3GPP TSG-RAN WG2 Meeting #113bis-e R2-21xxxxx

Online, April 12 – April 20, 2021

**Agenda item: 4.5**

**Source: Nokia**

**Title: Summary and discussion on [Post113-e][206][LTE] Clarification to Fallback band combination definition (Nokia)**

**WID/SID: TEI16 - Release 16**

**Document for: Discussion and Decision**

# Introduction

TS36.306 defines ‘Fallback band combination’ term, that specifically refers to ‘each band’ in terms of determining bandwiths supported by the UE by the obtained fallback band combination from the parent (for the fallback) band combination.

RAN2 discuss, since RAN2#111e, how to interpet the definition and pertaining UE capabilities on bandwiths supported by the UE by the obtained fallback band combination. The interpretation appeared umbiguous as the fallback band combination granularity (‘each band’) can be understood as a ‘carrier’ or ‘band entry’.

This document collects observations and clarifications made so far. Further it aims to collect and conclude companies views on fallback combination definition, and a need to clarify its interpretation in TS36.306, based on the following schedule:

* [Post113-e][206][LTE] Clarification to Fallback band combination definition (Nokia)

Scope: Clarify what is the right interpretation of fallbacks in RAN2. Should clarify if this can impact also NR.

Intended outcome: Discussion report + agreeable LTE CRs (if any)

Deadline: Long

# 2 Background

The issue has been originally identified in the input document to RAN2#111e in [R2-2007518](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_111_e/Docs/R2-2007518.zip). Since there was no conclusion on the subject, the same CR has been further provided to RAN2#113e in [R2-2100606](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113_e/Docs/R2-2100606.zip).

The CR motivation explains that existing definition of ‘Fallback band combination’ in TS36.306 use reference to “each band” in a way that contradicts with TS36.101 concept on bandwidths’ grid:

* TS36.306 states: “A fallback band combination and the parent band combination support the same bandwidths for each band of the fallback band combination.”
* While the definition makes a reference to a ‘band’ of a bandwidth (which in the light of RRC signalling would refer to a ‘band entry’), in TS36.101, the BCS is based on “Channel bandwidths for carrier”

That remains unclear what ‘band’ means and may leads to various interprations e.g. bandwidth of the band may refer to the Aggregated Bandwidth of all the CCs in this band or to the bandwidth of a single carrier in that band.

# 3 Interpretation issue

As per the last discussion on the topic (RAN2#113-e report in [R2-2101951](http://3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2101951.zip)), RAN2#113-e observed the reference to ‘each band’ in the fallback band combination definition seem to have two possible interpretations:

Alternatives

1) From RAN2 viewpoint, "band" means "band entry" - Nokia, LGE

2) From RAN2 viewpoint, "band" means "one carrier" - OPPO, Ericsson

The bandwidth of a ‘band’ obtained as the fallback band combination may lead to various interpretations e.g. bandwidth of the band may refer to:

* the aggregated bandwidth of all the component carriers in this band or,
* the bandwidth of a single carrier in that band.

‘Band’ normally may refer to intra-band contiguous CCs and intra-band non-contiguous CCs. Thus, it remains open for interpretation if the fallback band combination may concern only subsets of the parent band combination or can it be also implying any band combination which bandwidth equals to the parent bandwidth.

**Example 1:** UE supports inter-band contiguous CA: CA\_1A-3C (see Table 1 in the Annex).

The parent band combination is CA\_1A-3C: Let’s assume, in particular, supported parent bandwidths: 1A(20MHz)-3C (20MHz, 10Mhz).

In that case a fallback combination (supporting one SCG release) could be CA\_1A-3A, where particular carriers used in fallback band combinations can differ:

Fallback Option 1: CA\_1A(20MHz)-3A(20Mhz)

Fallback Option 2: CA\_1A(20MHz)-3A(10Mhz).

According to the definition a fallback band combination can be a combination that supports the same bandwidths as parent for ‘each band’.

Possible interpretation of ‘bandwidth for each band’ in the **fallback** combination is:

* 20MHz for first band entry/carrier
* 20MHz or 10MHz for second band entry/carrier

Possible interpretation of ‘bandwidth for each band’ in the **parent** combination is:

* 20MHz for first band entry/carrier
* 30MHz aggregated bandwidth for second band entry, while 10MHz for first carrier, 20MHz for second carrier.

While for the simple cases with a single carrier, the distinction between carrier and band entry does not make any difference, for bandwidths aggregated from more than two component carriers the interpretation of a bandwidth for each band/carrier vs. bandwidth for each band entry takes different meaning. It also depends on whether the bandwidth concern original band combination or fallback band combination.

The Example 1 makes it clearer that the given fallback band combinations do not support exactly the same or fully aggregated “bandwidths” sets as the parent band combination. The supported “bandwidths” in the fallback band combination are subset of the parent “bandwidths”.

In case “Bandwidths” are considered in terms of a:

* carrier: bandwidths supported in the Fallback Band Combinations are the same (as for parents) but only for these carriers that are used in the fallback.
* band entry: bandwidths supported in the Fallback Band Combinations are the same (as for parents) for each band entry, but also only for these components that are used in the fallback.

In result, not all parent carriers are defining a fallback subset. This leads to considerations, that besides ambiguity on ‘a band’ additional controversy arises due to the use of ‘each’ band in the definition.

Therefore, it remains to be clarified what the ‘each band’ in 36.306 definition refers to.

In order to achieve a common understanding on the definition meaning, companies are asked to provide answers to the following questions:

**Q1: Is the ‘each band’ in the TS36.306 definition referring to ‘each carrier’ or ‘each band entry’?**

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| **Company** | **View** |
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**Conclusion 1:**

**Proposal 1:**

**Q2: Is it necessary to clarify the existing definition on Fallback band combination in the TS36.306?**

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| **Company** | **View** |
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**Conclusion 2:**

**Proposal 2:**

**Q3: If the answer to Q2 is yes: from which release onwards the clarification should be introduced?**

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| **Company** | **View** |
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**Conclusion 3:**

**Proposal 3:**

# 3 Conclusion

**Conclusion 1:**

**Proposal 1:**

**Conclusion 2:**

**Proposal 2:**

**Conclusion 3:**

**Proposal 3:**

# Annex

The issue has been raised in the input document to RAN2#113e in [R2-2100606](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113_e/Docs/R2-2100606.zip). The CR led to the suggestion to include clarification on the fallback band combination in TS36.306 as follows:

# Excerpt from 36.306 CR:

## 3.1 Definitions

**Fallback band combination:** A band combination that would result from another band combination (parent band combination) by releasing at least one SCell or uplink configuration of SCell. A fallback band combination supports the same bandwidth(s) for a band entry as the parent band combination of the fallback band combination. An intra-band non-contiguous band combination is not considered to be a fallback band combination of an intra-band contiguous band combination.

# Excerpt from 36.306:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations (NOTE 4) | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_1A-3A | CA\_1A-3A | 1 |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 1 |  |  | Yes | Yes | Yes | Yes | 40 | 1 |
| 3 |  | Yes | Yes | Yes | Yes | Yes |
| CA\_1A-1A-3A | - | 1 | See CA\_1A-1A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | | 60 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-1A-7A | CA\_1A-7A | 1 | See CA\_1A-1A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | | 60 | 0 |
| 7 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-1A-7C | CA\_7C | 1 | See CA\_1A-1A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 80 | 0 |
| 7 | See CA\_7C in Table 5.6A.1-1 of 36.101 Bandwidth combination set 2 | | | | | |
| CA\_1A-3A-3A | CA\_1A-3A | 1 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 3 | See CA\_3A-3A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_1A-1A-3A-3A | - | 1 | See CA\_1A-1A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 80 | 0 |
| 3 | See CA\_3A-3A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_1A-3C | CA\_1A-3A, CA\_3C | 1 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 3 | See CA\_3C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |

Table 1: Excerpt from the TS36.306 Table 5.6A.1-2: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA (two bands)

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|  |  | E-UTRA CA configuration / Bandwidth combination set | | | | | | |
| E-UTRA CA configuration | Uplink CA configurations  (NOTE 3) | Component carriers in order of increasing carrier frequency | | | | | Maximum aggregated  bandwidth [MHz] | Bandwidth combination set |
| Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] |
| CA\_1C | CA\_1C | 15 | 15 |  |  |  | 40 | 0 |
| 20 | 20 |  |  |  |
| 5, 10, 15 | 20 |  |  |  | 40 | 1 |
| 20 | 5, 10, 15, 20 |  |  |  |
| CA\_2C |  | 5 | 20 |  |  |  | 40 | 0 |
| 10 | 15, 20 |  |  |  |
| 15 | 10, 15, 20 |  |  |  |
| 20 | 5, 10, 15, 20 |  |  |  |
| CA\_3B |  | 5 | 3 |  |  |  | 10 | 0 |
| 3, 5 | 5 |  |  |  |
| CA\_3C | CA\_3C | 5, 10, 15 | 20 |  |  |  | 40 | 0 |
| 20 | 5, 10, 15, 20 |  |  |  |

Table 2: Excerpt from the TS36.306 Table 5.6A.1-1: E-UTRA CA configurations and bandwidth combination sets defined for intra-band contiguous CA