 4: $n_{SCID}=0$

Table 8.3.1.1.2-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10MHz	R.1 TDD	OP.1 TDD	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	2.1
2	10 MHz	R.2 TDD	OP.1 TDD	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	11.5

8.3.1.2 R-PDCCH format with cross-interleaving

8.3.1.2.1 FDD

[TBD]

8.3.1.2.2 TDD

[TBD]

8.4 RRM aspects

<Text will be added>

9 Access link requirements

9.1 Transmitter

9.1.1 General

Unless otherwise stated, the requirements in sub-section 9.1 are expressed for a single transmitter antenna connector. In case of multi-carrier transmission with one or multiple transmitter antenna connectors, transmit diversity or MIMO transmission, the requirements apply for each transmitter antenna connector.

Unless otherwise stated, the transmitter characteristics are specified at the Relay antenna connector (test port A) with a full complement of transceivers for the configuration in normal operating conditions. If any external apparatus such as a TX amplifier, a filter or the combination of such devices is used, requirements apply at the far end antenna connector (port B in figure 8.1.1-1).

Unless otherwise stated the access link requirements in sub-section 9.1 applies at all times, i.e. during the Transmitter ON period, the Transmitter OFF period and the Transmitter transient period.

9.1.2 Output power

The rated output power for access link is listed in Table 9.1.2-1.

Table 9.1.2-1 Relay Rated output power

Relay power class	PRAT	Tolerance [dB] for normal conditions	Tolerance [dB) for extreme conditions
Power class 1	< + 24 dBm (for one transmit antenna port) < + 21 dBm (for two transmit antenna ports) < + 18 dBm (for four transmit antenna ports) < + 15 dBm (for eight transmit antenna ports)	±2 of rated output power declared by manufacturer	±2.5 of rated output power declared by manufacturer
Power class 2	< + 30 dBm (for one transmit antenna port) < +27 dBm (for two transmit antenna ports) < + 24dBm (for four transmit antenna ports) * < + 21dBm (for eight transmit antenna ports)*	±2 of rated output power declared by manufacturer	±2.5 of rated output power declared by manufacturer

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

9.1.3 Output power dynamics

The requirements in subclause 9.1.3 apply during the transmitter ON period. Transmit signal quality (as specified in subclause of RN access link signal quality) shall be maintained for the output power dynamics requirements of this clause.

Power control is used to limit the interference level.

9.1.3.1 RE Power control dynamic range

The RE Power control dynamic range for Relay access link should be applied the same requirement defined in subclause 6.3.1 of TS36.104.

9.1.3.2 Total power dynamic range

The Total power dynamic range for Relay access link should be applied the same requirement defined in subclause 6.3.2 of TS36.104.

9.1.3.3 Transmit ON/OFF power

The requirement in this subclause is only applied for TDD Relay access link.

9.1.3.3.1 Transmitter OFF power

The transmitter off power for Relay access link should be applied the same requirement defined in subclause 6.4.1 of TS36.104.

9.1.3.3.2 Transmitter transient period

The transmitter transient period for Relay access link should be applied the same requirement defined in subclause 6.4.2 of TS36.104.

9.1.4 Transmitted signal quality

9.1.4.1 Frequency error

Frequency error is the measure of the difference between the actual transmitting frequency of Relay access link and the assigned frequency. The modulated carrier frequency of Relay access link shall be accurate to within the accuracy range of [±0.1] PPM observed over a period of one subframe(1ms).

9.1.4.2 Error Vector Magnitude

The EVM requirements in subclause 6.5.2 of TS36.104 [7] apply for the access link.

9.1.4.3 Time alignment between different branches

The time alignment requirements in subclause 6.5.3 of TS36.104 [7] apply for the access link.

9.1.4.4 DL RS power

DL RS power is the resource element power of the Downlink Reference Symbol.

The absolute DL RS power is indicated on the DL-SCH. The absolute accuracy is defined as the maximum deviation between the DL RS power indicated on the DL-SCH and the DL RS power of each E-UTRA carrier at the BS antenna connector.

The absolute DL RS power (Reference-signal power) is signaled via broadcast (SIB). It is used for UL power control, i.e. the calculation of pathloss. In both UTRA and E-UTRA BS specs the minimum requirements is ±2.1dB and it's proposed to reuse this requirement for Relay Access Link.

9.1.5 Unwanted emissions

9.1.5.1 Adjacent Channel Leakage power Ratio (ACLR)

ACIR defines the protection against adjacent channel interference. In the access downlink, ACIR is determined by relay ACLR and UE ACS, in which UE ACS is assumed to be 33dB. According to the Relay coexistence simulation results, ACLR requirements for Relay backhaul transmitter shall be 45dB. The E-UTRA BS ACLR requirements defined in TS36.104 [7] are applied to the transmitter of Relay node access link.

9.1.5.2 Operating Band Unwanted Emission

The access link of Relay supports the 24 dBm and 30 dBm output power. And different operating band unwanted emissions are used for the two output power.

9.1.5.1.1 Operating Band Unwanted Emission (For 24 dBm Output Power)

For the 24 dBm output power, the operating band unwanted emission of local area BS for both category A and B in TS36.104 is reused.

9.1.5.2.2 Operating Band Unwanted Emission (For 30 dBm Output Power)

For the 30 dBm output power, the emissions shall not exceed the maximum levels specified in Tables 9.1.5.2.2-1 to 9.1.5.2.2-3.

Table 9.1.5.2.2-1: Relay operating band unwanted emission limits for 1.4 MHz channel bandwidth

Frequency offset of measurement filter -3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth (Note 1)
0 MHz ≤ Δf < 1.4 MHz	0.05 MHz ≤ f_offset < 1.45 MHz	$-15dBm-\frac{10}{1.4}\left(\frac{f\_offset}{MHz}-0.05\right)dB$	100 kHz
1.4 MHz ≤ Δf < 2.8 MHz	1.45 MHz ≤ f_offset < 2.85 MHz	-25 dBm	100 kHz
2.8 MHz ≤ Δf ≤ $Δf_{max}$	2.85 MHz ≤ f_offset < f_offset_{max}	-25 dBm	100 kHz

Table 9.1.5.2.2-2: Relay operating band unwanted emission limits for 3 MHz channel

Frequency offset of measurement filter -3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth (Note 1)
0 MHz ≤ Δf < 3 MHz	0.05 MHz ≤ f_offset < 3.05 MHz	$-19dBm-\frac{10}{3}\left(\frac{f\_offset}{MHz}-0.05\right)dB$	100 kHz
3 MHz ≤ Δf < 6 MHz	3.05 MHz ≤ f_offset < 6.05 MHz	-29 dBm	100 kHz
6 MHz ≤ Δf ≤ $Δf_{max}$	6.05 MHz ≤ f_offset < f_offset_{max}	-29 dBm	100 kHz

Table 9.1.5.2.2-3: Relay operating band unwanted emission limits for 5, 10, 15 and 20 MHz channel bandwidth

Frequency offset of measurement filter -3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth (Note 1)
0 MHz ≤ Δf < 5 MHz	0.05 MHz ≤ f_offset < 5.05 MHz	$-24dBm-\frac{7}{5}\left(\frac{f\_offset}{MHz}-0.05\right)dB$	100 kHz
5 MHz ≤ Δf < min(10 MHz, $Δf_{max}$)	5.05 MHz ≤ f_offset < min(10.05 MHz, f_offset_{max})	-31 dBm	100 kHz
10 MHz ≤ Δf ≤ $Δf_{max}$	10.05 MHz ≤ f_offset < f_offset_{max}	-31 dBm	100 kHz

9.1.5.3 Transmitter Spurious Emission

9.1.5.3.1 Mandatory requirement

The mandatory requirements of spurious emission are defined according to the ITU-R recommendation SM.329 and are independent of the type of transmitter considered. Therefore, the requirement defined in TS36.104 section 6.6.4.1 should be applied for Relay access link transmitter.

9.1.5.3.2 Protection of Relay access link receiver

This requirement is to protect the FDD Relay access link receivers that may be desensitised by emissions from a transmitter. For 24FDD Relay, the requirement for local area BS defined in TS36.104 section 6.6.4.2 shall be applied for Relay access link transmitter.

9.1.5.3.3 Additional spurious emission

These requirements are applied for the protection of specific equipment operating in specific systems (GSM, UTRA, E-UTRA, etc.) and are independent of the type of transmitter. The requirement defined in TS36.104 section 6.6.4.3 shall be applied for Relay access link transmitter.

9.1.5.3.4 Co-location with other Relays

For Relay access link, the spurious emission requirement defined in TS36.104 Table 6.6.4.4.1-2 for a local area BS co-located with another BS should be applied.

9.1.6 Transmitter intermodulation

The requirement defined section 6.7 in TS36.104 shall be applied to Relay access link transmitter.

9.2 Receiver

9.2.1 General

The requirements in sub-section 9.2 are expressed for a single receiver antenna connector. For receivers with antenna diversity, the requirements apply for each receiver antenna connector.

Unless otherwise stated, the receiver characteristics are specified at the Relay access link antenna connector (test port A in figure8.2.1-1) with a full complement of transceivers for the configuration in normal operating conditions. If any external apparatus such as a RX amplifier, a filter or the combination of such devices is used, requirements apply at the far end antenna connector (port B in figure 8.2.1-1).

Unless otherwise stated the requirements in sub-section 9.2 apply during the Relay access link receive period.

The throughput requirements defined for the receiver characteristics in this clause do not assume HARQ retransmissions.

9.2.2 Reference sensitivity

The reference sensitivity requirement for the access should not depend on operating band.

The reference sensitivity both for low (24dBm) and high (30dBm) power class should be defined in the same way as in TS 36.104 i.e. The throughput should be ≥ 95% of the maximum throughput of the reference measurement channel as specified in TS 36.104, Annex A with parameters specified in Table 8.2.2-1.

Table 9.2.2-1 Access antenna connector reference sensitivity

E-UTRA channel bandwidth [MHz]	Reference measurement channel of Annex A.1 in TS 36.104	Reference sensitivity power level, PREFSENS [dBm]	
		PRAT=24 dBm	PRAT=30 dBm
1.4	FRC A1-1	-98.8	-98.8
3	FRC A1-2	-95.0	-95.0
5	FRC A1-3	-93.5	-93.5
10	FRC A1-3*	-93.5	-93.5
15	FRC A1-3*	-93.5	-93.5
20	FRC A1-3*	-93.5	-93.5
Note*: $P_{REFSENS}$ is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of FRC A1-3 mapped to disjoint frequency ranges with a width of 25 resource blocks each			

9.2.3 In-channel selectivity

For the relay access link in-channel selectivity, the requirement for local area BS defined in TS 36.104 Section 7.4 is reused for both 24dBm and 30dBm power class.

For high power class (30dBm), the in-channel selectivity is FFS.

9.2.4 Adjacent Channel Selectivity (ACS)

According to the Relay coexistence simulation results, the BS ACS requirement should be reused for Relay node access link. For Relay node access link with both PRAT=24dBm and PRAT=30dBm, the ACS requirements defined in sub-clause 7.5.1 of TS36.104 [7] for local area (Pico) BS are applied.

9.2.5 Receiver Dynamic Range

For the relay access link dynamic range the requirement for local area BS in TS 36.104 is reused for both 24dBm and 30dBm power class.

For high power class (30dBm), the dynamic range is FFS.

9.2.6 Blocking characteristics

The blocking characteristic is a measure of the receiver ability to receive a wanted signal at its assigned channel in the presence of an unwanted interferer, which is either a 1.4 MHz, 3 MHz or 5 MHz E-UTRA signal for in-band blocking or a CW signal for out-of-band blocking. For the out-of-band blocking, the same requirement which is a -15 dBm CW signal as for general purpose BS may apply to the RN. In this paper, both the high power class (30dBm) and low power class (24dBm) cases are simulated. The deployment scenario and simulation assumptions are the same as in [9].

The total received power level at RN in 10 MHz bandwidth in Macro operating frequency from MUEs is calculated. Moreover, it is assumed that the macro UEs will be blocked due to the signal from RN, and this blocking threshold is configured as -39dBm (5dB higher than the blocking level of –44 dBm). The figure 9.2.6-1 and figure 9.2.6-2 show the CDF curves of total received power at 30dBm and 24dBm RN from aggressive Macro UEs respectively. The worst case appears when the Macro BS from the aggressive system and the one from victim system are co-sited as well as the Macro ISD equals 500m. It is observed that in all cases the interference levels will be less than -35dBm.

Therefore, It is proposed that the Relay access link blocking level can reuse the one for Pico NB.

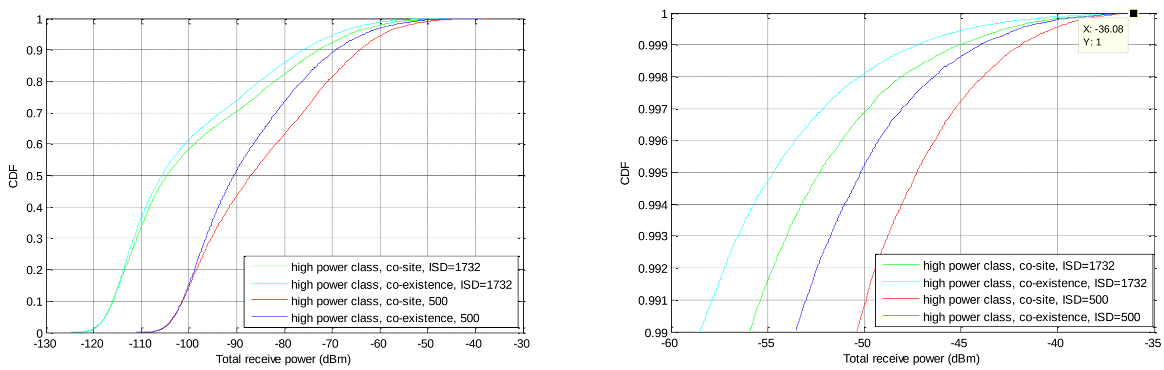


Figure. 9.2.6-1: CDF of the total received blocking power of high power class RN (normal and zoomed version)

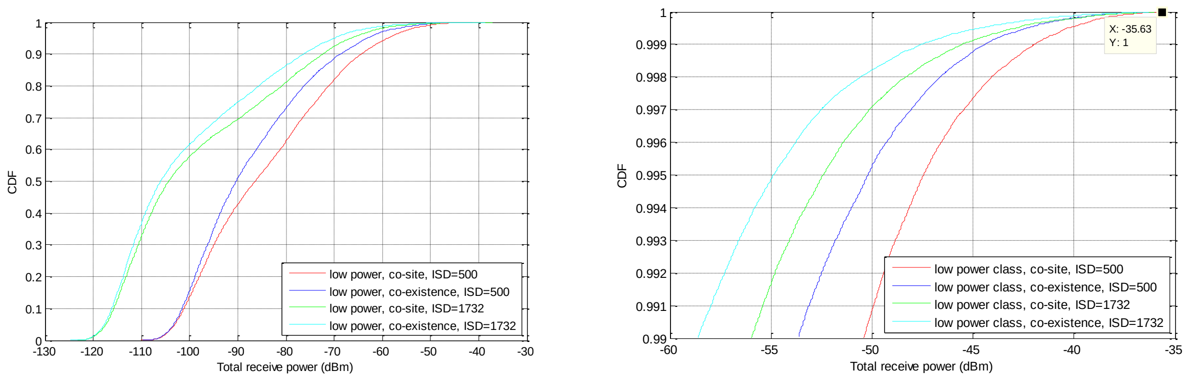


Figure. 9.2.6-2: CDF of the total received blocking power of low power class RN (normal and zoomed version)

For co-location blocking requirement, it is applied for the protection of Relay access link receivers when co-located with a BS of the same class operating in a different frequency band. Based on the assumption that the minimum coupling loss between co-located interfering transmitter and receiver is 30dB, the interfering signal mean power should be -6dBm for Relay access link with PRAT =24dBm. Therefore, the co-location blocking requirements defined in TS36.104 subclause 7.6.2 for Local Area BS shall be applied. For Relay access link with PRAT=30dBm, the interfering signal mean power from other co-located Relay should be 0dBm, and since Relay is deployed in E-UTRA bands, the co-location blocking requirement for GSM/UTRA bands is not necessary.

9.2.7 Narrow band blocking

The reference sensitivity for both low power and high power classes in access link are the same as LA BS. The narrow band blocking requirements for LA BS in TS36.104 section 7.5.1 is reused for relay access link.

9.2.8 Receiver spurious emissions

The requirement at TS36.104 should be applied to relay access link.

9.2.9 Receiver intermodulation

The requirements for receiver intermodulation in TS36.104 subclause 7.8 should be applied to relay access link with power class 1 and power class 2.

The intermodulation for Relay access link with power class 2 is FFS.

9.3 Performance

9.3.1 Performance requirements for PUSCH

9.3.1.1 Requirements in multipath fading propagation conditions

The PUSCH performance requirements in multipah fading propagation conditions are the same as defined in TS 36.104 [7]. The requirements associated with ETU 70Hz or ETU 300Hz are optional.

9.3.1.2 Requirements for UL timing adjustment

The requirements for UL timing adjustment are the same as defined in TS 36.104 [7].

9.3.1.3 Requirements for HARQ-ACK multiplexed on PUSCH

The performance requirements for HARQ-ACK multiplexed on PUSCH are the same as defined in TS 36.104 [7]. The requirements associated with ETU 70Hz are optional.

9.3.2 Performance requirements for PUCCH

9.3.2.1 DTX to ACK performance

The DTX to ACK performance requirements are the same as defined in TS 36.104 [7].

9.3.2.2 ACK missed detection requirements for single user PUCCH format 1a

The ACK missed detection requirements for single user PUCCH format 1a are the same as defined in TS 36.104 [7]. The requirements associated with ETU 70Hz or ETU 300Hz are optional.

9.3.2.3 CQI missed detection requirements for PUCCH format 2

The CQI missed detection requirements for PUCCH format 2 are the same as defined in TS 36.104 [7]. The requirements associated with ETU 70Hz are optional.

9.3.2.4 ACK missed detection requirements for multi user PUCCH format 1a

The ACK missed detection requirements for multi user PUCCH format 1a are optional and are the same as defined in TS 36.104 [7].

9.3.3 Performance requirements for PRACH

9.3.3.1 PRACH False alarm probability

The requirements for PRACH False alarm probability are the same as defined in TS 36.104 [7].

9.3.3.2 PRACH detection requirements

The PRACH detection requirements are the same as defined in TS 36.104 [7]. The requirements associated with ETU 70Hz are optional.

9.4 RRM aspects

9.4.1 Synchronization Requirement

The cell phase synchronization accuracy for a relay is defined as the maximum absolute deviation in frame start timing between the relay's access link DL transmission and its donor cell's DL transmission. A relay may support one of two synchronization cases: DL Case 1 and DL Case 3 as defined by RAN1 [*Editor's Note: FFS if we refer to RAN1 or if better terminology not referring to RAN1 is needed]*. It is optional for a relay to support either of the two cases as determined by RAN1. The requirements for the two cases are different and are given below.

In the case of DL Case 1, the transmit frame start timing of the relay's access downlink is set based on the time at which it receives the backhaul transmission from the donor cell. The minimum requirement on cell phase synchronization accuracy when using DL Case 1 is as follows for both FDD and TDD:

Table 9.4.1-1 Requirement for relay using DL Case 1

Donor Cell Type	Cell Radius	Requirement
Any	Any	$\leq 17\ \mu s + T_{prop}$

T_{prop} is the propagation delay between the relay and its donor cell.

In the case of DL Case 3, the transmit frame start timing of the relay's access downlink is set to be close to the transmission of the donor cell. The minimum requirement on cell phase synchronization accuracy when using DL Case 3 is as follows for both FDD and TDD:

Table 9.4.1-2 Requirement for relay using DL Case 3

Donor Cell Type	Cell Radius	Requirement
Small cell	≤ 3 km	≤ 3 μs
Large cell	> 3 km	≤ 10 μs

Whether the case1 should be precluded for TDD RN located within TBD distance away from its donor eNB and other limitations of application of one or both cases above in some scenarios are FFS.

10 Conformance test aspects

10.1 Performance requirements for access link requirements

10.1.1 Performance requirements for PUSCH

10.1.1.1 Requirements in multipath fading propagation conditions

The definition and applicability is the same as defined in TS 36.141 [12] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz or ETU 300Hz are optional.

The minimum requirement is defined in subclause 9.3.1.1.

The test purpose, test method and test requirement in multipath fading propagation conditions are the same as defined in TS 36.141 [12].

10.1.1.2 Requirements for UL timing adjustment

The definition and applicability is the same as defined in TS 36.141 [12] except that the conformance test is applied for a relay.

The minimum requirement is defined in subclause 9.3.1.2.

The test purpose, test method and test requirement for UL timing adjustment are the same as defined in TS 36.141 [12].

10.1.1.3 Requirements for HARQ-ACK multiplexed on PUSCH

The definition and applicability is the same as defined in TS 36.141 [12] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz are optional.

The minimum requirement is defined in subclause 9.3.1.3.

The test purpose, test method and test requirement for HARQ-ACK multiplexed on PUSCH are the same as defined in TS 36.141 [12].

10.1.2 Performance requirements for PUCCH

10.1.2.1 ACK missed detection requirements for single user PUCCH format 1a

The definition and applicability is the same as defined in TS 36.141 [12] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz or ETU 300Hz are optional.

The minimum requirements are defined in subclause 9.3.2.1 for DTX to ACK performance and subclause 9.3.2.2 for ACK missed detection.

The test purpose, test method and test requirement for PUCCH format 1a are the same as defined in TS 36.141 [12].

10.1.2.2 CQI missed detection requirements for PUCCH format2

The definition and applicability is the same as defined in TS 36.141 [12] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz are optional.

The minimum requirements are defined in subclause 9.3.2.3.

The test purpose, test method and test requirement for PUCCH format 2 are the same as defined in TS 36.141 [12].

10.1.2.3 ACK missed detection requirements for multi user PUCCH format 1a

The requirements for multi user PUCCH format 1a are optional. The definition and applicability is the same as defined in TS 36.141 [12] except that the conformance test is applied for a relay.

The minimum requirements are defined in subclause 9.3.2.4.

The test purpose, test method and test requirement for multi user PUCCH format 1a are the same as defined in TS 36.141 [12].

10.1.3 Performance requirements for PRACH

10.1.3.1 PRACH false alarm probability and missed detection

The definition and applicability is the same as defined in TS 36.141 [12] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz are optional.

The minimum requirements are defined in subclause 9.3.3.

The test purpose, test method and test requirement for PRACH are the same as defined in TS 36.141 [12].

10.2 Demodulation of R-PDCCH

10.2.1 FDD

10.2.1.1 FDD R-PDCCH performance based on UE-specific reference signals transmitted on antenna port 7 with 1x2 antenna configuration

10.2.1.1.1 Test purpose

This test verifies the demodulation performance of R-PDCCH when R-PDCCH is based on UE-specific reference signals transmitted on antenna port 7 with 1x2 antenna configuration. With a given SNR, the average probability of miss-detection of the Downlink Scheduling Grant for RN, tested on R-PDCCH of the specified reference measurement channels in B.1.1.1 remains below a given reference value.

10.2.1.1.2 Test applicability

This test applies to all types of E-UTRA FDD relay node release 11 and forward.

10.2.1.1.3 Minimum conformance requirements

The receiver characteristics of the R-PDCCH are determined by the probability of miss-detection of the relay Downlink Scheduling Grant (Pm-dsg).

Table 10.2.1.1.3-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 1
Cyclic prefix			Normal
Cell ID			0
Un subframe type in DeNB			Normal subframe
SubframeConfigurationFDD			10110101
Number of OFDM symbols for PDCCH		OFDM symbols	2
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)
Downlink power allocation	R-PDCCH_RA	dB	0
	R-PDCCH_RB	dB	0
Cell-specific reference symbols			Antenna port 0
CSI reference signal configuration			1
Number of CSI reference signals configured			1
CSI reference signal subframe configuration			I_{CSI-RS} = 37
N_{oc} at antenna port		dBm/15kHz	-98
Number of allocated resource blocks		PRB	2
Symbols for unused PRBs			OCNG (Note 2)
Simultaneous transmission (Note 3)			No
Beamforming Model			No precoding
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms
Note 1: as specified in Table 5.4-1 in TS 36.216 Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. Note 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused. Note 4: $n_{SCID} = 0$			

For the parameters specified in Table 10.2.1.1.3-1 the average probability of a missed relay downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 10.2.1.1.3-2.

Table 10.2.1.1.3-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10MHz	R.1 FDD	Table B.2.1-1	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	2.1

10.2.1.1.4 Test description

10.2.1.1.4.1 Initial conditions

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

Configurations of PDSCH and PDCCH before measurement are specified in TS 36.521-1 [10] Annex C.2.

Test Environment: Normal, as defined in TS 36.508 [11] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 36.508 [11] clause 4.3.1.1.

Channel Bandwidths to be tested: 10MHz, as defined in TS 36.508 [11] clause 4.3.1.1

1. Connect the SS, the faders and AWGN noise source to the RN antenna connector (s) as shown in TS 36.508 [11] Annex A, Figure A.9.

2. The parameter settings for the cell are set up according to Table 10.2.1.1.3-1.

3. The backhaul signals except for R-PDCCH are initially set up according to Annex C.1 and Annex C.3.2 defined in TS36.521-1[10] and uplink signals according to Annex H.1 and H.3.2 defined in TS36.521-1[10]. R-PDCCH is mapped to physical resources according to Table 10.2.1.1.3-1, Table 10.2.1.1.3-2 and Table B.1.1.1-1. The signals of R-PDCCH are initially set up according to Annex C.1.

4. Propagation conditions are set according to Annex A clause A.1.

5. Ensure the RN is in State 3A-RF according to TS 36.508 [11] clause 5.2A.2 with the following exceptions. Message contents are defined in clause 10.2.1.1.4.3.

Table 10.2.1.1.4.1-1: RN registration with test mode activation procedure (state 1 to state 2A)

Step	Procedure	Message Sequence	
		R - S	Message
1 to 17	Same procedure for steps 1 to 17 as specified in the procedure in Table 4.5.2A.3-1 [36.508]		
18	The SS transmits an *RNReconfiguration message to configurate the backhaul link*	<--	RRC: *RNReconfiguration*
19	The RN transmits an *RNReconfigurationComplete message to comfirm the configuration of backhal link*	-->	RRC: *RNReconfigurationComplete*
20	This message includes the ATTACH COMPLETE message. The ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT message is piggybacked in ATTACH COMPLETE.	-->	RRC: *ULInformationTransfer* NAS: ATTACH COMPLETE NAS: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT
21	The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC_IDLE (State 2A).	<--	RRC: *RRCConnectionRelease*

10.2.1.1.4.2 Test procedure

1. SS transmits PDSCH via R-PDCCH DCI format 2C for C_RNTI to transmit the DL RMC according to Table 10.2.1.1.3-1 and Table 10.2.1.1.3-2.The details of R-PDCCH and PDSCH are specified in Table B.1.1.1-1 and R.3 FDD in Table C.2-1respectively. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 10.2.1.1.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.4 defined in TS 36.521-1[10]. 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 10.2.1.1.5-1, pass the RN. Otherwise fail the RN. 10.2

10.2.1.1.4.3 Message contents

Message contents are according to TS 36.508 [11] clause 4.6 with the following exceptions.

Table 10.2.1.1.4.3-1: RRCConnectionSetupComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RRCConnectionSetupComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE {			
rrcConnectionSetupComplete-r8 SEQUENCE {			
selectedPLMN-Identity	1		
registeredMME	Not checked		
dedicatedInfoNAS	Present but contents not checked		
nonCriticalExtension SEQUENCE {			
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE {			
gummei-Type-r10	native		
rlf-InfoAvailable-r10	true		
logMeasAvailable-r10	true		
rn-SubframeConfigReq-r10	required		
nonCriticalExtension SEQUENCE{}	No checked		
}			
}			
}			
}			
}			
}			

Table10.2.1.1.4.3-2: RNReconfiguration

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfiguration ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-DL		
criticalExtensions CHOICE {			
c1 CHOISE {			
RnReconfiguration-r10 SEQUENCE{			
rn-SystemInfo-r10{}	Not checked		
rn-SubframeConfig-r10	RN-SubframeConfig-r10		
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE{}	Not checked		
}			
}			
}			

Table 10.2.1.1.4.3-3: RN-SubframeConfig

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RN-SubframeConfig-r10::= SEQUENCE {			
subframeConfigPattern-r10 CHOICE{			
subframeConfigPatternFDD-r10	10110101		
}			
rpdcch-Config-r10 SEQUENCE{			
resourceAllocationType-r10	type0		
resourceBlockAssignment-r10 CHOICE{			
type01-r10 SEQUENCE{			
nrb50-r10	0000 0000 1000 0000 0		
}			
}			
demodulationRS-r10 CHOICE{			
noInterleaving-r10	dmrs		
}			
pdsch-Start-r10	3		
pucch-Config-r10 CHOICE{			
fdd SEQUENCE{			
n1PUCCH-AN-P0-r10	0		
n1PUCCH-AN-P1-r10	Not checked]		
}			
}			
}			
}			

Table 10.2.1.1.4.3-4: RNReconfigurationComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfigurationComplete::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE{			
rnReconfigurationComplete-r10 SEQUENCE{			
lateNonCriticalExtension	Not checked		
nonCriticalExtension	Not checked		
}			
}			
criticalExtensionsFuture SEQUENCE{}	Not checked		
}			
}			

10.2.1.1.5 Test requirement

For the parameters specified in Table 10.2.1.1.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 10.2.1.1.5-1.

Table 10.2.1.1.5-1: Test requirement R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10MHz	R.1 FDD	Table B.2.1-1	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	3.1

10.2.1.2 FDD R-PDCCH performance based on UE-specific reference signals transmitted on antenna port 7 with 4x2 antenna configuration

10.2.1.2.1 Test purpose

This test verifies the demodulation performance of R-PDCCH when R-PDCCH is based on UE-specific reference signals transmitted on antenna port 7 with 4x2 antenna configuration. With a given SNR, the average probability of miss-detection of the Downlink Scheduling Grant for RN, tested on R-PDCCH of the specified reference measurement channels in B.1.1.1 remains below a given reference value.

10.2.1.2.2 Test applicability

This test applies to all types of E-UTRA FDD relay node release 11 and forward.

10.2.1.2.3 Minimum conformance requirements

The receiver characteristics of the R-PDCCH are determined by the probability of miss-detection of the relay Downlink Scheduling Grant (Pm-dsg).

Table 10.2.1.2.3-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 2
Cyclic prefix			Normal
Cell ID			0
Un subframe type in DeNB			Normal subframe
SubframeConfigurationFDD			10110101
Number of OFDM symbols for PDCCH		OFDM symbols	2
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)
Downlink power allocation	R-PDCCH_RA	dB	0
	R-PDCCH_RB	dB	0
Cell-specific reference symbols			Antenna port 0,1
CSI reference signal configuration			1
Number of CSI reference signals configured			4
CSI reference signal subframe configuration			$I_{\text{CSI-RS}}$ = 37
N_{oc} at antenna port		dBm/15kHz	-98
Number of allocated resource blocks		PRB	4
Symbols for unused PRBs			OCNG (Note 2)
Simultaneous transmission (Note 3)			No
Beamforming Model			a precoder vector $W(i)$ of size 4×1 is randomly selected with the number of layers $\upsilon = 1$ from Table 6.3.4.2.3-2 in TS 36.211 as beamforming weights
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms
Note 1: as specified in Table 5.4-1 in TS 36.216 Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. Note 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused. Note 4: $n_{\text{SCID}} = 0$			

For the parameters specified in Table 10.2.1.2.3-1 the average probability of a missed relay downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 10.2.1.2.3-2.

Table 10.2.1.2.3-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
2	10MHz	R.2 FDD	Table B.2.1-1	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	11.5

10.2.1.2.4 Test description

10.2.1.2.4.1 Initial conditions

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

Configurations of PDSCH and PDCCH before measurement are specified in TS 36.521-1 [10] Annex C.2.

Test Environment: Normal, as defined in TS 36.508 [11] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 36.508 [11] clause 4.3.1.1.

Channel Bandwidths to be tested: 10MHz, as defined in TS 36.508 [11] clause 4.3.1.1

1. Connect the SS, the faders and AWGN noise source to the RN antenna connector (s) as shown in TS 36.508 [11] Annex A, Figure A.11.
2. The parameter settings for the cell are set up according to Table 10.2.1.2.3-1.
3. The backhaul signals except for R-PDCCH are initially set up according to Annex C.1 and Annex C.3.2 and uplink signals according to Annex H.1 and H.3.2 defined in TS36.521-1[10]. R-PDCCH is mapped to physical resource according to Table 10.2.1.2.3-1, Table 10.2.1.2.3-2 and Table B.1.1.1-1. The signals of R-PDCCH are initially set up according to Annex C.1.
4. Propagation conditions are set according to Annex A clause A.1.
5. Ensure the RN is in State 3A-RF according to TS 36.508 [11] clause 5.2A.2 with the following exceptions. Message contents are defined in clause 10.2.1.2.4.3.

Table 10.2.1.2.4.1-1: RN registration with test mode activation procedure (state 1 to state 2A)

Step	Procedure	Message Sequence	
		R - S	Message
1 to 17	Same procedure for steps 1 to 17 as specified in the procedure in Table 4.5.2A.3-1 [36.508]		
18	The SS transmits an *RNReconfiguration message to configurate the backhaul link*	<--	RRC: *RNReconfiguration*
19	The RN transmits an *RNReconfigurationComplete message to comfirm the configuration of backhal link*	-->	RRC: *RNReconfigurationComplete*
20	This message includes the ATTACH COMPLETE message. The ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT message is piggybacked in ATTACH COMPLETE.	-->	RRC: *ULInformationTransfer* NAS: ATTACH COMPLETE NAS: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT
21	The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC_IDLE (State 2A).	<--	RRC: *RRCConnectionRelease*

10.2.1.2.4.2 Test procedure

1. SS transmits PDSCH via R-PDCCH DCI format 2C for C_RNTI to transmit the DL RMC according to Table 10.2.1.2.3-1 and Table 10.2.1.2.3-2. The details of R-PDCCH and PDSCH are specified in Table B1.1.1-1 and R.4 FDD in Table C.2-1 respectively. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 10.2.1.2.5-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.4 defined in TS 36.521-1[10]. 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 10.2.1.2.5-1, pass the UE. Otherwise fail the UE. If Pm-dsg is less than the value specified in table 10.2.1.2.5-1, pass the UE. Otherwise fail the UE.

10.2.1.2.4.3 Message contents

Message contents are according to TS 36.508 [11] clause 4.6 with the following exceptions [TBD].

Table 10.2.1.2.4.3-1: PhysicalConfigDedicated-DEFAULT

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
PhysicalConfigDedicated-DEFAULT ::= SEQUENCE {			
antennaInfo-r10 CHOICE {			
AntennaInfoDedicated-r10::= SEQUENCE {			
transmissionMode	tm9-v1020		
codebookSubsetRestriction-r10			
ue-TransmitAntennaSelection CHOICE {			
release	NULL		
}			
}			
}			
}			

Table 10.2.1.2.4.3-2: RRCConnectionSetupComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RRCConnectionSetupComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE {			
rrcConnectionSetupComplete-r8 SEQUENCE {			
selectedPLMN-Identity	1		
registeredMME	Not checked		
dedicatedInfoNAS	Present but contents not checked		
nonCriticalExtension SEQUENCE {			
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE {			
gummei-Type-r10	native		
rlf-InfoAvailable-r10	true		
logMeasAvailable-r10	true		
rn-SubframeConfigReq-r10	required		
nonCriticalExtension SEQUENCE{}	No checked		
}			
}			
}			
}			
}			
}			

Table 10.2.1.2.4.3-3: RNReconfiguration

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfiguration ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-DL		
criticalExtensions CHOICE {			
c1 CHOISE {			
RnReconfiguration-r10 SEQUENCE{			
rn-SystemInfo-r10{}	Not checked		
rn-SubframeConfig-r10	RN-SubframeConfig-r10		
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE{}	Not checked		
}			
}			
}			

Table 10.2.1.2.4.3-4: *RN-SubframeConfig*

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RN-SubframeConfig-r10::= SEQUENCE {			
subframeConfigPattern-r10 CHOICE{			
subframeConfigPatternFDD-r10	10110101		
}			
rpdcch-Config-r10 SEQUENCE{			
resourceAllocationType-r10	Type0		
resourceBlockAssignment-r10 CHOICE{			
type01-r10 SEQUENCE{			
nrb50-r10	0000 0001 1000 0000 0		
}			
}			
demodulationRS-r10 CHOICE{			
noInterleaving-r10	dmrs		
}			
pdsch-Start-r10	3		
pucch-Config-r10 CHOICE{			
fdd SEQUENCE{			
n1PUCCH-AN-P0-r10	0		
n1PUCCH-AN-P1-r10	Not checked		
}			
}			
}			
}			

Table 10.2.1.2.4.3-5: RNReconfigurationComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfigurationComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE{			
rnReconfigurationComplete-r10 SEQUENCE{			
lateNonCriticalExtension	Not checked		
nonCriticalExtension	Not checked		
}			
}			
criticalExtensionsFuture SEQUENCE{}	Not checked		
}			
}			

10.2.1.2.5 Test requirement

For the parameters specified in Table 10.2.1.2.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 10.2.1.2.5-1.

Table 10.2.1.2.5-1: Test requirement R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
2	10MHz	R.2 FDD	Table B.2.1-1	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	12.5

10.2.2 TDD

10.2.2.1 TDD R-PDCCH performance based on UE-specific reference signals transmitted on antenna port 7 with 1x2 antenna configuration

10.2.2.1.1 Test purpose

This test verifies the demodulation performance of R-PDCCH when R-PDCCH is based on UE-specific reference signals transmitted on antenna port 7 with 1x2 antenna configuration. With a given SNR, the average probability of miss-detection of the Downlink Scheduling Grant for RN, tested on R-PDCCH of the specified reference measurement channels in B.1.1.2 remains below a given reference value.

10.2.2.1.2 Test applicability

This test applies to all types of E-UTRA TDD relay node release 11 and forward.

10.2.2.1.3 Minimum conformance requirements

The receiver characteristics of the R-PDCCH are determined by the probability of miss-detection of the relay Downlink Scheduling Grant (Pm-dsg).

Table 10.2.2.1.3-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 1
Cyclic prefix			Normal
Cell ID			0
Un subframe type in DeNB			Normal subframe
SubframeConfigurationTDD			4
Number of OFDM symbols for PDCCH		OFDM symbols	2
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)
Downlink power allocation	R-PDCCH_RA	dB	0
	R-PDCCH_RB	dB	0
Cell-specific reference symbols			Antenna port 0
CSI reference signal configuration			1
Number of CSI reference signals configured			1
CSI reference signal subframe configuration			$I_{\text{CSI-RS}} = 35$
N_{oc} at antenna port		dBm/15kHz	-98
Number of allocated resource blocks		PRB	2
Symbols for unused PRBs			OCNG (Note 2)
Simultaneous transmission (Note 3)			No
Beamforming Model			No precoding
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms
Note 1: as specified in Table 5.4-1 in TS 36.216 Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. Note 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused. Note 4: $n_{\text{SCID}} = 0$			

For the parameters specified in Table 10.2.2.1.3-1 the average probability of a missed relay downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 10.2.2.1.3-2.

Table 10.2.2.1.3-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10MHz	R.1 TDD	Table B.2.1-1	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	2.1

10.2.2.1.4 Test description

10.2.2.1.4.1 Initial conditions

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

Configurations of PDSCH and PDCCH before measurement are specified in TS 36.521-1 [10] Annex C.2.

Test Environment: Normal, as defined in TS 36.508 [11] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 36.508 [11] clause 4.3.1.1.

Channel Bandwidths to be tested: 10MHz, as defined in TS 36.508 [11] clause 4.3.1.1

1. Connect the SS, the faders and AWGN noise source to the RN antenna connector (s) as shown in TS 36.508 [11] Annex A, Figure A.9.

2. The parameter settings for the cell are set up according to Table 10.2.2.1.3-1.

3. The backhaul link downlink signals except for R-PDCCH are initially set up according to Annex C.1 and Annex C.3.2 and uplink signals according to Annex H.1 and H.3.2 defined in TS36.521-1[10]. R-PDCCH is mapped to physical resources according to Table 10.2.2.1.3-1, Table 10.2.2.1.3-2 and Table B.1.1.2-1. The signals of R-PDCCH are initially set up according to AnnexC.1.

4. Propagation conditions are set according to Annex A clause A.1.

5. Ensure the RN is in State 3A-RF according to TS 36.508 [11] clause 5.2A.2 with the following exception. Message contents are defined in clause 10.2.2.1.4.3.

Table 10.2.2.1.4.1-1: RN registration with test mode activation procedure (state 1 to state 2A)

Step	Procedure	Message Sequence	
		R - S	Message
1 to 17	Same procedure for steps 1 to 17 as specified in the procedure in Table 4.5.2A.3-1 [36.508]		
18	The SS transmits an *RNReconfiguration message to configurate the backhaul link*	<--	RRC: *RNReconfiguration*
19	The RN transmits an *RNReconfigurationComplete message to comfirm the configuration of backhal link*	-->	RRC: *RNReconfigurationComplete*
20	This message includes the ATTACH COMPLETE message. The ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT message is piggybacked in ATTACH COMPLETE.	-->	RRC: *ULInformationTransfer* NAS: ATTACH COMPLETE NAS: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT
21	The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC_IDLE (State 2A).	<--	RRC: *RRCConnectionRelease*

10.2.2.1.4.2 Test procedure

1. SS transmits PDSCH via R-PDCCH DCI format 2C for C_RNTI to transmit the DL RMC according to Table 10.2.2.2.3-1 and Table 10.2.2.1.3-2.The details of R-PDCCH and PDSCH are specified in Table B1.1.2-1 and R.3 TDD in Table C.2-2 respectively. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 10.2.2.1.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.4 defined in TS 36.521-1[10]. 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 10.2.2.1.5-1, pass the RN. Otherwise fail the RN.

10.2.2.1.4.3 Message contents

Message contents are according to TS 36.508 [11] clause 4.6 with the following exceptions

Table 10.2.2.1.4.3-1: *RRCConnectionSetupComplete*

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RRCConnectionSetupComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE {			
rrcConnectionSetupComplete-r8 SEQUENCE {			
selectedPLMN-Identity	1		
registeredMME	Not checked		
dedicatedInfoNAS	Present but contents not checked		
nonCriticalExtension SEQUENCE {			
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE {			
gummei-Type-r10	native		
rlf-InfoAvailable-r10	true		
logMeasAvailable-r10	true		
rn-SubframeConfigReq-r10	required		
nonCriticalExtension SEQUENCE{}	No checked		
}			
}			
}			
}			
}			
}			

Table 10.2.2.1.4.3-2: *RNReconfiguration*

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfiguration ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-DL		
criticalExtensions CHOICE {			
c1 CHOISE {			
RnReconfiguration-r10 SEQUENCE{			
rn-SystemInfo-r10{}	Not checked		
rn-SubframeConfig-r10	RN-SubframeConfig-r10		
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE{}	Not checked		
}			
}			
}			

Table 10.2.2.1.4.3-3: *RN-SubframeConfig*

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RN-SubframeConfig-r10::= SEQUENCE {			
subframeConfigPattern-r10 CHOICE{			
subframeConfigPatternTDD-r10	4		
}			
rpdcch-Config-r10 SEQUENCE{			
resourceAllocationType-r10			
resourceBlockAssignment-r10 CHOICE{			
type01-r10 SEQUENCE{			
nrb50-r10	0000 0000 1000 0000 0		
}			
}			
demodulationRS-r10 CHOICE{			
noInterleaving-r10	dmrs		
}			
pdsch-Start-r10	3		
pucch-Config-r10 CHOICE{			
tdd choice{			
fallbackForFormat3 SEQUENCE{			
n1PUCCH-AN-P0-r10	0		
n1PUCCH-AN-P1-r10	Not checked		
}			
}			
}			
}			
}			

Table 10.2.2.1.4.3-4: *RNReconfigurationComplete*

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfigurationComplete::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE{			
rnReconfigurationComplete-r10 SEQUENCE{			
lateNonCriticalExtension	Not checked		
nonCriticalExtension	Not checked		
}			
}			
criticalExtensionsFuture SEQUENCE{}	Not checked		
}			
}			

10.2.2.1.5 Test requirement

For the parameters specified in Table 10.2.2.1.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 10.2.2.1.5-1.

Table 10.2.2.1.5-1: Test requirement R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10MHz	R.1 TDD	Table B.2.1-1	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	3.1

10.2.2.2 TDD R-PDCCH performance based on UE-specific reference signals transmitted on antenna port 7 with 4x2 antenna configuration

10.2.2.2.1 Test purpose

This test verifies the demodulation performance of R-PDCCH when R-PDCCH is based on UE-specific reference signals transmitted on antenna port 7 with 4x2 antenna configuration. With a given SNR, the average probability of miss-detection of the Downlink Scheduling Grant for RN, tested on R-PDCCH of the specified reference measurement channels in B.1.1.2 remains below a given reference value.

10.2.2.2.2 Test applicability

This test applies to all types of E-UTRA TDD relay node release 11 and forward.

10.2.2.2.3 Minimum conformance requirements

The receiver characteristics of the R-PDCCH are determined by the probability of miss-detection of the relay Downlink Scheduling Grant (Pm-dsg).

Table 10.2.2.2.3-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 2
Cyclic prefix			Normal
Cell ID			0
Un subframe type in DeNB			Normal subframe
SubframeConfigurationTDD			4
Number of OFDM symbols for PDCCH		OFDM symbols	2
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)
Downlink power allocation	R-PDCCH_RA	dB	0
	R-PDCCH_RB	dB	0
Cell-specific reference symbols			Antenna port 0
CSI reference signal configuration			1
Number of CSI reference signals configured			4
CSI reference signal subframe configuration			I_{CSI-RS} = 35
N_{oc} at antenna port		dBm/15kHz	-98
Number of allocated resource blocks		PRB	4
Symbols for unused PRBs			OCNG (Note 2)
Simultaneous transmission (Note 3)			No
Beamforming Model			a precoder vector $W(i)$ of size 4×1 is randomly selected with the number of layers $\upsilon = 1$ from Table 6.3.4.2.3-2 in TS 36.211 as beamforming weights
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms
Note 1: as specified in Table 5.4-1 in TS 36.216 Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. Note 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused. Note 4: $n_{\mathrm{SCID}} = 0$			

For the parameters specified in Table 10.2.2.2.3-1 the average probability of a missed relay downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 10.2.2.2.3-2.

Table 10.2.2.2.3-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
2	10MHz	R.2 TDD	B.2.2-1	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	11.5

10.2.2.2.4 Test description

10.2.2.2.4.1 Initial conditions

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

Configurations of PDSCH and PDCCH before measurement are specified in TS 36.521-1 [10] Annex C.2.

Test Environment: Normal, as defined in TS 36.508 [11] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 36.508 [11] clause 4.3.1.1.

Channel Bandwidths to be tested: 10MHz, as defined in TS 36.508 [11] clause 4.3.1.1

1. Connect the SS, the faders and AWGN noise source to the RN antenna connector (s) as shown in TS 36.508 [11] Annex A, Figure A.11.
2. The parameter settings for the cell are set up according to Table 10.2.2.2.3-1.
3. The backhaul link downlink signals except for R-PDCCH are initially set up according to Annex C.1 and Annex C.3.2 and uplink signals according to Annex H.1 and H.3.2 defined in TS36.521-1[10]. R-PDCCH is mapped to physical resources according to Table 10.2.2.2.3-1, Table 10.2.2.2.3-2 and Table B.1.1.2-1. The signals of R-PDCCH are initially set up according to AnnexC.1.
4. Propagation conditions are set according to Annex A clause A.1.
5. Ensure the RN is in State 3A-RF according to TS 36.508 [11] clause 5.2A.2 with the following exceptions. Message contents are defined in clause 10.2.2.2.4.3.

Table 10.2.2.2.4.1-1: RN registration with test mode activation procedure (state 1 to state 2A)

Step	Procedure	Message Sequence	
		R - S	Message
1 to 17	Same procedure for steps 1 to 17 as specified in the procedure in Table 4.5.2A.3-1 [36.508]		
18	The SS transmits an *RNReconfiguration message to configurate the backhaul link*	<--	RRC: RNReconfiguration
19	The RN transmits an *RNReconfigurationComplete message to comfirm the configuration of backhal link*	-->	RRC: *RNReconfigurationComplete*
20	This message includes the ATTACH COMPLETE message. The ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT message is piggybacked in ATTACH COMPLETE.	-->	RRC: *ULInformationTransfer* NAS: ATTACH COMPLETE NAS: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT
21	The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC_IDLE (State 2A).	<--	RRC: *RRCConnectionRelease*

10.2.2.2.4.2 Test procedure

1. SS transmits PDSCH via R-PDCCH DCI format 2C for C_RNTI to transmit the DL RMC according to Table 10.2.2.2.2.3-1 and Table 10.2.2.2.3-2. The details of R-PDCCH and PDSCH are specified in Table B1.1.2-1 and R.4 TDD in Table C.2-2 respectively. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 10.2.2.2.5-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.4 defined in TS 36.521-1[10]. 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 10.2.2.2.5-1, pass the RN. Otherwise fail the RN.

10.2.2.2.4.3 Message contents

Message contents are according to TS 36.508 [11] clause 4.6 with the following exceptions.

Table 10.2.2.2.4.3-1: PhysicalConfigDedicated-DEFAULT

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
PhysicalConfigDedicated-DEFAULT ::= SEQUENCE {			
antennaInfo-r10 CHOICE {			
AntennaInfoDedicated-r10::= SEQUENCE {			
transmissionMode	tm9-v1020		
codebookSubsetRestriction-r10			
ue-TransmitAntennaSelection CHOICE {			
release	NULL		
}			
}			
}			
}			

Table 10.2.2.2.4.3-2: RRCConnectionSetupComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RRCConnectionSetupComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE {			
rrcConnectionSetupComplete-r8 SEQUENCE {			
selectedPLMN-Identity	1		
registeredMME	Not checked		
dedicatedInfoNAS	Present but contents not checked		
nonCriticalExtension SEQUENCE {			
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE {			
gummei-Type-r10	native		
rlf-InfoAvailable-r10	true		
logMeasAvailable-r10	true		
rn-SubframeConfigReq-r10	required		
nonCriticalExtension SEQUENCE{}	No checked		
}			
}			
}			
}			
}			
}			

Table 10.2.2.2.4.3-3: RNReconfiguration

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfiguration ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-DL		
criticalExtensions CHOICE {			
c1 CHOISE {			
RnReconfiguration-r10 SEQUENCE{			
rn-SystemInfo-r10{}	Not checked		
rn-SubframeConfig-r10	RN-SubframeConfig-r10		
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE{}	Not checked		
}			
}			
}			

Table 10.2.2.2.4.3-4: RN-SubframeConfig

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RN-SubframeConfig-r10::= SEQUENCE {			
subframeConfigPattern-r10 CHOICE{			
subframeConfigPatternTDD-r10	4		
}			
rpdcch-Config-r10 SEQUENCE{			
resourceAllocationType-r10	type0		
resourceBlockAssignment-r10 CHOICE{			
type01-r10 SEQUENCE{			
nrb50-r10	0000 0001 1000 0000 0		
}			
}			
demodulationRS-r10 CHOICE{			
noInterleaving-r10	dmrs		
}			
pdsch-Start-r10	3		
pucch-Config-r10 CHOICE{			
tdd choice{			
fallbackForFormat3 SEQUENCE{			
n1PUCCH-AN-P0-r10	0		
n1PUCCH-AN-P1-r10	Not checked		
}			
}			
}			
}			
}			

Table 10.2.2.2.4.3-5: RNReconfigurationComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfigurationComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE{			
rnReconfigurationComplete-r10 SEQUENCE{			
lateNonCriticalExtension	Not checked		
nonCriticalExtension	Not checked		
}			
}			
criticalExtensionsFuture SEQUENCE{}	Not checked		
}			
}			

10.2.2.2.5 Test requirement

For the parameters specified in Table 10.2.2.2.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 10.2.2.2.5-1.

Table 10.2.2.2.5-1: Test requirement R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
2	10MHz	R.2 TDD	B.2.2-1	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	12.5

Annex A: Propagation models for relay demodulation requirements

A.1 Propagation models for backhaul link

A.1.1 Delay Profiles

Three representative delay profiles are selected corresponding to the LOS and NLOS scenarios.

A.1.1.1 LOS between eNB and relay

Table A.1.1-1 and Table A.1.1-2 show the delay profiles for the LOS scenarios: one with strong dominant component and the other with medium dominant component. Note that the first tap in both Table A.1.1-1 and Table A.1.1-2 corresponds to the LOS component, it is therefore a non-fading tap and the corresponding Doppler frequency is 0.

Table A.1.1-1 Delay Profile for LOS Scenario (strong dominant component)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-21.0
70	-22.0
90	-23.0

Note that as the first tap is at least 21dB stronger than the rest taps, this channel may be considered as an AWGN channel. The exact one-tap static AWGN channel model is FFS.

Table A.1.1-2 Delay Profile for LOS Scenario (medium dominant component)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-11.0
70	-12.0
90	-13.0
110	-18.0
190	-27.2
[410]	[-30.8]

Note that as the first tap is at least 11dB stronger than the rest taps, this channel may be characterized by one dominant path combined with significant scattering paths.

A.1.1.2 NLOS between eNB and relay

For NLOS scenario, the delay profile is given in Table A.1.1-3.

Table A.1.1-3 Delay Profile for NLOS Scenario

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.0
70	-2.0
90	-3.0
110	-8.0
190	-17.2
410	-20.8

A.1.2 Doppler Frequency

For NLOS between the eNB and the relay, as the relay nodes are often fixed, hence a low Doppler frequency of 2Hz is used. Note that this 2Hz Doppler frequency is only used for the new channels (such as R-PDCCH).

A.1.3 MIMO Correlation Matrices

For LOS component between the eNB and the relay, the spatial channel correlation matrix is modeled as an all one matrix unless cross-polarized antennas are deployed. This is because the correlation matrix for the channel with single LOS component is of rank 1.

For NLOS scenario, the correlation matrices are given in the following tables.

Table A.1.3-1 defines the correlation matrices for the eNB:

Table A.1.3-1 eNB correlation matrix

	One antenna	Two antennas	Four antennas
eNB Correlation	$R_{eNB}=1$	$R_{eNB}=\begin{pmatrix}1 & \alpha \\ \alpha^* & \mathbf{1}\end{pmatrix}$	$R_{eNB}=\begin{pmatrix}1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{1/9*} & 1 & \alpha^{1/9} & \alpha^{4/9} \\ \alpha^{4/9*} & \alpha^{1/9*} & 1 & \alpha^{1/9} \\ \alpha^* & \alpha^{4/9*} & \alpha^{1/9*} & 1\end{pmatrix}$

Table A.1.3-2 defines the correlation matrices for the relay:

Table A.1.3-2 Relay correlation matrix

	One antenna	Two antennas	Four antennas
Relay Correlation	$R_{\mathrm{Re}lay}=1$	$R_{\mathrm{Re}lay}=\begin{pmatrix}1 & \beta \\ \beta^* & 1\end{pmatrix}$	$R_{\mathrm{Re}lay}=\begin{pmatrix}1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9*} & 1 & \beta^{1/9} & \beta^{4/9} \\ \beta^{4/9*} & \beta^{1/9*} & 1 & \beta^{1/9} \\ \beta^* & \beta^{4/9*} & \beta^{1/9*} & 1\end{pmatrix}$

The values of α and β for different correlation types are given in Table A.1.3-3

Table A.1.3-3 Low, Medium and High Correlation Values

Low correlation		Medium Correlation		High Correlation	
α	β	α	β	α	β
0	0	0.3	0.9	0.9	0.9

For the channel from the eNB to the relay, the channel spatial correlation matrix R_{spat} is then given as the Kronecker product of the eNB correlation matrix and the relay correlation matrix, i.e. $R_{spat} = R_{eNB} \otimes R_{\mathrm{Relay}}$.

A.2 multipath propagation fading conditions for access link

Tables A.2-1 – Table A.2-3 show multi-path delay profiles that are used for the performance measurements in multi-path fading environment. All taps have classical Doppler spectrum, defined as:

(CLASS) $S(f) \propto 1/(1-(f/f_D)^2)^{0.5}$ for $f \in$ -f_D, f_D.

Table A.2-1 Extended Pedestrian A model (EPA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.0
70	-2.0
90	-3.0
110	-8.0
190	-17.2
410	-20.8

Table A.2-2 Extended Vehicular A model (EVA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.5
150	-1.4
310	-3.6
370	-0.6
710	-9.1
1090	-7.0
1730	-12.0
2510	-16.9

Table A.2-3 Extended Typical Urban model (ETU)

Excess tap delay [ns]	Relative power [dB]
0	-1.0
50	-1.0
120	-1.0
200	0.0
230	0.0
500	0.0
1600	-3.0
2300	-5.0
5000	-7.0

A multipath fading propagation condition is defined by a combination of a multi-path delay profile and a maximum Doppler frequency f_D which is either 5, 70 or 300 Hz.

Note that the ETU model shown in Table A.2-3 and Doppler frequency of 300Hz are optional for relay access link demodulation requirments.

The relay access link demodulation requirements are the same or subset of the eNB requirements as described in TS 36.104.

Annex B: Reference Measurement Channel

B.1 Reference measurement channels for R-PDCCH performance requirements

B.1.1 R-PDCCH format without cross-interleaving

B.1.1.1 FDD

Table B.1.1.1-1: Fixed Reference Channel for R-PDCCH transmitted on single-layer antenna port 7

Parameter	Unit	Value	
Reference channel		R.1 FDD	R.2 FDD
Number of transmitter antennas		1	4
Channel bandwidth	MHz	10	10
Allocated RB for R-PDCCH	RB	24, 25	23, 24, 25, 26
Aggregation level	PRB	2	4
DCI Format		Format 2C	Format 2C
Cell ID		0	0
Payload (without CRC)	Bits	42	42

B.1.1.2 TDD

Table B.1.1.2-1: Fixed Reference Channel for R-PDCCH transmitted on single-layer antenna port 7

Parameter	Unit	Value	
Reference channel		R.1 TDD	R.2 TDD
Number of transmitter antennas		1	4
Channel bandwidth	MHz	10	10
Allocated RB for R-PDCCH	RB	24, 25	23, 24, 25, 26
Aggregation level	PRB	2	4
DCI Format		Format 2C	Format 2C
Cell ID		0	0
Payload (without CRC)	Bits	45	45

B.2 OCNG patterns for R-PDCCH performance requirements

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test) and/or allocations used for MBSFN. The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG_RA and OCNG_RB which together with a relative power level (γ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

$$\gamma_i = PDSCH_i\_RA / OCNG\_RA = PDSCH_i\_RB / OCNG\_RB,$$

where γ_i denotes the relative power level of the i:th virtual UE. The parameter settings of OCNG_RA, OCNG_RB, and the set of relative power levels γ are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a constant transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH_RA/RB and PHICH_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

B.2.1 FDD

B.2.1.1 OCNG FDD pattern 1for R-PDCCH

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous (divided in two parts by the allocated area – two sided) or continuous (one sided) in the frequency domain, starts with PRB 0 and ends with PRB N_{RB}-1.

Table B.2.1-1: OCNG for FDD R-PDCCH

<table>
<tr><th colspan="5">Relative power level γ_{PRB} [dB]</th><th rowspan="6">PDSCH Data</th></tr>
<tr><th colspan="5">Subframe</th></tr>
<tr><th colspan="2">Allocated subframes for R-PDCCH</th><th colspan="3">Subframes unallocated for R-PDCCH</th></tr>
<tr><th>The 1st slot</th><th>The 2nd slot</th><th>0</th><th>5</th><th>Other subframes</th></tr>
<tr><th colspan="5">Allocation</th></tr>
<tr><td>0 – (First allocated PRB-1)
and
(Last allocated PRB+1) – (N_{RB}-1)</td><td>First unallocated PRB
–
Last unallocated PRB</td><td>First unallocated PRB
–
Last unallocated PRB</td><td>First unallocated PRB
–
Last unallocated PRB</td><td>First unallocated PRB
–
Last unallocated PRB</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Note 1</td></tr>
<tr><td colspan="6">Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.</td></tr>
</table>

B.2.2 TDD

B.2.2.1 OCNG TDD pattern 1for R-PDCCH

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous (divided in two parts by the allocated area – two sided) or continuous (one sided) in the frequency domain, starts with PRB 0 and ends with PRB N_{RB} -1.

Table B.2.2-1: OCNG for TDD R-PDCCH

Relative power level γ_{PRB} [dB]						PDSCH Data
Subframe (only if available for DL Note 2)						
Allocated subframes for R-PDCCH		Subframes unallocated for R-PDCCH				
The 1st slot	The 2nd slot	0	5	1 and 6 (as special subframes)	Other normal subframes	
Allocation						
0 – (First allocated PRB-1) and (Last allocated PRB+1) – (N_{RB}-1)	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	
0	0	0	0	0	0	Note 1

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211

Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

Annex C: Physical Channel Set-up for conformance tests

C.1 Set-up for R-PDCCH

Table C.1-1 is applicable for demodulation performance requirements in which uniform RS-to-EPRE boosting for R-PDCCH.

Table C.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Physical Channel	EPRE Ratio	Note
R-PDCCH	R-PDCCH_RA = ρ_A	
	R-PDCCH_RB = ρ_B	
PDSCH	PDSCH_RA = ρ_A	
	PDSCH_RB = ρ_B	

NOTE 1: $\rho_A = \rho_B = 0$ dB means no RS boosting.

NOTE 2: ρ_A denotes the ratio of PDSCH EPRE to cell-specific RS EPRE among PDSCH REs in all the OFDM symbols not containing cell-specific RS. ρ_B denotes the ratio of PDSCH EPRE to cell-specific RS EPRE among PDSCH REs in all the OFDM symbols containing cell-specific RS.

The power allocation for OFDM symbols and reference signals is the same as defined in Annex C.3.2 in TS36.521-1 [10].

The PDCCH aggregation level for R-PDCCH demodulation tests is 8 CCE-s.

C.2 Set-up for PDSCH

Table C.2-1: PDSCH Reference Channel FDD for R-PDCCH test

Parameter	Unit	Value	
Reference channel		R.3 FDD	R.4 FDD
Number of transmitter antennas		1	4
Channel bandwidth	MHz	10	10
Allocated Resource Blocks		24 (Note2)	21 (Note3)
Modulation		QPSK	QPSK
Target Coding Rate		1/3	1/3
Information Bit Payload			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2088	1480
For Sub-Frame 5		n/a	n/a
For Sub-Frame0	Bits	n/a	n/a
Number of Code Blocks per Sub-Frame			
For Sub-Frames 1,2,3,4,6,7,8,9		1	1
For Sub-Frame 5		n/a	n/a
For Sub-Frame 0		n/a	n/a
Binary Channel Bits Per Sub-Frame			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	6048	5040
For Sub-Frame 5	Bits	n/a	n/a
For Sub-Frame 0		n/a	n/a
Note 1: 2 symbols allocated to PDCCH for all BW, and DMRS port 7 is used. Note 2: PRB #0 to RPB #23 is allocated for PDSCH transmission. Note 3: PRB #0 to RPB #20 is allocated for PDSCH transmission.			

Table C.2-2: PDSCH Reference Channel TDD for R-PDCCH test

Parameter	Unit	Value		
Reference channel		R.3 TDD	R.4 TDD	
Number o transmitter antennas		1	4	
Channel bandwidth	MHz	10	10	
Uplink-Downlink Configuration (Note 2)		1	1	
Special subframe configuration(Note 3)		4	4	
Allocated Resource Blocks		24 (Note4)	21 (Note5)	
Modulation		QPSK	QPSK	
Target Coding Rate		1/3	1/3	
Information Bit Payload				
For Sub-Frame 4,9		2088	1480	
For Sub-Frame 1,6	Bits	n/a	n/a	
For Sub-Frame 5	Bits	n/a	n/a	
For Sub-Frame 0	Bits	n/a	n/a	
Number of Code Blocks per Sub-Frame				
For Sub-Frame 4,9	Bits	1	1	
For Sub-Frame 1,6	Bits	n/a	n/a	
For Sub-Frame 5	Bits	n/a	n/a	
For Sub-Frame 0	Bits	n/a	n/a	
Binary Channel Bits Per Sub-Frame				
For Sub-Frame 4,9	Bits	6048	5040	
For Sub-Frame 1,6	Bits	n/a	n/a	
For Sub-Frame 5	Bits	n/a	n/a	
For Sub-Frame 0	Bits	n/a	n/a	
Note 1: 2 symbols allocated to PDCCH for all BW, and DMRS port 7 is used. Note 2: As per Table 4.2-2 in TS 36.211 Note 3: As specified in Table 4.2-1 in TS 36.211 Note 4: PRB #0 to RPB #23 is allocated for PDSCH transmission. Note 5: PRB #0 to RPB #20 is allocated for PDSCH transmission.				

Annex D: Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2010-02	RAN4-54				First skeleton	-	0.0.1
2010-05	RAN4-55	R4-102285			The following TPs are implemented: R4-101450 "TP on Relay Report scope" Editorial changes: Version number increased.	0.0.1	0.1.0
2010-08	RAN4-56	R4-103705			The following TPs are implemented: R4-103336, "TP on relay synchronization requirements" R4-103391, "Updates on Relay coexistence simulation assumptions" R4-103440, "LTE Relay ad-hoc minutes" R4-103441, "Overall scenario description for relay coexistence study" R4-103442, "Propagation models and MCL for relay coexistence study" R4-103443, "ACIR model for relay coexistence study" R4-103444, "Throughput performance model for relay coexistence study" R4-103465, "Suggested simulation cases for relay coexistence study" Editorial changes: Minor correction to reference numbering. References overlapping, but identical in a number of TP. Version number increased.	0.1.0	0.2.0
2010-10	RAN4-AH#4	R4-103943			The following TPs are implemented: R4-103945, "Resource allocation and interference calculations for coex studies" R4-103954, "TP on Relay uplink power control for coexistence study" R4-103968, "Outdoor assumptions for coex studies" R4-103969, "Relay and user location and propagation in thruwall scenarios" Editorial changes: Version number increased.	0.2.0	0.3.0
2010-11	RAN4-57	R4-104868			The following TPs are implemented: R4-104884, "Text Proposal for Relay TR" R4-104912, "TP for multipath fading conditions for relay performance requirements on access link" R4-104996, "TP for relay backhaul link channel models" Editorial changes: Version number increased.	0.3.0	0.4.0
2011-01		R4-110036			Editorial updates: Erroneous implementation of R4-103945 corrected TR number and Title added	0.4.0	0.4.1
2011-01	RAN4-57AH	R4-110546			The following TPs are implemented: R4-110047, "TP for relay performance requirements for access link" R4-110545, "TP on Relay reference sensitivity" R4-110584, "TP for frequency error of Relay Node" Editorial updates: Subclause 6.6 moved to make subclause order correct	0.4.1	0.5.0
2011-02	RAN4-58	R4-111689			The following TPs are implemented: R4-110996, "Channel model for Relay backhaul" R4-111031, "TP of RF requirements on Relay" R4-111096, "TP on frequency error for Relay access link" R4-111543, "Clarification of Coexistence case F and H" R4-111545, "TP for TR36.826, section6.6: Power control for Indoor and Thruwall relay scenarios" Editorial updates: Version number increased and date updated Table numbering in R4-111545 corrected	0.5.0	0.6.1
2011-04	RAN4-58AH	R4-112243			The following TPs are implemented: R4-111836, "TP for the thru-wall relay scenario in TR 36.826" R4-112104, "Relay clarifications on locations" Editorial updates: R4-112327, "Agreement on Relay coexistence modelling"	0.6.1	0.7.1

					R4-112233, "Clarification of cell selection assumption in truwall relay scenarios" Version number and date updated Table of contents updated Subclause 6.9 renumbered to subclause 6.10 to make room for new text		
2011-06	RAN4-59AH	R4-113851			The following TPs are implemented: R4-112948, "TP on general part for Relay core requirements" R4-113167, "Relay supported bandwidth" R4-113168, "Reference sensitivity for relays" R4-113265, "TP for R-PDCCH performance requirements" Editorial updates: Version number and date updated Table of contents updated Subclause 8.2.1 and 9.2.1 renumbered to subclause 8.2.2 and 9.2.2 to resolve collision between R4-112948 and R4-113168	0.7.1	0.8.1
2011-08	RAN4-60	R4-114357			The following TPs are implemented: R4-113873, "relay backhaul link ACLR and ACS" R4-113875, "TP for relay access link signal quality" R4-113876, "TP for the operating band unwanted emission requirement in TR 36.826" R4-113919, "TP on general part of transmitter requirements for Relay" R4-113925, "TP for TR 36.826 on relay output power: lower power case" Editorial updates: Version number and date updated Table of contents updated	0.8.1	0.10.0
2011-10	RAN4-60AH	R4-115168			The following TPs are implemented: R4-114731, "TP for output power dynamics of Relay" R4-114732, "TP of relay dynamic range in TR 36.826" R4-114835, "Relay transmitter RF requirements" Editorial updates: Restructuring of document Version number and date updated Table of contents updated	0.10.0	0.11.0
2011-11	RAN4-61	R4-115944			The following TPs are implemented: R4-115170, "Summary of Relay Coexistence studies" R4-115422, "Relay access link spurious emission requirement" R4-115423, "Relay receiver RF requirements" R4-115424, "TP of access link output power for high power class in TR 36.826" R4-115425, "TP of relay output power class in TR 36.826" R4-115426, "TP for the operating band unwanted emission requirement for high power class in TR 36.826" R4-115440, "36.826 TP: on R-PDCCH performance requirements" Editorial updates: Version number and date updated Table of contents updated	0.11.0	0.12.0
2012-02	RAN4-62	R4-120596			The following TPs are implemented: R4-115858, "Relay ICS requirement" R4-115978, "TP for Transmitter IM requirement of Relay access link" R4-116207, "TP for output power of Relay backhaul link" Editorial updates: Version number and date updated Table of contents updated	0.12.0	0.13.0
2012-03	RAN4-62bis	R4-121910			The following TPs are implemented: R4-120035, "TP of access link receiver spurious emissions in TR 36.826" R4-120036, "TP of access link receiver intermodulation in TR 36.826" R4-120039, "TP of backhaul link Transmitter Intermodulation in TR 36.826" R4-120040, "TP of backhaul link EVM in TR 36.826" R4-120552, "Text proposal on blocking characteristic for Relay access link" R4-120564, "TP for Relay classification" R4-120565, "TP for ON/OFF time mask of backhaul link" R4-120952, "36.826 TP: on R-PDCCH performance requirements" R4-120985, "Text proposal on reference sensitivity for high power class RN access link" R4-121037, "TP of relay power class in TR 36.826"	0.13.0	0.14.0

					R4-121097, "Reference sensitivity for the backhaul link" Editorial updates: Version number and date updated Table of contents updated Reference added from R4-120552 which was referenced but not included in TP. Figures renumbered where necessary		
2012-05	RAN4-63	R4-122833			The following TPs are implemented: R4-121310, "TP of access link high power class dynamic range in TR 36.826" R4-121313, "TP of access link narrow band blocking in TR 36.826" R4-121317, "TP of backhaul link receiver spurious in TR 36.826" R4-121455, "TP on ACS requirement for 30dBm Relay access link" R4-121458, "TP on In-channel selectivity requirement for 30dBm Relay access link" R4-121459, "TP on Transmitter spurious emission requirement for 30dBm Relay access link" R4-121460, "TP for correction on Relay backhaul link" R4-121481, "TP for R-PDCCH Conformance test" R4-121608, "Performance conformance test for Relay access link" R4-121621, "TP on Relay backhaul link power control requirement" R4-121622, "TP on TP on Relay access link Rx intermodulation requirement" R4-122089, "TP on Relay access link narrow band blocking requirement" R4-122091, "TP on Relay backhaul link receiver dynamic range" R4-122092, "TP on Relay backhaul link blocking requirement" R4-122115, "TP of backhaul link ACS in TR 36.826" R4-122116, "Text proposal on receiver intermodulation for relay backhaul link TR 36.826" R4-122181, "36.826 TP: OCNG pattern for R-PDCCH demodulation performance" Editorial updates: Version number and date updated Table of contents updated Clauses and references renumbered where necessary	0.14.0	0.15.0
2-08	RAN4-64	R4-124581			The following TPs are implemented: R4-122290, "TP of backhaul link Transmitter Spurious Emission in TR 36.826" R4-122613, "TP for Relay backhaul link transmit OFF power" R4-123540, "36.826 TP: OCNG pattern for R-PDCCH demodulation performance requirements" Editorial updates: Version number and date updated Table of contents updated	0.15.0	0.16.0
2012-08	RAN4-64	R4-124917			The following TPs are implemented: R4-123859, "TP for Relay Access Link DL RS power" R4-123943, "TAE requirement for Relay backhaul link" R4-124807, "Corrections on R-PDCCH conformance tests" Editorial updates: Version number and date updated Table of contents updated Subclause renumbering	0.16.0	0.17.0
2012-09	RAN-57	RP-121232			Version for submission Updates of version number	0.17.0	1.0.0
2012-09	RAN-57	RP-121232			TR Approved by RAN	1.0.0	11.0.0
2012-12	RAN-58	RP-121904	001		TP for 36.826 Relay on backhaul link conformance test	11.0.0	11.0.1
2012-12	RAN-58	RP-121904	003	1	Correction of R-PDCCH conformance test	11.0.0	11.0.1
2012-12	RAN-58	RP-121904	004	1	Corrections on Relay backhaul link R-PDCCH performance	11.0.0	11.0.1
2013-03	RP-59	RP-130286	005		CR for 36.826: corrections of R-PDCCH conformance test	11.1.0	11.2.0
2013-03	RP-59	RP-130286	006		CR on TR36.826 Section 9.1.5.2.2 (Operating Band UEM requirement)	11.1.0	11.2.0
2013-06	RP-60	RP-130770	007		CR for R-PDCCH conformance test	11.2.0	11.3.0
2013-06	RP-60	RP-130765	008	1	Correction for R-PDCCH conformance test	11.2.0	11.3.0