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3GPP

Postal address

3GPP support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet
http://www.3gpp.org

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Foreword

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1 Scope

The purpose of this TR is to summarize the study of radio requirements for the Base Station (BS) radio transmission and reception as part of the Rel-10 work item on **C**arrier **A**ggregation for LTE (CA).

2 References

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

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

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

[2] 3GPP TS 36.104 (9.2.0): "Base Station (BS) radio transmission and reception".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Aggregated Channel Bandwidth: The RF bandwidth in which a Base Station transmits and receives multiple contiguously aggregated carriers. The aggregated channel bandwidth is measured in MHz.

Higher Edge: The highest frequency in the aggregated channel bandwidth for multiple contiguously aggregated carriers, or the highest frequency in the channel bandwidth of a single E-UTRA carrier, or the highest frequency in the channel bandwidth of the highest carrier for E-UTRA multi-carrier; used as a frequency reference point for transmitter and receiver requirements.

Highest Carrier: The carrier with the highest carrier centre frequency transmitted/received in a specified frequency band.

Lower Edge: The lowest frequency in the aggregated channel bandwidth for multiple contiguously aggregated carriers, or the lowest frequency in the channel bandwidth of a single E-UTRA carrier, or the lowest frequency in the channel bandwidth of the lowest carrier for E-UTRA multi-carrier; used as a frequency reference point for transmitter and receiver requirements.

Lowest Carrier: The carrier with the lowest carrier centre frequency transmitted/received in a specified frequency band.

Symbols

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

$BW_{Channel\_CA}$	Aggregated channel bandwidth, expressed in MHz. $BW_{Channel\_CA} = F_{edge\_high} - F_{edge\_low}$.
F_{C_low}	The carrier centre frequency of the *lowest carrier*, expressed in MHz.
F_{C_high}	The carrier centre frequency of the *highest carrier*, expressed in MHz.

F_{edge_low} The *lower edge* of aggregated channel bandwidth, expressed in MHz. $F_{edge\_low} = F_{C\_low} - F_{offset}$.
F_{edge_high} The *higher edge* of aggregated channel bandwidth, expressed in MHz. $F_{edge\_high} = F_{C\_high} + F_{offset}$.
F_{offset} Frequency offset from F_{C_high} to the *higher edge* or F_{C_low} to the *lower edge*.

Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

CA Carrier Aggregation

4 General

4.1 Base station classes

Unless stated otherwise in clause 4.2, CA related requirements would apply to all BS classes.

It would need to be investigated if the LA and Home BS class specific requirements for Base station output power remain appropriate under CA:

6.2 Base station output power (this might require co-existence studies)

6.2.4 Home BS output power for adjacent E-UTRA channel protection

6.2.4 Home BS output power for adjacent E-UTRA channel protection

- the Home BS output power behaviour with intra-band CA and two adjacent operators is not defined and requires further considerations

Also the operating band unwanted emissions for LA and Home BS class would require further considerations.

It is proposed to limit the FDD BS CA related RF requirements within the Rel10 timeframe to the WA BS class.

4.2 Regional requirements

No changes are foreseen for this clause.

Applicability of requirements

For a BS conforming to both, 36- and 37-series of specifications there would be a significant overlap among the core RF requirements and the related conformance testing efforts. In many cases the corresponding MSR RF core requirements are either identical or more stringent and hence any E-UTRA capable BS compliant to 37-series is also compliant to 36-series for these requirements.

It is proposed for a BS additionally conforming to TS 37.104, that conformance to some of the RF requirements in TS36.104 can be demonstrated through the corresponding requirements in TS 37.104. This can be captured within TS 36.104 by adding a new clause, ‘4.4 Applicability of requirements’.

5 Operating bands and channel arrangement

5.1 General

No changes are foreseen for this clause.

5.2 Void

5.3 Void

5.4 Void

5.5 Operating bands

A *Carrier aggregation configuration* is defined as a set of one or more operating bands across which the BS aggregates carriers with a specific set of technical requirements. The carrier aggregation configurations shall be defined in appropriate Tables.

The supported carrier aggregation configuration(s) and the maximum bandwidth supported by the BS in which multiple carriers can be aggregated on the UL and DL within an operating band shall be declared by the manufacturer.

Channel bandwidth

Figure 5.6-1 below illustrates the channel bandwidth for contiguous carrier aggregation.

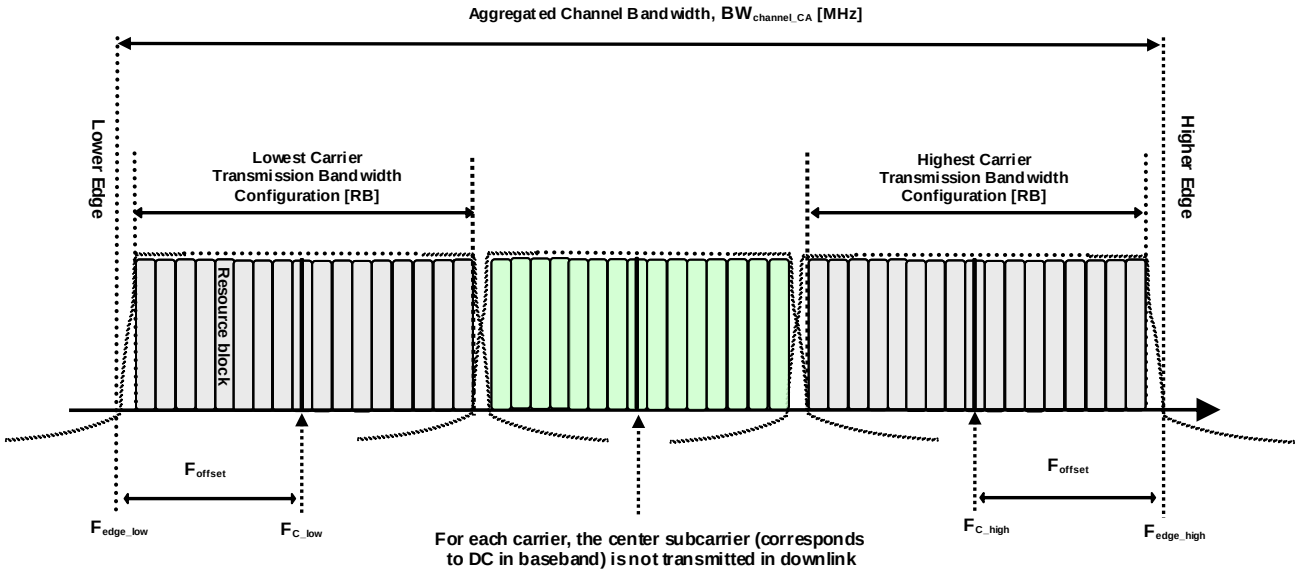

Figure 5.6-1 Definition of Aggregated Channel Bandwidth for contiguous carrier aggregation

The *lower edge* of the *Aggregated Channel Bandwidth* ($BW_{Channel\_CA}$) is defined as $F_{edge\_low} = F_{C\_low} - F_{offset}$.

The *higher edge* of the aggregated channel bandwidth is defined as $F_{edge\_high} = F_{C\_high} + F_{offset}$.

The *Aggregated Channel Bandwidth*, $BW_{Channel\_CA}$, is defined as follows:

$$BW_{Channel\_CA} = F_{edge\_high} - F_{edge\_low} \text{ [MHz]}$$

F_{offset} is defined in Table 5.6-1 below where $BW_{Channel}$ is defined in TS36.104, Table 5.6-1.

Table 5.6-1: Definition of F_{offset}

Channel Bandwidth of the Lowest or Highest Carrier: $BW_{Channel}$[MHz]	F_{offset}[MHz]
5, 10, 15, 20	$BW_{Channel}/2$
1.4, 3	FFS

The receiver and transmitter RF requirements shall apply from the frequency reference point with offset F_{offset} from the carrier centre frequency of the lowest/highest carriers received/transmitted. The frequency reference points are defined as $F_{C\_low} - F_{offset}$ and $F_{C\_high} + F_{offset}$, respectively, with F_{offset} defined in Table 5.6-1. For contiguous carrier aggregation, these frequency reference points coincide with lower/higher edge of the aggregated channel bandwidth, which are F_{edge_low} or F_{edge_high} respectively.

5.7 Channel arrangement

5.7.1 Channel spacing

The nominal channel spacing between centre frequencies of contiguously aggregated component carriers shall be a multiple of 300 kHz (in order to be compatible with the 100 kHz frequency raster of LTE Rel-9 and at the same time preserve orthogonality of the subcarriers with 15 kHz spacing). This constraint would need to be added to Clause 5.7.1 Channel spacing.

The nominal channel spacing between two adjacent aggregated E-UTRA carriers is defined as follows:

$$\text{Nominal channel spacing} = \left\lfloor \frac{BW_{Channel(1)} + BW_{Channel(2)} - 0.1\left|BW_{Channel(1)} - BW_{Channel(2)}\right|}{0.6} \right\rfloor 0.3 \ \ [\text{MHz}]$$

where $BW_{Channel(1)}$ and $BW_{Channel(2)}$ are the channel bandwidths of the two respective E-UTRA component carriers according to Table 5.6-1 in [2] with values in MHz. The channel spacing for intra-band contiguous carrier aggregation can be adjusted to any multiple of 300 kHz less than the nominal channel spacing to optimize performance in a particular deployment scenario.

The nominal channel spacing values for two adjacent aggregated E-UTRA carriers are listed in table 5.7.1-1.

Table 5.7.1-1 Nominal channel spacing between contiguously aggregated component carriers

Carrier spacing [MHz]		Channel bandwidth $BW_{Channel}$ [MHz] specified in Table 5.6-1					
		1.4	**3**	**5**	**10**	**15**	**20**
Channel bandwidth $BW_{Channel}$ [MHz] specified in table 5.6-1	1.4	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
	3		Note 1	Note 1	Note 1	Note 1	Note 1
	5			Note 1	Note 1	Note 1	Note 1
	10					12	14.4
	15					15	17.1
	20						19.8

Note 1: FFS, not applicable for REL-10

For network deployments also minimum carrier spacing can be used. Minimum carrier spacing values are listed in table 5.7.1-2.

Table 5.7.1-2 Minimum channel spacing between contiguously aggregated component carriers

Carrier spacing [MHz]		Channel bandwidth $BW_{Channel}$ [MHz] specified in Table 5.6-1					
		1.4	**3**	**5**	**10**	**15**	**20**
Channel bandwidth $BW_{Channel}$ [MHz] specified in table 5.6-1	1.4	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
	3		Note 1	Note 1	Note 1	Note 1	Note 1
	5			Note 1	Note 1	Note 1	Note 1
	10					11.4	13.8
	15					13.8	15.9
	20						18.3

Note 1: FFS, not applicable for REL-10

5.7.2 Channel raster

No changes are foreseen for this clause.

5.7.3 Carrier frequency and EARFCN

No changes are foreseen for this clause.

6 Transmitter characteristics

6.1 General

A BS supporting contiguous CA in a specified band transmits multiple component carriers aggregated contiguously. A BS supporting non-contiguous CA transmits multiple component carriers in the specified bands.

The BS RF performance requirements in the 25 series, 36 series and in 37 series have been characterized in the way that the requirements are applied at each antenna connector. The same principle shall be adopted to define the requirements for BS transmitter supporting multiple-carrier transmission including carrier aggregation.

Therefore some clarifications regarding the transmit antenna connector configurations for the applicable CA scenarios are needed. It is proposed to cover not only multi-carrier transmission with CA, but to formulate it generally for any multi-carrier transmission using multiple antenna connectors, as this aspect is not adequately covered in the present TS36.104. The proposal is to align with the statement already adopted for MSR in TS37.104, i.e. that

> In case of *multi-carrier transmission with multiple transmitter antenna connectors*, transmit diversity or MIMO transmission, the requirements apply for each transmitter antenna connector;

with the understanding that *multi-carrier transmission with multiple transmitter antenna connectors* includes the cases of

> use of one or multiple PA's for intra-band multi-carrier transmission.
>
> Use of one or multiple PA's for inter-band multi-carrier transmission.

For example, if three E-UTRA carriers are transmitted from two antenna connectors with the first two carriers in one antenna and the third carrier transmitter from another antenna, the requirements shall apply to each of antenna connectors.

Base station output power

For the definition of minimum requirements and test procedure for Base station output power related to CA, it is proposed to align TS 36.104/141 with the methodology used for MSR within TS 37.104/141 as much as possible. It's also desirable to minimize the changes to TS 36.104/141 whenever possible. This approach would allow carrier aggregation to be smoothly introduced into the MSR specifications, while at the same time reflect requirements specific to the support of CA in the core specifications TS36.104.

The Rel-9 definitions regarding "Base station output power" in TS 36.104 are as follows:

> *Output power, Pout, of the base station is the mean power of one carrier delivered to a load with resistance equal to the nominal load impedance of the transmitter.*
>
> *Maximum output power, Pmax, of the base station is the mean power level per carrier measured at the antenna connector during the transmitter ON period in a specified reference condition.*
>
> *Rated output power, PRAT, of the base station is the mean power level per carrier that the manufacturer has declared to be available at the antenna connector during the transmitter ON period.*

The corresponding definitions from MSR TS 37.104 regarding "Base station output power" are as follows:

> *Output power of the base station is the mean power delivered to a load with resistance equal to the nominal load impedance of the transmitter.*
>
> *The configured carrier power is the target maximum power for a specific carrier for the operating mode set in the BS within the limits given by the manufacturer's declaration.*
>
> *The maximum total output power, P_{max}, of the base station is the mean power level measured at the antenna connector during the transmitter ON period in a specified reference condition.*
>
> *The maximum RAT output power, $P_{max,RAT}$, of the base station is the mean power level measured at the antenna connector during the transmitter ON period for a specific RAT in a specified reference condition.*
>
> *The maximum carrier output power, $P_{max,c}$ of the base station is the mean power level measured at the antenna connector during the transmitter ON period for a specific carrier in a specified reference condition.*

Comparing the MSR 37 series with single-RAT E-UTRA in 36 series specifications, they are largely consistent and the following commonalities can be identified:

- Minimum requirements are specified for "maximum carrier output power" in TS 37.104 or "maximum output power per carrier" in TS 36.104, which are denoted as $P_{max,c}$ in TS 37.104 and P_{max} in TS 36.104, respectively.
- Tolerance is +/- 2dB in normal condition and +/-2.5 dB in extreme condition for each "maximum carrier output power" in TS 37.104 or "maximum output power per carrier" in TS 36.104.

Continuing the comparison between TS 37.104 and TS 36.104, some differences can be identified regarding the "declared power":

- In MSR TS 37.104, the "configured carrier power" is obtained for each "operating mode" according to the manufacturer's declaration.
- In TS 36.104, "rated output power per carrier" is given by manufacturer's declaration. It's not clearly specified in TS 36.104 that the "rated output power per carrier" is "operating mode" dependent in which the "operating mode" can be the transmission of E-UTRA single carrier, multiple carriers, or aggregated carriers.

However, it is specified in TS 36.141 subclause 4.6.3 that the BS rated output power shall be declared for each supported transmit channel bandwidth by the manufacturer. In order to fully capture the core requirements for BS output power concerning multiple carriers and carrier aggregation, it shall be clarified that the "rated output power per carrier" depends on the transmission mode set.

The text proposal captured in R4-104924 is for TS 36.104. It's expected to have corresponding changes in subclause 4.6.3 of TS 36.141.

6.3 Output power dynamics

6.3.1 RE Power control dynamic range

In TS36.104, it is defined that,

"RE power control dynamic range is the difference between the power of an RE and the average RE power for a BS at maximum output power for a specified reference condition."

The RE dynamic range (dB) can be positive or negative, depending on RE power up/down. The requirements for these up/down limits are based on investigations and discussions with considerations of eNB Tx characteristics such as EVM, unwanted emissions. To extend the existing RE Power control dynamic range requirements for LTE-A BS supporting carrier aggregation, the "total Tx power" and the "maximum BS output power" shall be aligned with defined terms.

6.3.2 Total power dynamic range

The total power dynamic range is the difference between the maximum and the minimum output power of an OFDM symbol for a specified reference condition. For E-UTRA BS, values for Total power dynamic range are derived from TX of 1 PRB when compared with full PRB allocation for each carrier. The existing requirement defined in TS 36.104 Rel.9 Table 6.3.2.1-1 shall be adopted for each component carrier supported by LTE-A CA BS.

6.4 Transmit ON/OFF power

The requirements in subclause 6.4 are only applied for LTE/LTE-A TDD BS.

Transmitter OFF power

Transmitter OFF power requirement is only applied for LTE/LTE-A TDD BS. In TS36.104 V9.3.0 Clause 6.4.1, it is described that,

"*Transmitter OFF power is defined as the mean power measured over 70 us filtered with a square filter of bandwidth equal to the transmission bandwidth configuration of the BS (BW_{Config}) centred on the assigned channel frequency during the transmitter OFF period.*"

For BS supporting contiguous CA, the transmitter OFF power should be measured while all the component carriers are OFF. And the bandwidth of the square filter should be equal to the Aggregated Channel Bandwidth BWChannel_CA. In addition, the same minimum requirement for transmitter OFF power spectral density specified for LTE BS Rel.8/9 should be adopted, i.e. the transmitter OFF power spectral density shall be less than -85dBm/MHz.

Transmitter transient period

The transmitter transient period is the time period during which the transmitter is changing from the OFF period to the ON period or vice versa.

For BS supporting contiguous CA, the same requirement specified for LTE BS Rel.8/9 should be adopted.

6.5 Transmitted signal quality

6.5.1 Frequency error

Frequency error is the measure of the difference between the actual BS transmit frequency and the assigned frequency. The same source shall be used for RF frequency and data clock generation.

Minimum requirement

For BS supporting CA, the modulated carrier frequency of each component carrier supported by the BS shall be accurate to within the accuracy range given in Table 6.5.1-1 observed over a period of one subframe (1ms).

Table 6.5.1.1-1: Frequency error minimum requirement

BS class	Accuracy
Wide Area BS	±0.05 ppm
Local Area BS	±0.1 ppm
Home BS	±0.25 ppm

6.5.2 Error Vector Magnitude

The Error Vector Magnitude is a measure of the difference between the ideal symbols and the measured symbols after the equalization. For LTE-A BS supporting CA, the same requirement in TS 36.104 can be adopted for each component carrier in order to maintain the present system performance.

6.5.3 Time alignment between transmitter branches

Minimum requirement should be specified separately for

- MIMO or TX diversity transmissions
- intra-band carrier aggregation with or without MIMO or TX diversity
- inter-band carrier aggregation, with or without MIMO or TX diversity

6.5.3.1 TAE for specific scenarios of CA

A too large TAE between DL component carriers could cause spread of reception timings on a UL carrier if single Timing Advance (TA) group is configured to number of Ues, and BS demodulation performance might be degraded as a consequence.

The followings were taken as assumptions to discuss the above mentioned issue:

- (Assumption 1) 2 Ues (UE1 and UE2) are in a coverage area of 2 overlapping carriers (Cell1 and Cell2) that operate CA.
- (Assumption 2) UE1 is configured with Cell1 as the Pcell, and Cell2 as the Scell. UE2 is configured with Cell2 as the Pcell, and Cell1 as the Scell.
- (Assumption 3) Both UE1 and UE2 are configured with 2UL/2DL CA.
- (Assumption 4) Both UE1 and UE2 are configured with single TA group.

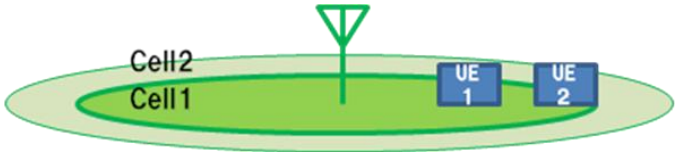

Figure 6.5.3.1-1 Locations of Cells and Ues

With the above assumptions, UE1 adjust UL transmission timing aiming for the DL transmission timing at the Cell1 (Timing A in Figure 6.5.3.1-2), and UE2 adjust that for the DL transmission timing at the Cell2 (Timing B in Figure 6.5.3.1-2). Then, the following uncertainties need to be taken into account in order to calculate possible dispersion of reception timings on a UL carrier:

- Accuracy of TA, i.e., ±8 Ts derived from the half of TA unit resolution 16Ts (expressed as (1) in Figure 6.5.3.1-2).
- Allowed TA adjustment accuracy of the Pcell TA value, which is $\pm 4T_S$ from TS 36.133 subclause 7.3 (expressed as (2) in Figure 6.5.3.1-2).
- Uncertainty of the reception time in the UE downlink (expressed as (3) in Figure 6.5.3.1-2), taken as ±10 Ts.
- Channel dispersion (expressed as (4) in Figure 6.5.3.1-2).

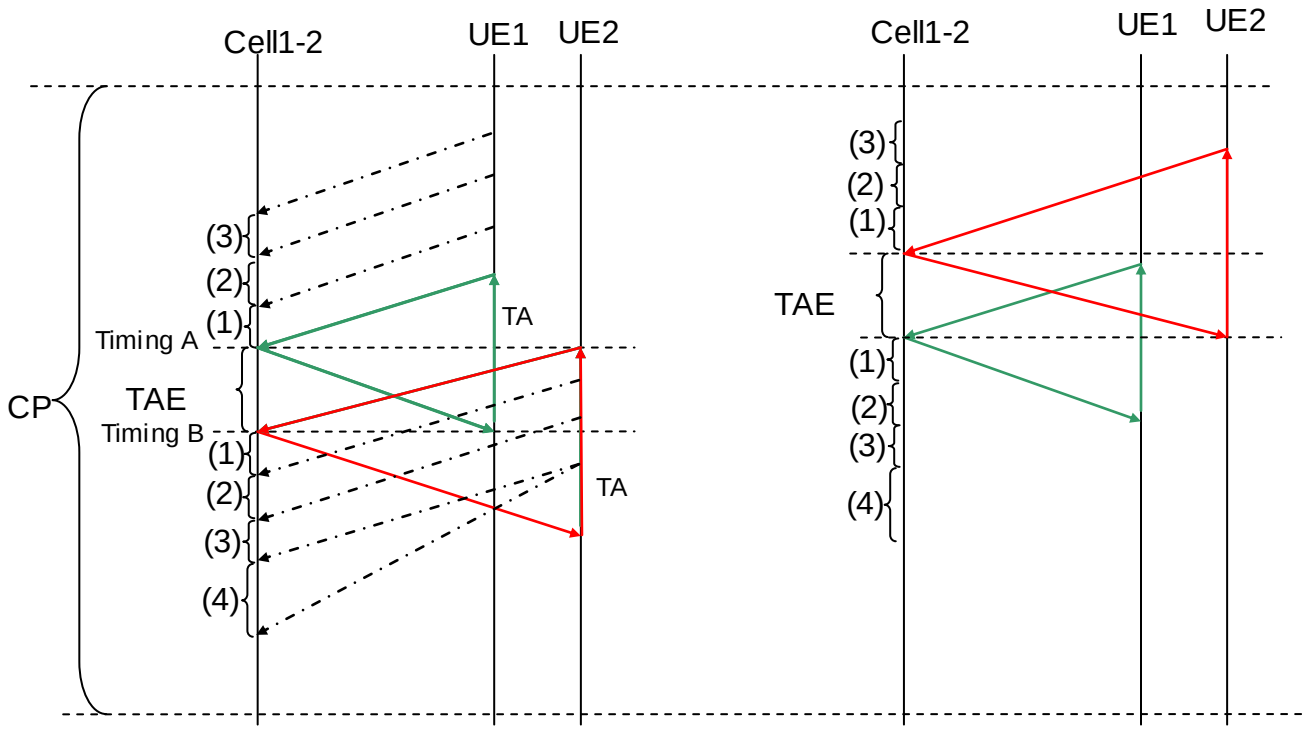

Figure 6.5.3.1-2: 2 Ues, Single TA group, 2 DL, 2 UL, rioritize, different Pcells

However, the eNB does not know which carrier comes first. TAE is a relative requirement. This is shown in figure 1, where both of two Ues use 2 UL (cells) and are configured to use different carriers as the Pcells. The eNB transmits the carriers with a relative difference of TAE

In order for the timing error in the UL not to impact the BS receiver performance, the following equation shall be satisfied::

$$2*TAE + 2 \times [(1) + (2) + (3)] + (4) < Length\ of\ CP$$

The equation depends on the channel dispersion (4) and the assumed channel model. Three typical E-UTRA channel models predict excess tap delay of 0.41, 2.51 and 5 μs for the EPA, EVA and ETU model respectively. For inter-band CA with low-high band combination an extra relative spread in the arrival times of 0.52 μs (~16 Ts) for 3% of of a simulated UE population was estimated with ray trace simulation in urban environment and has to be added to the channel dispersion.

Adding up the timing errors in (1), (2) and (3) in the equation above, we get a worst case timing error of: 1.43 μs. The current TAE of 1.3 μs would worsen that timing error and therefore it makes sense to limit the TAE in the BS as far as possible in order to allow inter-band CA with two simultaneous Uls and one TAE. The performance of two simultaneous Uls with one TA depends on the actual dispersion of the channel.

A 3GPP release 10 UE with one TAG and Dual CA UL is possible, but there are several prerequisites:
- Dual UE UL developed in general. This will take place in rel-12.
- Band combination ready for 2 UL. This will take place in rel-12.
- Developed band combination in approved TS 36.307.
- Tighter CA interband TAE, 260 ns, or similar, instead of 1.3 μs.

Release-10 UE with one TAG and Dual CA UL is possible, but only after rel-12 dual UE UL work.

6.5.4 DL RS power

For LTE-A BS supporting CA, the existing requirement for E-UTRA BS should be applied for each component carrier.

6.6 Unwanted emissions

6.6.1 Occupied bandwidth

In some regions the concept of "Occupied bandwidth" is used in current regulation to define the value of "Necessary bandwidth" (N.B.) for the BS. N.B. may be used in radio regulation as a parameter to separate the spurious domain from the out-of-band domain.

Presently TS36.104 defines Occupied bandwidth (OBW) for transmission of a single carrier only. As it is expected that "Occupied bandwidth" may be adopted as a regulatory requirement in some regions also for contiguously aggregated CCs, it is proposed to define in TS 36.104 an OBW requirement specifically for contiguous CA.

Occupied bandwidth can be derived from the Base Station Aggregated Channel Bandwidth, $BW_{Channel\_CA,}$ (see Clause 5.6), as follows:

$$\text{Occupied bandwidth} \leq BW_{Channel\_CA} \text{ [MHz]}$$

in which the carrier spacing between component carriers shall be in accordance with the nominal channel spacing defined for contiguously aggregated component carriers in Clause 5.4.

The carrier spacing between component carriers is assumed as the nominal channel spacing in order to obtain a well-defined, single requirement for the BS equipment.

6.6.2 Adjacent Channel Leakage power Ratio (ACLR)

The following points shall be taken into account when specifying the ACLR requirements for BS supporting CA:

- For the outermost component carrier with channel bandwidth ≥5 MHz, the channel bandwidth of the outermost component carrier should be considered for ACLR requirements.
- The ACLR requirements shall be FFS if channel bandwidth of the outermost component carrier < 5MHz.

To avoid rephrasing of the existing requirements, the CA channel edge shall be aligned with the channel edge of the outermost component carriers, and the outermost component carrier shall be considered for ACLR requirement. The ACLR of 45dB in current specification shall also be applicable to BS supporting CA.

6.6.3 Operating band unwanted emissions

The following points shall be taken into account when specifying the ACLR requirements for BS supporting CA:

- For the outermost component carrier with channel bandwidth ≥5 MHz, the channel bandwidth of the outermost component carrier should be considered for UEM requirements.
- The UEM requirements shall be FFS if channel bandwidth of the outermost component carrier < 5MHz.

For BS configured for contiguous carrier aggregation, the lower edge of the carrier transmitted at the lowest carrier frequency and the higher edge of the carrier transmitted at the highest carrier frequency shall be the start points of UEM. This is well aligned with the existing UEM definition for LTE Rel-8 multiple carrier BS.

6.6.3.1 Minimum requirements for Category A

No changes are foreseen for this clause.

6.6.3.2 Minimum requirements for Category B

No changes are foreseen for this clause.

6.6.3.3 Additional requirements

No changes are foreseen for this clause.

Transmitter spurious emissions

The E-UTRA Rel-8/9 spurious emission limits apply in frequency ranges that are more than 10 MHz below the lowest BS transmitter frequency of the operating band and more than 10 MHz above the highest BS transmitter frequency of the operating band. The spurious emission limits in frequency ranges that are more than 10 MHz outside the operating band are well aligned among E-UTRA, UTRA and MSR.

The requirements apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification. As BS supporting contiguous CA transmits multiple component carriers and multi-carrier transmission mode is already covered by the existing requirements, no changes due to CA are foreseen in this respect.

Transmitter spurious emissions are defined in ITU-R Radio Regulations and ITU-R recommendations SM.329. They are included as regional requirements within TS 36.104. SM.329 recommends the 5th harmonic of the transmitting signal frequency as the upper bound of the measurement range for the spurious domain requirements from 600 MHz to 5.2 GHz. In current 3GPP specification, the upper bounds for spurious domain measurement in UTRA, E-UTRA and MSR are set at 12.75 GHz which corresponds to a maximum operation frequency of about 2.6 GHz. As in Rel-10 the scope of the CA WI does not include frequency bands beyond 2.4 GHz, no changes due to CA are expected for clause 6.6.4 in the Rel-10 timeframe.

In future CA WI additional frequency bands beyond 2.6 GHz such as the bands 3.4-3.6 GHz and 3.6-3.8 GHz may be introduced into the TS 36.104. This will require further consideration how to set the SM.329 upper limits for such bands as well as considerations regarding practical measurements and testing times and is left FFS.

6.6.4.1 Mandatory Requirements

6.6.4.1.1 Spurious emissions (Category A)

No changes due to CA in Rel-10.

6.6.4.1.2 Spurious emissions (Category B)

No changes due to CA in Rel-10.

6.6.4.2 Protection of the BS receiver of own or different BS

No changes due to CA in Rel-10.

6.6.4.3 Additional spurious emissions requirements

No changes due to CA in Rel-10.

6.6.4.4 Co-location with other base stations

No changes due to CA in Rel-10.

Transmitter intermodulation

The transmitter intermodulation requirement is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the own transmit signal and an interfering signal reaching the transmitter via the antenna. The intermodulation requirement shall apply whatever the type of transmitter considered (single carrier, multi-carrier, or transmitter supporting carrier aggregation). In contiguous CA scenario, the center frequency of each CC is not the center of the channel bandwidth. Therefore, the lower (higher) edge is introduced as the offset reference point for the interfering signal.

The wanted signal is clarified to include E-UTRA single carrier, or multi-carrier, or multiple contiguously aggregated carriers.

7 Receiver characteristics

7.1 General

For all receiver requirements, the carrier aggregation can be introduced with minimal impact on existing specifications. A note in existing specifications can be added that the requirements are applicable for each received carrier.

Furthermore, for ACS, blocking and intermodulation characteristics, negative and positive offsets of the interfering signal shall be introduced. The negative offsets of the interfering signal shall apply relative to the lower channel edge of the lowest carrier received and positive offsets of the interfering signal shall apply relative to the higher channel edge of the highest carrier received. This change is aligned with existing specifications 25.104 and 37.104.

7.2 Reference sensitivity level

In order to reduce the complexity of test configurations, the reference sensitivity power can be measured for each component carrier separately. The wanted signal power and SNR operating point is suggested to be the same as Rel-8. It is suggested to apply the existing throughput requirement to each carrier in this clause in case of CA.

7.3 Dynamic range

In order to reduce the complexity of test configurations, the dynamic range can be measured for each component carrier separately. The wanted signal power and SNR operating point is suggested to be the same as Rel-8. It is suggested to apply the existing throughput requirement to each carrier in this clause in case of CA.

7.4 In-channel selectivity

In order to reduce the complexity of test configurations, the in-channel selectivity capability can be measured for each component carrier separately. The wanted signal power and SNR operating point is suggested to be the same as Rel-8. It is suggested to apply the existing throughput requirement to each carrier in this clause in case of CA.

Adjacent Channel Selectivity (ACS) and narrow-band blocking

In order to reduce the complexity of test configurations, the adjacent channel selectivity and narrow-band blocking capability can be measured for each component carrier separately. The wanted signal power and SNR operating point is suggested to be the same as Rel-8. It is suggested to apply the existing throughput requirement to each carrier in this clause in case of CA.

Positive and negative offsets of the interfering signal relative to the lower (higher) edge shall be introduced.

7.6 Blocking

7.6.1 General blocking requirement

In order to reduce the complexity of test configurations, the blocking capability can be measured for each component carrier separately. The wanted signal power and SNR operating point is suggested to be the same as Rel-8. It is suggested to apply the existing throughput requirement to each carrier in this clause in case of CA.

Positive and negative offsets of the interfering signal relative to the lower (higher) edge shall be introduced.

7.6.2 Co-location with other base stations

No changes due to CA are needed as noted in section 7.1 that current requirement is applicable for each received component carrier.

7.7 Receiver spurious emissions

No changes due to CA are needed as noted in section 7.1 that current requirement is applicable for each received component carrier.

Receiver intermodulation

In order to reduce the complexity of test configurations, the receiver intermodulation capability can be measured for each component carrier separately. The wanted signal power and SNR operating point is suggested to be the same as Rel-8. It is suggested to apply the existing throughput requirement to each carrier in this clause in case of CA.

Positive and negative offsets of the interfering signal relative to the lower (higher) edge shall be introduced.

8 Performance requirement

8.1 General

For all BS demodulation performance requirements, carrier aggregation can be introduced in Rel-10 with minimal impact on existing specifications as current requirements will be applied on a Rel-8 single component carrier basis.

Following per Rel-8 component carrier implementation of carrier aggregation, SRS transmission will not affect BS demodulation performance requirements, as its transmission was optional in Rel-8 requirements.

Power control feature was not configured for Rel-8 LTE demodulation performance tests. Therefore, aiming at re-use of Rel-8 requirements, power control agreements for UL PC in CA are not relevant and do not have impact on the LTE-A BS performance demodulation requirements.

HARQ-ACK feedback is utilised in number of Rel-8 BS demodulation performance tests. HARQ-ACK physical transmission scheme on PHICH will be reused in Rel-10 from Rel-8. Therefore, no impact on the Rel-8 demodulation performance tests is foreseen from the PHICH point of view. PHICH will be transmitted only on the DL component carrier that was used to transmit the UL grant.

8.2 Performance requirements for PUSCH

8.2.1 Requirements in multipath fading propagation conditions

Both frequency-contiguous and frequency non-contiguous (i.e. clustered) PUSCH resource allocation are considered to be supported on each carrier in CA.

Single RB allocation PUSCH performance requirements shall be re-used from Rel-8 for single carrier allocation and shall not be considered for CA purposes.

Requirements for frequency contiguous allocation

PUSCH performance requirements for frequency-contiguous resource allocation will be re-used from Rel-8 specification, on per component carrier basis.

If the CA channel bandwidths of UL CC's are different, the test will be conducted at different SNR level for each of those CC's, as the PUSCH performance requirements at different channel bandwidths require different SNR level, as defined in Rel-8.

In order to reduce number of test cases for CA testing purposes, one CC combination for testing purposes is seen sufficient for maintaining PUSCH test coverage. Selection criterion of such CC combination is suggested to select the CC combination with largest aggregated bandwidth and the largest number of CC's.

A note in 36.104 specification section 8.1 (General) was added (similar to the DC-HSUPA case), stating that PUSCH throughput requirements for a BS supporting aggregated carriers are defined in terms of the existing Rel-8 single carrier throughput requirements.

8.2.1.2 Requirements for frequency non-contiguous allocation

Performance requirements for frequency non-contiguous RA (i.e. PUSCH/PUSCH and PUCCH/PUSCH) were deprioritized due to ITU-R submission mandatory issues to be covered first and the performance requirements for these transmit schemes will not be defined for Rel-10 timeline. Rel-11 performance requirements for frequency non-contiguous RA are [FFS].

Frequency hopping is not supported simultaneously with non-contiguous PUSCH resource allocation.

Maximum number of PUSCH clusters for clustered PUSCH resource allocation is 2 with the restriction of clustered allocation to be allowed only on one UL CC (per UE).

Possible future BS performance requirements for clustered PUSCH will not cover dynamic switching between single cluster Rel-8 scheme and clustered Rel-10 scheme.

Requirements for UL timing adjustment

For Rel-10 timeframe, intra-band CA was prioritized, leading to only single TA value in UL for carrier aggregation purposes. Therefore no changes are foreseen for UL timing adjustment performance requirement.

In case of multiple TA values being allowed e.g. for inter band case, UL TA requirement will require certain clarification.

The Rel-8/9 requirement is reused for the UL TA requirement tests, which are conducted only for the lowest and the highest channel bandwidths supported by the BS.

Requirements for high speed train

No changes are foreseen for this clause.

The Rel-8/9 requirement is reused for the high speed train requirement tests, which are conducted only for the lowest and the highest channel bandwidths supported by the BS.

Requirements for HARQ-ACK multiplexed on PUSCH

Irrespective of the conclusion on the possible simultaneous transmission of PUCCH and PUSCH, Rel-8 mechanism of multiplexing UCI onto PUSCH is always supported as the fallback mechanism when simultaneous PUSCH and PUCCH is considered as not feasible. No changes are foreseen for this requirement due to this agreement.

The Rel-8/9 requirement is reused for the HARQ-ACK multiplexed on PUSCH requirement tests, which are conducted only for the lowest and the highest channel bandwidths supported by the BS.

Performance requirements for PUCCH

PUCCH transmission of A/N and periodic CSI reporting supporting up to 5 DL CCs will be possible only within single, UE-specific UL component carrier.

Two PUCCH transmit schemes were introduced for CA purposes:

1. PUCCH format 1b with channel selection: supporting up to 4 A/N bits

Performance requirements for PUCCH format 1b with channel selection will be defined for Rel-10. The following performance measures will be evaluated for PUCCH format 1b with channel selection:

- DTX → ACK: (1%);
- ACK missed detection (ACK → NAK, DTX): 1%, after first transmission;

Performance requirements for this PUCCH mode will be defined with 4AN bits of UL feedback, where both above listed measures shall be fulfilled at the same time. One common requirement will be defined for FDD and TDD modes, based on the alignment results analysis.

2. PUCCH format 3 (DFT-S-OFDM): supporting full range of A/N bits

Performance requirements for PUCCH format 3 will be defined for Rel-10. The following performance measures will be evaluated for PUCCH format 3:

- ACK false alarm (DTX → ACK): 1%;
- ACK missed detection (ACK → NAK, DTX): 1%, after first transmission;
- NAK → ACK: 0,1%.

In case of ACK misdetection and NAK→ACK performance measures consideration, the following structure of the requirement to be introduced:

- ACK missed detection + ACK false alarm, as one requirement;
- NAK → ACK + ACK false alarm, as second requirement.

For PUCCH format 3, generic requirements for the number of A/N bits less than 11 can be applied for both FDD and TDD. Requirements for the number of A/N bits more than 11 apply only for TDD.

Performance requirements for this PUCCH mode will be defined for the following UL feedback cases:

- 4bits;
- 16bits (TDD only).

Simultaneous PUCCH and PUSCH transmission from single UE was introduced by CA. Performance requirements for simultaneous PUCCH and PUSCH will not be covered within Rel-10 and are [FFS] for Rel-11 timeframe.

Simulation assumptions for Rel-10 PUCCH performance requirements were captured in Annex B.

DTX to ACK performance

The definition of DTX to ACK probability for multiple A/N bits for CA purposes is as follows:

$$\text{Prob}(\text{PUCCH DTX} \rightarrow \text{ACK bits}) = \frac{\#(\text{false ACK bits})}{\#(\text{PUCCH DTX}) \times \#(\text{ACK/NAK bits})} \leq 10^{-2}$$

Where:

- Each falsely received ACK bit is accounted as one error;
- #(ACK/NAK bits) denote the number of encoded bits per subframe;
- #(PUCCH DTX) denotes the number of DTX occasions.

For BS not supporting CA, current DTX → ACK definition is to be reused.

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

No changes are foreseen for this clause.

8.3.3 CQI missed detection requirements for PUCCH format 2

No changes are foreseen for this clause.

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

No changes are foreseen for this clause.

8.4 Performance requirements for PRACH

PRACH test can be reused from Rel-8 specification. The justification is that despite of the fact that UE may be scheduled over multiple component carriers in UL, only one random access procedure shall be ongoing at any time. Therefore, no new test is foreseen to be needed due to introduction of CA. Therefore, no changes are foreseen for this clause.

9 Propagation conditions

9.1 Multi-path fading propagation conditions

For carrier aggregation requirements it shall be clarified in the annex, that the fading of the signals for each carrier shall be independent irrespective of the resource allocation scenario.

Annex A:
CA deployment scenarios

A.1 General

RAN4 will adopt the following working assumptions in RP-100390 to complete the CA WI for Rel-10:

- The signaling and protocol specifications to support carrier aggregation shall be designed in a generic way, and able to support carrier aggregation scenarios that are introduced in later RAN4 Releases;
- Specification of carrier aggregation shall be done in Release independent manner;
- Scenarios which are not treated in Release 10 timeframe should be captured in appropriate TR for future reference;
- New work items should be created when new carrier aggregation scenarios are introduced in Rel-10 and future 3GPP specifications – Noting that CA operating bands are release independent.

The following way forward in RP-100380 is followed:

Rel-10 signalling (e.g., RRC, MAC, HARQ, CQI, SRS, …) should support aggregation of up to 5 DL CCs and 5 UL CCs, irrespective of intra- or inter-band CA.

With regards to FDD DL:

- Rel-10 should support both intra- and inter-band aggregation;
- Rel-10 should support inter-band aggregation under deployments with RRH and repeaters, i.e., with different signal reception timings across CCs of different bands.

With regards to FDD UL:

- Work on intra-band aggregation should be rioritized in RAN4 till March 2011;
- Deployment scenarios with RRH and repeaters (and hence multiple TA maintenance) should be supported when inter-band aggregation is supported, e.g., in Rel-11.

With regards to TDD:

- Work on intra-band aggregation should be rioritized in RAN4 till March 2011, for both DL and UL;
- Deployment scenarios with RRH and repeaters (and hence multiple TA maintenance) should be supported when inter-band aggregation is supported, e.g., in Rel-11.

A.2 Intra – band Contiguous CA

Intra-band contiguous scenarios for the Rel-10 CA WI are shown in Table A.2-1.

Table A.2-1 Intra-band contiguous CA

E-UTRA CA Band	E-UTRA operating Band	Uplink (UL) band		Downlink (DL) band		Duplex mode
		UE transmit / BS receive	Channel BW MHz	UE receive / BS transmit	Channel BW MHz	
		F_{UL_low} (MHz) – F_{UL_high} (MHz)		F_{DL_low} (MHz) – F_{DL_high} (MHz)		

CA_40	40	2300	–	2400	50[1]	2300	–	2400	50[1]	TDD
CA_1	1	1920	–	1980	40	2110	–	2170	40	FDD
Note 1: BS requirements will be developed for both 50 MHz and 40 MHz aggregated channel BWs for the CA_40 scenario in release-10 timeframe										

A.3 Inter band Non-Contiguous CA

Inter-band non-contiguous scenarios for the Rel-10 CA WI are shown in Table A.3-1.

Table A.3-1 Inter-band non-contiguous CA

E-UTRA CA Band	E-UTRA operating Band	Uplink (UL) band				Downlink (DL) band				Duplex mode
		UE transmit / BS receive			Channel BW MHz	UE receive / BS transmit			Channel BW MHz	
		F_{UL_low} (MHz) – F_{UL_high} (MHz)				F_{DL_low} (MHz) – F_{DL_high} (MHz)				
CA_1-5	1	1920	–	1980	10 [1)]	2110	–	2170	10	FDD
	5	824	–	849	10 [1)]	869	–	894	10	
CA_3-7	3	1710	–	1785	10, 15 [2)]	1805	–	1880	10, 15, 20	FDD
	7	2500	–	2570	10, 15 [2)]	2620	–	2690	10, 15, 20	
CA_4-13	4	1710	–	1755	10 [2)]	2110	–	2155	10	FDD
	13	777	–	787	10 [2)]	746	–	756	10	
CA_4-17	4	1710	–	1755	10 [2)]	2110	–	2155	10	FDD
	17	704	–	716	10 [2)]	734	–	746	10	
Note 1: Only one uplink component carrier is used in any of the two frequency bands at any time Note 2: The first part of the WI considers only one uplink component carrier to be used in any of the two frequency bands at any time.										

Annex B:
BS demodulation requirements: Rel-10 PUCCH simulation assumptions

This Annex captures simulation assumptions for Rel-10 PUCCH performance requirements.

Table B.1-1 Rel-10 PUCCH simulation assumptions

<table>
<tr><td>Performance measures</td><td colspan="2">

Below listed measures are to be considered for PUCCH performance requirements:
<table>
<tr><th>Measure</th><th>Threshold</th></tr>
<tr><td>ACK false alarm (DTX → ACK)</td><td>1%</td></tr>
<tr><td>ACK missed detection
(ACK → NAK, DTX)</td><td>1%, after first transmission</td></tr>
<tr><td>NAK → ACK</td><td>0,1% - for PUCCH format 3 only</td></tr>
</table>

PUCCH format1b with Channel Selection

One generic requirement for FDD and TDD to be defined

PUCCH format3

Generic requirements for the number of A/N bits less than 11 can be applied for both FDD and TDD.
Requirements for the number of A/N bits more than 11 apply only for TDD.

In case of ACK misdetection and NAK→ ACK performance measures consideration, the following structure of the requirement to be introduced:

ACK missed detection + ACK false alarm, as one requirement
NAK → ACK + ACK false alarm, as second requirement.

</td></tr>
<tr><td>ACK false alarm definition</td><td colspan="2">

Measure definition:

$$\text{Prob}(\text{PUCCH DTX} \rightarrow \text{ACK bits}) = \frac{\#(\text{false ACK bits})}{\#(\text{PUCCH DTX}) \times \#(\text{ACK/NAK bits})} \leq 10^{-2}$$

Each falsely received ACK bit will be accounted as one error, for DTX→ACK (i.e. ACK false alarm) performance evaluation.
#(ACK/NAK bits) denote the number of encoded bits per subframe
#(PUCCH DTX) denotes the number of DTX occasions

</td></tr>
<tr><td>ACK missed detection definition</td><td colspan="2">

Each missed ACK bit will be accounted as one error when ACK is sent

</td></tr>
<tr><td>ACK codeword selection</td><td colspan="2">

PUCCH format 1b with Channel Selection: fixed codeword AAAA
PUCCH format 3:

Random codeword selection: picking one out of 2^N codewords with equal probability, where N=#ACK/NAK bits.

Sequential codeword selection is not excluded

All codewords from applicable codebook to be considered

</td></tr>
<tr><td rowspan="3">UL feedback size</td><td>PUCCH format 1b with Channel Selection</td><td>4bits</td></tr>
<tr><td rowspan="2">PUCCH format 3</td><td>FDD: 4bits</td></tr>
<tr><td>TDD: 4bits, 16bits</td></tr>
</table>

ACK repetitions	Disabled
NAK to ACK definition	• Measure definition: $\text{Prob}(\text{PUCCH NACK} \rightarrow \text{ACK bits}) = \frac{\#(\text{NACK bits decoded as ACK bits})}{\#(\text{Total NACK bits})}$ • $\#(\text{Total NACK bits})$ denotes the total number of NAK bits transmitted at the transmitter. • $\#(\text{NACK bits decoded as ACK bits})$ denotes the number of NAK bits decoded as ACK bits at the receiver, i.e. the number of received ACK bits. • NAK bits in the definition do not contain the NAK bits which are mapped from DTX, i.e. NAK bits received when DTX is sent should not be considered. • All NAK bits shall be regarded as feedback for incorrectly detected transport blocks.
NAK codeword selection	• Random NAK to ACK codeword selection: picking one out of 2^N codewords with equal probability, where N=#ACK/NAK bits. ▪ Sequential codeword selection is not excluded • All codewords from applicable codebook to be considered for PUCCH format 1b with Channel Selection and for PUCCH format 3.
Propagation conditions	• EPA5, EVA70 • Propagation channel definitions to be reused from 36.104.
Cyclic Prefix	• Normal CP
Channel BWs	• 10, 15, 20MHz NOTE: 5MHz channel BW to be considered also after specification of applicable CA scenarios
Carrier definition	• Carrier frequency: 2.0 GHz • PUCCH on single CC, UL feedback for 2DL CC's • signal BW: 180kHz • Number of PRBs for PUCCH: 1 • Resource allocation: edge PRB of the channel BW
PUCCH multiplexing	• 1UE • $\Delta_{\text{shift}}^{\text{PUCCH}} = 2$
Antenna's configuration	• UE: 1Tx • BS: 2Rx, 4Rx • correlation between branches is 0

	• no power imbalance between branches
Channel estimation	• Noise mode: AWGN • ML channel estimator with real noise estimation • Pilot power consideration only, for channel estimation purposes
Timing estimation	Perfect timing estimation
Frequency hopping	At slot boundary
DMRS frequency hopping	Disabled
Power control	Off

Annex D:
Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2010-02	R4#54	R4-100965			Skeleton Technical Report / E-UTRA Carrier Aggregation, BS radio transmission and reception		0.0.1
2010-05	R4#55	R4-102082			Agreed Text Proposals in RAN4-AH#2010-02: **R4-101170**, " TP for CA BS TR: Clause 8.4 (Performance requirements for PRACH)" **R4-101485**, " TP for CA BS TR, deployment scenarios" **R4-101548**, " TP for CA BS TR: Clause 5.5 (Operating bands)" **R4-101556**, " TP for CA BS TR: Clause 8.1 (Performance requirement: General)" **R4-101557**, " TP for CA BS TR: Clause 8.2 (Performance requirements for PUSCH)" **R4-101558**, " TP for CA BS TR: Clause 8.3 (Performance requirements for PUCCH" **R4-101559**, " TP for CA BS TR: Annex B.2 (Multi-path fading propagation conditions)"	0.0.1	0.0.2
2010-05	R4#55	R4-102329			Agreed Text Proposals in RAN4#55: **R4-101784**, " TP for CA BS TR, inclusion of Annex B.2 and F" **R4-102193**, " TP for CA BS TR: New Clause 4.4 Applicability of requirements" **R4-102312**, " TP for CA BS TR: Clause 4 (General)" **R4-101559**, " TP for CA BS TR: Annex B.2 (Multi-path fading propagation conditions)"	0.0.2	0.1.0
2010-06	R4-AH#10-03	R4-102376			Agreed Text Proposals in RAN4-AH#2010-03: **R4-102376** " BS TR for CA WI, TR 36.808, V0.1.1", editorial update to include TR number	0.1.0	0.1.1
2010-08	R4#56	R4-103140			Agreed Text Proposals in RAN4-AH#2010-03: **R4-102376** " Text proposal for CA BS TR, section 7.1, 7.2, 7.3 and 7.4"	0.1.1	0.2.0
2010-08	R4#56	R4-103432			Agreed Text Proposals in RAN4#56: **R4-103093** " Text Proposal for CA BS TR Clause 3 and Clause 5.6" **R4-103219** " Text proposal for CA BS TR: Clause 6.6.1 (Occupied bandwidth)" **R4-103217** " Text proposal for CA BS TR: Clause 5.4 (Channel arrangement)" **R4-103177** " Text proposal for CA BS TR: Introducing MSR as appendix C" **R4-103387** " Text proposal for CA BS TR: Clause 6.1 (General)" **R4-103099** " TP CA BS TR Clause 7.5 ACS and narrow-band blocking" **R4-103100** " TP CA BS TR Clause 7.6 Blocking" **R4-103102** " TP CA BS TR Clause 7.8 Receiver intermodulation" **R4-103101** " TP CA BS TR Clause 7.7 Receiver spurious emissions" **R4-103408** " TP CA BS TR: Clause 6.6.2 ACLR" **R4-103409** " TP CA BS TR Clause 6.6.3 Operating band unwanted emission" **R4-103098** " TP CA BS TR: Clause 6.7 Transmitter intermodulation"	0.2.0	0.3.0
2010-09	R4-AH#10-04	R4-103854			Agreed Text Proposals in RAN4#56: **R4-103178** " TP for CA BS TR appendix A"	0.3.0	0.3.1
2010-11	R4#57	R4-			Agreed Text Proposals in R4-AH#10-04:	0.3.1	0.4.0

		104174			**R4-103490** "TP for TR 36.808: Clause 6.6.4 (Transmitter spurious emissions)" **R4-103491** " TP for TR 36.808: Clause 6.6.1 (Occupied bandwidth)" **R4-103658** "CA BS TR 36.808 TP: PUSCH performance requirements" **R4-103948** "TP CA BS TR Clause 6.2 Base station output power" **R4-103971** "Time alignment between carriers" **R4-103981** "MSR requirements for CA; TP for annex C"		
2010-11	R4#57	R4-104686			Agreed Text Proposals in RAN4#57: **R4-104730,** "TP BS CA TR Clause 6.4 Transmit ON/OFF power" **R4-104805**, "TP BS CA TR Clause 6.3 Output power dynamics" **R4-104806**, "TP BS CA TR Clause 6.5.1, 6.5.2 and 6.5.4" **R4-104825** "TP for TR 36.808: Channel spacing for intra-band contiguous CA"	0.4.0	0.5.0
2010-11	RP#50	RP-101163			Presentation of TR 36.808 to TSG RAN#50 for information	0.5.0	1.0.0
2011-01	R4#57AH	R4-110201			Agreed Text Proposals in RAN4#57: **R4-104953,** "TP: PUCCH performance requirements" **R4-105003**, "CA BS TR 36.808 TP: clarifications on PUSCH performance requirements"	1.0.0	1.1.0
2011-02	R4#58	R4-110737			Agreed Text Proposals in RAN4#57AH: **R4-110065,** "TP for removal of brackets from BS RF transmitter requirements (time alignment) TR 36.808" **R4-110067**, "PUSCH demodulation requirements; impact of frequency error" **R4-110504**, "TP for BS on: Introduction of band 3 and band 7, band 4 + band 13 and band 4 + band 17 for LTE-A CA". This version was not approved, revised in R4-111495.	1.1.0	1.2.0
2011-02	R4#58	R4-111495			Agreed Text Proposals in RAN4#57AH: **R4-110065,** "TP for removal of brackets from BS RF transmitter requirements (time alignment) TR 36.808" **R4-110067**, "PUSCH demodulation requirements; impact of frequency error" **R4-110504**, "TP for BS on: Introduction of band 3 and band 7, band 4 + band 13 and band 4 + band 17 for LTE-A CA". In addition Annex A.4, Annex B and Annex C removed	1.2.0	1.3.0
2011-04	R4#58AH	R4-111725			Agreed Text Proposals in RAN4#58: **R4-111606,** "Clarification on PUSCH performance requirements" **R4-111647**, "[CA BS TR] PUCCH simulation assumptions" **R4-111648**, "[CA BS TR] PUCCH performance requirements skeleton" New content added to Annex B. Old references to Annex B removed or replaced.	1.3.0	1.4.0
2011-05	R4#59	R4-112432			Agreed Text Proposals in RAN4#58AH: **R4-112278,** "Test cases for PUSCH performance requirements"	1.4.0	1.5.0
2011-06	R4#59AH	R4-113691			Agreed Text Proposals in RAN4#59: **R4-112871,** "TR36.808: implementation of latest BS performance requirements related decisions"	1.5.0	1.6.0
2011-08	R4#60	R4-114265			Agreed Text Proposals in RAN4#59AH: **R4-113339,** "TR36.808: BS performance requirements agreements"	1.6.0	1.7.0
2012-06	RP#56	RP-120595			Presentation of TR 36.808 to TSG RAN#56 for approval	1.7.0	2.0.0
2012-06	RP#56				Approved by RAN	2.0.0	10.0.0
2013-06	RP-60	RP-130766	005		Additional information for required TAE for some inter-band CA scenarios	10.0.0	10.1.0