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3rd Generation Partnership Project;

Technical Specification Group Radio Access Networks;

LTE inter-band CA for x bands DL with 2 bands UL with x=3,4,5

(Release 16)

 

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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 present document is a technical report for LTE inter-band Carrier Aggregation for x bands (x=3, 4, 5) DL with 2 bands UL under Rel-16 time frame. The purpose is to gather the relevant background information and studies in order to address x bands (x= 3, 4, 5) DL and 2 bands UL Carrier Aggregation requirements.

This TR covers the relevant background information and studies core and performance requirements for the Rel-16 band combinations in Table 1-1, 1-2 and 1-3.

**Table 1-1: 3 bands DL/2 bands UL CA configurations part of the WI**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_3A-11A-18A | CA\_3A-11A | 3 |  |  | | Yes | Yes | Yes | Yes | 45 | 0 |
| 11 |  |  | | Yes | Yes |  |  |
| 18 |  |  | | Yes | Yes | Yes |  |
| CA\_3A-11A-26A | CA\_3A-11A | 3 |  |  | | Yes | Yes | Yes | Yes | 45 | 0 |
| 11 |  |  | | Yes | Yes |  |  |
| 26 |  |  | | Yes | Yes | Yes |  |
| CA\_1A-3A-42C | CA\_1A-42C  CA\_3A-42C | 1 |  |  | | Yes | Yes | Yes | Yes | 80 | 0 |
| 3 |  |  | | Yes | Yes | Yes | Yes |
| 42 | See CA\_42C Bandwidth combination set 0 in Table 5.6A.1-1 in TS36.101 | | | | | | |
| CA\_2A-4A-13A | CA\_2A-13A  CA\_4A-13A | 2 |  |  | | Yes | Yes | Yes | Yes | 50 | 0 |
| 4 |  |  | | Yes | Yes | Yes | Yes |
| 13 |  |  | | Yes | Yes |  |  |
| CA\_2A-2A-4A-5A | CA\_2A-5A  CA\_4A-5A | 2 | See CA\_2A-2A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | | | 70 | 0 |
| 4 |  |  | | Yes | Yes | Yes | Yes |
| 5 |  |  | | Yes | Yes |  |  |
| CA\_2A-2A-5A-66A-66A | CA\_2A-5A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | | 90 | 0 |
| 5 |  |  | | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | |
| CA\_2A-5B-66A-66A | CA\_2A-5A  CA\_5A-66A | 2 |  |  | | Yes | Yes | Yes | Yes | 80 | 0 |
| 5 | See CA\_5B Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | |
| CA\_2A-5A-46D | CA\_2A-5A | 2 |  |  | | Yes | Yes | Yes | Yes | 90 | 0 |
| 5 |  |  | | Yes | Yes |  |  |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | |
| CA\_5A-46D-66A | CA\_5A\_46A  CA\_5A\_66A | 5 |  |  | | Yes | Yes |  |  | 90 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | |
| 66 |  |  | | Yes | Yes | Yes | Yes |
| CA\_2A-13A-66A-66B | CA\_2A-13A  CA\_13A-66A | 2 |  |  | | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | | Yes | Yes |  |  |
| 66 |  |  | | Yes | Yes | Yes | Yes |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| CA\_2A-13A-48A-48C | CA\_2A-13A | 2 |  |  | | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | | Yes | Yes |  |  |
| 48 |  |  | | Yes | Yes | Yes | Yes |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| CA\_13A-46D-66A | CA\_13A-66A | 13 |  |  | | Yes | Yes |  |  | 90 | 0 |
| 46 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| 66 |  |  | | Yes | Yes | Yes | Yes |
| CA\_2A-13A-46D | CA\_2A-13A | 2 |  |  | | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | | Yes | Yes |  |  |
| 46 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| CA\_1A-3A-38A | CA\_1A-3A | 1 |  |  | | Yes | Yes | Yes | Yes | 60 | 0 |
| 3 |  |  | | Yes | Yes | Yes | Yes |
| 38 |  |  | | Yes | Yes | Yes | Yes |
| 3 |  |  | | Yes | Yes | Yes | Yes |
| CA\_2A-12A-66A | CA\_2A-12A  CA\_2A-66A  CA\_12A-66A | 2 |  |  | | Yes | Yes | Yes | Yes | 50 | 0 |
| 12 |  |  | | Yes | Yes |  |  |
| 66 |  |  | | Yes | Yes | Yes | Yes |
| CA\_1A-3A-42D | CA\_1A-3A,  CA\_1A-42A  CA\_3A-42A,  CA\_1A-42C  CA\_3A-42C | 1 |  |  | | Yes | Yes | Yes | Yes | 100 | 0 |
| 3 |  |  | | Yes | Yes | Yes | Yes |
| 42 | See CA\_42D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| CA\_2A-5A-66A | CA\_5A-66A,  CA\_2A-5A | 2 |  |  | Yes | | Yes | Yes | Yes | 50 | 0 |
| 5 |  |  | Yes | | Yes |  |  |
| 66 |  |  | Yes | | Yes | Yes | Yes |
| CA\_2A-13A-66A | CA\_2A-13A,  CA\_13A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 50 | 0 |
| 13 |  |  | Yes | | Yes |  |  |
| 66 |  |  | Yes | | Yes | Yes | Yes |
| CA\_2A-48A-66A | CA\_48A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 60 | 0 |
| 48 |  |  | Yes | | Yes | Yes | Yes |
| 66 |  |  | Yes | | Yes | Yes | Yes |
| CA\_2A-2A-5A-66A | CA\_2A-5A,  CA\_5A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 of [1] | | | | | | | 70 | 0 |
| 5 |  |  | Yes | | Yes |  |  |
| 66 |  |  | Yes | | Yes | Yes | Yes |
| CA\_2A-5A-66A-66A | CA\_2A-5A,  CA\_5A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 70 | 0 |
| 5 |  |  | Yes | | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 of [1] | | | | | | |
| CA\_2A-5A-66B | CA\_2A-5A,  CA\_5A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 50 | 0 |
| 5 |  |  | Yes | | Yes |  |  |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| CA\_2A-5A-66C | CA\_2A-5A,  CA\_5A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 70 | 0 |
| 5 |  |  | Yes | | Yes |  |  |
| 66 | See CA\_66C Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| CA\_2A-5B-66A | CA\_2A-5A,  CA\_5A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 60 | 0 |
| 5 |  |  | Yes | | Yes |  |  |
| 66 |  |  | Yes | | Yes | Yes | Yes |
| CA\_2A-2A-13A-66A | CA\_2A-13A,  CA\_13A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 of [1] | | | | | | | 70 | 0 |
| 13 |  |  | Yes | | Yes |  |  |
| 66 |  |  | Yes | | Yes | Yes | Yes |
| CA\_2A-13A-66A-66A | CA\_2A-13A,  CA\_13A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 of [1] | | | | | | |
| CA\_2A-13A-66B | CA\_2A-13A,  CA\_13A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | | Yes |  |  |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| CA\_2A-13A-66C | CA\_2A-13A,  CA\_13A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | | Yes |  |  |
| 66 | See CA\_66C Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| CA\_2A-2A-5A-66A-66A | CA\_2A-5A,  CA\_5A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 of [1] | | | | | | | 90 | 0 |
| 5 |  |  | Yes | | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 of [1] | | | | | | |
| CA\_2A-2A-5A-66B | CA\_2A-5A,  CA\_5A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 of [1] | | | | | | | 90 | 0 |
| 5 |  |  | Yes | | Yes |  |  |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| CA\_2A-2A-5A-66C | CA\_2A-5A,  CA\_5A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 of [1] | | | | | | | 110 | 0 |
| 5 |  |  | Yes | | Yes |  |  |
| 66 | See CA\_66C Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| CA\_2A-5B-66B | CA\_2A-5A,  CA\_5A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 80 | 0 |
| 5 | See CA\_5B Bandwidth Combination Set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| CA\_2A-5B-66C | CA\_2A-5A,  CA\_5A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 100 | 0 |
| 5 | See CA\_5B Bandwidth Combination Set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| 66 | See CA\_66C Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| CA\_2A-46D-48A | CA\_2A-48A | 2 |  |  | Yes | | Yes | Yes | Yes | 100 | 0 |
| 46 | See the CA\_46D Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| 48 |  |  | Yes | | Yes | Yes | Yes |
| CA\_2A-46E-48A | CA\_2A-48A | 2 |  |  | Yes | | Yes | Yes | Yes | 120 | 0 |
| 46 | See the CA\_46E Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | | |
| 48 |  |  | Yes | | Yes | Yes | Yes |
| CA\_3A-8A-38A | CA\_3A-8A | 1 |  |  | Yes | | Yes | Yes | Yes | 50 | 0 |
| 3 |  |  | Yes | | Yes |  |  |
| 38 |  |  | Yes | | Yes | Yes | Yes |
| CA\_1A-1A-3C-5A | CA\_1A-3A,  CA\_1A-5A  CA\_3A-5A | 1 | See CA\_1A-1A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | | 90 | 0 |
| 3 | See CA\_3C Bandwidth combination set 0 in table 5.6A.1-1 | | | | | | |
| 5 |  |  | Yes | | Yes |  |  |
| CA\_1A-1A-3C-28A | CA\_1A-3A,  CA\_1A-28A  CA\_3A-28A | 1 | See CA\_1A-1A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | | 100 | 0 |
| 3 | See CA\_3C Bandwidth combination set 0 in table 5.6A.1-1 | | | | | | |
| 28 |  |  | Yes | | Yes | Yes | Yes |
| CA\_1A-3A-3A-7A | CA\_1A-3A, CA\_1A-7A, CA\_3A-7A | 1 |  |  | Yes | | Yes | Yes | Yes | 80 | 0 |
| 3 | See the CA\_3A-3A Bandwidth combination set 0 in the Table 5.6A.1-3 | | | | | | |
| 7 |  |  | Yes | | Yes | Yes | Yes |
| CA\_1A-3A-3A-7A-7A | CA\_1A-3A, CA\_1A-7A, CA\_3A-7A | 1 |  |  | Yes | | Yes | Yes | Yes | 100 | 0 |
| 3 | See the CA\_3A-3A Bandwidth combination set 0 in Table below | | | | | | |
| 7 | See the CA\_7A-7A Bandwidth combination set 1 in Table below | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_2A-14A-30A | CA\_2A-14A  CA\_14A-30A | 2 |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 30 |  |  | Yes | Yes |  |  |
| CA\_2A-14A-66A | CA\_2A-14A  CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_14A-30A-66A | CA\_14A-30A  CA\_14A-66A | 14 |  |  |  | Yes | Yes |  | 40 | 0 |
| 30 |  |  |  | Yes | Yes |  |
| 66 |  |  |  | Yes | Yes | Yes |
| CA\_2A-2A-14A-66A | CA\_2A-14A  CA\_14A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 70 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_14A-30A-66A-66A | CA\_14A-30A  CA\_14A-66A | 14 |  |  | Yes | Yes |  |  | 60 | 0 |
| 30 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-14A-66A-66A | CA\_2A-14A  CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 | See CA\_6`6A-66A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-2A-14A-66A-66A | CA\_2A-14A  CA\_14A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 90 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-14A-66A-66A-66A | CA\_2A-14A  CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-4 | | | | | |
| CA\_2A-13A-46A-46D | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46A-46D Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-46D | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-13A-46A-46C | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46A-46C Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-46C | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-13A-46A-46A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46A-46A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-46A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 50 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 |  |  |  | Yes |  | Yes |
| CA\_2A-13A-46E | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46E Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-46E-66A | CA\_2A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 120 | 0 |
| 46 | See the CA\_46E Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46D-66A | CA\_2A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 | See the CA\_46D Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46C-66A | CA\_2A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| 46 | See the CA\_46C Bandwidth combination set 0 in the Table 5.6A.1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46A-66A | CA\_2A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 60 | 0 |
| 46 |  |  |  | Yes |  | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-48A-66A | CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 60 | 0 |
| 46 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_13A-48A-66A | CA\_13A-48A  CA\_13A-66A  CA\_48A-66A | 13 |  |  | Yes | Yes |  |  | 50 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46D-48C | CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 120 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_46D-48C-66A | CA\_48A-66A | 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 120 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46C-48C | CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-46D-48A | CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 |  |  | Yes | Yes | Yes | Yes |
| CA\_46C-48C-66A | CA\_48A-66A | 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 100 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_46A-48C-66A | CA\_48A-66A | 46 |  |  |  | Yes |  | Yes | 80 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_46D-48A-66A | CA\_48A-66A | 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 100 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-48C-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46A-48C | CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| 46 |  |  | Yes | Yes | Yes | Yes |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-46C-48A | CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-46A-48A | CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 60 | 0 |
| 46 |  |  |  | Yes |  | Yes |
| 48 |  |  | Yes | Yes | Yes | Yes |
| CA\_46C-48A-66A | CA\_48A-66A | 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 80 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_46A-48A-66A | CA\_48A-66A | 46 |  |  |  | Yes |  | Yes | 60 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_1A-7A-20A | CA\_1A-7A  CA\_1A-20A  CA\_7A-20A | 1 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 7 |  |  |  | Yes | Yes | Yes |
| 20 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-3A-3A-8A | CA\_1A-3A  CA\_1A-8A  CA\_3A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 3 | See CA\_3A-3A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-7A-8A | CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 7 |  |  |  | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-7A-7A-8A | CA\_1A-7A  CA\_1A-8A  CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 7 | See CA\_7A-7A Bandwidth combination set 1 in Table 5.6A.1-3 | | | | | |
| 8 |  |  | Yes | Yes |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_2A-5A-48A | CA\_2A-48A  CA\_5A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 50 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-5A-48C | CA\_2A-48A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-5A-48D | CA\_2A-5A  CA\_5A-48A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-48A-66A | CA\_2A-48A  CA\_2A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 60 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-48A-66A-66A | CA\_48A-66A  CA\_2A-48A  CA\_2A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-48D-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-48C-66A-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-48D-66A-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 120 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-48E-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 48 | See CA\_48E Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-48E-66A-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 120 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-66A | CA\_2A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 50 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-66A-66A | CA\_13A-66A  CA\_2A-13A  CA\_2A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-48A | CA\_2A-48A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 50 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-13A-48C | CA\_2A-48A  CA\_13A-48A  CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-13A-48D | CA\_2A-48A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_5A-48A-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 50 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_5A-48A-66A-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 70 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_5A-48C-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 70 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_5A-48C-66A-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 90 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_5A-48D-66A | CA\_48A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 90 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_5A-48D-66A-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 110 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_13A-48A-66A | CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 50 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_13A-48A-66A-66A | CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 13 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_13A-48C-66A | CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 70 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_13A-48C-66A-66A | CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 120 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_13A-48D-66A | CA\_48A-66A  CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 90 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_13A-48D-66A-66A | CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 110 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-5A-66A-66A | CA\_2A-66A  CA\_5A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_1A-18A-41A | CA\_1A-18A  CA\_1A-41A  CA\_18A-41A | 1 |  |  | Yes | Yes | Yes | Yes | 55 | 0 |
| 18 |  |  | Yes | Yes | Yes |  |
| 41 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-18A-41C | CA\_1A-18A  CA\_1A-41A  CA\_1A-41C  CA\_18A-41A  CA\_18A-41C | 1 |  |  | Yes | Yes | Yes | Yes | 75 | 0 |
| 18 |  |  | Yes | Yes | Yes |  |
| 41 | See CA\_41C Bandwidth combination set 0 in Table 5.6A.1-1 in TS36.101 | | | | | |

Table 1-2: 4 bands DL/2 bands UL CA configurations part of the WI

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_2A-13A-48C-66A | CA\_2A-13A  CA\_13A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-13A-48A-48A-66A | CA\_2A-13A  CA\_13A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48A-48A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-3A-8A-38A | CA\_1A-3A  CA\_1A-8A  CA\_3A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| 38 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-46E-48A-66A | CA\_2A-48A  CA\_66A-48A | 2 |  |  | Yes | Yes | Yes | Yes | 140 | 0 |
| 46 | See CA\_46E Bandwidth combination set 0 in  Table 5.6A.1-1 of 36.101 | | | | | |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-3A-41C-42C | CA\_1A-3A,  CA\_1A-42A,  CA\_1A-42C,  CA\_3A-42A,  CA\_3A-42C | 1 |  |  | Yes | Yes | Yes | Yes | 120 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 41 | See CA\_41C Bandwidth Combination Set 0 in Table 5.6A.1-1 of TS36.101 | | | | | |
| 42 | See CA\_42C Bandwidth combination set 1 in Table 5.6A.1-1 of TS36.101 | | | | | |
| CA\_1A-3A-41C-42A | CA\_1A-3A,  CA\_1A-42A,  CA\_3A-42A | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 41 | See CA\_41C Bandwidth Combination Set 0 in Table 5.6A.1-1 of TS36.101 | | | | | |
| 42 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-3A-41A-42C | CA\_1A-3A,  CA\_1A-42A,  CA\_1A-42C,  CA\_3A-42A,  CA\_3A-42C | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 41 |  |  | Yes | Yes | Yes | Yes |
| 42 | See CA\_42C Bandwidth combination set 1 in Table 5.6A.1-1 of TS36.101 | | | | | |
| CA\_1A-3A-41A-42A | CA\_1A-3A,  CA\_1A-42A,  CA\_3A-42A | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 41 |  |  | Yes | Yes | Yes | Yes |
| 42 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-14A-30A-66A | CA\_2A-14A  CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 30 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-2A-14A-30A-66A | CA\_2A-14A  CA\_14A-30A  CA\_14A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 80 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 30 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-14A-30A-66A-66A | CA\_2A-14A  CA\_14A-30A  CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 30 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-46E-66A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 130 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See the CA\_46E Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-13A-46D-66A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See the CA\_46D Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-46C-66A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See the CA\_46C Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-46A-66A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 |  |  |  | Yes |  | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46D-48C-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 140 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46C-48C-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 120 | 0 |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46D-48A-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 120 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 |  |  |  | Yes |  | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46A-48C-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 |  |  |  | Yes |  | Yes |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46C-48A-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| A\_2A-46A-48A-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| 46 |  |  |  | Yes |  | Yes |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_1A-3A-7A-20A | CA\_1A-3A,  CA\_1A-7A,  CA\_1A-20A,  CA\_3A-7A,  CA\_3A-20A,  CA\_7A-20A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 |  |  |  | Yes | Yes | Yes |
| 20 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-3A-7A-8A | CA\_1A-8A,  CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 |  |  |  | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-3A-7A-8A | CA\_1A-8A,  CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 1 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-3A-3A-7A-8A | CA\_1A-3A,  CA\_1A-7A, CA\_1A-8A,  CA\_3A-7A,  CA\_3A-8A, CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 3 | See the CA\_3A-3A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-3A-7A-7A-8A | CA\_1A-3A,  CA\_1A-7A, CA\_1A-8A,  CA\_3A-7A,  CA\_3A-8A, CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 | See the CA\_7A-7A Bandwidth combination set 1 in Table 5.6A.1-3 | | | | | |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-3A-3A-7A-7A-8A | CA\_1A-3A,  CA\_1A-7A, CA\_1A-8A,  CA\_3A-7A,  CA\_3A-8A, CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 110 | 0 |
| 3 | See the CA\_3A-3A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| 7 | See the CA\_7A-7A Bandwidth combination set 1 in Table 5.6A.1-3 | | | | | |
| 8 |  |  | Yes | Yes |  |  |
| CA\_2A-5A-48A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-5A-48C-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-5A-48A-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-5A-48C-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-5A-48D-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-5A-48D-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 130 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-48C-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-48C-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-48D-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-48D-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 130 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-48A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-48A-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |

Table 1-3: 5 bands DL/2 bands UL CA configurations part of the WI

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
|  |  |  |  |  |  |  |  |  |  |  |

This TR contains a general part and band specific combination part. The actual requirements are added to the corresponding technical specifications.

# 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 TR 30.007: “Guideline on WI/SI for new Operating Bands”

[3] 3GPP TS 36.101: “Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception”

[4] RP-180778, “New WID on Rel16 LTE inter-band CA for x bands DL with 2 bands UL with x=3,4,5”, LG Electronics”

# 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].

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

**Channel bandwidth:** The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

**Inter-band carrier aggregation:** Carrier aggregation of component carriers in different operating bands**.**

**Mixed Intra-band and inter-band carrier aggregation:** Carrier aggregation of component carriers in same operating band and different operating bands**.**

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

## 3.2 Symbols

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

<symbol> <Explanation>

## 3.3 Abbreviations

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

# 4 Background

The present document is a technical report for LTE inter-band Carrier aggregation for x bands DL/2 bands UL with x=3, 4, 5 under Rel-16 time frame. It covers both the UE and BS side. The document is divided in two different parts:

- General part: this part covers BS and UE specific which is band combination independent.

- Specific band combination part: this part covers each band combination and its specific issues independently from each other (i.e. one subclause is defined per band combination)

The specific band combination parts are independent and therefore, the working speed also differs

# 5 LTE x bands DL/2 bands UL Inter-Band Carrier Aggregation: General part

## 5.1 UE RF specific

## 5.1.1 UE general architecture

RAN4 should reuse the UE architecture from xDLs/2UL CA: General part in Rel-15 to derive Maximum Sensitivity Degradation (MSD) for x bands DL (x=3, 4, 5) with 2 bands UL inter-band CA in Rel-16. This UE general architecture includes TDD-FDD CA related to each CA band combination in Rel-16 and applies to LTE only. We do not consider the non-standalone (NSA) NR UE DC/CA operation with NR bands and LTE bands.



**Figure 5.1.1-1 UE example RF architecture using cascaded-Diplexer in Rel-15**

### 5.1.2 General treatment of ∆TIB and ∆RIB values

RAN4 should consider to reuse agreed additional insertion loss in xDL/1UL CA UE when new RF components are not introduced for x bands DL (x=3, 4, 5) with 2 bands UL inter-band CA. If the new RF components are introduced, then more detail decription will be captured in some specific inter-band CA band combinations.

### 5.1.3 Fallback CA mode and mandatory support of all paired 2 UL CA configurations

RAN4 has defined Fallback CA mode by agreed Way-forward (R4-168853) in Rel-14.

### 5.1.4 General TX/RX requirements

### 5.1.4.1 Transmitter requirements

Transmitter requirements were already analyzed in TR36.860 for dual uplink inter-band CA. UEs of x bands DL (x=3, 4, 5) with 2 bands UL inter-band CA follow the common UE RF TX requirements in Table 5.1.4.1-1.

**Table 5.1.4.1-1: Common UE RF TX requirements for dual uplink inter-band CA configuration**

|  |  |
| --- | --- |
| Section / Clause in TS36.101 | Description |
| 5.6A.1 | Channel bandwidths per operating band for CA |
| 6.2.2A | UE maximum output power for CA |
| 6.2.5A | Configured transmitted Power for CA |
| 6.3.2A | UE Minimum output power for CA |
| 6.3.3A | UE Transmit OFF power for CA |
| 6.3.4A | ON/OFF time mask for CA |
| 6.3.5A | Power control for CA |
| 6.5.1A | Frequency error for CA |
| 6.5.2A | Transmit modulation quality for CA |
| 6.6.1A | Occupied bandwidth for CA |
| 6.6.2.1A | Spectrum emission mask for CA |
| 6.6.2.3 | Adjacent Channel Leakage Ratio |
| 6.6.3.1A | Spurious Emission for CA |
| 6.6.3.2A | Spurious emission band UE co-existence for CA |
| 6.7.1A | Transmit intermodulation for CA |

### 5.1.4.2 Recevier requirements

Receiver requirements were already analyzed in TR36.860 for dual uplink inter-band CA and additional UE RF receiver requirements of x bands DL (x=3, 4, 5) with 2 bands UL inter-band CA are listed in Table 5.1.4.2-1. The x bands DL with 2 bands UL combinations without self-interference issues can follow the common xDL/1UL CA UE RF requriements. Since RAN4 decided to cover 2DL/2UL test coverage of out-of-band blocking and spurious response by applying 1UL test (i.e. single carrier LTE and 1UL/2DL CA), the x bands DL with 2 bands UL inter-band CA combinations do not need to be tested for out-of-band blocking and spurious response again. Therefore, only REFSENS test for x bands DL with 2 bands UL inter-band CA is needed when all x bands downlink and 2 bands uplink are performed at the same time. Moreover, RAN4 should derive a new maximum sensitivity degradation (MSD) value when the x bands DL with 2 bands UL inter-band CA combinations have self-interference issues.

Table 5.1.4.2-1: Common UE RF Rx requirements for dual uplink inter-band CA configuration

|  |  |  |
| --- | --- | --- |
| Section / Clause in TS36.101 | **Description** | **Comments** |
| 7.3.1A | Reference sensitivity for CA | Applied to all x bands DL/ 2 bandsUL CA |
| 7.6.2.1A | Out-of-band blocking for CA | No need |
| 7.7.1A | Spurious response for CA | No need |

5.1.5 Summary of interference studies

Table 5.1.5-1 summarizes self-interference problems for LTE-A inter-band carrier aggregation (CA) 3 bands DL with 2 bands UL.

**Table 5.1.5-1: Summary of self-interference analysis for 3 bands DL with 2 bands UL CA**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Downlink  CA configuration** | **Uplink  CA configuration** | **Harmonic**  **relation to 3rd band  without uplink** | **Intermodulation to 3rd band  without uplink** | **Interference due to small frequency separation** | | **MSD**  **(Maximum Sensitivity Degradation)** |
| CA\_3A-11A-18A | CA\_3A-11A | - | 5th IMD | - | | 4.9 dB |
| CA\_3A-11A-26A | CA\_3A-11A | - | 5th IMD | - | | 4.9 dB |
| CA\_1A-3A-42C | CA\_1A-42C | - | - | - | | N/A |
| CA\_1A-3A-42C | CA\_3A-42C | - | - | - | | N/A |
| CA\_2A-4A-13A | CA\_2A-13A | - | 4th IMD | - | | 7.6 dB |
| CA\_4A-13A | - | 4th IMD | - | | 6.2 dB |
| CA\_2A-2A-4A-5A | CA\_2A-5A | - | 4th IMD | - | | 7.6 dB |
| CA\_4A-5A | - | 2nd IMD  5th IMD | - | | - 2nd and 5th IMD problems were already covered in Table 7.3.1A-0f:2DL/2UL\_4A-5A of TS36.101. |
| CA\_2A-2A-5A-66A-66A  CA\_2A-5A-66A,  CA\_2A-5A-66B,  CA\_2A-5A-66C,  CA\_2A-5B-66A,  CA\_2A-5B-66B,  CA\_2A-5B-66C,  CA\_2A-2A-5A-66A,  CA\_2A-2A-5A-66B,  CA\_2A-2A-5A-66C,  CA\_2A-5A-66A-66A,  CA\_2A-5B-66A-66A | CA\_2A-5A | - | 4th IMD | - | | 7.2 dB |
| CA\_5A-66A | - | - | - | | N/A |
| CA\_2A-5A-66A | CA\_2A-66A | - | - | - | | N/A |
| CA\_2A-5A-66A-66A | CA\_2A-66A | - | - | - | | N/A |
| CA\_5A-66A | - | - | - | | N/A |
| CA\_2A-5A-48A | CA\_2A-48A | - | - | - | | N/A |
| CA\_5A-48A | - | 3rd IMD | - | | 15.6 dB |
| CA\_2A-5A-48C  CA\_2A-5A-48D | CA\_2A-48A | - | - | - | | N/A |
| CA\_5A-48A | - | 3rd IMD | - | | 15.6 dB |
| CA\_2A-5A | 2nd harmonic at high frequency band edge | 3rd IMD | - | | 16.6 dB |
| CA\_2A-5A-46D | CA\_2A-5A | 3rd Harmonic | 4th IMD  5th IMD | - | | - No need to study for 3rd harmonic impact from B2 to B46 since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101.  - No need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS36.101. |
| CA\_5A-46D-66A | CA\_5A\_46A | - | 5th IMD | - | | 0.3 dB |
| CA\_5A\_66A | 3rd Harmonic | 4th IMD  5th IMD | - | | - No need to study for 3rd harmonic impact from B66 to B46 since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101.  - No need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS36.101. |
| CA\_2A-13A-66A-66B  CA\_2A-13A-66A,  CA\_2A-2A-13A-66A,  CA\_2A-13A-66A-66A,  CA\_2A-13A-66B,  CA\_2A-13A-66C, | CA\_2A-13A | - | 4th IMD | - | | 7.2 dB |
| CA\_13A-66A | - | 4th IMD | - | | 6.2 dB |
| CA\_2A-13A-66A,  CA\_2A-13A-66A-66A | CA\_2A-66A | - | - | - | | N/A |
| CA\_2A-13A-48A | CA\_2A-48A | - | - | - | | N/A |
| CA\_13A-48A | - | 3rd IMD | - | | 15.6 dB |
| CA\_2A-13A-48A-48C | CA\_2A-13A | 2nd Harmonic at high frequency band edge | - | - | | 2nd harmonic impact from B2 to B48 was covered in  Table 7.3.1A-0a of TS 36.101. |
| CA\_13A-46D-66A | CA\_13A-66A | 3rd Harmonic | 4th IMD  5th IMD | - | | - No need to study for 3rd harmonic impact from B66 to B46 since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101.  - No need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS36.101. |
| CA\_2A-13A-46D  CA\_2A-13A-46A-46D  CA\_2A-13A-46A-46C  CA\_2A-13A-46C  CA\_2A-13A-46A-46A  CA\_2A-13A-46A  CA\_2A-13A-46E | CA\_2A-13A | 3rd Harmonic | 4th IMD | - | | - No need to study for 3rd harmonic impact from B2 to B46 since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101.  - No need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS36.101. |
| CA\_1A-3A-38A | CA\_1A-3A | - | - | Yes | | Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101. |
| CA\_2A-12A-66A | CA\_2A-12A | 3rd Harmonic impact from B12 to B66 | - | - | | - 3rd harmonic impact from B12 to B66 was covered in Table 7.3.1A-0a of TS36.101. |
| CA\_2A-66A | - | - | - | | N/A |
| CA\_12A-66A | 3rd Harmonic impact from B12 to B66 | Side lobe impact of 4th IMD | - | | - 3rd harmonic impact from B12 to B66 was covered in Table 7.3.1A-0a of TS36.101.  - No side lobe impact of 4th IMD to band 2 |
| CA\_1A-3A-42D | CA\_1A-3A | 2nd Harmonic impact from B3 to B42 | 4th IMD | Yes | | - Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101.  - 2nd harmonic impact from B3 to B42 was covered in Table 7.3.1A-0a of TS36.101.  - 4th IMD problem was already covered in Table 7.3.1A0g:3DL/2UL\_CA\_1A-3A-42A/CA\_1A-3A of TS36.101. |
| CA\_1A-42A | - | - | - | | N/A |
| CA\_3A-42A | - | - | - | | N/A |
| CA\_1A-42C | - | - | - | | N/A |
| CA\_3A-42C | - | - | - | | N/A |
| CA\_2A-46E-48A,  CA\_2A-46D-48A  CA\_2A-46D-48C  CA\_2A-46C-48C  CA\_2A-46D-48A  CA\_2A-46A-48C  CA\_2A-46C-48A  CA\_2A-46A-48A | CA\_2A-48A | 3rd Harmonic | 2nd IMD  3rd IMD | - | | - No need to study for 3rd harmonic impact from B2 to B46 since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS 36.101  - No need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS36.101 |
| CA\_2A-48A-66A  CA\_2A-48A-66A-66A,  CA\_2A-48D-66A,  CA\_2A-48C-66A-66A,  CA\_2A-48D-66A-66A,  CA\_2A-48E-66A,  CA\_2A-48E-66A-66A | CA\_2A-48A | - | 4th IMD | - | | - 12.1 dB |
| CA\_48A-66A | - | 2nd IMD  5th IMD | - | | - 28.3 dB for IMD2  - No impact of 5th IMD to band 2 |
| CA\_2A-48A-66A,  CA\_2A-48A-66A-66A,  CA\_2A-48D-66A  CA\_2A-48C-66A-66A,  CA\_2A-48D-66A-66A,  CA\_2A-48E-66A,  CA\_2A-48E-66A-66A | CA\_2A-66A | 2nd Harmonics | 2nd IMD | - | 32.0 dB | |
| CA\_3A-8A-38A | CA\_3A-8A | - | 2nd IMD  3rd IMD | - | | - 26.4 dB for IMD2  - 15.7 dB for IMD3 |
| CA\_1A-1A-3C-5A | CA\_1A-3A | - | - | Yes | | Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101. |
| CA\_1A-5A | - | - | - | | N/A |
| CA\_3A-5A | - | - | - | | N/A |
| CA\_1A-1A-3C-28A | CA\_1A-3A | - | - | Yes | | Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101. |
| CA\_1A-28A | - | 5th IMD | - | | - 4 dB for IMD5 |
| CA\_3A-28A | 3rd Harmonic | 4th IMD | - | | - 3rd harmonic impact from B28 to B1 was covered in Table 7.3.1A-0a of TS36.101.  - 11 dB for IMD5 |
| CA\_1A-3A-3A-7A,  CA\_1A-3A-3A-7A-7A | CA\_1A-3A | - | - | Yes | | Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101. |
| CA\_1A-7A | - | - | - | | N/A |
| CA\_3A-7A | - | - | - | | N/A |
| CA\_2A-14A-30A | CA\_2A-14A | - | - | - | | N/A |
| CA\_14A-30A | - | - | - | | N/A |
| CA\_2A-14A-66A  CA\_2A-2A-14A-66A  CA\_2A-14A-66A-66A  CA\_2A-2A-14A-66A-66A  CA\_2A-14A-66A-66A-66A | CA\_2A-14A | - | 4th IMD | - | | 7.2 dB  (The same as CA\_2A-13A-66A) |
| CA\_14A-66A | - | 4th IMD | - | | 6.2 dB  (The same as CA\_2A-13A-66A) |
| CA\_14A-30A-66A  CA\_14A-30A-66A-66A | CA\_14A-30A | - | - | - | | N/A |
| CA\_14A-66A | - | - | - | | N/A |
| CA\_2A-46E-66A  CA\_2A-46D-66A  CA\_2A-46C-66A  CA\_2A-46A-66A | CA\_2A-66A | 3rd harmonic | 3rd IMD  5th IMD | - | | - No need to study for 3rd harmonic impact from B2 to B46 since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS 36.101. |
| CA\_13A-48A-66A  CA\_13A-48A-66A-66A  CA\_13A-48C-66A | CA\_13A-48A | - | 3rd IMD | - | | -17.1 dB |
| CA\_13A-66A | 2nd harmonic | 5th IMD | - | | - 2nd harmonic impact from B66 to B48 was covered in Table 7.3.1A-0a of TS36.101.  -no impact from 5th IMD to band 48 |
| CA\_48A-66A | - | - | - | | N/A |
| CA\_46D-48C-66A  CA\_46C-48C-66A  CA\_46A-48C-66A  CA\_46D-48A-66A  CA\_46C-48A-66A  CA\_46A-48A-66A | CA\_48A-66A | 3rd harmonic | 2nd IMD  3rd IMD | - | | - No need to study for 3rd harmonic impact since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101.  - No need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS36.101. |
| CA\_1A-7A-20A | CA\_1A-7A | - | 5th IMD | - | | MSD is proposed to be 0 dB as the similar CA combination CA\_1A-5A-7A has a very small MSD requirement (i.e., 1 dB) which should not be specified. |
| CA\_1A-20A | - | - | - | | N/A |
| CA\_7A-20A | - | - | - | | N/A |
| CA\_1A-3A-3A-8A | CA\_1A-3A | - | - | Yes | | - Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101. |
| CA\_1A-8A | - | - | - | | N/A |
| CA\_3A-8A | - | - | - | | N/A |
| CA\_1A-7A-8A  CA\_1A-7A-7A-8A | CA\_7A-8A | - | - | - | | N/A |
| CA\_1A-7A-7A-8A | CA\_1A-7A | - | - | - | | N/A |
| CA\_1A-8A | 3rd harmonic | - | - | | - 3rd harmonic impact from B8 to B7 was covered in Table 7.3.1A-0a of TS36.101. |
| CA\_2A-13A-48C | CA\_2A-48A | - | - | - | | N/A |
| CA\_13A-48A | - | 3rd IMD | - | | 15.6 dB |
| CA\_2A-13A | 2nd harmonic at high frequency band edge | - | - | | -2nd harmonic impact from B2 to B48 was covered in Table 7.3.1A-0a of TS36.101. |
| CA\_2A-13A-48D | CA\_13A-48A | - | 3rd IMD | - | | 15.6 dB |
| CA\_2A-48A | - | - | - | | N/A |
| CA\_13A-48C-66A-66A,  CA\_13A-48D-66A-66A | CA\_48A-66A | - | - | - | | N/A |
| CA\_13A-48A | - | 3rd IMD | - | | - 3rd IMD problem was already covered in Table 7.3.1A0g:3DL/2UL\_CA\_13A-48A-66A/CA\_13A-48A of TS36.101. |
| CA\_13A-66A | 2nd harmonic | 5th IMD | - | | -2nd harmonic impact from B66 to B48 was covered in Table 7.3.1A-0a of TS36.101.  - No MSD is needed. |
| CA\_13A-48D-66A | CA\_48A-66A | - | - | - | | N/A |
| CA\_13A-48A | - | 3rd IMD | - | | - 3rd IMD problem was already covered in Table 7.3.1A0g:3DL/2UL\_CA\_13A-48A-66A/CA\_13A-48A of TS36.101. |
| CA\_5A-48A-66A,  CA\_5A-48C-66A,  CA\_5A-48A-66A-66A,  CA\_5A-48D-66A-66A,  CA\_5A-48C-66A-66A | CA\_48A-66A | - | - | - | | N/A |
| CA\_5A-66A | 2nd harmonic | 5th IMD | - | | -2nd harmonic impact from B66 to B48 was covered in Table 7.3.1A-0a of TS36.101.  -No MSD is needed. |
| CA\_5A-48A | - | - | - | | N/A |
| CA\_5A-48D-66A | CA\_48A-66A | - | - | - | | N/A |
| CA\_5A-48A | - | - | - | | N/A |
| CA\_1A-18A-41C | CA\_1A-18A | - | - | - | | N/A |
| CA\_1A-41A | - | 5th IMD | - | | - No need to specify MSD for 5th IMD because the band 18 is only limited to Japan. |
| CA\_1A-41C | - | 5th IMD | - | | - No need to specify MSD for 5th IMD because the band 18 is only limited to Japan. |
| CA\_18A-41A | - | - | - | | N/A |
| CA\_18A-41C | - | - | - | | N/A |
| CA\_1A-18A-41A | CA\_1A-18A | - | - | - | | N/A |
| CA\_1A-41A | - | 5th IMD | - | | - No need to specify MSD for 5th IMD because the band 18 is only limited to Japan. |
| CA\_18A-41A | - | - | - | | N/A |

**Table 5.1.5-2: Summary of self-interference analysis for 4 bands DL with 2 bands UL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Downlink  CA configuration** | **Uplink  CA configuration** | **Harmonic**  **relation to 3rd band  without uplink** | **Intermodulation to 3rd band  without uplink** | **Interference due to small frequency separation** | **MSD**  **(Maximum Sensitivity Degradation)** |
| CA\_2A-13A-48C-66A | CA\_2A-13A | 2nd Harmonic at high frequency band edge | 4th IMD into B66 | - | - 2nd harmonic impact from B2 to B48 was covered in  Table 7.3.1A-0a of TS 36.101.  - 4th IMD problem was already covered in 3DL\_2A-13A-66A\_2UL\_2A-13A |
| CA\_13A-66A | 2nd Harmonic | 4th IMD into B2  5th IMD into B48 | - | - 2nd harmonic impact from B66 to B48 was covered in  Table 7.3.1A-0a of TS 36.101.  - 4th IMD problem was already covered in 3DL\_2A-13A-66A\_2UL\_13A-66A  - 5th IMD problem was alreadycovered in 3DL\_13A-48A-66A\_2UL\_13A-66A |
| CA\_2A-13A-48A-66A,  CA\_2A-13A-48C-66A,  CA\_2A-13A-48A-66A-66A,  CA\_2A-13A-48C-66A-66A,  CA\_2A-13A-48D-66A,  CA\_2A-13A-48D-66A-66A | CA\_2A-66A | 2nd harmonic impact from B2 to B48 | 2nd IMD into B48 | - | - 2nd harmonic impact from B2 to B48 was covered in  Table 7.3.1A-0a of TS 36.101. |
| CA\_2A-48A | - | 4th IMD into B66 | - | - 4th IMD problem was already covered in 3DL\_2A-48A-66A\_2UL\_2A-48A. |
| CA\_48A-66A | - | 2nd IMD into B2 | - | - 2nd IMD problem was already covered in 3DL\_2A-48A-66A\_2UL\_48A-66A. |
| CA\_13A-66A | 2nd harmonic impact from B13 to B48 | 4th IMD into B2  5th IMD into B48 | - | - 2nd harmonic impact from B66 to B48 was covered in  Table 7.3.1A-0a of TS 36.101.  - 4th IMD problem was already covered in 3DL\_2A-13A-66A\_2UL\_13A-66A  - 5th IMD problem was already covered in 3DL\_13A-48A-66A\_2UL\_13A-66A |
| CA\_13A-48A | - | 3rd IMD into B2 | - | - 3rd IMD problem was covered in 3DL\_2A-13A-48A\_2UL\_13A-48A. |
| CA\_2A-13A-48A-48A-66A | CA\_2A-13A | 2nd Harmonic at high frequency band edge | 4th IMD into B66 | - | - 2nd harmonic impact from B2 to B48 was covered in  Table 7.3.1A-0a of TS 36.101.  - 4th IMD problem was already covered in 3DL\_2A-13A-66A\_2UL\_13A-66A |
| CA\_13A-66A | 2nd Harmonic | 4th IMD into B2  5th IMD into B48 | - | - 2nd harmonic impact from B66 to B48 was covered in  Table 7.3.1A-0a of TS 36.101.  - 4th IMD problem was already covered in 3DL\_2A-13A-66A\_2UL\_13A-66A  - 5th IMD problem was already covered in 3DL\_13A-48A-66A\_2UL\_13A-66A |
| CA\_1A-3A-8A-38A | CA\_1A-3A | - | - | Yes | Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101. |
| CA\_1A-8A | 2nd Harmonic impact from B8 to B3 |  | - | - 2nd harmonic impact from B8 to B3 was covered in Table 7.3.1A-0a of TS36.101. |
| CA\_3A-8A | - | 2nd,3rd IMDs into B38 | - | - MSD for 2nd and 3rd IMDs into B38 was already covered in 3DL\_3A-8A-38A\_2UL\_3A-8A. |
| CA\_2A-46E-48A-66A  CA\_2A-46D-48C-66A  CA\_2A-46C-48C-66A  CA\_2A-46D-48A-66A  CA\_2A-46A-48C-66A  CA\_2A-46C-48A-66A  CA\_2A-46A-48A-66A | CA\_2A-48A | 3rd Harmonic impact from B2 to B46 | 2nd, 3rd IMDs into B46  4th IMD into B2 and B66 | - | - No need to study for 3rd harmonic impact from B2 to B46 since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101.  - No need to study for 2nd and 3rd IMDs into B46 since Reference sensitivity for CA with band 46 is specified in Table 7.3.1A-0eA of TS36.101.  - MSD for 4th IMD into B2 and B66 was already covered in 3 bands DL\_2A-48A-66A\_2 bands UL\_2A-48A. |
| CA\_48A -66A | 3rd Harmonic impact from B66 to B46 | 2nd,3rd IMDs into B46  5th IMD into B2 |  | - No need to study for 3rd harmonic impact from B66 to B46 since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101.  - No need to study for 2nd and 3rd IMDS into B46 since Reference sensitivity for CA with band 46 is specified in Table 7.3.1A-0eA of TS36.101.  - MSD for 5th IMD into B2 was already coveredin 3 bands DL\_2A-48A-66A\_2 bands UL\_48A-66A. |
| CA\_1A-3A-41C-42C | CA\_1A-3A | 2nd Harmonic impact from B3 to B42 | 4th IMD into B42  5th IMD into B41 | Yes | - Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101.  - 2nd harmonic impact from B3 to B42 was covered in Table 7.3.1A-0a of TS36.101.  - 4th IMD into B42 problem was already covered in Table 7.3.1A-0g: 3 bands DL\_1A-3A-42A/2 bands UL\_1A-3A of TS36.101.  - 5th IMD into B41 problem was already covered in Table 7.3.1A-0g: 3bands DL\_1A-3A-41/2 bands UL\_1A-3A. |
| CA\_1A-42A | - | 4th IMD into B41 | - | - For 4th IMD into B41, no need to study since B41 and B42 are always synchronized. |
| CA\_1A-42C | - | 4th IMD into B41 | - | - For 4th IMD into B41, no need to study since B41 and B42 are always synchronized. |
| CA\_3A-42A | - | - | - | N/A |
| CA\_3A-42C | - | - | - | N/A |
| CA\_1A-3A-41C-42A | CA\_1A-3A | 2nd Harmonic impact from B3 to B42 | 4th IMD into B42  5th IMD into B41 | Yes | - Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101.  - 2nd harmonic impact from B3 to B42 was covered in Table 7.3.1A-0a of TS36.101.  - 4th IMD into B42 problem was already covered in Table 7.3.1A-0g: 3 bands DL\_1A-3A-42A/2 bands UL\_1A-3A of TS36.101.  - 5th IMD into B41 problem was already covered in Table 7.3.1A-0g: 3bands DL\_1A-3A-41/2 bands UL\_1A-3A. |
| CA\_1A-42A | - | 4th IMD into B41 | - | - For 4th IMD into B41, no need to study since B41 and B42 are always synchronized. |
| CA\_3A-42A | - | - | - | N/A |
| CA\_1A-3A-41A-42C | CA\_1A-3A | 2nd Harmonic impact from B3 to B42 | 4th IMD into B42  5th IMD into B41 | Yes | - Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101.  - 2nd harmonic impact from B3 to B42 was covered in Table 7.3.1A-0a of TS36.101.  - 4th IMD into B42 problem was already covered in Table 7.3.1A-0g: 3 bands DL\_1A-3A-42A/2 bands UL\_1A-3A of TS36.101.  - 5th IMD into B41 problem was already covered in Table 7.3.1A-0g: 3bands DL\_1A-3A-41/2 bands UL\_1A-3A. |
| CA\_1A-42A | - | 4th IMD into B41 | - | - For 4th IMD into B41, no need to study since B41 and B42 are always synchronized. |
| CA\_1A-42C | - | 4th IMD into B41 | - | - For 4th IMD into B41, no need to study since B41 and B42 are always synchronized. |
| CA\_3A-42A | - | - | - | N/A |
| CA\_3A-42C | - | - | - | N/A |
| CA\_1A-3A-41A-42A | CA\_1A-3A | 2nd Harmonic impact from B3 to B42 | 4th IMD into B42  5th IMD into B41 | Yes | - Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101.  - 2nd harmonic impact from B3 to B42 was covered in Table 7.3.1A-0a of TS36.101.  - 4th IMD into B42 problem was already covered in Table 7.3.1A-0g: 3 bands DL\_1A-3A-42A/2 bands UL\_1A-3A of TS36.101.  - 5th IMD into B41 problem was already covered in Table 7.3.1A-0g: 3bands DL\_1A-3A-41/2 bands UL\_1A-3A. |
| CA\_1A-42A | - | 4th IMD into B41 | - | - For 4th IMD into B41, no need to study since B41 and B42 are always synchronized. |
| CA\_3A-42A | - | - | - | N/A |
| CA\_2A-14A-30A-66A  CA\_2A-2A-14A-30A-66A  CA\_2A-14A-30A-66A-66A | CA\_2A-14A |  | 4th IMD into B66 | - | - MSD for 4th IMD into B66 was analyzed in 3 bands DL\_2A-14A-66A\_2 bands UL 2A-14A. |
| CA\_14A-66A |  | 4th IMD into B2 | - | - MSD for 4th IMD into B2 was analyzed in 3 bands DL\_2A-14A-66A\_2 bands UL 14A-66A. |
| CA\_2A-2A-14A-30A-66A  CA\_2A-14A-30A-66A-66A | CA\_14A-30A | - | - | - | N/A |
| CA\_2A-13A-46E-66A  CA\_2A-13A-46D-66A  CA\_2A-13A-46C-66A  CA\_2A-13A-46A-66A | CA\_2A-13A | 3rd harmonic impact from B2 to B46 | 4th IMD into B46  4th IMD into B66 | - | - No need to study for 3rd harmonic impact since B46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101.  - No need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS36.101.  - MSD for 4th IMD into B66 was already covered in Table 7.3.1A-0g of TS36.101. |
| CA\_1A-3A-7A-20A | CA\_1A-3A | - | - | Yes | - Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101. |
| CA\_1A-7A | - | 5th IMD into B20 | - | - MSD for 5th IMD into B20 was analyzed in 3 bands DL 1A-7A-20A 2 bands UL 1A-7A and no MSD is needed. |
| CA\_1A-20A | - | - | - | N/A |
| CA\_3A-7A | - | - | - | N/A |
| CA\_3A-20A | - | 2nd and 3rd IMDs into B7 | - | - MSD for 2nd IMD into B7 was already covered in Table 7.3.1A-0g of TS36.101. |
| CA\_7A-20A | - | - | - | N/A |
| CA\_1A-3A-7A-8A | CA\_1A-8A | -2nd harmonic impact from B8 to B3  -3rd harmonic impact from B8 to B7 | - | - | - 2nd harmonic impact from B8 to B3 was already covered in Table 7.3.1A-0a of TS36.101.  - 3rd harmonic impact from B8 to B7 was already covered in Table 7.3.1A-0a of TS36.101. |
| CA\_7A-8A | 2nd harmonic impact from B8 to B3 | - | - | - 2nd harmonic impact from B8 to B3 was already covered in Table 7.3.1A-0a of TS36.101. |
| CA\_1A-3A-3A-7A-8A  CA\_1A-3A-7A-7A-8A  CA\_1A-3A-3A-7A-7A-8A | CA\_1A-3A | - | - | Yes | - Close proximity issue was already covered in Table 7.3.1A-0bA in TS 36.101. |
| CA\_1A-7A | - | 5th IMD into B8 | - | - MSD for 5th IMD into B8 was analyzed in 3 bands DL 1A-7A-7A-8A 2 bands UL 1A-7A, |
| CA\_1A-8A | - 2nd harmonic impact from B8 to B3  - 3rd harmonic impact from B8 to B7 | - | - | - 2nd harmonic impact from B8 to B3 was already covered in Table 7.3.1A-0a of TS36.101.  - 3rd harmonic impact from B8 to B7 was already covered in Table 7.3.1A-0a of TS36.101. |
| CA\_3A-7A | - | 3rd IMD into B8 | - | - MSD for 3rd IMD into B8 was already covered in Table 7.3.1A-0g of TS36.101. |
| CA\_3A-8A | -2nd harmonic impact from B8 to B7 | 2nd and 3rd IMD into B7 | - | - 2nd harmonic impact from B8 to B7 was already covered in Table 7.3.1A-0a of TS36.101.  - MSD for 2nd and 3rd IMDs into B7 was already covered in Table 7.3.1A-0g of TS36.101. |
| CA\_7A-8A | 2nd harmonic impact from B8 to B3 | - | - | - 2nd harmonic impact from B8 to B3 was already covered in Table 7.3.1A-0a of TS36.101. |
| CA\_2A-5A-48A-66A,  CA\_2A-5A-48C-66A,  CA\_2A-5A-48A-66A-66A, CA\_2A-5A-48C-66A-66A,  CA\_2A-5A-48D-66A,  CA\_2A-5A-48D-66A-66A | CA\_2A-66A | 2nd harmonic impacts from B2 and B66 to B48 | 2nd IMD into B48 | - | - 2nd harmonic impacts from B2 and B66 to B48 was already covered in Table 7.3.1A-0a of TS36.101.  - 2nd IMD problem was covered in 3DL\_2A-48A-66A\_2UL\_2A-66A. |
| CA\_2A-48A | - | 4th IMD into B66 | - | - 4th IMD problem was already covered in 3 bands DL\_2A-48A-66A\_2 bands UL\_2A-48A. |
| CA\_48A-66A | - | 2nd IMD into B2 | - | - 2nd IMD problem was already covered in 3 bands DL\_2A-48A-66A\_2 bands UL\_48A-66A. |
| CA\_5A-66A | 2nd harmonic impact from B66 to B48 | 5th IMD into B48 | - | - 2nd harmonic impact from B66 to B48 was already covered in Table 7.3.1A-0a of TS36.101.  - 5th IMD problem was covered in 3DL\_5A-48A-66A\_2UL\_5A-66A and no MSD is needed. |
| CA\_5A-48A | - | 3rd IMD into B2 | - | - 3rd IMD problem was covered in 3DL\_2A-5A-48A\_2UL\_5A-48A. |
| CA\_2A-5A | 2nd harmonic impact from B2 to B48 | 3rd IMD into B48  4th IMD into B66 | - | - 2nd harmonic impact from B2 to B48 was already covered in Table 7.3.1A-0a of TS36.101.  - 3rd IMD problem was covered in 3DL\_2A-5A-48A\_2UL\_2A-5A.  - 4th IMD problem was already covered in 3DL\_2A-5A-66A\_2UL\_2A-5A. |
| CA\_2A-5A-48C-66A-66A | CA\_2A-66A | 2nd harmonic impact from B2 and B66 to B48 | 2nd IMD into B48 | - | - 2nd harmonic impacts from B2 and B66 to B48 was already covered in Table 7.3.1A-0a of TS36.101.  - 2nd IMD problem was covered in 3DL\_2A-48A-66A\_2UL\_2A-66A. |
| CA\_2A-48A | - | 4th IMD into B66 | - | - 4th IMD problem was already covered in 3 bands DL\_2A-48A-66A\_2 bands UL\_2A-48A. |
| CA\_48A-66A | - | 2nd IMD into B2 | - | - 2nd IMD problem was already covered in 3 bands DL\_2A-48A-66A\_2 bands UL\_48A-66A. |
| CA\_5A-66A | 2nd harmonic impact from B66 to B48 | 5th IMD into B48 | - | - 2nd harmonic impact from B66 to B48 was already covered in Table 7.3.1A-0a of TS36.101.  - 5th IMD problem was covered in 3DL\_5A-48A-66A\_2UL\_5A-66A and no MSD is needed. |
| CA\_5A-48A | - | 3rd IMD into B2 | - | - 3rd IMD problem was covered in 3DL\_2A-5A-48A\_2UL\_5A-48A. |

**Table 5.1.5-3: Summary of self-interference analysis for 5 bands DL with 2 bands UL**

*<Table will be added if there are proposed in related basket WID>*

Based on the MSD test configuration as summarized in Table 5.1.5-1, 5.1.5-2, and 5.1.5-3, it is proposed to define the following REFSENS exceptions and test configurations in the core specifications for 3 bands DL/2 bands UL inter-band CA with IMD problems.

**Table 5.1.5.4 Proposed 3 bands DL/ 2 bands UL inter-band CA REFSENS exceptions and test configurations**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_3A-11A-18A | CA\_3A-11A | 3 | 1730 | 5 | 25 | 1825 | 5 | N/A | FDD | IMD5 |
| 11 | 1442.9 | 5 | 25 | 1490.9 | 5 |
| 18 | 823.7 | 5 | 25 | 868.7 | 5 | **4.9** |
| CA\_3A-11A-26A | CA\_3A-11A | 3 | 1730 | 5 | 25 | 1825 | 5 | N/A | FDD | IMD5 |
| 11 | 1442.9 | 5 | 25 | 1490.9 | 5 |
| 26 | 823.7 | 5 | 25 | 868.7 | 5 | **4.9** |
| CA\_2A-4A-13A | CA\_2A-13A | 2 | 1855 | 5 | 25 | 1935 | 5 | N/A | FDD | IMD4 |
| 13 | 782 | 5 | 25 | 751 | 5 |
| 4 | 1746 | 5 | 25 | 2146 | 5 | **7.6** |
| CA\_4A-13A | 4 | 1750 | 5 | 25 | 2150 | 5 | N/A | FDD | IMD4 |
| 13 | 780 | 5 | 25 | 749 | 5 |
| 2 | 1860 | 5 | 25 | 1940 | 5 | **6.2** |
| CA\_2A-2A-4A-5A | CA\_2A-5A | 2 | 1900 | 5 | 25 | 1980 | 5 | N/A | FDD | IMD4 |
| 5 | 834 | 5 | 25 | 879 | 5 |
| 4 | 1732 | 5 | 25 | 2132 | 5 | **7.6** |
| CA\_2A-5B-66A-66A  CA\_2A-5A-66A,  CA\_2A-5A-66B,  CA\_2A-5A-66C,  CA\_2A-5B-66A,  CA\_2A-5B-66B,  CA\_2A-5B-66C,  CA\_2A-2A-5A-66A,  CA\_2A-2A-5A-66B,  CA\_2A-2A-5A-66C,  CA\_2A-5A-66A-66A,  CA\_2A-2A-5A-66A-66A | CA\_2A-5A | 2 | 1900 | 5 | 25 | 1980 | 5 | N/A | FDD | IMD4 |
| 5 | 834 | 5 | 25 | 879 | 5 |
| 66 | 1712 | 5 | 25 | 2132 | 5 | **7.2** |
| CA\_2A-13A-66A,  CA\_2A-2A-13A-66A,  CA\_2A-13A-66A-66A,  CA\_2A-13A-66B,  CA\_2A-13A-66C,  CA\_2A-13A-66A-66B | CA\_2A-13A | 2 | 1860 | 5 | 25 | 1940 | 5 | N/A | FDD | IMD4 |
| 13 | 782 | 5 | 25 | 751 | 5 |
| 66 | 1736 | 5 | 25 | 2156 | 5 | **7.2** |
| CA\_13A-66A | 2 | 1880 | 5 | 25 | 1960 | 5 | **6.2** | FDD | IMD4 |
| 13 | 782 | 5 | 25 | 751 | 5 | N/A |
| 66 | 1762 | 5 | 25 | 2162 | 5 |
| CA\_2A-12A-66A | CA\_12A-66A | 2 | 1907.5 | 5 | 25 | 1987.5 | 5 | **0** | FDD | IMD4 |
| 12 | 713.5 | 5 | 25 | 743.5 | 5 | N/A |
| 66 | 1712.5 | 5 | 25 | 2112.5 | 5 |
| CA\_2A-48A-66A | CA\_48A-66A | 2 | 1880 | 5 | 25 | 1960 | 5 | **28.3** | FDD-TDD | IMD2 |
| 48 | 3695 | 5 | 25 | 3695 | 5 | N/A |
| 66 | 1735 | 5 | 25 | 2135 | 5 | N/A |
| 2 | 1895 | 5 | 25 | 1975 | 5 | **0** | FDD-TDD | IMD5 |
| 48 | 3620 | 5 | 25 | 3620 | 5 | N/A |
| 66 | 1755 | 5 | 25 | 2155 | 5 | N/A |
| CA\_3A-8A-38A | CA\_3A-8A | 3 | 1720 | 5 | 25 | 1815 | 5 | N/A | FDD-TDD | IMD2 |
| 8 | 885 | 5 | 25 | 930 | 5 | N/A |
| 38 | 2605 | 5 | 25 | 2605 | 5 | **26.4** |
| 3 | 1745 | 5 | 25 | 1840 | 5 | N/A | FDD-TDD | IMD3 |
| 8 | 895 | 5 | 25 | 940 | 5 | N/A |
| 38 | 2595 | 5 | 25 | 2595 | 5 | **15.7** |
| CA\_1A-1A-3C-28A | CA\_1A-28A | 1 | 1975 | 5 | 25 | 2165 | 5 | N/A | FDD | IMD5 |
| 3 | 1731 | 5 | 25 | 1826 | 5 | **4.0** |
| 28 | 708 | 5 | 25 | 763 | 5 | N/A |
| CA\_3A-28A | 1 | 1949 | 5 | 25 | 2139 | 5 | **11.0** | FDD | IMD4 |
| 3 | 1780 | 5 | 25 | 1875 | 5 | N/A |
| 28 | 710.5 | 5 | 25 | 765.5 | 5 | N/A |
| CA\_2A-48A-66A  CA\_2A-48C-66A | CA\_2A-48A | 2 | 1905 | 5 | 25 | 1985 | 5 | N/A | FDD-TDD | IMD4 |
| 48 | 3560 | 5 | 25 | 3560 | 5 | N/A |
| 66 | 1755 | 5 | 25 | 2155 | 5 | **12.1** |
| CA\_2A-14A-66A  CA\_2A-2A-14A-66A  CA\_2A-14A-66A-66A  CA\_2A-2A-14A-66A-66A  CA\_2A-14A-66A-66A-66A | CA\_2A-14A | 2 | 1870 | 5 | 25 | 1950 | 5 | N/A | FDD | IMD4 |
| 14 | 793 | 5 | 25 | 763 | 5 | N/A |
| 66 | 1734 | 5 | 25 | 2154 | 5 | **7.2** |
| CA\_14A-66A | 2 | 1874 | 5 | 25 | 1954 | 5 | **6.2** | FDD | IMD4 |
| 14 | 793 | 5 | 25 | 763 | 5 | N/A |
| 66 | 1770 | 5 | 25 | 2190 | 5 | N/A |
| CA\_13A-48A-66A | CA\_13A-48A | 13 | 782 | 5 | 25 | 751 | 5 | N/A | FDD-TDD | IMD3 |
| 48 | 3695 | 5 | 25 | 3695 | 5 | N/A |
| 66 | 1731 | 5 | 25 | 2131 | 5 | **17.1** |
| CA\_13A-66A | 13 | 782 | 5 | 25 | 751 | 5 | N/A | FDD-TDD | IMD5 |
| 48 | 3626 | 5 | 25 | 3626 | 5 | **0.0** |
| 66 | 1730 | 5 | 25 | 2130 | 5 | N/A |
| CA\_1A-7A-20A | CA\_1A-7A | 1 | 1960 | 5 | 25 | 2150 | 5 | N/A | FDD | IMD5 |
| 7 | 2540 | 10 | 50 | 2660 | 10 | N/A |
| 20 | 841 | 5 | 25 | 800 | 5 | **0.0** |
| CA\_2A-5A-48A  CA\_2A-5A-48C  CA\_2A-5A-48D | CA\_5A-48A | 2 | 1882 | 5 | 25 | 1962 | 5 | **15.6** | FDD-TDD | IMD3 |
| 5 | 839 | 5 | 25 | 884 | 5 | N/A |  |  |
| 48 | 3640 | 5 | 25 | 3640 | 5 | N/A |  |  |
| CA\_2A-5A-48C  CA\_2A-5A-48D | CA\_2A-5A | 2 | 1905 | 5 | 25 | 1985 | 5 | N/A | FDD-TDD | IMD3 |
| 5 | 844 | 5 | 25 | 889 | 5 | N/A |
| 48 | 3593 | 5 | 25 | 3593 | 5 | **16.6** |
| CA\_2A-13A-48A  CA\_2A-13A-48C  CA\_2A-13A-48D | CA\_13A-48A | 2 | 1903.5 | 5 | 25 | 1983.5 | 5 | **15.6** | FDD-TDD | IMD3 |
| 13 | 784.5 | 5 | 25 | 753.5 | 5 | N/A |
| 48 | 3552.5 | 5 | 25 | 3552.5 | 5 | N/A |
| CA\_2A-48A-66A,  CA\_2A-48D-66A,  CA\_2A-48E-66A,  CA\_2A-48A-66A-66A,  CA\_2A-48C-66A-66A,  CA\_2A-48D-66A-66A,  CA\_2A-48E-66A-66A | CA\_2A-66A | 2 | 1855 | 5 | 25 | 1935 | 5 | N/A | FDD-TDD | IMD2 |
| 48 | 3625 | 5 | 25 | 3625 | 5 | **32.0** |
| 66 | 1770 | 5 | 25 | 2190 | 5 | N/A |
| CA\_5A-48A-66A,  CA\_5A-48C-66A,  CA\_5A-48A-66A-66A,  CA\_5A-48D-66A-66A,  CA\_5A-48C-66A-66A | CA\_5A-66A | 5 | 829 | 5 | 25 | 874 | 5 | N/A | FDD-TDD | IMD5 |
| 48 | 3622 | 5 | 25 | 3622 | 5 | **0.0** |
| 66 | 1760 | 5 | 25 | 2180 | 5 | N/A |

## 5.2 RRM specific

**[Editor Note] It will be updated in future**

# 6 LTE 3 bands DL/2 bands UL Inter-Band Carrier Aggregation: Specific Band Combination Part

## 6.1 LTE-A inter-band CA: Band 3 and Band 11 and Band 18 DL with 2 bands UL

### 6.1.1 List of specific combination issues

#### 6.1.1.1 Channel bandwidths per operating band for CA

Table 6.1.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_3A-11A-18A | CA\_3A-11A | 3 |  |  | Yes | Yes | Yes | Yes | 45 | 0 |
| 11 |  |  | Yes | Yes |  |  |
| 18 |  |  | Yes | Yes | Yes |  |

#### 6.1.1.2 Co-existence studies for LTE-A UL CA\_3A-11A and DL CA\_3A-11A-18A

For 2UL / 3DL own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 6.1.1.2-1

Table 6.1.1.2-1: Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **Fx\_low** | **Fx\_high** | **Fy\_low** | **Fy\_high** |
| UL frequency (MHz) | 1427.9 | 1447.9 | 1710 | 1785 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 2855.8 | 2895.8 | 3420 | 3570 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 4283.7 | 4343.7 | 5130 | 5355 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 262.1 | 357.1 | 3137.9 | 3232.9 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 1070.8 | 1185.8 | 1972.1 | 2142.1 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4565.8 | 4680.8 | 4847.9 | 5017.9 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 2498.7 | 2633.7 | 3682.1 | 3927.1 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 524.2 | 714.2 |  |  |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 5993.7 | 6128.7 | 6557.9 | 6802.9 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 6275.8 | 6465.8 |  |  |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5712.1 | 5392.1 | 4081.6 | 3926.6 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 2499.2 | 2234.2 | 923.7 | 713.7 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 8267.9 | 8587.9 | 7421.6 | 7576.6 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 7985.8 | 8250.8 | 7703.7 | 7913.7 |

Based on Table 6.1.1.2-1, the 5th order IMD products by Band 3 and Band 11 falls into the own Rx frequency of Band 18.

#### 6.1.1.3 MSD

When uplink CA configurations CA\_3A\_11A is paired with downlink CA configuration CA\_3A-11A-18A, the 5th order IMD products by Band 3 and Band 11 falls into the own Rx frequency of Band 18.

MSD evaluation is shown in Table 6.1.1.3-1.

**Table 6.1.1.3-1: MSD summary for UL CA\_3A-11A and DL CA\_3A-11A-18A**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_3A-11A-18A | CA\_3A-11A | 3 | 1725 | 5 | 25 | 1820 | 5 | N/A | FDD | IMD5 |
| 11 | 1440 | 5 | 25 | 1488 | 5 |
| 18 | 825 | 5 | 25 | 870 | 5 | 4.9 |

#### 6.1.1.4 ∆TIB and ∆RIB values

The same requirements of lower order combination which are specified in TS36.101 can be applied.

## 6.2 LTE-A inter-band CA: Band 3 and Band 11 and Band 26 DL with 2 bands UL

### 6.2.1 List of specific combination issues

#### 6.2.1.1 Channel bandwidths per operating band for CA

Table 6.2.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_3A-11A-26A | CA\_3A-11A | 3 |  |  | Yes | Yes | Yes | Yes | 45 | 0 |
| 11 |  |  | Yes | Yes |  |  |
| 26 |  |  | Yes | Yes | Yes |  |

#### 6.2.1.2 Co-existence studies for LTE-A UL CA\_3A-11A and DL CA\_3A-11A-26A

For 2UL / 3DL own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 6.2.1.2-1

Table 6.2.1.2-1: Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **Fx\_low** | **Fx\_high** | **Fy\_low** | **Fy\_high** |
| UL frequency (MHz) | 1427.9 | 1447.9 | 1710 | 1785 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 2855.8 | 2895.8 | 3420 | 3570 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 4283.7 | 4343.7 | 5130 | 5355 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 262.1 | 357.1 | 3137.9 | 3232.9 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 1070.8 | 1185.8 | 1972.1 | 2142.1 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4565.8 | 4680.8 | 4847.9 | 5017.9 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 2498.7 | 2633.7 | 3682.1 | 3927.1 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | - | - |
| IMD frequency limits (MHz) | 524.2 | 714.2 | - | - |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 5993.7 | 6128.7 | 6557.9 | 6802.9 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| | - | - |
| IMD frequency limits (MHz) | 6275.8 | 6465.8 | - | - |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5712.1 | 5392.1 | 4081.6 | 3926.6 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 2499.2 | 2234.2 | 923.7 | 713.7 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 8267.9 | 8587.9 | 7421.6 | 7576.6 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 7985.8 | 8250.8 | 7703.7 | 7913.7 |

Based on Table 6.2.1.2-1, the 5th order IMD products by Band 3 and Band 11 falls into the own Rx frequency of Band 26.

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#### 6.2.1.3 MSD

When uplink CA configurations CA\_3A\_11A is paired with downlink CA configuration CA\_3A-11A-26A, the 5th order IMD products by Band 3 and Band 11 falls into the own Rx frequency of Band 26.

MSD evaluation is shown in Table 6.2.1.3-1.

**Table 6.2.1.3-1: MSD summary for UL CA\_3A-11A and DL CA\_3A-11A-26A**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | | | |
| EUTRA CA DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_3A-11A-26A | CA\_3A-11A | 3 | 1725 | 5 | 25 | 1820 | 5 | N/A | FDD | IMD5 |
| 11 | 1440 | 5 | 25 | 1488 | 5 |
| 26 | 825 | 5 | 25 | 870 | 5 | 4.9 |

#### 6.2.1.4 ∆TIB and ∆RIB values

The same requirements of lower order combination which are specified in TS36.101 can be applied.

## 6.3 LTE-A inter-band CA: Band 2 and Band 4 and Band 13 DL with 2 bands UL

### 6.3.1 List of specific combination issues

#### 6.3.1.1 Channel bandwidth per operating band for CA

Table 6.3.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-4A-13A | CA\_2A-13A | 2 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 4 |  |  | Yes | Yes | Yes | Yes |
| 13 |  |  | Yes | Yes |  |  |
| CA\_4A-13A | 2 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 4 |  |  | Yes | Yes | Yes | Yes |
| 13 |  |  | Yes | Yes |  |  |

#### 6.3.1.2 Co-existence studies for LTE-A inter-band UL CA\_2A-13A and DL CA\_2A-4A-13A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.3.1.2-1.

Table 6.3.1.2-1: Co-existence study for UL CA\_2A-13A and DL CA\_2A-4A-13A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 1850 | 1910 | 777 | 787 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1554 | 1574 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2331 | 5550 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1133 | 1063 | 2627 | 2697 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2913 | 3043 | 356 | 276 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4477 | 4607 | 3404 | 3484 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4763 | 4953 | 421 | 511 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6327 | 6517 | 4181 | 4271 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2126 | 2266 | 5254 | 5394 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1298 | 1198 | 6863 | 6613 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 4958 | 5058 | 8177 | 8427 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 1339 | 1489 | 4176 | 3976 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6031 | 6181 | 7104 | 7304 |

#### 6.3.1.3 Co-existence studies for LTE-A inter-band UL CA\_4A-13A and DL CA\_2A-4A-13A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.3.1.3-1.

Table 6.3.1.3-1: Co-existence study for UL CA\_4A-13A and DL CA\_2A-4A-13A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 1710 | 1755 | 777 | 787 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3510 | 1554 | 1574 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5265 | 2331 | 2361 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 978 | 923 | 2487 | 2542 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2633 | 2733 | 201 | 136 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4197 | 4297 | 3264 | 3329 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4343 | 4488 | 576 | 651 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 5907 | 6052 | 4041 | 4116 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 1846 | 1956 | 4974 | 5084 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1438 | 1353 | 6243 | 6053 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 4818 | 4903 | 7617 | 7807 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 1059 | 1179 | 3711 | 3556 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 5751 | 5871 | 6684 | 6839 |

#### 6.3.1.4 MSD

When uplink CA\_2A\_13A is paired with downlink CA\_2A-4A-13A, the 4th order IMD product by band 2 and band 13 falls into the own Rx frequency band 4.

When uplink CA\_4A\_13A is paired with downlink CA\_2A-4A-13A, the 4th order IMD product by Band 4 and band 13 falls into its own Rx frequency band 2.

In Table 6.3.1.4-1, evaluated MSD values of 3 bands DL\_CA\_2A-4A-13A with 2 bands UL is shown.

**Table 6.3.1.4-1: MSD summary for 2 bands UL and DL CA\_2A-4A-13A**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-4A-13A | CA\_2A-13A | 2 | 1855 | 5 | 25 | 1935 | 5 | N/A | FDD | IMD4 |
| 13 | 782 | 5 | 25 | 751 | 5 |
| 4 | 1746 | 5 | 25 | 2146 | 5 | 7.6 |
| CA\_4A-13A | 4 | 1750 | 5 | 25 | 2150 | 5 | N/A | FDD | IMD4 |
| 13 | 780 | 5 | 25 | 749 | 5 |
| 2 | 1860 | 5 | 25 | 1940 | 5 | 6.2 |

#### 6.3.1.5 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.4 LTE-A inter-band CA: Band 2 and Band 4 and Band 5 DL with 2 bands UL

### 6.4.1 List of specific combination issues

#### 6.4.1.1 Channel bandwidth per operating band for CA

Table 6.4.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | | 10 MHz | | 15 MH z | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-2A-4A-5A | CA\_2A-5A  CA\_4A-5A | 2 | See CA\_2A-2A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | | | | 70 | 0 |
| 4 |  |  | Yes | Yes | | Yes | | Yes |
| 5 |  |  | Yes | Yes | |  | |  |

#### 6.4.1.2 Co-existence studies for LTE-A inter-band UL CA\_2A-5A and DL CA\_2A-2A-4A-5A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.4.1.2-1.

Table 6.4.1.2-1: Co-existence study for UL CA\_2A-5A and DL CA\_2A-2A-4A-5A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 1850 | 1910 | 824 | 849 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1648 | 1698 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2472 | 2547 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1086 | 1001 | 2674 | 2759 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2851 | 2996 | 262 | 152 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4524 | 4669 | 3498 | 3608 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4701 | 4906 | 562 | 697 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6374 | 6579 | 4322 | 4457 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2002 | 2172 | 5348 | 5518 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1546 | 1386 | 6816 | 6551 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 5146 | 5306 | 8224 | 8489 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 1153 | 1348 | 4082 | 3852 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6172 | 6367 | 7198 | 7428 |

#### 6.4.1.3 Co-existence studies for LTE-A inter-band UL CA\_4A-5A and DL CA\_2A-2A-4A-5A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.4.1.3-1.

Table 6.4.1.3-1: Co-existence study for UL CA\_4A-5A and DL CA\_2A-2A-4A-5A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1710** | **1755** | **824** | **849** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3510 | 1648 | 1698 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5265 | 2472 | 2547 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | **931** | **861** | 2534 | 2604 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 2571 | 2686 | 107 | 12 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4244 | 4359 | 3358 | 3453 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 4281 | 4441 | 717 | 837 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5954 | 6114 | 4182 | 4302 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 1722 | 1862 | 5068 | 5208 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 1686 | 1541 | 6196 | 5991 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 5006 | 5151 | 7664 | 7869 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | **873** | **1038** | 3617 | 3432 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 5892 | 6057 | 6778 | 6963 |

#### 6.4.1.4 MSD

When uplink CA\_2A\_5A is paired with downlink CA\_2A-2A-4A-5A, the 4th order IMD product by band 2 and band 5 falls into the own Rx frequency band 4.

In Table 6.4.1.4-1, evaluated MSD value of UL CA\_2A-5A and DL CA\_2A-2A-4A-5A with is shown.

**Table 6.4.1.4-1: MSD summary for UL CA\_2A-5A and DL CA\_2A-2A-4A-5A**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-2A-4A-5A | CA\_2A-5A | 2 | 1900 | 5 | 25 | 1980 | 5 | N/A | FDD | IMD4 |
| 5 | 834 | 5 | 25 | 879 | 5 |
| 4 | 1732 | 5 | 25 | 2132 | 5 | 7.6 |

When uplink CA\_4A\_5A is paired with downlink CA\_2A-2A-4A-5A, the 2nd order IMD product by band 4 and band 5 falls into the own Rx frequency band 5.

When uplink CA\_4A\_5A is paired with downlink CA\_2A-2A-4A-5A, the 5th order IMD product by Band 4 and band 5 falls into its own Rx frequency band 5.

2nd and 5th IMD problems were already covered in Table 7.3.1A-0f: 2DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations of TS36.101.

#### 6.4.1.5 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.5 LTE-A inter-band CA: Band 2 and Band 5 and Band 66 DL with 2 bands UL

### 6.5.1 List of specific combination issues

#### 6.5.1.1 Channel bandwidth per operating band for CA

Table 6.5.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-2A-5A-66A-66A | CA\_2A-5A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-5B-66A-66A | CA\_2A-5A  CA\_5A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 5 | See CA\_5B Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-5A-66A | CA\_2A-5A  CA\_5A-66A  CA\_2A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-5A-66B | CA\_2A-5A  CA\_5A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-5B-66A | CA\_2A-5A  CA\_5A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 5 | See CA\_5B Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-5B-66B | CA\_2A-5A  CA\_5A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 5 | See CA\_5B Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-5A-66C | CA\_2A-5A  CA\_5A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| A5 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-5B-66C | CA\_2A-5A  CA\_5A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 5 | See CA\_5B Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-2A-5A-66A | CA\_2A-5A  CA\_5A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 70 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-2A-5A-66B | CA\_2A-5A  CA\_5A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 70 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-2A-5A-66C | CA\_2A-5A  CA\_5A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-5A-66A-66A | CA\_2A-5A  CA\_2A-66A  CA\_5A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-2A-5A-66A-66A | CA\_5A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

#### 6.5.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 5 and DL CA band 2 and band 5 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.5.1.2-1.

Table 6.5.1.2-1: Co-existence study for UL CA band 2 and band 5 and DL CA band 2 and band 5 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **824** | **849** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1648 | 1698 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2472 | 2547 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1086 | 1001 | 2674 | 2759 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 2851 | 2996 | 262 | 152 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4524 | 4669 | 3498 | 3608 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 4701 | 4906 | 562 | 697 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6374 | 6579 | 4322 | 4457 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | **2002** | **2172** | 5348 | 5518 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 1546 | 1386 | 6816 | 6551 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 5146 | 5306 | 8224 | 8489 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1153 | 1348 | 4082 | 3852 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6172 | 6367 | 7198 | 7428 |

#### 6.5.1.3 Co-existence studies for LTE-A inter-band UL CA band 5 and band 66 and DL CA band 2 and band 5 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.5.1.3-1.

Table 6.5.1.3-1: Co-existence study for UL CA band 5 and band 66 and DL CA band 2 and band 5 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **824** | **849** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | **861** | **956** | 2534 | 2629 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 132 | 12 | 2571 | 2736 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 3358 | 3478 | 4244 | 4409 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 692 | 837 | 4281 | 4516 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4182 | 4327 | 5954 | 6189 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 1912 | 1722 | 5068 | 5258 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 6296 | 5991 | 1686 | 1516 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 7664 | 7969 | 5006 | 5176 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 3692 | 3432 | **873** | **1088** |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6778 | 7038 | 5892 | 6107 |

6.5.1.4 Co-existence studies for LTE-A inter-band UL CA band 2 and band 66 and DL CA band 2 and band 5 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.5.1.4-1.

**Table 6.5.1.4-1: Co-existence study for UL CA band 2 and band 66 and DL CA band 2 and band 5 and band 66**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 200 | 70 | 3560 | 3690 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1920 | 2110 | 1510 | 1710 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5410 | 5600 | 5270 | 5470 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 3770 | 4020 | 3220 | 3490 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7260 | 7510 | 6980 | 7250 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 140 | 400 | 7120 | 7380 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 5270 | 4930 | 5930 | 5620 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 8690 | 9030 | 9110 | 9420 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1640 | 1310 | 2310 | 1990 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 8830 | 9160 | 8970 | 9290 |

According to Table 6.5.1.4-1, no harmonic impact and no IMD product by band 2 and band 66 falls into the own Rx frequency band 5.

#### 6.5.1.4 MSD

When uplink CA (band 2 and band 5) is paired with downlink CA (band 2 and band 5 and band 66), the 4th order IMD product by band 2 and band 5 falls into the own Rx frequency band 66.

In Table 6.5.1.4-1, evaluated MSD value of UL CA\_2A-5A and DL CA\_2A-2A-5A-66A-66A is shown.

**Table 6.5.1.4-1: MSD summary for UL CA\_2A-5A and DL CA\_2A-2A-5A-66A-66A**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-2A-5A-66A-66A | CA\_2A-5A | 2 | 1900 | 5 | 25 | 1980 | 5 | N/A | FDD | IMD4 |
| 5 | 834 | 5 | 25 | 879 | 5 |
| 66 | 1712 | 5 | 25 | 2132 | 5 | 7.2 |

When uplink CA (band 5 and band 66) is paired with downlink CA (band 2 and band 5 and band 66), the 5th order IMD product by Band 5 and band 66 falls into its own Rx frequency band 5.

2nd and 5th IMD problems were already covered in Table 7.3.1A-0f: 2DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations of TS36.101.

#### 6.5.1.6 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.6 LTE-A inter-band CA: Band 2 and Band 5 and Band 46 DL with 2 bands UL

### 6.6.1 List of specific combination issues

#### 6.6.1.1 Channel bandwidth per operating band for CA

Table 6.6.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-5A-46D | CA\_2A-5A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |

#### 6.6.1.2 Co-existence studies for LTE-A inter-band UL CA\_2A-5A and DL CA\_2A-5A-46D

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.6.1.2-1.

Table 6.6.1.2-1: Co-existence study for UL CA\_2A-5A and DL CA\_2A-5A-46D

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 1850 | 1910 | 824 | 849 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1648 | 1698 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2472 | 2547 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1086 | 1001 | 2674 | 2759 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2851 | 2996 | 262 | 152 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4524 | 4669 | 3498 | 3608 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4701 | 4906 | 562 | 697 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6374 | 6579 | 4322 | 4457 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2002 | 2172 | 5348 | 5518 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1546 | 1386 | 6816 | 6551 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 5146 | 5306 | 8224 | 8489 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 1153 | 1348 | 4082 | 3852 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6172 | 6367 | 7198 | 7428 |

In Table 6.6.1.2-1, 3rd harmonic from the band 2 can impact the band 46 and the band 46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101. Therefore, there is no need to study for this harmonic problem.

#### 6.6.1.3 MSD

When uplink CA\_2A\_5A is paired with downlink CA\_2A-5A-46D, the 4th and 5th order IMD products by band 2 and band 5 falls into the own Rx frequency band 46.

For band combinations including band 46, there is no need to study for MSD since the requirements are already specified in Table 7.3.1A-0eA: Reference sensitivity QPSK PREFSENS (CA with band 46 or Band 49) and when band 46 have self-interference problems by operating dual uplink CA, then these requirements do not need to apply in exclusion zone which is frequency range within (harmonics frequency region + delta FHD in Table 7.3.1A-0eC) and IMD frequency region as below.

**Table 6.6.1.3-1: IMD frequency range for UL CA\_2A-5A and DL CA\_2A-5A-46D**

|  |  |  |  |
| --- | --- | --- | --- |
| DL\_CA configuration | UL\_CA configuration | Exclusion zone center frequency | Exclusion zone BW |
| CA\_2A-5A-46D | CA\_2A-5A | 3\*fc\_5A + 1\*fc\_2A | 3\*BW\_5A + 1\*BW\_2A |
| CA\_2A-5A-46D | CA\_2A-5A | 2\*fc\_5A – 3\*fc\_2A | 2\*BW\_5A + 3\*BW\_2A |

#### 6.6.1.4 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.7 LTE-A inter-band CA: Band 5 and Band 46 and Band 66 DL with 2 bands UL

### 6.7.1 List of specific combination issues

#### 6.7.1.1 Channel bandwidth per operating band for CA

Table 6.7.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_5A-46D-66A | CA\_5A-46A | 5 |  |  | Yes | Yes |  |  | 90 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_5A-66A | 5 |  |  | Yes | Yes |  |  | 90 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |

#### 6.7.1.2 Co-existence studies for LTE-A inter-band UL CA\_5A-46A and DL CA\_5A-46D-66A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.7.1.2-1.

Table 6.7.1.2-1: Co-existence study for UL CA\_5A-46A and DL CA\_5A-46D-66A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 824 | 849 | 5150 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 10300 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 15450 | 17775 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4301 | 5101 | 5974 | 6774 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 4277 | 3452 | 9451 | 11026 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 6798 | 7623 | 11124 | 12699 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 3453 | 2603 | 14601 | 16951 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 7622 | 8472 | 16274 | 18624 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 10202 | 8602 | 11948 | 13548 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 22876 | 19751 | 1754 | 2629 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 21424 | 24549 | 8446 | 9321 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 16127 | 13752 | 7753 | 9378 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 17098 | 19473 | 12772 | 14397 |

#### 6.7.1.3 Co-existence studies for LTE-A inter-band UL CA\_5A-66A and DL CA\_5A-46D-66A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.7.1.3-2.

Table 6.7.1.3-2: Co-existence study for UL CA\_5A-66A and DL CA\_5A-46D-66A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 824 | 849 | 1710 | 1780 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 5130 | 5340 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 861 | 956 | 2534 | 2629 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 132 | 12 | 2571 | 2736 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3358 | 3478 | 4244 | 4409 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 692 | 837 | 4281 | 4516 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 4182 | 4327 | 5954 | 6189 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 1912 | 1722 | 5068 | 5258 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6296 | 5991 | 1686 | 1516 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 7664 | 7969 | 5006 | 5176 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 3692 | 3432 | 873 | 1088 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6778 | 7038 | 5892 | 6107 |

In Table 6.7.1.3-2, 3rd harmonic from the band 66 can impact the band 46. Since the band 46 is already specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101, there is no need to study for this harmonic problem.

#### 6.7.1.4 MSD

When uplink CA\_5A\_46A is paired with downlink CA\_5A-46D-66A, the 5th order IMD product by band 5 and band 46 falls into the own Rx frequency band 66.

In Table 6.7.1.4-1, evaluated MSD values of UL\_CA\_5A-46ADL\_CA\_5A-46D-66A is shown.

**Table 6.7.1.4-1: MSD summary for UL CA\_5A\_46Aand DL CA\_5A-46D-66A**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_5A-46D-66A | CA\_5A\_46A | 5 | 834 | 5 | 25 | 879 | 5 | N/A | FDD | IMD5 |
| 46 | 5491 | 20 | 100 | 5491 | 20 | TDD |
| 66 | 1755 | 5 | 25 | 2155 | 5 | 0.3 | FDD |

When uplink CA\_5A-66A is paired with downlink CA\_5A-46D-66A, the 4th and 5th order IMD products by band 5 and band 66 falls into the own Rx frequency band 46.

For band combinations including band 46, there is no need to study for MSD since the requirements are already specified in Table 7.3.1A-0eA: Reference sensitivity QPSK PREFSENS (CA with band 46 or Band 49) and when band 46 have self-interference problems by operating dual uplink CA, then these requirements do not need to apply in exclusion zone which is frequency range within (harmonics frequency region + delta FHD in Table 7.3.1A-0eC) and IMD frequency region as below.

**Table 6.7.1.4-2: IMD frequency range for UL CA\_5A-66A and DL CA\_5A-46D-66A**

|  |  |  |  |
| --- | --- | --- | --- |
| **DL\_CA configuration** | **UL\_CA configuration** | **Exclusion zone center frequency** | **Exclusion zone BW** |
| CA\_5A-46D-66A | CA\_5A-66A | 3\*fc\_66A + 1\*fc\_5A | 3\*BW\_66A + 1\*BW\_5A |
| CA\_5A-46D-66A | CA\_5A-66A | 2\*fc\_66A – 3\*fc\_5A | 2\*BW\_66A + 3\*BW\_5A |
| CA\_5A-46D-66A | CA\_5A-66A | 2\*fc\_66A + 3\*fc\_5A | 2\*BW\_66A + 3\*BW\_5A |

#### 6.7.1.5 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.8 LTE-A inter-band CA: Band 2 and Band 13 and Band 66 DL with 2 bands UL

### 6.8.1 List of specific combination issues

#### 6.8.1.1 Channel bandwidth per operating band for CA

Table 6.8.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-13A-66A-66B | CA\_2A-13A  CA\_13A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-13A-66A | CA\_2A-13A  CA\_13A-66A  CA\_2A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-13A-66B | CA\_2A-13A  CA\_13A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66B Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | |
| CA\_2A-13A-66C | CA\_2A-13A  CA\_13A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66C Bandwidth combination set 0 in Table 5.6A.1-1 of [1] | | | | | |
| CA\_2A-2A-13A-66A | CA\_2A-13A  CA\_13A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 of [1] | | | | | | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-13A-66A-66A | CA\_2A-13A  CA\_13A-66A  CA\_2A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 of [1] | | | | | |

#### 6.8.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 13 and DL CA band 2 and band 13 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.8.1.2-1.

Table 6.8.1.2-1: Co-existence study for UL CA band 2 and band 13 and DL CA band 2 and band 13 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 1850 | 1910 | 777 | 787 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1554 | 1574 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2331 | 2361 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1133 | 1063 | 2627 | 2697 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2913 | 3043 | 356 | 276 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4477 | 4607 | 3404 | 3484 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4763 | 4953 | 421 | 511 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6327 | 6517 | 4181 | 4271 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2126 | 2266 | 5254 | 5394 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1298 | 1198 | 6863 | 6613 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 4958 | 5058 | 8177 | 8427 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 1339 | 1489 | 4176 | 3976 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6031 | 6181 | 7104 | 7304 |

#### 6.8.1.3 Co-existence studies for LTE-A inter-band UL CA band 13 and band 66 and DL CA band 2 and band 13 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.8.1.3-1.

Table 6.8.1.3-1: Co-existence study for UL CA band 13 and band 66 and DL CA band 2 and band 13 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **777** | **787** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1554 | 1574 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2331 | 2361 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 923 | 1003 | 2487 | 2567 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 226 | 136 | 2633 | 2783 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 3264 | 3354 | 4197 | 4347 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 551 | 651 | 4343 | 4563 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4041 | 4141 | 5907 | 6127 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | **2006** | **1846** | 4974 | 5134 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 6343 | 6053 | 1438 | 1328 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 7617 | 7907 | 4818 | 4928 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 3786 | 3556 | 1059 | 1229 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6684 | 6914 | 5751 | 5921 |

#### 6.8.1.4 Co-existence studies for LTE-A inter-band UL CA band 2 and band 66 and DL CA band 2 and band 13 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.8.1.4-1.

Table 6.8.1.4-1: Co-existence study for UL CA band 2 and band 66 and DL CA band 2 and band 13 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 200 | 70 | 3560 | 3690 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1920 | 2110 | 1510 | 1710 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5410 | 5600 | 5270 | 5470 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 3770 | 4020 | 3220 | 3490 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7260 | 7510 | 6980 | 7250 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 140 | 400 | 7120 | 7380 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 5270 | 4930 | 5930 | 5620 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 8690 | 9030 | 9110 | 9420 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1640 | 1310 | 2310 | 1990 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 8830 | 9160 | 8970 | 9290 |

#### 6.8.1.5 MSD

When uplink CA (band 2 and band 13) is paired with downlink CA (band 2 and band 13 and band 66), the 4th order IMD product by band 2 and band 13 falls into the own Rx frequency band 66.

In Table 6.8.1.5-1, evaluated MSD value of 3 bands (band 2 and band 13 and band 66) DL with 2 bands (band 2 and band 13) UL is shown.

**Table 6.8.1.5-1: MSD summary for UL CA band 2 and band 13 with DL CA band 2 and band 13 and band 66**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-13A-66A-66B,  CA\_2A-13A-66A,  CA\_2A-13A-66B,  CA\_2A-13A-66C,  CA\_2A-2A-13A-66A,  CA\_2A-13A-66A-66A | CA\_2A-13A | 2 | 1860 | 5 | 25 | 1940 | 5 | N/A | FDD | IMD4 |
| 13 | 782 | 5 | 25 | 751 | 5 |
| 66 | 1736 | 5 | 25 | 2156 | 5 | 7.2 |

When uplink CA (band 13 and band 66) is paired with downlink CA (band 2 and band 13 and band 66), the 4th order IMD product by band 13 and band 66 falls into the own Rx frequency band 2. In Table 6.8.1.5-2, evaluated MSD values of 3 bands (band 2 and band 13 and band 66) DL with 2 bands (band 13 and band 66) UL is shown.

**Table 6.8.1.5-2: MSD summary for UL band 13 and band 66 with DL band 2 and band 13 and band 66**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-13A-66A-66B  CA\_2A-13A-66A,  CA\_2A-13A-66B,  CA\_2A-13A-66C,  CA\_2A-2A-13A-66A,  CA\_2A-13A-66A-66A | CA\_13A-66A | 2 | 1880 | 5 | 25 | 1960 | 5 | 6.2 | FDD | IMD4 |
| 13 | 782 | 5 | 25 | 751 | 5 | N/A |
| 66 | 1762 | 5 | 25 | 2162 | 5 | N/A |

When uplink CA (band 2 and band 66) is paired with downlink CA (band 2 and band 13 and band 66), no IMD product by band 2 and band 66 falls into the own Rx frequency band 2. Therefore, no MSD is needed.

#### 6.8.1.6 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.9 LTE-A inter-band CA: Band 13 and Band 46 and Band 66 DL with 2 bands UL

### 6.9.1 List of specific combination issues

#### 6.9.1.1 Channel bandwidth per operating band for CA

Table 6.9.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_13A-46D-66A | CA\_13A-66A | 13 |  |  | Yes | Yes |  |  | 90 | 0 |
| 46 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |

#### 6.9.1.2 Co-existence studies for LTE-A inter-band UL CA\_13A-66A and DL CA\_13A-46D-66A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.9.1.2-1.

Table 6.9.1.2-1: Co-existence study for UL CA\_13A-66A and DL CA\_13A-46D-66A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 777 | 787 | 1710 | 1780 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1554 | 1574 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2331 | 2361 | 5130 | 5340 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 923 | 1003 | 2487 | 2567 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 226 | 136 | 2633 | 2783 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3264 | 3354 | 4197 | 4347 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 551 | 651 | 4343 | 4563 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 4041 | 4141 | 5907 | 6127 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2006 | 1846 | 4974 | 5134 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6343 | 6053 | 1438 | 1328 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 7617 | 7907 | 4818 | 4928 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 3786 | 3556 | 1059 | 1229 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6684 | 6914 | 5751 | 5921 |

In Table 6.9.1.2-1, 3rd harmonic from the band 66 can impact the band 46 and this band is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101. Therefore, there is no need to study for this harmonic problem.

#### 6.9.1.3 MSD

When uplink CA\_13A\_66A is paired with downlink CA\_13A-46D-66A, the 4th and 5th order IMD products by band 13 and band 66 falls into the own Rx frequency band 46.

For band combinations including band 46, there is no need to study for MSD since the requirements are already specified in Table 7.3.1A-0eA: Reference sensitivity QPSK PREFSENS (CA with band 46 or Band 49) and when band 46 have self-interference problems by operating dual uplink CA, then these requirements do not need to apply in exclusion zone which is frequency range within (harmonics frequency region + delta FHD in Table 7.3.1A-0eC) and IMD frequency region as below.

**6.9.1.3-1: IMD frequency range for UL CA\_13A-66A and DL CA\_13A-46D-66A**

|  |  |  |  |
| --- | --- | --- | --- |
| DL\_CA configuration | UL\_CA configuration | Exclusion zone center frequency | Exclusion zone BW |
| CA\_13A-46D-66A | CA\_13A-66A | 2\*fc\_66A + 2\*fc\_13A | 2\*BW\_66A + 2\*BW\_13A |
| CA\_13A-46D-66A | CA\_13A-66A | 2\*fc\_66A + 3\*fc\_13A | 2\*BW\_66A + 3\*BW\_13A |

#### 6.9.1.4 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.10 LTE-A inter-band CA: Band 2 and Band 13 and Band 46 DL with 2 bands UL

### 6.10.1 List of specific combination issues

#### 6.10.1.1 Channel bandwidth per operating band for CA

Table 6.10.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-13A-46D | CA\_2A-13A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-13A-46A-46D | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46A-46D Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-46A-46C | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46A-46C Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-46C | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-13A-46A-46A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46A-46A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-46A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 50 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 |  |  |  | Yes |  | Yes |
| CA\_2A-13A-46E | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See CA\_46E Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |

#### 6.10.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 13and DL CA band 2 and band 13 and band 46

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.10.1.2-1.

Table 6.10.1.2-1: Co-existence study for UL CA band 2 and band 13 and DL CA band 2 and band 13 and band 46

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 1850 | 1910 | 777 | 787 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1554 | 1574 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2331 | 2361 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1133 | 1063 | 2627 | 2697 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2913 | 3043 | 356 | 276 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4477 | 4607 | 3404 | 3484 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4763 | 4953 | 421 | 511 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6327 | 6517 | 4181 | 4271 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2126 | 2266 | 5254 | 5394 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1298 | 1198 | 6863 | 6613 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 4958 | 5058 | 8177 | 8427 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 1339 | 1489 | 4176 | 3976 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6031 | 6181 | 7104 | 7304 |

In Table 6.10.1.2-1, 3rd harmonic from the band 2 can impact the band 46. Since the band 46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101, there is no need to study for this harmonic problem.

#### 6.10.1.3 MSD

When uplink CA band 2 and band 13 is paired with downlink CA band 2 and band 13 and band 46, the 4th order IMD product by band 2 and band 13 falls into the own Rx frequency band 46.

For band combinations including band 46, there is no need to study for MSD since the requirements are already specified in Table 7.3.1A-0eA: Reference sensitivity QPSK PREFSENS (CA with band 46 or Band 49) and when band 46 have self-interference problems by operating dual uplink CA, then these requirements do not need to apply in exclusion zone which is frequency range within (harmonics frequency region + delta FHD in Table 7.3.1A-0eC) and IMD frequency region as below.

**6.10.1.3-1: IMD frequency range for UL CA band 2 and band 13 and DL CA band 2 and band 13 and band 46**

|  |  |  |  |
| --- | --- | --- | --- |
| **DL\_CA configuration** | **UL\_CA configuration** | **Exclusion zone center frequency** | **Exclusion zone BW** |
| CA\_2A-13A-46D,  CA\_2A-13A-46A-46D,  CA\_2A-13A-46A-46C,  CA\_2A-13A-46C,  CA\_2A-13A-46A-46A,  CA\_2A-13A-46A,  CA\_2A-13A-46E | CA\_2A-13A | 3\*fc\_13A + 1\*fc\_2A | 3\*BW\_13A + 1\*BW\_2A |

#### 6.10.1.4 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.11 LTE-A inter-band CA: Band 2 and Band 12 and Band 66 DL with 2 bands UL

### 6.11.1 List of specific combination issues

#### 6.11.1.1 Channel bandwidths per operating band for CA

Table 6.11.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA  Configuration | Uplink CA  configurations | E-UTRA Bands | 1.4 MHz | 3MHz | 5MHz | 10 MHz | 15 MHz | 20 MHz | **Maximum aggregated bandwidth**  [MHz] | Bandwidth  Combination Set |
| CA\_2A-12A-66A | CA\_2A-12A  CA\_2A-66A  CA\_12A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 12 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |

#### 6.11.1.2 Co-existence studies for LTE-A UL CA\_2A-12A and DL CA\_2A-12A-66A

For 2UL / 3DL own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 6.11.1.2-1

Table 6.11.1.2-1: Co-existence study for UL\_CA\_2A-12A and DL\_CA\_2A-12A-66A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **Fx\_low** | **Fx\_high** | **Fy\_low** | **Fy\_high** |
| UL frequency (MHz) | 1850 | 1910 | 699 | 716 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1398 | 1432 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2097 | 2148 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1211 | 1134 | 2549 | 2626 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2984 | 3121 | 512 | 418 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4399 | 4536 | 3248 | 3342 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4834 | 5031 | 187 | 298 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 2268 | 2422 | 5098 | 2388 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 6249 | 6446 | 3947 | 4058 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6941 | 6684 | 1014 | 886 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 4332 | 4118 | 1552 | 1723 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 8099 | 8356 | 4646 | 4774 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6948 | 7162 | 5797 | 5968 |

Based on Table 6.11.1.2-1, there is no IMDs products fall into own Rx of Band 66.

#### 6.11.1.3 Co-existence studies for LTE-A UL CA\_2A-66A and DL CA\_2A-12A-66A

For 2UL / 3DL own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 6.11.1.3-1

Table 6.11.1.3-1: Co-existence study for UL\_CA\_2A-66A and DL\_CA\_2A-12A-66A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **Fx\_low** | **Fx\_high** | **Fy\_low** | **Fy\_high** |
| UL frequency (MHz) | 1850 | 1910 | 1710 | 1780 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 5130 | 5340 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 200 | 70 | 3560 | 3690 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | **1920** | **2110** | 1510 | 1710 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 5410 | 5600 | 5270 | 5470 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 3770 | 4020 | 3220 | 3490 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 140 | 400 | 7120 | 7380 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 7260 | 7510 | 6980 | 7250 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5270 | 4930 | 5930 | 5620 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1640 | 1310 | **2310** | **1990** |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 8690 | 9030 | 9110 | 9420 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 8830 | 9160 | 8970 | 9290 |

Based on Table 6.11.1.3-1, the 3rd order IMD products by the band 2 and the band 66 falls into the Rx frequency of band 2, the 5th order IMD products by the band 2 and the band 66 falls into the Rx frequency of band 66, However the IMD problem is already covered in 2DL/2UL CA\_2A-66A in Table 7.3.1A-0f in TS 36.101. For band 12, there is no harmonics and IMDs products that fall into own Rx of Band 12.

#### 6.11.1.4 Co-existence studies for LTE-A UL CA\_12A-66A and DL CA\_2A-12A-66A

For 2UL / 3DL own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 6.11.1.4-1

Table 6.11.1.4-1: Co-existence study for UL\_CA\_12A-66A and DL\_CA\_2A-12A-66A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **Fx\_low** | **Fx\_high** | **Fy\_low** | **Fy\_high** |
| UL frequency (MHz) | 699 | 716 | 1710 | 1780 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1398 | 1432 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2097 | 2148 | 5130 | 5340 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 994 | 1081 | 2409 | 2496 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 382 | 278 | 2704 | 2861 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3108 | 3212 | 4119 | 4276 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 317 | 438 | 4414 | 4641 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | **2162** | **1988** | 4818 | 4992 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 3807 | 3928 | 5829 | 6056 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6421 | 6124 | 1154 | 1016 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 3942 | 3698 | 1272 | 1463 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 7539 | 7836 | 4506 | 4644 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6528 | 6772 | 5517 | 5708 |

Based on Table 6.11.1.4-1, the 4th order IMD products by the band 12 and the band 66 falls into the Rx frequency of band 2. It should be noted that the 4th order IMD products falls within 1988 – 2162 MHz, which has 2MHz overlap with the Rx frequency of band 2 (1930 - 1990 MHz). Therefore, the 4th order IMD products from Tx in band 12 and 66 to Rx in band 2 could be observed. However, this 4th order IMD products could happen only in the case where Tx in the uppermost edge of band 12 with the lowest edge band 66 paired with Rx in the uppermost edge of band 2 is utilized.

#### 6.11.1.5 MSD

When uplink CA configurations CA\_2A-66A is paired with downlink CA configuration CA\_2A-12A-66A, the 3rd order IMD products by the band 2 and the band 66 falls into the own Rx frequency of band 2, the 5th order IMD products by the band 2 and the band 66 falls into the own Rx frequency of band 66. For this case, the MSD value from 2DL/2UL CA\_2A-66A in Table 7.3.1A-0f in TS 36.101 can be reused.

When uplink CA configurations CA\_12A-66A is paired with downlink CA configuration CA\_2A-12A-66A, the 4th order IMD products from uplink in band 12 and 66 to downlink in band 2 could be observed. However, this 4th order IMD products could happen only in the case where uplink in the uppermost edge of band 12 with the lowest edge band 66 paired with downlink in the uppermost edge of band 2 is utilized.

In Table 6.11.1.5-1, the MSD analysis results from interested companies are summarized.

Table 6.11.1.5-1: MSD values provided by companies

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **DL CA** | **UL CA** | **IMD** | | **LGE** | **Nokia** | **Avg.**  **MSD [dB]** |
| CA\_2A-12A-66A | B12 | IMD4 | |2\*fB66 -2\*fB12| | 0 | 0 | 0 |
| B66 |

Based on the provided MSD results, the MSD requirement shown in table 6.11.1.5-2 is proposed to capture in TS36.101.

**Table 6.11.1.5-2: MSD summary for UL CA\_12A-66A and DL CA\_2A-12A-66A**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| **EUTRA CA**  **DL Configuration** | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-12A-66A | CA\_12A-66A | 2 | 1907.5 | 5 | 25 | 1987.5 | 5 | 0 | FDD | IMD4 |
| 12 | 713.5 | 5 | 25 | 743.5 | 5 | N/A | N/A |
| 66 | 1712.5 | 5 | 25 | 2112.5 | 5 | N/A | N/A |

Based on the analysis of MSD, there is no MSD issue.

#### 6.11.1.6 ∆TIB and ∆RIB values

∆TIB and ∆RIB values are already specified in TS36.101 for combination 3DL/1UL CA\_2-12-66 which can be applied here.

**Table 6.12.2-1: ΔTIB,c**

| Inter-band CA Configuration | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_2A-12A-66A | 2 | 0.5 |
| 12 | 0.8 |
| 66 | 0.5 |

**Table 6.12.2-2: ΔRIB**

| Inter-band CA Configuration | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_2A-12A-66A | 2 | 0.3 |
| 12 | 0.5 |
| 66 | 0.3 |

## 6.12 LTE-A inter-band CA: Band 2 and Band 13 and Band 48 DL with 2 bands UL

### 6.12.1 List of specific combination issues

#### 6.12.1.1 Channel bandwidth per operating band for CA

Table 6.12.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | | 3 MHz | | 5 MHz | | | 10 MHz | | 15 MHz | | 20 MHz | | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-13A-48A-48C | CA\_2A-13A | 2 |  | |  | | Yes | | | Yes | | Yes | | Yes | | 90 | 0 |
| 13 |  |  | | | Yes | | Yes | | |  | |  | |
| 48 |  |  | | | Yes | | Yes | | | Yes | | Yes | |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | | | | | | | |
| CA\_2A-13A-48A | CA\_2A-48A  CA\_13A-48A | 2 | Yes | | | Yes | | Yes | | | Yes | | Yes | | Yes | 50 | 0 |
| 13 |  | | |  | | Yes | | | Yes | |  | |  |
| 48 |  | | |  | | Yes | | | Yes | | Yes | | Yes |
| CA\_2A-13A-48C | CA\_2A-48A  CA\_13A-48A  CA\_2A-13A | 2 | Yes | | | Yes | | Yes | | | Yes | | Yes | | Yes | 70 | 0 |
| 13 |  | | |  | | Yes | | | Yes | |  | |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | | | | | | | |
| CA\_2A-13A-48D | CA\_2A-48A  CA\_13A-48A | 2 | Yes | | | Yes | | Yes | | | Yes | | Yes | | Yes | 90 | 0 |
| 13 |  | | |  | | Yes | | | Yes | |  | |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | | | | | | | |

#### 6.12.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 13and DL CA band 2 and band 13 and band 48

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.12.1.2-1.

Table 6.12.1.2-1: Co-existence study for UL CA band 2 and band 13and DL CA band 2 and band 13 and band 48

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **777** | **787** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1554 | 1574 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2331 | 2361 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1133 | 1063 | 2627 | 2697 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 2913 | 3043 | 356 | 276 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4477 | 4607 | 3404 | 3484 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 4763 | 4953 | 421 | 511 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6327 | 6517 | 4181 | 4271 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 2126 | 2266 | 5254 | 5394 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 1298 | 1198 | 6863 | 6613 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 4958 | 5058 | 8177 | 8427 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1339 | 1489 | 4176 | 3976 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6031 | 6181 | 7104 | 7304 |

#### 6.12.1.3 Co-existence studies for LTE-A inter-band UL CA band 2 and band 48 and DL CA band 2 and band 13 and band 48

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.12.1.3-1.

Table 6.12.1.3-1: Co-existence study for UL CA band 2 and band 48 and DL CA band 2 and band 13 and band 48

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1640 | 1850 | 5400 | 5610 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 0 | 270 | 5190 | 5550 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7250 | 7520 | 8950 | 9310 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1850 | 2180 | 8740 | 9250 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 9100 | 9430 | 12500 | 13010 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3700 | 3280 | 10800 | 11220 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 12950 | 12290 | 4090 | 3700 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 16050 | 16710 | 10950 | 11340 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7400 | 6830 | 1370 | 1850 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14350 | 14920 | 12650 | 13130 |

According to Table 6.12.1.3-1, no harmonic impact to own Rx downlink band 13.

#### 6.12.1.4 Co-existence studies for LTE-A inter-band UL CA band 13 and band 48 and DL CA band 2 and band 13 and band 48

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.12.1.4-1.

Table 6.12.1.4-1: Co-existence study for UL CA band 13 and band 48 and DL CA band 2 and band 13 and band 48

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **777** | **787** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1554 | 1574 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2331 | 2361 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 2763 | 2923 | 4327 | 4487 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | **2146** | **1976** | 6313 | 6623 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5104 | 5274 | 7877 | 8187 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1369 | 1189 | 9863 | 10323 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5881 | 6061 | 11427 | 11887 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 5846 | 5526 | 8654 | 8974 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 14023 | 13413 | 402 | 592 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 14977 | 15587 | 6658 | 6848 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 9546 | 9076 | 4739 | 5069 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 12204 | 12674 | 9431 | 9761 |

#### 6.12.1.5 MSD

When uplink CA band 2 and band 13is paired with downlink CA band 2 and band 13 and band 48, there are no harmonic and IMD products falling into own Rx bands. Therefore, no MSD needs to be addressed.

When uplink CA band 2 and band 48 is paired with downlink CA band 2 and band 13 and band 48, there are no harmonic and no IMD products falling into own Rx downlink band 13.

When uplink CA (band 13 and band 48) is paired with downlink CA (band 2 and band 13 and band 48), the 3rd order IMD products by band 13 and band 48 falls into the own Rx frequency band 2. In Table 6.12.1.5-1, evaluated MSD values of 3 bands (band 2 and band 13 and band 48) DL with 2 bands (band 13 and band 48) UL is shown.

**Table 6.12.1.5-1: MSD summary for UL CA band 13 and band 48 and DL CA band 2 and band 13 and band 48**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-13A-48A  CA\_2A-13A-48C  CA\_2A-13A-48D | CA\_13A-48A | 2 | 1903.5 | 5 | 25 | 1983.5 | 5 | 15.6 | FDD-TDD | IMD3 |
| 13 | 784.5 | 5 | 25 | 753.5 | 5 | N/A |
| 48 | 3552.5 | 5 | 25 | 3552.5 | 5 | N/A |

#### 6.12.1.6 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.13 LTE-A inter-band CA: Band 1 and Band 3 and Band 42 DL with 2 bands UL

### 6.13.1 List of specific combination issues

#### 6.13.1.1 Channel bandwidth per operating band for CA

Table 6.13.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-42C | CA\_1A-42C, CA\_3A-42C | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 42 | See CA\_42C Bandwidth combination set 1 in Table 5.6A.1-1 of TS36.101 | | | | | |

#### 6.13.1.2 Co-existence studies for LTE-A inter-band UL CA\_1A-42C and DL CA\_1A-3A-42C

Co-existence studies for 3 bands DL CA\_1A-3A-42A with 2 bands UL summarized in Table 5.1.5-1 of TR 36.714-00-02 can be referred.

#### 6.13.1.3 Co-existence studies for LTE-A inter-band UL CA\_3A-42C and DL CA\_1A-3A-42C

Co-existence studies for 3 bands DL CA\_1A-3A-42A with 2 bands UL summarized in Table 5.1.5-1 of TR 36.714-00-02 can be referred.

#### 6.13.1.4 MSD

There are no additional requirements for the CA configurations.

#### 6.13.1.5 ∆TIB and ∆RIB values

The requirements of low order combinations 3 bands DL CA\_1-3-42 with 1 band UL from TS36.101 can be applied.

## 6.14 LTE-A inter-band CA: Band 1 and Band 3 and Band 38 DL with 2 bands UL

### 6.14.1 List of specific combination issues

#### 6.14.1.1 Channel bandwidth per operating band for CA

Table 6.14.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-38A | CA\_1A-3A | 1 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 38 |  |  | Yes | Yes | Yes | Yes |

#### 6.14.1.2 Co-existence studies for LTE-A inter-band UL CA\_1A-3A and DL CA\_1A-3A-38A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.14.1.2-1.

Table 6.14.1.2-1: Co-existence study for UL CA\_1A-3A and DL CA\_1A-3A-38A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 1710 | 1785 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 | 3420 | 3570 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 | 5130 | 5355 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 270 | 135 | 3630 | 3765 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | **2055** | **2250** | 1440 | 1650 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 5550 | 5745 | 5340 | 5550 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 3975 | 4230 | 3150 | 3435 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 7470 | 7725 | 7050 | 7335 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 270 | 540 | 7260 | 7530 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5220 | 4860 | 6210 | 5895 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1515 | 1170 | 2520 | 2190 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 8760 | 9120 | 9390 | 9705 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 8970 | 9315 | 9180 | 9510 |

In Table 6.14.1.2-1, there is 3rd IMD product by the band 1 and band 3 falls into the band 1.

#### 6.14.1.3 MSD

When uplink CA\_1A\_3A is paired with downlink CA\_1A-3A-38A, the 3rd order IMD product by band 1 and band 3 falls into the own Rx frequency band 1. It has been solved by fallback combination CA\_1A\_3A.

#### 6.14.1.4 ∆TIB and ∆RIB values

The requirements of ∆TIB values in table 6.2.5-3 from TS36.101 can be applied for CA\_1-3-38.

The requirements of ∆RIB values in table 7.3.1-1B from TS36.101 can be applied for CA\_1-3-38.

## 6.15 LTE-A inter-band CA: Band 2 and Band 46 and Band 48 DL with 2 bands UL

### 6.15.1 List of specific combination issues

#### 6.15.1.1 Channel bandwidth per operating band for CA

Table 6.15.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-46E-48A | CA\_2A-48A | 2 |  | |  | Yes | Yes | Yes | Yes | 120 | 0 |
| 46 | See the CA\_46E Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| 48 |  | |  | Yes | Yes | Yes | Yes |
| CA\_2A-46D-48A | CA\_2A-48A | 2 |  | |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 | See CA\_46D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| 48 |  | |  | Yes | Yes | Yes | Yes |
| CA\_2A-46D-48C | CA\_2A-48A | 2 | Yes | | Yes | Yes | Yes | Yes | Yes | 120 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| CA\_2A-46C-48C | CA\_2A-48A | 2 | Yes | | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| CA\_2A-46A-48C | CA\_2A-48A | 2 | Yes | Yes | | Yes | Yes | Yes | Yes | 80 | 0 |
| 46 |  |  | | Yes | Yes | Yes | Yes |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| CA\_2A-46C-48A | CA\_2A-48A | 2 | Yes | Yes | | Yes | Yes | Yes | Yes | 80 | 0 |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | |
| 48 |  |  | | Yes | Yes | Yes | Yes |
| CA\_2A-46A-48A | CA\_2A-48A | 2 | Yes | Yes | | Yes | Yes | Yes | Yes | 60 | 0 |
| 46 |  |  | |  | Yes |  | Yes |
| 48 |  |  | | Yes | Yes | Yes | Yes |

#### 6.15.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 48 and DL CA band 2 and band 46 and band 48

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.15.1.2-1.

Table 6.15.1.2-1: Co-existence study for UL CA band 2 and band 48 and DL CA band 2 and band 46 and band 48

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **3500** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 7000 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | **5550** | **5730** | 10500 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1590 | 1850 | **5350** | **5610** |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 0 | 320 | **5090** | **5550** |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7200 | 7520 | 8850 | 9310 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1850 | 2230 | 8590 | 9250 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 9050 | 9430 | 12350 | 13010 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3700 | 3180 | 10700 | 11220 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 12950 | 12090 | 4140 | 3700 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15850 | 16710 | 10900 | 11340 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7400 | 6680 | 1270 | 1850 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14200 | 14920 | 12550 | 13130 |

For 3rd harmonic, there is no need to study since band 46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS 36.101.

#### 6.15.1.3 MSD

When uplink CA (band 2 and band 48) is paired with downlink CA (band 2 and band 46 and band 48), the 2nd and 3rd order IMD products by band 2 and band 48 falls into the own Rx frequency band 46. However, we do not need to study for these MSD since reference sensitivity for CA with band 46 is specified in Table 7.3.1A-0eA of TS 36.101.  
 For band combinations including band 46, there is no need to study for MSD since the requirements are already specified in Table 7.3.1A-0eA: Reference sensitivity QPSK PREFSENS (CA with band 46 or Band 49) and when band 46 have self-interference problems by operating dual uplink CA, then these requirements do not need to apply in exclusion zone which is frequency range within (harmonics frequency region + delta FHD in Table 7.3.1A-0eC) and IMD frequency region as below.

**6.15.1.3-1: IMD frequency range for UL CA band 2 and band 48 and DL CA band 2 and band 46 and band 48**

|  |  |  |  |
| --- | --- | --- | --- |
| DL\_CA configuration | UL\_CA configuration | Exclusion zone center frequency | Exclusion zone BW |
| CA\_2A-46E-48A,  CA\_2A-46D-48A  CA\_2A-46D-48C  CA\_2A-46C-48C  CA\_2A-46D-48A  CA\_2A-46A-48C  CA\_2A-46C-48A  CA\_2A-46A-48A | CA\_2A-48A | 1\*fc\_2A + 1\*fc\_48A  2\*fc\_48A – 1\*fc\_2A | 1\*BW\_2A + 1\*BW\_48A  2\*BW\_48A + 1\*BW\_2A |

#### 6.15.1.4 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.16 LTE-A inter-band CA: Band 2 and Band 48 and Band 66 DL with 2 bands UL

### 6.16.1 List of specific combination issues

#### 6.16.1.1 Channel bandwidth per operating band for CA

Table 6.16.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-48A-66A | CA\_2A-48A  CA\_48A-66A  CA\_2A-66A | 2 |  |  | Yes | | Yes | Yes | Yes | 60 | 0 |
| 48 |  |  | Yes | | Yes | Yes | Yes |
| 66 |  |  | Yes | | Yes | Yes | Yes |
| CA\_2A-48C-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | | Yes | Yes | 80 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| 66 | Yes | Yes | Yes | Yes | | Yes | Yes |
| CA\_2A-48A-66A-66A | CA\_48A-66A  CA\_2A-48A  CA\_2A-66A | 2 | Yes | Yes | Yes | Yes | | Yes | Yes | 80 | 0 |
| 48 |  |  | Yes | Yes | | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | |
| CA\_2A-48D-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | | Yes | Yes | 100 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| 66 | Yes | Yes | Yes | Yes | | Yes | Yes |
| CA\_2A-48C-66A-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | | Yes | Yes | 100 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | |
| CA\_2A-48D-66A-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | | Yes | Yes | 120 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | |
| CA\_2A-48E-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | | Yes | Yes | 100 | 0 |
| 48 | See CA\_48E Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| 66 | Yes | Yes | Yes | Yes | | Yes | Yes |
| CA\_2A-48E-66A-66A | CA\_48A-66A  CA\_2A-66A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | | Yes | Yes | 120 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | |

#### 6.16.1.2 Co-existence studies for LTE-A inter-band UL CA band 48 and band 66 and DL CA band 2 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.16.1.2-1.

Table 6.16.1.2-1: Co-existence study for UL CA band 48 and band 66 and DL CA band 2 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1710** | **1780** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3560 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5340 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | **1770** | **1990** | 5260 | 5480 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 280 | 10 | 5320 | 5690 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6970 | 7260 | 8810 | 9180 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1430 | 1790 | 8870 | 9390 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 8680 | 9040 | 12360 | 12880 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3980 | 3540 | 10520 | 10960 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 13090 | 12420 | 3570 | 3140 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15910 | 16580 | 10390 | 10820 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7680 | 7090 | **1760** | **2270** |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14070 | 14660 | 12230 | 12740 |

#### 6.16.1.3 Co-existence studies for LTE-A inter-band UL CA band 2 and band 48 and DL CA band 2 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.16.1.3-1.

Table 6.16.1.3-1: Co-existence study for UL CA band 2 and band 48 and DL CA band 2 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1640 | 1850 | 5400 | 5610 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 0 | 270 | 5190 | 5550 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7250 | 7520 | 8950 | 9310 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | **1850** | **2180** | 8740 | 9250 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 9100 | 9430 | 12500 | 13010 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3700 | 3280 | 10800 | 11220 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 12950 | 12290 | 4090 | 3700 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 16050 | 16710 | 10950 | 11340 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7400 | 6830 | 1370 | 1850 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14350 | 14920 | 12650 | 13130 |

#### 6.16.1.4 Co-existence studies for LTE-A inter-band UL CA band 2 and band 66 and DL CA band 2 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.16.1.4-1.

Table 6.16.1.4-1: Co-existence study for UL CA band 2 and band 66 and DL CA band 2 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | **3700** | **3820** | **3420** | **3560** |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 200 | 70 | **3560** | **3690** |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1920 | 2110 | 1510 | 1710 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5410 | 5600 | 5270 | 5470 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 3770 | 4020 | 3220 | 3490 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7260 | 7510 | 6980 | 7250 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 140 | 400 | 7120 | 7380 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 5270 | 4930 | 5930 | 5620 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 8690 | 9030 | 9110 | 9420 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1640 | 1310 | 2310 | 1990 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 8830 | 9160 | 8970 | 9290 |

#### 6.16.1.5 MSD

When uplink CA (band 48 and band 66) is paired with downlink CA (band 2 and band 48 and band 66), the 2nd and 5th order IMD products by band 48 and band 66 falls into the own Rx frequency band 2. In Table 6.16.1.3-1, evaluated MSD values of 3 bands (band 2 and band 48 and band 66) DL with 2 bands (band 48 and band 66) UL is shown.

**Table 6.16.1.5-1: MSD summary for UL CA band 48 and band 66 and DL CA band 2 and band 48 and band 66**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-48A-66A  CA\_2A-48C-66A | CA\_48A-66A | 2 | 1880 | 5 | 25 | 1960 | 5 | 28.3 | FDD-TDD | IMD2 |
| 48 | 3695 | 5 | 25 | 3695 | 5 | N/A |
| 66 | 1735 | 5 | 25 | 2135 | 5 | N/A |
| 2 | 1895 | 5 | 25 | 1975 | 5 | 0 | IMD5 |
| 48 | 3620 | 5 | 25 | 3620 | 5 | N/A |
| 66 | 1755 | 5 | 25 | 2155 | 5 | N/A |

When uplink CA (band 2 and band 48) is paired with downlink CA (band 2 and band 48 and band 66), the 4th order IMD product by band 2 and band 48 falls into the own Rx frequency band 66. In Table 6.16.1.4-2, evaluated MSD values of 3 bands (band 2 and band 48 and band 66) DL with 2 bands (Band 2 and band 48) UL is shown.

**Table 6.16.1.5-2: MSD summary for UL CA band 2 and band 48 and DL CA band 2 and band 48 and band 66**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-48A-66A  CA\_2A-48C-66A | CA\_2A-48A | 2 | 1905 | 5 | 25 | 1985 | 5 | N/A | FDD-TDD | IMD4 |
| 48 | 3560 | 5 | 25 | 3560 | 5 | N/A |
| 66 | 1755 | 5 | 25 | 2155 | 5 | 12.1 |

When uplink CA (band 2 and band 66) is paired with downlink CA (band 2 and band 48 and band 66), the 2nd order IMD product by band 2 and band 66 falls into the own Rx frequency band 48. In Table 6.16.1.5-3, evaluated MSD values of 3 bands (band 2 and band 48 and band 66) DL with 2 bands (Band 2 and band 66) UL is shown.

**Table 6.16.1.5-3: MSD summary for UL CA band 2 and band 66 and DL CA band 2 and band 48 and band 66**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-48A-66A,  CA\_2A-48D-66A,  CA\_2A-48E-66A,  CA\_2A-48A-66A-66A,  CA\_2A-48C-66A-66A,  CA\_2A-48D-66A-66A,  CA\_2A-48E-66A-66A | CA\_2A-66A | 2 | 1855 | 5 | 25 | 1935 | 5 | N/A | FDD-TDD | IMD2 |
| 48 | 3625 | 5 | 25 | 3625 | 5 | 32.0 |
| 66 | 1770 | 5 | 25 | 2190 | 5 | N/A |

#### 6.16.1.6 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.17 LTE-A inter-band CA: Band 1 and Band 3 and Band 5 DL with 2 bands UL

### 6.17.1 List of specific combination issues

#### 6.17.1.1 Channel bandwidth per operating band for CA

Table 6.17.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-1A-3C-5A | CA\_1A-5A | 1 | See CA\_1A-1A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 90 | 0 |
| 3 | See CA\_3C Bandwidth combination set 0 in table 5.6A.1-1 | | | | | |
| 5 |  |  | Yes | Yes |  |  |
| CA\_1A-1A-3C-5A | CA\_3A-5A | 1 | See CA\_1A-1A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 90 | 0 |
| 3 | See CA\_3C Bandwidth combination set 0 in table 5.6A.1-1 | | | | | |
| 5 |  |  | Yes | Yes |  |  |

#### 6.17.1.2 Co-existence studies for LTE-A inter-band UL CA 2 bands and DL CA\_1A-1A-3C-5A

There is no harmonic issue for this band combination according to the same band combination defined in TS 36.101 [2].

For 3 bands DL with 2 bands UL of CA\_1A-1A-3C-5A with UL configurations in Table 6.17.1.1-1, there is no self-receiver desensitization due to intermodulation products with 2 UL bands.

#### 6.17.1.3 MSD

The MSD requirement due to close proximity of UL to DL channel should be reflected in the specification as below:

Table 6.17.1.3-1: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions for three bands due to close proximity of UL to DL channel) from Table 7.3.1A-0bC

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Channel bandwidth** | | | | | | | | |
| EUTRA CA Configuration | EUTRA band | 1.4 MHz (dBm) | 3 MHz (dBm) | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | Duplex mode |
| CA\_1A-1A-3C-5A4 | 312 |  |  | -94 | -91.5 | -90 | -89 | FDD |
| CA\_1A-1A-3C-5A5 | 3 |  |  | -97 | -94 | -92.2 | -91 | FDD |

Table 6.17.1.3-2: Uplink configuration for the uplink band (exceptions for three bands due to close proximity of UL to DL channel) from Table 7.3.1A-0bD

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth of the affected DL band / NRB / Duplex mode | | | | | | | | |
| E-UTRA CA Configuration | UL band | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Duplex mode |
| CA\_1A-1A-3C-5A1, 2 | 1 |  |  | 25 | 25 | 25 | 25 | FDD |
| CA\_1A-1A-3C-5A1, 3 | 1 |  |  | 25 | 45 | 45 | 45 | FDD |

#### 6.17.1.4 ∆TIB and ∆RIB values

The requirements of low-order combination from TS 36.101 can be applied.

## 6.18 LTE-A inter-band CA: Band 3 and Band 8 and Band 38 DL with 2 bands UL

### 6.18.1 List of specific combination issues

#### 6.18.1.1 Channel bandwidth per operating band for CA

Table 6.18.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_3A-8A-38A | CA\_3A-8A | 3 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 8 |  |  | Yes | Yes |  |  |
| 38 |  |  | Yes | Yes | Yes | Yes |

#### 6.18.1.2 Co-existence studies for LTE-A inter-band UL CA\_3A-8A and DL CA\_3A-8A-38A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.18.1.2-1.

Table 6.18.1.2-1: Co-existence study for DL CA\_3A-8A-38A with UL CA\_3A-8A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1710** | **1785** | **880** | **915** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3570 | 1760 | 1830 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5355 | 2640 | 2745 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 905 | 795 | **2590** | **2700** |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | **2505** | **2690** | 25 | 120 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4300 | 4485 | 3470 | 3615 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4215 | 4475 | 855 | 1035 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 6010 | 6270 | 4350 | 4530 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1590 | 1810 | 5180 | 5400 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1950 | 1735 | 6260 | 5925 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 675 | 930 | 3595 | 3300 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5230 | 5445 | 7720 | 8055 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6060 | 6315 | 6890 | 7185 |

When uplink CA\_3A\_8A is paired with downlink CA\_3A-8A-38A, the 2nd and 3rd order IMD product by band 3 and band 8 may fall into the Rx frequency band 38.

#### 6.18.1.3 MSD

When uplink CA\_3A\_8A is paired with downlink CA\_3A-8A-38A, the MSD issue is analysed in this proposal [3] from Huawei. In Table 6.18.1.3-1, the MSD analysis results from interested companies are summarized.

Table 6.18.1.3-1: MSD values provided by companies

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **DL CA** | **UL CA** | **IMD** | | **Huawei** | **LGE** | **Avg.**  **MSD [dB]** |
| CA\_3A-8A-38A | B3 | IMD2 | |fB3 + fB8| | 24.1 | 28.6 | 26.4 |
| B8 |
| CA\_3A-8A-38A | B3 | IMD3 | |2\*fB3 - fB8| | 15.7 | 15.7 | 15.7 |
| B8 |

And the MSD results are listed as below.

Table 6.18.1.3-2: MSD summary for UL CA\_3A-8A and DL CA\_3A-8A-38A

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EUTRA CA | EUTRA CA | EUTRA band | UL Fc | UL BW | UL | DL Fc | DL BW | MSD | Duplex mode | Source of IMD |
| DL Configuration | UL Configuration | (MHz) | (MHz) | CLRB | (MHz) | (MHz) | (dB) |
| CA\_3A-8A-38A | CA\_3A-8A | 3 | 1720 | 5 | 25 | 1815 | 5 | N/A | FDD | N/A |
| 8 | 890 | 5 | 25 | 935 | 5 | N/A | FDD | N/A |
| 38 | 2610 | 5 | 25 | 2610 | 5 | 26.4 | TDD | IMD2 |
| CA\_3A-8A | 3 | 1750 | 5 | 25 | 1845 | 5 | N/A | FDD | N/A |
| 8 | 900 | 5 | 25 | 945 | 5 | N/A | FDD | N/A |
| 38 | 2600 | 5 | 25 | 2600 | 5 | 15.7 | TDD | IMD3 |

#### 6.18.1.4 ∆TIB and ∆RIB values

The requirements of ∆TIB values in table 6.2.5-3 from TS36.101 can be applied for CA\_3-8-38.

The requirements of ∆RIB values in table 7.3.1-1B from TS36.101 can be applied for CA\_3-8-38.

## 6.19 LTE-A inter-band CA: Band 1 and Band 3 and Band 28 DL with 2 bands UL

### 6.19.1 List of specific combination issues

#### 6.19.1.1 Channel bandwidth per operating band for CA

Table 6.19.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-1A-3C-28A | CA\_1A-3A | 1 | See CA\_1A-1A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 100 | 0 |
| 3 | See CA\_3C Bandwidth combination set 0 in table 5.6A.1-1 | | | | | |
| 5 |  |  | Yes | Yes |  |  |
| CA\_1A-1A-3C-28A | CA\_1A-28A | 1 | See CA\_1A-1A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 100 | 0 |
| 3 | See CA\_3C Bandwidth combination set 0 in table 5.6A.1-1 | | | | | |
| 5 |  |  | Yes | Yes |  |  |
| CA\_1A-1A-3C-28A | CA\_3A-28A | 1 | See CA\_1A-1A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 100 | 0 |
| 3 | See CA\_3C Bandwidth combination set 0 in table 5.6A.1-1 | | | | | |
| 5 |  |  | Yes | Yes |  |  |

#### 6.19.1.2 Co-existence studies for LTE-A inter-band UL CA 2 bands and DL CA\_1A-1A-3C-28A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.19.1.2-1.

Table 6.19.1.2-1: Co-existence study for UL CA\_3A-28A and DL CA\_1A-1A-3C-28A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **Fx\_low** | **Fx\_high** | **Fy\_low** | **Fy\_high** |
| **UL frequency (MHz)** | **703** | **748** | **1710** | **1785** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1406 | 1496 | 3420 | 3570 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | **2109** | **2244** | 5130 | 5355 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 962 | 1082 | 2413 | 2533 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 379 | 214 | 2672 | 2867 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3116 | 3281 | 4123 | 4318 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 324 | 534 | 4382 | 4652 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | **2164** | **1924** | 4826 | 5066 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 3819 | 4029 | 5833 | 6103 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6437 | 6092 | 1282 | 1027 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 3949 | 3634 | 1176 | 1461 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 7543 | 7888 | 4522 | 4777 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6536 | 6851 | 5529 | 5814 |

In Table 6.19.1.2-1, 3rd harmonic from the band 28 can impact the band 1 and the harmonic MSD has been captured in Table 7.3.1A-0a of TS 36.101. Therefore, there is no need to study for this harmonic problem.

#### 6.19.1.3 MSD

When uplink CA\_3A\_28A is paired with downlink CA\_1A-1A-3C-28A, the 4th order IMD products by band 28 and band 3 falls into the own Rx frequency band 1.

When uplink CA\_1A\_28A is paired with downlink CA\_1A-1A-3C-28A, the 5th order IMD products by band 1 and band 28 falls into the own Rx frequency band 3.

There is no need to study for the IMD4 and IMD5 due to the fact that it was already covered by Table 7.3.1A-0g: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations in TS 36.101.

For UL CA\_1A-3A paired with downlink CA\_1A-1A-3C-28A, there is no IMD products falls into the own Rx band.

MSD values for the CA configuration CA\_1A-1A-3C-28Adue to IMD issue can reuse those defined for CA\_1A-3A-28A in TS 36.101.

Table 6.19.1.3: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations from Table 7.3.1A-0g

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | | | Source of IMD |
| **EUTRA CA** | EUTRA CA | EUTRA band | UL Fc | UL BW | UL | DL Fc | DL BW | MSD | Duplex mode |
| **DL Configuration** | UL Configuration | (MHz) | (MHz) | CLRB | (MHz) | (MHz) | (dB) |
| CA\_1A-1A-3C-28A | CA\_1A-28A | 1 | 1975 | 5 | 25 | 2165 | 5 | N/A | FDD | N/A |
| 28 | 710.5 | 5 | 25 | 765.5 | 5 | N/A | N/A |
| 3 | 1723.5 | 5 | 25 | 1818.5 | 5 | 4.0 | IMD5 |
| CA\_3A-28A | 3 | 1780 | 5 | 25 | 1875 | 5 | N/A | FDD | N/A |
| 28 | 710.5 | 5 | 25 | 765.5 | 5 | N/A | N/A |
| 1 | 1949 | 5 | 25 | 2139 | 5 | 11.0 | IMD4 |

#### 6.19.1.4 ∆TIB and ∆RIB values

The requirements of low-order combination from TS 36.101 can be applied.

## 6.20 LTE-A inter-band CA: Band 1 and Band 3 and Band 42 with 2 bands UL

### 6.20.1 List of specific combination issues

#### 6.20.1.1 Channel bandwidths per operating band for CA

Table 6.20.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-42D | CA\_1A-3A  CA\_1A-42A  CA\_3A-42A | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 42 | See CA\_42D Bandwidth Combination Set 0 in Table 5.6A.1-1 in TS 36.101 | | | | | |

#### 6.20.1.2 Co-existence studies

Co-existence studies for UL CA\_1A-3A, 1A-42A, and 3A-42A and DL CA\_1A-3A-42D are covered by UL CA\_1A-3A, 1A-42A, and 3A-42A and DL CA\_1A-3A-42A (42C), which has been specified in 36.101.

#### 6.20.1.3 MSD

MSD for UL CA\_1A-3A, 1A-42A, and 3A-42A and DL CA\_1A-3A-42D are covered by UL CA\_1A-3A, 1A-42A, and 3A-42A and DL CA\_1A-3A-42A (42C), which has been specified in 36.101.

#### 6.20.1.4 ∆TIB and ∆RIB values

∆TIB and ∆RIB values for UL CA\_1A-3A, 1A-42A, and 3A-42A and DL CA\_1A-3A-42D are covered by UL CA\_1A-3A, 1A-42A, and 3A-42A and DL CA\_1A-3A-42A (42C), which has been specified in 36.101.

## 6.21 LTE-A inter-band CA: Band 1 and Band 3 and Band 7 DL with 2 bands UL

### 6.21.1 List of specific combination issues

#### 6.21.1.1 Channel bandwidths per operating band for CA

Table 6.21.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-3A-7A | CA\_1A-3A, CA\_1A-7A, CA\_3A-7A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 3 | See the CA\_3A-3A Bandwidth combination set 0 in the Table 5.6A.1-3 | | | | | |
| 7 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-3A-3A-7A-7A | CA\_1A-3A, CA\_1A-7A, CA\_3A-7A | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 3 | See the CA\_3A-3A Bandwidth combination set 0 in Table below | | | | | |
| 7 | See the CA\_7A-7A Bandwidth combination set 1 in Table below | | | | | |

#### 6.21.1.2 Co-existence studies

Coexistence studies can be covered by CA\_1A-3A-7A 3DL/2UL combination, based on the study in TR 36.714-00-02, when uplink CA configurations CA\_1A-3A, CA\_1A-7A and CA\_3A-7A are paired with downlink CA configuration CA\_1A-3A-7A there are no interference components from 2 uplink operation which would interfere the downlink of the third band.

#### 6.21.1.3 MSD

No additional REFSENS exceptions are expected for this CA combination.

#### 6.21.1.4 ∆TIB and ∆RIB values

The requirements of low-order combinations from TS36.101 [2] can be applied.

## 6.22 LTE-A inter-band CA: Band 1 and Band 3 and Band 8 DL with 2 bands UL

### 6.22.1 List of specific combination issues

#### 6.22.1.1 Channel bandwidths per operating band for CA

Table 6.22.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-3A-8A | CA\_1A-3A, CA\_1A-8A, CA\_3A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 3 | See CA\_3A-3A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| 8 |  |  | Yes | Yes |  |  |

#### 6.22.1.2 Co-existence studies

Coexistence studies can be covered by CA\_1A-3A-8A 3DL/2UL combination, based on the study in TR 36.879-13, when uplink CA configurations CA\_1A-3A, CA\_1A-8A and CA\_3A-8A are paired with downlink CA configuration CA\_1A-3A-8A there are no interference components from 2 uplink operation which would interfere the downlink of the third band.

#### 6.22.1.3 MSD

No additional REFSENS exceptions are expected for this CA combination.

#### 6.22.1.4 ∆TIB and ∆RIB values

The requirements of low-order combinations from TS36.101 [3] can be applied.

## 6.23 LTE-A inter-band CA: Band 1 and Band 7 and Band 8 DL with 2 bands UL

### 6.23.1 List of specific combination issues

#### 6.23.1.1 Channel bandwidths per operating band for CA

Table 6.23.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-7A-8A | CA\_1A-7A, CA\_1A-8A,  CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 7 |  |  |  | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| 1 |  |  | Yes | Yes | Yes | Yes | 50 | 1 |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-7A-7A-8A | CA\_1A-7A, CA\_1A-8A,  CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 7 | See CA\_7A-7A Bandwidth combination set 1 in Table 5.6A.1-3 | | | | | |
| 8 |  |  | Yes | Yes |  |  |

#### 6.23.1.2 Co-existence studies for LTE-A UL CA 7A-8A and DL CA 1A-7A-8A and DL CA 1A-7A-8A

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analysed in Table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | **880** | **915** | **2500** | **2570** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1760 | 1830 | 5000 | 5140 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | **2640** | **2745** | 7500 | 7710 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1585 | 1690 | 3380 | 3485 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 810 | 670 | 4085 | 4260 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4260 | 4400 | 5880 | 6055 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 70 | 245 | 6585 | 6830 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 5140 | 5315 | 8380 | 8625 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limits (MHz) | 3380 | 3170 | 6760 | 6970 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 9400 | 9085 | **1160** | **950** |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 10880 | 11195 | 6020 | 6230 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limits (MHz) | 5950 | 5670 | 2255 | 2500 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 9260 | 9540 | 7640 | 7885 |

Based on the table above, no own Rx impact on the 3rd band is observed for DL CA\_1A-7A-8A, CA\_1A-7A-7A-8A paired with UL CA\_7A-8A.

Note that the coexistence studies for DL CA\_1A-7A-7A-8A paired with UL CA\_1A-7A and CA\_1A-8A can be covered by the studies for DL CA\_1A-7A-8A paired with CA\_1A-7A and CA\_1A-8A in TR 36.714-00-02. Based on the studies in TR 36.714-00-02, the 5th order IMD generated by dual uplink of Band 1 + Band 7 may fall into own Rx of band 8, but it was decided not to define MSD requirement since the IMD5 is fairly small and the overlapped region is quite small portion.

#### 6.23.1.3 MSD

No additional REFSENS exceptions are expected for this CA combination.

#### 6.23.1.4 ∆TIB and ∆RIB values

The requirements of low-order combinations from TS36.101 [3] can be applied.

## 6.24 LTE-A inter-band CA: Band 2 and Band 46 and Band 66 DL with 2 bands UL

### 6.24.1 List of specific combination issues

#### 6.24.1.1 Channel bandwidth per operating band for CA

Table 6.24.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-46E-66A | CA\_2A-66A | 2 | Yes | Yes | | Yes | Yes | Yes | Yes | 120 | 0 |
| 46 | See the CA\_46E Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | | |
| 66 | Yes | | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46D-66A | CA\_2A-66A | 2 | Yes | | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 | See the CA\_46D Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | | |
| 66 | Yes | | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46C-66A | CA\_2A-66A | 2 | Yes | | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| 46 | See the CA\_46C Bandwidth combination set 0 in the Table 5.6A.1 | | | | | | |
| 66 | Yes | | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46A-66A | CA\_2A-66A | 2 | Yes | | Yes | Yes | Yes | Yes | Yes | 60 | 0 |
| 46 |  | |  |  | Yes |  | Yes |
| 66 | Yes | | Yes | Yes | Yes | Yes | Yes |

#### 6.24.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 66 and DL CA band 2 and band 46 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.24.1.2-1.

Table 6.24.1.2-1: Co-existence study for UL CA band 2 and band 66 and DL CA band 2 and band 46 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | **5550** | **5730** | **5130** | **5340** |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 200 | 70 | 3560 | 3690 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1920 | 2110 | 1510 | 1710 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | **5410** | **5600** | **5270** | **5470** |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 3770 | 4020 | 3220 | 3490 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7260 | 7510 | 6980 | 7250 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 140 | 400 | 7120 | 7380 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | **5270** | **4930** | **5930** | **5620** |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 8690 | 9030 | 9110 | 9420 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1640 | 1310 | 2310 | 1990 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 8830 | 9160 | 8970 | 9290 |

In Table 6.24.1.2-1, 3rd harmonics from the band 2 and 66 can impact the band 46. Since the band 46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS36.101, there is no need to study for this harmonic problem.

#### 6.24.1.3 MSD

When uplink CA band 2 and band 66 is paired with downlink CA band 2 and band 46 and band 66, the 3rd and 5th order IMD products by band 2 and band 66 falls into the own Rx frequency band 46.

For band combinations including band 46, there is no need to study for MSD since the requirements are already specified in Table 7.3.1A-0eA: Reference sensitivity QPSK PREFSENS (CA with band 46 or Band 49) and when band 46 have self-interference problems by operating dual uplink CA, then these requirements do not need to apply in exclusion zone which is frequency range within (harmonics frequency region + delta FHD in Table 7.3.1A-0eC) and IMD frequency region as below.

**6.24.1.3-1: IMD frequency range for UL CA band 2 and band 66 and DL CA band 2 and band 46 and band 66**

|  |  |  |  |
| --- | --- | --- | --- |
| DL\_CA configuration | **UL\_CA configuration** | **Exclusion zone center frequency** | **Exclusion zone BW** |
| CA\_2A-46E-66A  CA\_2A-46D-66A  CA\_2A-46C-66A  CA\_2A-46A-66A | CA\_2A-66A | 2\*fc\_2A + 1\*fc\_66A  2\*fc\_66A + 1\*fc\_2A  1\*fc\_2A – 4\*fc\_66A  1\*fc\_66A – 4\*fc\_2A | 2\*BW\_2A + 1\*BW\_66A  2\*BW\_66A + 1\*BW\_2A  1\*BW\_2A + 4\*BW\_66A  1\*BW\_66A + 4\*BW\_2A |

#### 6.24.1.4 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.25 LTE-A inter-band CA: Band 13 and Band 48 and Band 66 DL with 2 bands UL

### 6.25.1 List of specific combination issues

#### 6.25.1.1 Channel bandwidth per operating band for CA

Table 6.25.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_13A-48A-66A | CA\_13A-48A  CA\_13A-66A  CA\_48A-66A | 13 |  |  | Yes | Yes |  |  | 50 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_13A-48A-66A-66A | CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 13 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_13A-48C-66A | CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 70 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_13A-48C-66A-66A | CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 120 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_13A-48D-66A | CA\_48A-66A  CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 90 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_13A-48D-66A-66A | CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 110 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |

#### 6.25.1.2 Co-existence studies for LTE-A inter-band UL CA band 13 and band 48 and DL CA band 13 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.25.1.2-1.

Table 6.25.1.2-1: Co-existence study for UL CA band 13 and band 48 and DL CA band 13 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **777** | **787** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1554 | 1574 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2331 | 2361 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 2763 | 2923 | 4327 | 4487 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 2146 | 1976 | 6313 | 6623 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5104 | 5274 | 7877 | 8187 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1369 | 1189 | 9863 | 10323 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5881 | 6061 | 11427 | 11887 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 5846 | 5526 | 8654 | 8974 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 14023 | 13413 | 402 | 592 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 14977 | 15587 | 6658 | 6848 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 9546 | 9076 | 4739 | 5069 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 12204 | 12674 | 9431 | 9761 |

According to Table 6.25.1.2.-1 above, no harmonic from the band 13 and 48 is found.

#### 6.25.1.3 Co-existence studies for LTE-A inter-band UL CA band 13 and band 66 and DL CA band 13 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.25.1.3-1.

Table 6.25.1.3-1: Co-existence study for UL CA band 13 and band 66 and DL CA band 13 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **777** | **787** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1554 | 1574 | **3420** | **3560** |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2331 | 2361 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 923 | 1003 | 2487 | 2567 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 226 | 136 | 2633 | 2783 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 3264 | 3354 | 4197 | 4347 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 551 | 651 | 4343 | 4563 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4041 | 4141 | 5907 | 6127 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 2006 | 1846 | 4974 | 5134 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 6343 | 6053 | 1438 | 1328 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 7617 | 7907 | 4818 | 4928 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | **3786** | **3556** | 1059 | 1229 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6684 | 6914 | 5751 | 5921 |

In Table 6.25.1.3-1, 2nd harmonic from the band 66 can impact the band 48. Since harmonic issues have been already analysed in TS 36.101, there is no need to study for this harmonic problem.

#### 6.25.1.4 Co-existence studies for LTE-A inter-band UL CA band 48 and band 66 and DL CA band 13 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.25.1.4-1.

Table 6.25.1.4-1: Co-existence study for UL CA band 48 and band 66 and DL CA band 13 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1710** | **1780** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3560 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5340 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1770 | 1990 | 5260 | 5480 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 280 | 10 | 5320 | 5690 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6970 | 7260 | 8810 | 9180 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1430 | 1790 | 8870 | 9390 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 8680 | 9040 | 12360 | 12880 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3980 | 3540 | 10520 | 10960 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 13090 | 12420 | 3570 | 3140 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15910 | 16580 | 10390 | 10820 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7680 | 7090 | 1760 | 2270 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14070 | 14660 | 12230 | 12740 |

#### 6.25.1.5 MSD

When uplink CA (band 13 and band 48) is paired with downlink CA (band 13 and band 48 and band 66), 3rd order IMD product by band 13 and band 48 falls into the own Rx frequency band 66.

When uplink CA (band 13 and band 66) is paired with downlink CA (band 13 and band 48 and band 66), 5th order IMD product by band 13 and band 66 falls into the own Rx frequency band 48. In Table 6.x.1.x-1, evaluated MSD values of 3 bands (band 13 and band 48 and band 66) DL with 2 bands (band 13 and band 48 & band 14 and band 66) UL is shown.

When uplink CA (band 48 and band 66) is paired with downlink CA (band 13 and band 48 and band 66), there are no harmonic and IMD products falling into own Rx bands. Therefore, no MSD needs to be addressed for this uplink configuration.

**Table 6.25.1.5-1: MSD summary for 2 bands UL CA and DL CA band 13 and band 48 and band 66**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_13A-48A-66A | CA\_13A-48A | 13 | 782 | 5 | 25 | 751 | 5 | N/A | FDD-TDD | IMD3 |
| 48 | 3695 | 5 | 25 | 3695 | 5 | N/A |
| 66 | 1731 | 5 | 25 | 2131 | 5 | 17.1 |
| CA\_13A-66A | 13 | 782 | 5 | 25 | 751 | 5 | N/A | FDD-TDD | IMD5 |
| 48 | 3626 | 5 | 25 | 3626 | 5 | 0 |
| 66 | 1730 | 5 | 25 | 2130 | 5 | N/A |

#### 6.25.1.6 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.26 LTE-A inter-band CA: Band 46 and Band 48 and Band 66 DL with 2 bands UL

### 6.26.1 List of specific combination issues

#### 6.26.1.1 Channel bandwidth per operating band for CA

Table 6.26.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_46A-48A-66A | CA\_48A-66A | 46 |  |  |  | Yes |  | Yes | 60 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_46A-48C-66A | CA\_48A-66A | 46 |  |  |  | Yes |  | Yes | 80 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_46C-48A-66A | CA\_48A-66A | 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 80 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_46C-48C-66A | CA\_48A-66A | 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 100 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_46D-48A-66A | CA\_48A-66A | 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 100 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_46D-48C-66A | CA\_48A-66A | 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 120 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |

#### 6.26.1.2 Co-existence studies for LTE-A inter-band UL CA band 48 and band 66 and DL CA band 46 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.26.1.2-1.

Table 6.26.1.2-1: Co-existence study for UL CA band 48 and band 66 and DL CA band 46 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1710** | **1780** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3560 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | **5130** | **5340** | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1770 | 1990 | **5260** | **5480** |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 280 | 10 | **5320** | **5690** |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6970 | 7260 | 8810 | 9180 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1430 | 1790 | 8870 | 9390 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 8680 | 9040 | 12360 | 12880 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3980 | 3540 | 10520 | 10960 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 13090 | 12420 | 3570 | 3140 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15910 | 16580 | 10390 | 10820 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7680 | 7090 | 1760 | 2270 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14070 | 14660 | 12230 | 12740 |

For 3rd harmonic, there is no need to study since band 46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS 36.101.

#### 6.26.1.3 MSD

When uplink CA (band 48 and band 66) is paired with downlink CA (band 46 and band 48 and band 66), 2nd and 3rd order IMD products by band 48 and band 66 falls into the own Rx frequency band 46.

For band combinations including band 46, there is no need to study for MSD since the requirements are already specified in Table 7.3.1A-0eA: Reference sensitivity QPSK PREFSENS (CA with band 46 or Band 49) and when band 46 have self-interference problems by operating dual uplink CA, then these requirements do not need to apply in exclusion zone which is frequency range within (harmonics frequency region + delta FHD in Table 7.3.1A-0eC) and IMD frequency region as below.

**6.26.1.3-1: IMD frequency range for UL CA band 48 and band 66 and DL CA band 46 and band 48 and band 66**

|  |  |  |  |
| --- | --- | --- | --- |
| DL\_CA configuration | UL\_CA configuration | Exclusion zone center frequency | Exclusion zone BW |
| CA\_46D-48C-66A  CA\_46C-48C-66A  CA\_46A-48C-66A  CA\_46D-48A-66A  CA\_46C-48A-66A  CA\_46A-48A-66A | CA\_48A-66A | 1\*fc\_48A + 1\*fc\_66A  2\*fc\_48A – 1\*fc\_66A | 1\*BW\_48A + 1\*BW\_66A  2\*BW\_48A + 1\*BW\_66A |

#### 6.26.1.4 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.27 LTE-A inter-band CA: Band 1 and Band 7 and Band 20 DL with 2 bands UL

### 6.27.1 List of specific combination issues

#### 6.27.1.1 Channel bandwidth per operating band for CA

Table 6.27.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-7A-20A | CA\_1A-7A  CA\_1A-20A  CA\_7A-20A | 1 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 7 |  |  |  | Yes | Yes | Yes |
| 20 |  |  | Yes | Yes |  |  |
| 1 |  |  | Yes | Yes | Yes | Yes | 60 | 1 |
| 7 |  |  |  | Yes | Yes | Yes |
| 20 |  |  | Yes | Yes | Yes | Yes |
| 1 |  |  | Yes | Yes | Yes | Yes | 60 | 2 |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 20 |  |  | Yes | Yes | Yes | Yes |

#### 6.27.1.2 Co-existence studies for LTE-A inter-band CA 3 bands DL CA\_1A-7A-20A and 2 bands UL

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.27.1.2-1/6.27.1.2-2/6.27.1.2-3.

Table 6.27.1.2-1: Co-existence study for DL CA\_1A-7A-20A with UL CA\_1A-7A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1920** | **1980** | **2500** | **2570** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 | 5000 | 5140 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 | 7500 | 7710 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 7680 | 7920 | 10000 | 10280 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 9600 | 9900 | 12500 | 12850 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 520 | 650 | 4420 | 4550 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 1270 | 1460 | 3020 | 3220 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 6340 | 6530 | 6920 | 7120 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 3190 | 3440 | 5520 | 5790 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 8260 | 8510 | 9420 | 9690 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1300 | 1040 | 8840 | 9100 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 8360 | 8020 | 5420 | 5110 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 3870 | 3540 | **940** | **620** |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 11920 | 12260 | 10180 | 10490 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 11340 | 11670 | 10760 | 11080 |

When uplink CA\_1A-7A is paired with downlink CA\_1A-7A-20A, the 5th order IMD product by band 1 and band 7 falls into the Rx frequency band 20. The MSD exception should be considered.

Table 6.27.1.2-2: Co-existence study for DL CA\_1A-7A-20A with UL CA\_1A-20A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1920** | **1980** | **832** | **862** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 | 1664 | 1724 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 | 2496 | 2586 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1148 | 1058 | 2752 | 2842 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2978 | 3128 | 316 | 196 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4672 | 4822 | 3584 | 3704 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4898 | 5108 | 516 | 666 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 6592 | 6802 | 4416 | 4566 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | **2116** | **2296** | 5504 | 5684 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1528 | 1348 | 7088 | 6818 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1254 | 1464 | 4276 | 4036 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5248 | 5428 | 8512 | 8782 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6336 | 6546 | 7424 | 7664 |

When uplink CA\_1A-20A is paired with downlink CA\_1A-7A-20A, the 4th order IMD product by band 1 and band 20 falls into the Rx frequency band 1. The MSD has been solved by DL\_1A-20A\_UL\_1A-20A

Table 6.27.1.2-3: Co-existence study for DL CA\_1A-7A-20A with UL CA\_7A-20A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **2500** | **2570** | **832** | **862** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 5000 | 5140 | 1664 | 1724 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 7500 | 7710 | 2496 | 2586 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1738 | 1638 | 3332 | 3432 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 4138 | 4308 | **906** | **776** |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 5832 | 6002 | 4164 | 4294 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 6638 | 6878 | 74 | 86 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 8332 | 8572 | 4996 | 5156 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3276 | 3476 | 6664 | 6864 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | **948** | **758** | 9448 | 9138 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | **2414** | **2644** | 6046 | 5776 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5828 | 6018 | 10832 | 11142 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 7496 | 7726 | 9164 | 9434 |

When uplink CA\_7A-20A is paired with downlink CA\_1A-7A-20A, the 3rd and 5th order IMD product by band 7 and band 20 falls into the Rx frequency band 20. The MSD has been solved by DL\_7A-20A\_UL\_7A-20A.

When uplink CA\_7A-20A is paired with downlink CA\_1A-7A-20A, the 5th order IMD product by band 7 and band 20 falls into the Rx frequency band 7. The MSD has been solved by DL\_7A-20A\_UL\_7A-20A.

#### 6.27.1.3 MSD

When uplink CA\_1A\_7A is paired with downlink CA\_1A-7A-20A, the MSD issue is analysed as below. We use main/diversity antenna topology as RF front-end architecture in our analysis. The component linearity assumptions are listed in table 6.27.1.3-1, and the component attenuation and isolation values are listed in table 6.27.1.3-2.

Table 6.27.1.3-1 General linearity parameters

|  |  |
| --- | --- |
| **Component** | **IP5(dBm)** |
| Antenna switch | 53 |
| Diplexer | 53 |
| Duplexer | 53 |
| PA forward mixing | 28 |
| PA reverse mixing | 30 |
| LNA | -10 |

Table 6.27.1.3-2 Attenuation and isolation values

|  |  |  |
| --- | --- | --- |
| **Attenuation and Isolation Parameter** | **Value (dB)** | **Comment** |
| **Antenna ISO** | 10 | Main antenna to diversity antenna |
| **L-H Diplexer IL** | 0.5 |  |
| **H-H Diplexer IL** | 0.5 |  |
| **Antenna switch IL** | 1 |  |
| **PA gain** | 25 |  |
| **PCB isolation Paout-Pain** | 60 | PCB isolation (PA forward mixing) |
| **Duplexer IL** | 4 |  |
| **Diplexer isolation T1-T2** | 50 |  |

Table 4 MSD calculation for victim Rx of band 38

|  |  |  |
| --- | --- | --- |
| **Component** | IMD5 (dBm) | |
| Main\_@Antenna | Div\_@Antenna |
| **B1 PA Forward mixing interference** | -157 | - |
| **B7 PA Forward mixing interference** | -120 | - |
| **B1 PA Reserve mixing interference** | -280 | - |
| **B7 PA Reserve mixing interference** | -205 | - |
| **Diplexer (H-H)** | -116.5 | - |
| **B1/B7 Duplexer** | -165.5 | - |
| **B20 LNA via filters** | -202 | - |
| **B20 LNA via PCB coupling** | -130 | - |
| **Diplexer (L-H)** | -109.5 | -161.5 |
| **Antenna switch** | -119 | -163 |
| **interference From main path** | - | -118 |
| **Total** | -108 | -118 |

According to the analysis, the interference signal is very little, so the MSD results are listed as below.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EUTRA CA | EUTRA CA | EUTRA band | UL Fc | UL BW | UL | DL Fc | DL BW | MSD | Duplex mode | Source of IMD |
| DL Configuration | UL Configuration | (MHz) | (MHz) | CLRB | (MHz) | (MHz) | (dB) |
| CA\_1A-7A-20A | CA\_1A-7A | 1 | 1950 | 5 | 25 | 2140 | 5 | N/A | FDD | N/A |
| 7 | 2520 | 5 | 25 | 2640 | 5 | N/A | FDD | N/A |
| 20 | 851 | 5 | 25 | 810 | 5 | 0 | FDD | IMD5 |

#### 6.27.1.4 ∆TIB and ∆RIB values

The requirements of ∆TIB values in table 6.2.5-3 from TS36.101 [2] can be applied for CA\_1-7-20.

The requirements of ∆RIB values in table 7.3.1-1B from TS36.101 [2] can be applied for CA\_1-7-20.

6.28 LTE-A inter-band CA: Band 2 and Band 5 and Band 48 DL with 2 bands UL

6.28.1 List of specific combination issues

6.28.1.1 Channel bandwidth per operating band for CA

**Table 6.28.1.1-1: CA configurations under study**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| **E-UTRA CA Configuration** | **Uplink CA configurations** | **E-UTRA Bands** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| CA\_2A-5A-48A | CA\_2A-48A  CA\_5A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 50 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-5A-48C | CA\_2A-48A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_2A-5A-48D | CA\_2A-5A  CA\_5A-48A  CA\_2A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |

6.28.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 5 and DL CA band 2 and band 5 and band 48

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.28.1.2-1.

**Table 6.28.1.2-1: Co-existence study for UL CA band 2 and band 5 and DL CA band 2 and band 5 and band 48**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **824** | **849** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | **3700** | **3820** | 1648 | 1698 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2472 | 2547 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1086 | 1001 | 2674 | 2759 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 2851 | 2996 | 262 | 152 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4524 | 4669 | **3498** | **3608** |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 4701 | 4906 | 562 | 697 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6374 | 6579 | 4322 | 4457 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 2002 | 2172 | 5348 | 5518 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 1546 | 1386 | 6816 | 6551 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 5146 | 5306 | 8224 | 8489 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1153 | 1348 | 4082 | 3852 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6172 | 6367 | 7198 | 7428 |

2nd harmonic from the band 2 can impact the band 48 and the harmonic MSD has been captured in Table 7.3.1A-0a of TS 36.101. Therefore, there is no need to study for this harmonic problem.

6.28.1.3 Co-existence studies for LTE-A inter-band UL CA band 2 and band 48 and DL CA band 2 and band 5 and band 48

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.28.1.3-1.

**Table 6.28.1.3-1: Co-existence study for UL CA band 2 and band 48 and DL CA band 2 and band 5 and band 48**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1640 | 1850 | 5400 | 5610 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 0 | 270 | 5190 | 5550 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7250 | 7520 | 8950 | 9310 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1850 | 2180 | 8740 | 9250 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 9100 | 9430 | 12500 | 13010 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3700 | 3280 | 10800 | 11220 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 12950 | 12290 | 4090 | 3700 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 16050 | 16710 | 10950 | 11340 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7400 | 6830 | 1370 | 1850 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14350 | 14920 | 12650 | 13130 |

According to Table 6.28.1.3-1, no harmonic impact and no IMD products by band 2 and band 66 falls into the own Rx frequency band 5.

6.28.1.4 Co-existence studies for LTE-A inter-band UL CA band 5 and band 48 and DL CA band 2 and band 5 and band 48

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.28.1.4-1.

**Table 6.28.1.4-1: Co-existence study for UL CA band 5 and band 48 and DL CA band 2 and band 5 and band 48**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **824** | **849** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 2701 | 2876 | 4374 | 4549 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | **2052** | **1852** | 6251 | 6576 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5198 | 5398 | 7924 | 8249 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1228 | 1003 | 9801 | 10276 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6022 | 6247 | 11474 | 11949 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 5752 | 5402 | 8748 | 9098 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 13976 | 13351 | 154 | 404 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15024 | 15649 | 6846 | 7096 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 9452 | 8952 | 4553 | 4928 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 12298 | 12798 | 9572 | 9947 |

6.28.1.5 MSD

When uplink CA (band 2 and band 5) is paired with downlink CA (band 2 and band 5 and band 48), the 3rd order IMD product by band 2 and band 5 falls into the own Rx frequency band 48. In Table 6.28.1.5-1, evaluated MSD values of 3 bands (band 2 and band 5 and band 48) DL with 2 bands (Band 2 and band 5) UL is shown.

**Table 6.28.1.5-1: MSD summary for UL CA band 2 and band 5 and DL CA band 2 and band 5 and band 48**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-5A-48C  CA\_2A-5A-48D | CA\_2A-5A | 2 | 1905 | 5 | 25 | 1985 | 5 | N/A | FDD-TDD | IMD3 |
| 5 | 844 | 5 | 25 | 889 | 5 | N/A |
| 48 | 3593 | 5 | 25 | 3593 | 5 | 16.6 |

When uplink CA (band 5 and band 48) is paired with downlink CA (band 2 and band 5 and band 48), the 3rd order IMD product by band 5 and band 48 falls into the own Rx frequency band 2. In Table 6.28.1.5-2, evaluated MSD values of 3 bands (band 2 and band 5 and band 48) DL with 2 bands (Band 5 and band 48) UL is shown.

**Table 6.28.1.5-2: MSD summary for UL CA band 5 and band 48 and DL CA band 2 and band 5 and band 48**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_2A-5A-48A  CA\_2A-5A-48C  CA\_2A-5A-48D | CA\_5A-48A | 2 | 1882 | 5 | 25 | 1962 | 5 | 15.6 | FDD-TDD | IMD3 |
| 5 | 839 | 5 | 25 | 884 | 5 | N/A |
| 48 | 3640 | 5 | 25 | 3640 | 5 | N/A |

6.28.1.6 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

6.29 LTE-A inter-band CA: Band 5 and Band 48 and Band 66 DL with 2 bands UL

6.29.1 List of specific combination issues

6.29.1.1 Channel bandwidth per operating band for CA

**Table 6.29.1.1-1: CA configurations under study**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| **E-UTRA CA Configuration** | **Uplink CA configurations** | **E-UTRA Bands** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| CA\_5A-48A-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 50 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_5A-48A-66A-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 70 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_5A-48C-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 70 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_5A-48C-66A-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 90 | 0 |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_5A-48D-66A | CA\_48A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 90 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_5A-48D-66A-66A | CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 5 |  |  | Yes | Yes |  |  | 110 | 0 |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |

6.29.1.2 Co-existence studies for LTE-A inter-band UL CA band 5 and band 48 and DL CA band 5 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.29.1.2-1.

**Table 6.29.1.2-1: Co-existence study for UL CA band 5 and band 48 and DL CA band 5 and band 48 and band 66**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **824** | **849** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 2701 | 2876 | 4374 | 4549 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 2052 | 1852 | 6251 | 6576 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5198 | 5398 | 7924 | 8249 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1228 | 1003 | 9801 | 10276 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6022 | 6247 | 11474 | 11949 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 5752 | 5402 | 8748 | 9098 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 13976 | 13351 | 154 | 404 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15024 | 15649 | 6846 | 7096 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 9452 | 8952 | 4553 | 4928 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 12298 | 12798 | 9572 | 9947 |

According to Table 6.29.1.2-1, no harmonic impact and no IMD product by band 5 and band 48 falls into the own Rx frequency band 66.

6.29.1.3 Co-existence studies for LTE-A inter-band UL CA band 5 and band 66 and DL CA band 5 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.29.1.3-1.

**Table 6.29.1.3-1: Co-existence study for UL CA band 5 and band 66 and DL CA band 5 and band 48 and band 66**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **824** | **849** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | **3420** | **3560** |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 861 | 956 | 2534 | 2629 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 132 | 12 | 2571 | 2736 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 3358 | 3478 | 4244 | 4409 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 692 | 837 | 4281 | 4516 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4182 | 4327 | 5954 | 6189 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 1912 | 1722 | 5068 | 5258 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 6296 | 5991 | 1686 | 1516 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 7664 | 7969 | 5006 | 5176 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | **3692** | **3432** | 873 | 1088 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6778 | 7038 | 5892 | 6107 |

2nd harmonic from the band 66 can impact the band 48 and the harmonic MSD has been captured in Table 7.3.1A-0a of TS 36.101. Therefore, there is no need to study for this harmonic problem.

6.29.1.4 Co-existence studies for LTE-A inter-band UL CA band 48 and band 66 and DL CA band 5 and band 48 and band 66

For 3 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 6.29.1.4-1.

**Table 6.29.1.4-1: Co-existence study for UL CA band 48 and band 66 and DL CA band 5 and band 48 and band 66**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **3550** | **3700** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 7100 | 7400 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 10650 | 11100 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1990 | 1770 | 5260 | 5480 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 5320 | 5690 | 280 | 10 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 8810 | 9180 | 6970 | 7260 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 8870 | 9390 | 1430 | 1790 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 12360 | 12880 | 8680 | 9040 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3540 | 3980 | 10520 | 10960 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 3570 | 3140 | 13090 | 12420 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 10390 | 10820 | 15910 | 16580 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1760 | 2270 | 7680 | 7090 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 12230 | 12740 | 14070 | 14660 |

According to Table 6.29.1.4-1, no harmonic impact and no IMD products by band 48 and band 66 falls into the own Rx frequency band 5.

6.29.1.5 MSD

When uplink CA (band 5 and band 66) is paired with downlink CA (band 5 and band 48 and band 66), the 5th order IMD product by band 5 and band 66 falls into the own Rx frequency band 48. In Table 6.29.1.5-1, evaluated MSD values of 3 bands (band 5 and band 48 and band 66) DL with 2 bands (Band 5 and band 66) UL is shown.

**Table 6.29.1.5-1: MSD summary for UL CA band 5 and band 66 and DL CA band 5 and band 48 and band 66**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | |
| EUTRA CA  DL Configuration | EUTRA CA  UL Configuration | EUTRA band | UL Fc  (MHz) | UL BW  (MHz) | UL  CLRB | DL Fc (MHz) | DL BW  (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_5A-48A-66A,  CA\_5A-48C-66A,  CA\_5A-48A-66A-66A,  CA\_5A-48D-66A-66A,  CA\_5A-48C-66A-66A | CA\_5A-66A | 5 | 829 | 5 | 25 | 874 | 5 | 0 | FDD-TDD | IMD5 |
| 48 | 3622 | 5 | 25 | 3622 | 5 | TBD |
| 66 | 1760 | 5 | 25 | 2180 | 5 | N/A |

#### 6.29.1.6 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 6.30 LTE-A inter-band CA: Band 1 and Band 18 and Band 41 DL with 2 bands UL

### 6.30.1 List of specific combination issues

#### 6.30.1.1 Channel bandwidth per operating band for CA

Table 6.30.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-18A-41A | CA\_1A-18A  CA\_1A-41A  CA\_18A-41A | 1 |  |  | Yes | Yes | Yes | Yes | 55 | 0 |
| 18 |  |  | Yes | Yes | Yes |  |
| 41 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-18A-41C | CA\_1A-18A  CA\_1A-41A  CA\_1A-41C  CA\_18A-41A  CA\_18A-41C | 1 |  |  | Yes | Yes | Yes | Yes | 75 | 0 |
| 18 |  |  | Yes | Yes | Yes |  |
| 41 | See CA\_41C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | |

#### 6.30.1.2 Co-existence studies

Co-existence studies of CA\_1-18-41 already covered in the constituent fall-back modes, the harmonic mixing issue and IMD issues for this band combination are as below list:

- B41 uplink frequency may fall into the 3rd harmonic position of Band18 Rx

- 5th order IMDs generated by dual uplink of band 1 and band 41 maybe fall into the Rx of band 18, Since B18 only was used in Japan, considering Operator’s spectrum, there is no IMD impact to Band 18.

#### 6.30.1.3 MSD

Table 6.30.1.3-1 and Table 6.30.1.3-2 show the MSD due to harmonic mixing issue and IMD issue separately.

Table 6.30.1.3-1: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions due to harmonic mixing issue)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel bandwidth | | | | | | | | |
| EUTRA CA Configuration | EUTRA band | 1.4 MHz (dBm) | 3 MHz (dBm) | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | Duplex mode |
| CA\_1A-18A-41A19  CA\_1A-18A-41C19 | 41 |  |  | N/A | N/A | N/A | N/A | TDD |
| NOTE 19: No requirements apply for the case that there is at least one individual RE within the uplink transmission bandwidth of the relative higher band and when the frequency range of relative higher band’s uplink channel bandwidth or uplink 1st adjacent channel bandwidth is fully or partially overlapped with the 3 times of the frequency range of the relative lower band’s downlink channel bandwidth. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply). | | | | | | | | |

Table6.30.1.3-2: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | Source of IMD |
| EUTRA CA | EUTRA CA | EUTRA band | UL Fc | UL BW | UL | DL Fc | DL BW | MSD | Duplex mode |
| DL Configuration | UL Configuration | (MHz) | (MHz) | CLRB | (MHz) | (MHz) | (dB) |
| CA\_1A-18A-41A  CA\_1A-18A-41C | CA\_1A-41A | 1 | N/A | N/A | N/A | N/A | N/A | N/A | FDD | N/A |
| 41 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 18 | N/A | N/A | N/A | N/A | N/A | N/A1 | IMD5 |
| Note1: no MSD requirement apply, when the uplink channel in B41 is located at the frequency range of 2595MHz-2645MHz. | | | | | | | | | | |

#### 6.30.1.4 ΔTIB,c and ΔRIB,c values

The ΔTIB,c and ΔRIB,c values of CA\_1-18-41 are given in the tables below, based on the values of its consistent 2 Bands fallback mode.

Table 6.30.1.4-1: ΔTIB,c for 3DLs aggregation

|  |  |  |
| --- | --- | --- |
| Inter-band CA Configuration | E-UTRA Band | ΔTIB,c [dB] |
| CA\_1-18-41 | 1 | 0.5 |
| 18 | 0.3 |
| 41 | 0.5 |

Table 6.30.1.4-2: ΔRIB,c for 3DLs aggregation

|  |  |  |
| --- | --- | --- |
| Inter-band CA Configuration | E-UTRA Band | ΔRIB,c [dB] |
| CA\_1-18-41 | 1 | 0 |
| 18 | 0 |
| 41 | 0 |

6.31 LTE-A inter-band CA: Band 2 and Band 14 and Band 66 DL with 2 bands UL

6.31.1 List of specific combination issues

6.31.1.1 Channel bandwidth per operating band for CA

**Table 6.31.1.1-1: CA configurations under study**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| **E-UTRA CA Configuration** | **Uplink CA configurations** | **E-UTRA Bands** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Maximum aggregated bandwidth**  **[MHz]** | **Bandwidth combination set** |
| CA\_2A-14A-66A | CA\_2A-14A  CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 50 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-2A-14A-66A | CA\_2A-14A  CA\_14A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 70 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-2A-14A-66A-66A | CA\_2A-14A  CA\_14A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 90 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-14A-66A-66A | CA\_2A-14A  CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-14A-66A-66A-66A | CA\_2A-14A  CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-4 | | | | | |

6.31.1.2 Co-existence studies for LTE-A inter-band CA 3 bands DL CA\_2A-14A-60A and 2 bands UL

For 2UL band 2 and band 14, the harmonics and intermodulation products are calculated in the following table.

**Table 6.31.1.2-1: Co-existence study for DL CA\_2A-14A-66A with UL CA\_2A-14A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequencies (MHz)** | **788** | **798** | **1850** | **1910** |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1576 | 1596 | 3700 | 3820 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2364 | 2394 | 5550 | 5730 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1052 | 1122 | 2638 | 2708 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -334 | -254 | 2902 | 3032 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3426 | 3506 | 4488 | 4618 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 454 | 544 | 4752 | 4942 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4214 | 4304 | 6338 | 6528 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | **-2244** | **-2104** | 5276 | 5416 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -6852 | -6602 | -1342 | -1242 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 8188 | 8438 | 5002 | 5102 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -4154 | -3954 | 1306 | 1456 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 7126 | 7326 | 6064 | 6214 |

For 2UL band 14 and band 30, the harmonics and intermodulation products are calculated in the following table.

**Table 6.31.1.2-1: Co-existence study for DL CA\_2A-14A-66A with UL CA\_14A-66A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequencies (MHz)** | **788** | **798** | **1710** | **1780** |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1576 | 1596 | 3420 | 3560 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2364 | 2394 | 5130 | 5340 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 912 | 992 | 2498 | 2578 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -204 | -114 | 2622 | 2772 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3286 | 3376 | 4208 | 4358 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 584 | 684 | 4332 | 4552 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4074 | 4174 | 5918 | 6138 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | **-1984** | **-1824** | 4996 | 5156 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -6332 | -6042 | -1482 | -1372 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 7628 | 7918 | 4862 | 4972 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -3764 | -3534 | 1026 | 1196 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6706 | 6936 | 5784 | 5954 |

It is concluded that IMD issues exist for the own receiver bands in the following.

* The 4th IMD of 2UL band 2 and band 14 falls into DL band 66.
* The 4th IMD of 2UL band 14 and band 66 falls into DL band 2.

6.31.1.3 MSD

UE RF architecture for CA\_2-14-66 is smilar to CA\_2-13-66 which has the same IMD4 issues as identified above. The same MSD values are prposed as summarized in Table 5.1.5.4.

6.31.1.4 ∆TIB and ∆RIB values

The relaxation values are already specified for 3DL/1UL in the following and is applied to 3DL/2U.

**Table 6.31.1.4-1: ΔTIB,c**

| Inter-band CA Configuration | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_2-14-66 | 2 | 0.5 |
| 14 | 0.3 |
| 66 | 0.5 |

**Table 6.31.1.4-2: ΔRIB**

| Inter-band CA Configuration | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_2-14-66 | 2 | 0.3 |
| 14 | 0 |
| 66 | 0.3 |

6.32 LTE-A inter-band CA: Band 2 and Band 14 and Band 30 DL with 2 bands UL

6.32.1 List of specific combination issues

6.32.1.1 Channel bandwidth per operating band for CA

**Table 6.32.1.1-1: CA configurations under study**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| **E-UTRA CA Configuration** | **Uplink CA configurations** | **E-UTRA Bands** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Maximum aggregated bandwidth**  **[MHz]** | **Bandwidth combination set** |
| CA\_2A-14A-30A | CA\_2A-14A  CA\_14A-30A | 2 |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 30 |  |  | Yes | Yes |  |  |

6.32.1.2 Co-existence studies for LTE-A inter-band CA 3 bands DL CA\_2A-14A-30A and 2 bands UL

For 2UL band 2 and band 14, the harmonics and intermodulation products are calculated in the following table.

**Table 6.32.1.2-1: Co-existence study for DL CA\_2A-14A-30A with UL CA\_2A-14A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequencies (MHz)** | **788** | **798** | **1850** | **1910** |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1576 | 1596 | 3700 | 3820 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2364 | 2394 | 5550 | 5730 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1052 | 1122 | 2638 | 2708 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -334 | -254 | 2902 | 3032 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3426 | 3506 | 4488 | 4618 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 454 | 544 | 4752 | 4942 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4214 | 4304 | 6338 | 6528 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -2244 | -2104 | 5276 | 5416 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -6852 | -6602 | -1342 | -1242 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 8188 | 8438 | 5002 | 5102 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -4154 | -3954 | 1306 | 1456 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 7126 | 7326 | 6064 | 6214 |

For 2UL band 14 and band 30, the harmonics and intermodulation products are calculated in the following table.

**Table 6.32.1.2-1: Co-existence study for DL CA\_2A-14A-30A with UL CA\_14A-30A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequencies (MHz)** | **788** | **798** | **2305** | **2315** |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1576 | 1596 | 4610 | 4630 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2364 | 2394 | 6915 | 6945 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1507 | 1527 | 3093 | 3113 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -739 | -709 | 3812 | 3842 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3881 | 3911 | 5398 | 5428 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 49 | 89 | 6117 | 6157 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4669 | 4709 | 7703 | 7743 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -3054 | -3014 | 6186 | 6226 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -8472 | -8422 | -887 | -837 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 10008 | 10058 | 5457 | 5507 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -5369 | -5319 | 2216 | 2266 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 8491 | 8541 | 6974 | 7024 |

It is concluded that there is no harmonic or intermodulation relation to the own receiver bands in this 3DL/2UL band combination.

6.32.1.3 MSD

No MSD issues are identified for this band combination.

6.32.1.4 ∆TIB and ∆RIB values

The relaxation values are already specified for 3DL/1UL in the following and is applied to 3DL/2U.

**Table 6.32.1.4-1: ΔTIB,c**

| Inter-band CA Configuration | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_2-14-30 | 2 | 0.5 |
| 14 | 0.3 |
| 30 | 0.5 |

**Table 6.32.1.4-2: ΔRIB**

| Inter-band CA Configuration | 2 | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_2-14-30 | 14 | 0.3 |
| 30 | 0 |
| 2 | 0.3 |

6.33 LTE-A inter-band CA: Band 14 and Band 30 and Band 66 DL with 2 bands UL

6.33.1 List of specific combination issues

6.33.1.1 Channel bandwidth per operating band for CA

**Table 6.33.1.1-1: CA configurations under study**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| **E-UTRA CA Configuration** | **Uplink CA configurations** | **E-UTRA Bands** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Maximum aggregated bandwidth**  **[MHz]** | **Bandwidth combination set** |
| CA\_14A-30A-66A | CA\_14A-30A  CA\_14A-66A | 14 |  |  | Yes | Yes |  |  | 40 | 0 |
| 30 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_14A-30A-66A-66A | CA\_14A-30A  CA\_14A-66A | 14 |  |  | Yes | Yes |  |  | 60 | 0 |
| 30 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

6.33.1.2 Co-existence studies for LTE-A inter-band CA 3 bands DL CA\_14A-30A-66A and 2 bands UL

For 2UL band 14 and band 30, the harmonics and intermodulation products are calculated in the following table.

**Table 6.33.1.2-1: Co-existence study for DL CA\_14A-30A-66A with UL CA\_14A-30A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequencies (MHz)** | **788** | **798** | **2305** | **2315** |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1576 | 1596 | 4610 | 4630 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2364 | 2394 | 6915 | 6945 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1507 | 1527 | 3093 | 3113 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -739 | -709 | 3812 | 3842 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3881 | 3911 | 5398 | 5428 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 49 | 89 | 6117 | 6157 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4669 | 4709 | 7703 | 7743 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -3054 | -3014 | 6186 | 6226 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -8472 | -8422 | -887 | -837 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 10008 | 10058 | 5457 | 5507 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -5369 | -5319 | 2216 | 2266 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 8491 | 8541 | 6974 | 7024 |

For 2UL band 14 and band 66, the harmonics and intermodulation products are calculated in the following table.

**Table 6.33.1.2-1: Co-existence study for DL CA\_14A-30A-66A with UL CA\_14A-66A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequencies (MHz)** | **788** | **798** | **1710** | **1780** |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1576 | 1596 | 3420 | 3560 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2364 | 2394 | 5130 | 5340 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 912 | 992 | 2498 | 2578 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -204 | -114 | 2622 | 2772 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3286 | 3376 | 4208 | 4358 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 584 | 684 | 4332 | 4552 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4074 | 4174 | 5918 | 6138 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -1984 | -1824 | 4996 | 5156 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -6332 | -6042 | -1482 | -1372 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 7628 | 7918 | 4862 | 4972 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -3764 | -3534 | 1026 | 1196 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6706 | 6936 | 5784 | 5954 |

It is concluded that there is no harmonic or intermodulation relation to the own receiver bands in this 3DL/2UL band combination.

6.33.1.3 MSD

No MSD issues are identified for this band combination.

6.33.1.4 ∆TIB and ∆RIB values

The relaxation values are already specified for 3DL/1UL in the following and is applied to 3DL/2U.

**Table 6.33.1.4-1: ΔTIB,c**

| Inter-band CA Configuration | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_14-30-66 | 14 | 0.3 |
| 30 | 0.3 |
| 66 | 0.5 |

**Table 6.33.1.4-2: ΔRIB**

| Inter-band CA Configuration | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_14-30-66 | 14 | 0 |
| 30 | 0.5 |
| 66 | 0.4 |

# 7 LTE 4 bands DL/2 bands UL Inter-Band Carrier Aggregation: Specific Band Combination Part

## 7.1 LTE-A inter-band CA: Band 2 and Band 13 and Band 48 and Band 66 DL with 2 bands UL

### 7.1.1 List of specific combination issues

#### 7.1.1.1 Channel bandwidth per operating band for CA

Table 7.1.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-13A-48C-66A | CA\_2A-13A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_13A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |

#### 7.1.1.2 Co-existence studies for LTE-A inter-band UL CA\_2A-13A and DL CA\_2A-13A-48C-66A

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.1.1.2-1.

Table 7.1.1.2-1: Co-existence study for UL CA\_2A-13A and DL CA\_2A-13A-48C-66A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 1850 | 1910 | 777 | 787 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1554 | 1574 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2331 | 2361 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1133 | 1063 | 2627 | 2697 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2913 | 3043 | 356 | 276 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4477 | 4607 | 3404 | 3484 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4763 | 4953 | 421 | 511 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6327 | 6517 | 4181 | 4271 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2126 | 2266 | 5254 | 5394 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1298 | 1198 | 6863 | 6613 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 4958 | 5058 | 8177 | 8427 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 1339 | 1489 | 4176 | 3976 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6031 | 6181 | 7104 | 7304 |

In Table 7.1.1.2-1, 2**nd** harmonic from the band 2 can possibly impact high frequency edge of the band 48 and there is 4**th** IMD product by the band 2 and band 13 falls into the band 66.

#### 7.1.1.3 Co-existence studies for LTE-A inter-band UL CA\_13A-66A and DL CA\_2A-13A-48C-66A

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.1.1.3-1.

Table 7.1.1.3-1: Co-existence study for UL CA\_13A-66A and DL CA\_2A-13A-48C-66A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 777 | 787 | 1710 | 1780 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1554 | 1574 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2331 | 2361 | 5130 | 5340 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 923 | 1003 | 2487 | 2567 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 226 | 136 | 2633 | 2783 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3264 | 3354 | 4197 | 4347 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 551 | 651 | 4343 | 4563 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 4041 | 4141 | 5907 | 6127 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2006 | 1846 | 4974 | 5134 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6343 | 6053 | 1438 | 1328 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 7617 | 7907 | 4818 | 4928 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 3786 | 3556 | 1059 | 1229 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6684 | 6914 | 5751 | 5921 |

In Table 7.1.1.3-1, 2nd harmonic from the band 66 can impact the band 48 and there is 4th and 5th IMD products by the band 13 and band 66 falls into the band 2 and the band 48, respectively.

#### 7.1.1.4 MSD

When uplink CA\_2A\_13A is paired with downlink CA\_2A-13A-48C-66A, the 4th order IMD product by band 2 and band 13 falls into the own Rx frequency band 66. For this case, the MSD value from 3 DL 2A-13A-66A / 2 UL 2A-13A can be applied.

When uplink CA\_13A\_66A is paired with downlink CA\_2A-13A-48C-66A, the 4th and 5th order IMD products by Band 13 and band 44 falls into its own Rx frequency band 2 and band 48, respectively. The MSD value from 3 DL 2A-13A-66A / 2 UL 13A-66A can be applied to 4th IMD product and the same MSD value also can be applied to 5th IMD product.

#### 7.1.1.5 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 7.2 LTE-A inter-band CA: Band 2 and Band 13 and Band 48 and Band 66 DL with 2 bands UL

### 7.2.1 List of specific combination issues

#### 7.2.1.1 Channel bandwidth per operating band for CA

Table 7.2.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-13A-48A-48A-66A | CA\_2A-13A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48A-48A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_13A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48A-48A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-13A-48C-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-48C-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-48D-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-48D-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 130 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-13A-48A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-48A-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_13A-66A  CA\_13A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |

#### 7.2.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 13and DL CA band 2 and band 13 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.2.1.2-1.

Table 7.2.1.2-1: Co-existence study for UL CA band 2 and band 13and DL CA band 2 and band 13 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 1850 | 1910 | 777 | 787 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1554 | 1574 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2331 | 2361 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1133 | 1063 | 2627 | 2697 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2913 | 3043 | 356 | 276 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4477 | 4607 | 3404 | 3484 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4763 | 4953 | 421 | 511 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6327 | 6517 | 4181 | 4271 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2126 | 2266 | 5254 | 5394 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1298 | 1198 | 6863 | 6613 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 4958 | 5058 | 8177 | 8427 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 1339 | 1489 | 4176 | 3976 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6031 | 6181 | 7104 | 7304 |

In Table 7.2.1.2-1, 2nd harmonic from the band 2 can possibly impact high frequency edge of the band 48 and there is 4th IMD product by the band 2 and band 13 falls into the band 66.

#### 7.2.1.3 Co-existence studies for LTE-A inter-band UL CA band 13 and band 66and DL CA band 2 and band 13 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.2.1.3-1.

Table 7.2.1.3-1: Co-existence study for UL CA band 13 and band 66and DL CA CA band 2 and band 13 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | Fx\_low | Fx\_high | Fy\_low | Fy\_high |
| UL frequency (MHz) | 777 | 787 | 1710 | 1780 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1554 | 1574 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2331 | 2361 | 5130 | 5340 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 923 | 1003 | 2487 | 2567 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 226 | 136 | 2633 | 2783 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3264 | 3354 | 4197 | 4347 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 551 | 651 | 4343 | 4563 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 4041 | 4141 | 5907 | 6127 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2006 | 1846 | 4974 | 5134 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6343 | 6053 | 1438 | 1328 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 7617 | 7907 | 4818 | 4928 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 3786 | 3556 | 1059 | 1229 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6684 | 6914 | 5751 | 5921 |

In Table 7.2.1.3-1, 2nd harmonic from the band 66 can impact the band 48 and there is 4th and 5th IMD products by the band 13 and band 66 falls into the band 2 and the band 48, respectively.

#### 7.2.1.4 Co-existence studies for LTE-A inter-band UL CA band 2 and band 66 and DL CA band 2 and band 13 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.2.1.4-1.

Table 7.2.1.4-1: Co-existence study for UL CA band 2 and band 66 and DL CA band 2 and band 13 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | **3700** | **3820** | **3420** | **3560** |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 200 | 70 | **3560** | **3690** |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1920 | 2110 | 1510 | 1710 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5410 | 5600 | 5270 | 5470 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 3770 | 4020 | 3220 | 3490 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7260 | 7510 | 6980 | 7250 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 140 | 400 | 7120 | 7380 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 5270 | 4930 | 5930 | 5620 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 8690 | 9030 | 9110 | 9420 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1640 | 1310 | 2310 | 1990 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 8830 | 9160 | 8970 | 9290 |

In Table 7.2.1.4-1, 2nd harmonics from band 2 and band 66 can impact band 48 and there is 2nd IMD product by band 2 and band 66 falls into band 48.

#### 7.2.1.5 Co-existence studies for LTE-A inter-band UL CA band 2 and band 48 and DL CA band 2 and band 13 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.2.1.5-1.

Table 7.2.1.5-1: Co-existence study for UL CA band 2 and band 48 and DL CA band 2 and band 13 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1640 | 1850 | 5400 | 5610 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 0 | 270 | 5190 | 5550 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7250 | 7520 | 8950 | 9310 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | **1850** | **2180** | 8740 | 9250 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 9100 | 9430 | 12500 | 13010 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3700 | 3280 | 10800 | 11220 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 12950 | 12290 | 4090 | 3700 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 16050 | 16710 | 10950 | 11340 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7400 | 6830 | 1370 | 1850 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14350 | 14920 | 12650 | 13130 |

#### 7.2.1.6 Co-existence studies for LTE-A inter-band UL CA band 48 and band 66 and DL CA band 2 and band 13 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.2.1.6-1.

Table 7.2.1.6-1: Co-existence study for UL CA band 48 and band 66 and DL CA band 2 and band 13 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1710** | **1780** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3560 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5340 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | **1770** | **1990** | 5260 | 5480 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 280 | 10 | 5320 | 5690 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6970 | 7260 | 8810 | 9180 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1430 | 1790 | 8870 | 9390 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 8680 | 9040 | 12360 | 12880 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3980 | 3540 | 10520 | 10960 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 13090 | 12420 | 3570 | 3140 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15910 | 16580 | 10390 | 10820 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7680 | 7090 | **1760** | **2270** |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14070 | 14660 | 12230 | 12740 |

#### 7.2.1.7 Co-existence studies for LTE-A inter-band UL CA band 13 and band 48 and DL CA band 2 and band 13 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.2.1.7-1.

Table 7.2.1.7-1: Co-existence study for UL CA band 13 and band 48 and DL CA band 2 and band 13 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **777** | **787** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1554 | 1574 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2331 | 2361 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 2763 | 2923 | 4327 | 4487 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | **2146** | **1976** | 6313 | 6623 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5104 | 5274 | 7877 | 8187 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1369 | 1189 | 9863 | 10323 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5881 | 6061 | 11427 | 11887 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 5846 | 5526 | 8654 | 8974 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 14023 | 13413 | 402 | 592 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 14977 | 15587 | 6658 | 6848 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 9546 | 9076 | 4739 | 5069 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 12204 | 12674 | 9431 | 9761 |

#### 7.2.1.8 MSD

When uplink CA(band 2 and band 13)is paired with downlink CA band 2 and band 13 and band 48 and band 66, the 4th order IMD product by band 2 and band 13 falls into the own Rx frequency band 66. The MSD value from 3 DL band 2 and band 13 and band 66/ 2 UL band 13 and band 66can applied to 4th IMD product.

When uplink CA(band 13 and band 66)is paired with downlink CA band 2 and band 13 and band 48 and band 66, the 4th and 5th order IMD products by band 13 and band 44 falls into its own Rx frequency band 2 and band 48, respectively. The MSD value from 3 DL band 2 and band 13 and band 66/ 2 UL band 13 and band 66can be re-used for 4th IMD product and 5th IMD product also can take the same MSD value.

When uplink CA (band 2 and band 66) is paired with downlink CA (band 2 and band 13 and band 48 and band 66), the 2nd order IMD product by band 2 and band 66 falls into the own Rx frequency band 48. The MSD value from 3 DL band 2 and band 48 and band 66 / 2 UL band 2 and band 66 can be re-used for 2nd order IMD product.

When uplink CA (band 2 and band 48) is paired with downlink CA (band 2 and band 13 and band 48 and band 66), the 4th order IMD product by band 2 and band 48 falls into the own Rx frequency band 66. The MSD value from 3 DL band 2 and band 48 and band 66 / 2 UL band 2 and band 48 can be re-used for 4th IMD product.

When uplink CA (band 48 and band 66) is paired with downlink CA (band 2 and band 13 and band 48 and band 66), the 2nd and 5th order IMD products by band 48 and band 66 falls into the own Rx frequency band 2. The MSD value from 3 DL band 2 and band 48 and band 66 / 2 UL band 48 and band 66 can be re-used for 2nd and 5th order IMD products.

When uplink CA (band 13 and band 48) is paired with downlink CA (band 2 and band 13 and band 48 and band 66), 3rd order IMD products by band 13 and band 48 falls into the own Rx frequency band 2 and band 66. The MSD values from 3 DL band 2 and band 13 and band 48 / 2 UL band 13 and band 48 can be re-used for 3rd IMD product by band 13 and band 48 falls into the own Rx frequency band 2. For 3rd IMD product by band 13 and band 49 falls into the own Rx frequency band 13, the MSD value from 3 DL band 13 and band 48 and band 66 / 2 UL band 13 and band 48 can be re-used.

#### 7.2.1.9 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

## 7.3 LTE Advanced Carrier Aggregation: Band 1 and Band 3 and Band 41 and Band 42 DL with 2 bands UL

### 7.3.1 List of specific combination issues

#### 7.3.1.1 Channel bandwidth per operating band for CA

Table 7.3.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-41C-42C | CA\_1A-3A,  CA\_1A-42A,  CA\_1A-42C,  CA\_3A-42A,  CA\_3A-42C | 1 |  |  | Yes | Yes | Yes | Yes | 120 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 41 | See CA\_41C Bandwidth Combination Set 0 in Table 5.6A.1-1 of TS36.101 | | | | | |
| 42 | See CA\_42C Bandwidth combination set 1 in Table 5.6A.1-1 of TS36.101 | | | | | |
| CA\_1A-3A-41C-42A | CA\_1A-3A, CA\_1A-42A CA\_3A-42A | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 41 | See CA\_41C Bandwidth Combination Set 0 in Table 5.6A.1-1 of TS36.101 | | | | | |
| 42 |  |  | Yes | Yes | Yes | Yes |
| CA\_1A-3A-41A-42C | CA\_1A-3A. CA\_1A-42A, CA\_1A-42C. CA\_3A-42A, CA\_3A-42C | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 41 |  |  | Yes | Yes | Yes | Yes |
| 42 | See CA\_42C Bandwidth combination set 1 in Table 5.6A.1-1 of TS36.101 | | | | | |
| CA\_1A-3A-41A-42A | CA\_1A-3A, CA\_1A-42A, CA\_3A-42A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 41 |  |  | Yes | Yes | Yes | Yes |
| 42 |  |  | Yes | Yes | Yes | Yes |

#### 7.3.1.2 Co-existence studies for LTE-A inter-band UL CA 2 bands and DL CA\_1-3-41-42

For 4 bands DL with 2 bands UL, co-existence studies for lower order CA of 3 bands DL with 2 bands UL summarized in Table 5.1.5-1 of TR 36.716-03-02, TR 36.715-00-02 and TR 36.714-00-02can be referred.

#### 7.3.1.3 MSD

The requirements of low order combinations CA\_3BDL\_1A-3A-41A\_2BUL\_1A-3A, CA\_3BDL\_1A-3A-42A\_2BUL\_1A-3A, CA\_3BDL\_1A-3A-42A\_2BUL\_3A-42A and CA\_3BDL\_3A-41A-42A\_2BUL\_3A-42A from TS36.101 can be applied.

#### 7.3.1.4 ∆TIB and ∆RIB values

The requirements of low order combinations 4 bands DL CA\_1-3-41-42 with 1 band UL from TS36.101 can be applied.

## 7.4 LTE-A inter-band CA: Band 1 and Band 3 and Band 8 and Band 38 DL with 2 Bands UL

### 7.4.1 List of specific combination issues

#### 7.4.1.1 Channel bandwidth per operating band for CA

Table 7.4.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-8A-38A | CA\_1A-3A  CA\_3A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| 38 |  |  | Yes | Yes | Yes | Yes |

#### 7.4.1.2 Co-existence studies for LTE-A inter-band UL CA\_1A-3A and DL CA\_1A-3A-8A-38A

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.4.1.2-1.

Table 7.4.1.2-1: Co-existence study for UL CA\_1A-3A and DL CA\_1A-3A-8A-38A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1920** | **1980** | **1710** | **1785** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 | 3420 | 3570 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 | 5130 | 5355 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 270 | 135 | 3630 | 3765 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | **2055** | **2250** | 1440 | 1650 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 5550 | 5745 | 5340 | 5550 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 3975 | 4230 | 3150 | 3435 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 7470 | 7725 | 7050 | 7335 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 270 | 540 | 7260 | 7530 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5220 | 4860 | 6210 | 5895 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1515 | 1170 | 2520 | 2190 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 8760 | 9120 | 9390 | 9705 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 8970 | 9315 | 9180 | 9510 |

In Table 7.4.1.2-1, there is 3rd IMD product by the band 1 and band 3 falls into the band 1.

#### 7.4.1.3 Co-existence studies for LTE-A inter-band UL CA\_3A-8A and DL CA\_1A-3A-8A-38A

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.4.1.3-1.

Table 7.4.1.3-1: Co-existence study for UL CA\_3A-8A and DL CA\_1A-3A-8A-38A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1710 | 1785 | 880 | 915 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3570 | 1760 | 1830 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5355 | 2640 | 2745 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 905 | 795 | 2590 | 2700 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2505 | 2690 | 25 | 120 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4300 | 4485 | 3470 | 3615 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4215 | 4475 | 855 | 1035 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 6010 | 6270 | 4350 | 4530 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | **1590** | **1810** | 5180 | 5400 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | **1950** | **1735** | 6260 | 5925 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 675 | 930 | 3595 | 3300 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5230 | 5445 | 7720 | 8055 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6060 | 6315 | 6890 | 7185 |

#### 7.4.1.3 MSD

When uplink CA\_1A\_3A is paired with downlink CA\_1A-3A-8A-38A, the 3rd order IMD product by band 1 and band 3 falls into the own Rx frequency band 1. It has been solved by fallback combination CA\_1A\_3A.

When uplink CA\_3A\_8A is paired with downlink CA\_1A-3A-8A-38A, the 4th and 5th order IMD product by band 3 and band 8 falls into the own Rx frequency band 3. It has been solved by fallback combination CA\_3A-8A.

When uplink CA\_3A\_8A is paired with downlink CA\_1A-3A-8A-38A, the 2nd and 3rd order IMD product by band 3 and band 8 falls into the own Rx frequency band 3. It is solved by fallback combination CA\_3A-8A-38A\_UL\_3A-8A.

#### 7.4.1.4 ∆TIB and ∆RIB values

The requirements of ∆TIB values in table 6.2.5-4 from TS36.101 can be applied for CA\_1-3-8-38.

The requirements of ∆RIB values in table 7.3.1-1C from TS36.101 can be applied for CA\_1-3-8-38.

## 7.5 LTE-A inter-band CA: Band 1 and Band 3 and Band 8 and Band 38 DL with 2 bands UL

### 7.5.1 List of specific combination issues

#### 7.5.1.1 Channel bandwidth per operating band for CA

Table 7.5.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-8A-38A | CA\_1A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| 38 |  |  | Yes | Yes | Yes | Yes |

#### 7.5.1.2 Co-existence studies for LTE-A inter-band UL CA\_1A-8A and DL CA\_1A-3A-8A-38A

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.5.1.2-1.

Table 7.5.1.2-1: Co-existence study for UL CA\_1A-8A and DL CA\_1A-3A-8A-38A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 880 | 915 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 | **1760** | **1830** |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 | 2640 | 2745 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1100 | 1005 | 2800 | 2895 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2925 | 3080 | 220 | 90 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4720 | 4875 | 3680 | 3810 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4845 | 5060 | 660 | 825 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 6640 | 6855 | 4560 | 4725 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | **2010** | **2200** | 5600 | 5790 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1740 | 1540 | 7040 | 6765 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1095 | 1320 | 4180 | 3930 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5440 | 5640 | 8560 | 8835 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6480 | 6705 | 7520 | 7770 |

In Table 7.5.1.2-1, 2nd harmonic from the band 8 can possibly impact low frequency edge of the band 3 and there is 4th IMD product by the band 1 and band 8 falls into the band 1.

#### 7.5.1.3 MSD

When uplink CA\_1A\_8A is paired with downlink CA\_1A-3A-8A-38A, the 2nd order harmonic product by band 8 falls into the own Rx frequency band 3. It has been solved by fallback combination CA\_3A\_8A.

When uplink CA\_1A\_8A is paired with downlink CA\_1A-3A-8A-38A, the 4rd order IMD product by band 1 and band 8 falls into the own Rx frequency band 1. It has been solved by fallback combination CA\_1A\_8A.

#### 7.5.1.4 ∆TIB and ∆RIB values

The requirements of ∆TIB values in table 6.2.5-4 from TS36.101 can be applied for CA\_1-3-8-38.

The requirements of ∆RIB values in table 7.3.1-1C from TS36.101can be applied for CA\_1-3-8-38.

## 7.6 LTE-A inter-band CA: Band 2 and Band 13 and Band 46 and Band 66 DL with 2 bands UL

### 7.6.1 List of specific combination issues

#### 7.6.1.1 Channel bandwidth per operating band for CA

Table 7.6.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-13A-46E-66A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 130 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See the CA\_46E Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-13A-46D-66A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See the CA\_46D Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-46C-66A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 | See the CA\_46C Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-13A-46A-66A | CA\_2A-13A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 13 |  |  | Yes | Yes |  |  |
| 46 |  |  |  | Yes |  | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |

#### 7.6.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 13 and DL CA band 2 and band 13 and band 46 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.6.1.2-1.

Table 7.6.1.2-1: Co-existence study for UL CA band 2 and band 13 and DL CA\_band 2 and band 13 and band 46 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **777** | **787** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 1554 | 1574 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | **5550** | **5730** | 2331 | 2361 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1133 | 1063 | 2627 | 2697 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 2913 | 3043 | 356 | 276 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4477 | 4607 | 3404 | 3484 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 4763 | 4953 | 421 | 511 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6327 | 6517 | 4181 | 4271 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | **2126** | **2266** | **5254** | **5394** |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 1298 | 1198 | 6863 | 6613 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 4958 | 5058 | 8177 | 8427 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1339 | 1489 | 4176 | 3976 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6031 | 6181 | 7104 | 7304 |

In Table 7.6.1.2-1, 3rd harmonic from the band 2 can impact the band 46 and there is no need to study for this harmonic issue since the band 46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS 36.101.

#### 7.6.1.3 MSD

When uplink CA (band 2 and band 13) is paired with downlink CA (band 2 and band 13 and band 46 and band 66), 4th order IMD product by band 2 and band 13 falls into its own Rx frequency band 46. For the band 46, there is no need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS 36.101 and its exclusion zone has been specified from 3 bands DL (band 2 and band 13 and band 46) with 2 bands UL (band 2 and band 13).

When uplink CA (band 2 and band 13) is paired with downlink CA (band 2 and band 13 and band 46 and band 66), the 4th order IMD product by band 2 and band 13 falls into the other Rx frequency band 66. For this case, the MSD value from 3 bands DL (band 2 and band 13 and band 66) with 2 bands UL (band 2 and band 13) can be applied.

#### 7.6.1.4 ∆TIB and ∆RIB values

The requirements of low-order combination from TS 36.101 can be applied.

## 7.7 LTE-A inter-band CA: Band 2 and Band 46 and Band 48 and Band 66 DL with 2 bands UL

### 7.7.1 List of specific combination issues

#### 7.7.1.1 Channel bandwidth per operating band for CA

Table 7.7.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-46E-48A-66A | CA\_2A-48A  CA\_48A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 140 | 0 |
| 46 | See CA\_46E Bandwidth combination set 0 in  Table 5.6A.1-1 of 36.101 | | | | | |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-46D-48C-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 140 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46C-48C-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 120 | 0 |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46D-48A-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 120 | 0 |
| 46 | See CA\_46D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 |  |  |  | Yes |  | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46A-48C-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 |  |  |  | Yes |  | Yes |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46C-48A-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 100 | 0 |
| 46 | See CA\_46C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-46A-48A-66A | CA\_2A-48A  CA\_48A-66A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| 46 |  |  |  | Yes |  | Yes |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |

#### 7.7.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 48 and DL CA band 2 and band 46 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.7.1.2-1.

Table 7.7.1.2-1: Co-existence study for UL CA band 2 and band 48 and DL CA band 2 and band 46 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **1850** | **1910** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | **5550** | **5730** | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1640 | 1850 | **5400** | **5610** |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 0 | 270 | **5190** | **5550** |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7250 | 7520 | 8950 | 9310 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | **1850** | **2180** | 8740 | 9250 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 9100 | 9430 | 12500 | 13010 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | **3700** | **3280** | 10800 | 11220 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 12950 | 12290 | 4090 | 3700 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 16050 | 16710 | 10950 | 11340 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7400 | 6830 | 1370 | 1850 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14350 | 14920 | 12650 | 13130 |

In Table 7.7.1.2-1, 3rd harmonic from the band 2 can impact the band 46 and there is no need to study for this harmonic impact since the band 46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS 36.101.

#### 7.7.1.3 Co-existence studies for LTE-A inter-band UL CA band 48 and band 66 and DL CA band 2 and band 46 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.7.1.3-1.

Table 7.7.1.3-1: Co-existence study for UL CA band 48 and band 66 and DL CA band 2 and band 46 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **1710** | **1780** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3560 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | **5130** | **5340** | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | **1770** | **1990** | **5260** | **5480** |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 280 | 10 | **5320** | **5690** |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6970 | 7260 | 8810 | 9180 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | **1430** | **1790** | 8870 | 9390 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 8680 | 9040 | 12360 | 12880 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3980 | 3540 | 10520 | 10960 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 13090 | 12420 | 3570 | 3140 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15910 | 16580 | 10390 | 10820 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7680 | 7090 | **1760** | **2270** |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14070 | 14660 | 12230 | 12740 |

In Table 7.7.1.3-1, 3rd harmonic from the band 66 can impact the band 46 and there is no need to study for this harmonic impact since the band 46 is specified as reference measurement exclusion region in Table 7.3.1A-0eC of TS 36.101.

#### 7.7.1.4 MSD

When uplink CA (band 2 and band 48) is paired with downlink CA (band 2 and band 46 and band 48 and band 66), 2nd and 3rd order IMD products by band 2 and band 48 falls into the own Rx frequency band 46. For the band 46, there is no need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS 36.101 and its exclusion zone has been specified from 3 bands DL (band 2 and band 46 and band 48) with 2 bands UL (band 2 and band 48).

When uplink CA (band 2 and band 48) is paired with downlink CA (band 2 and band 46 and band 48 and band 66), 4th order IMD product by band 2 and band 48 falls into the other Rx frequency band 66. For this case, the MSD value from 3 bands DL (band 2 and band 48 and band 66) with 2 bands UL (band 2 and band 48) can be applied.

When uplink CA (band 48 and band 66) is paired with downlink CA (band 2 and band 46 and band 48 and band 66), 2nd and 3rd order IMD products by band 48 and band 66 falls into the own Rx frequency band 46. For the band 46, there is no need to study for MSD since the requirements do not need to apply in exclusion zone in Table 7.3.1A-0eA of TS 36.101 and its exclusion zone has been specified from 3 bands DL (band 2 and band 48 and band 66) with 2 bands UL (band 48 and band 66).

When uplink CA (band 48 and band 66) is paired with downlink CA (band 2 and band 46 and band 48 and band 66), 2nd and 5th order IMD products by band 48 and band 66 falls into the other Rx frequency band 2. For this case, the MSD values from 3 bands DL (band 2 and band 48 and band 66) with 2 bands UL (band 48 and band 66) can be applied.

#### 7.7.1.5 ∆TIB and ∆RIB values

The requirements of low-order combination from TS 36.101 can be applied.

## 7.8 LTE-A inter-band CA: Band 1 and Band 3 and Band 7 and Band 8 DL with 2 bands UL

### 7.8.1 List of specific combination issues

#### 7.8.1.1 Channel bandwidths per operating band for CA

Table 7.8.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-7A-8A | , CA\_1A-8A, CA\_3A-7A, CA\_3A-8A, CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 |  |  |  | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| 1 |  |  | Yes | Yes | Yes | Yes | 70 | 1 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-3A-3A-7A-8A | CA\_1A-3A, CA\_1A-7A, CA\_1A-8A, CA\_3A-7A, CA\_3A-8A, CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 3 | See the CA\_3A-3A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-3A-7A-7A-8A | CA\_1A-3A, CA\_1A-7A, CA\_1A-8A, CA\_3A-7A, CA\_3A-8A, CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 | See the CA\_7A-7A Bandwidth combination set 1 in Table 5.6A.1-3 | | | | | |
| 8 |  |  | Yes | Yes |  |  |
| CA\_1A-3A-3A-7A-7A-8A | CA\_1A-3A, CA\_1A-7A, CA\_1A-8A, CA\_3A-7A, CA\_3A-8A, CA\_7A-8A | 1 |  |  | Yes | Yes | Yes | Yes | 110 | 0 |
| 3 | See the CA\_3A-3A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |
| 7 | See the CA\_7A-7A Bandwidth combination set 1 in Table 5.6A.1-3 | | | | | |
| 8 |  |  | Yes | Yes |  |  |

#### 7.8.1.2 Co-existence studies

For 4 bands DL with 2 bands UL, co-existence studies for lower order CA of 3 bands DL with 2 bands can be referred.

#### 7.8.1.3 MSD

The MSD requirements can be covered by low order combinations. No additional REFSENS exceptions are expected for those CA combinations.

#### 7.8.1.4 ∆TIB and ∆RIB values

The requirements of low-order combinations from TS36.101 can be applied.

## 7.9 LTE-A inter-band CA: Band 1 and Band 3 and Band 7 and Band 20 DL with 2 bands UL

### 7.9.1 List of specific combination issues

#### 7.9.1.1 Channel bandwidth per operating band for CA

Table 7.9.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | 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-7A-20A | CA\_1A-7A  CA\_1A-3A  CA\_1A-20A  CA\_3A-7A  CA\_3A-20A  CA\_7A-20A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 |  |  |  | Yes | Yes | Yes |
| 20 |  |  | Yes | Yes | Yes | Yes |
| 1 |  |  | Yes | Yes | Yes | Yes | 80 | 1 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 20 |  |  | Yes | Yes | Yes | Yes |

#### 7.9.1.2 Co-existence studies for LTE-A inter-band CA 3 bands DL CA\_1A-7A-20A and 2 bands UL

For 4 bands DL with 2 bands UL, co-existence studies for lower order CA of 3 bands DL with 2 bands UL summarized in Table 5.1.5-1 of TR 36.716-03-02, TR 36.715-00-02 and TR 36.714-00-02can be referred.

#### 7.9.1.3 MSD

The requirements of low order combinations CA\_3BDL\_1A-7A-20A\_2BUL\_1A-7A, CA\_3BDL\_3A-7A-20A\_2BUL\_3A-7A, CA\_3BDL\_3A-7A-20A\_2BUL\_3A-20A from TS36.101 can be applied.

#### 7.9.1.4 ∆TIB and ∆RIB values

The requirements of ∆TIB values in table 6.2.5-4 from TS36.101 [2] can be applied for CA\_1-3-7-20.

The requirements of ∆RIB values in table 7.3.1-1C from TS36.101 [2] can be applied for CA\_1-3-7-20.

## 7.10 LTE-A inter-band CA: Band 2 and Band 5 and Band 48 and Band 66 DL with 2 bands UL

### 7.10.1 List of specific combination issues

#### 7.10.1.1 Channel bandwidth per operating band for CA

Table 7.10.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-5A-48A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-5A-48C-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-5A-48A-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 |  |  | Yes | Yes | Yes | Yes |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-5A-48C-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48C Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_2A-5A-48D-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | Yes | Yes | Yes | Yes | Yes | Yes | Yes | 110 | 0 |
|  |  | Yes | Yes |  |  |  |
| See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | |
| Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_2A-5A-48D-66A-66A | CA\_2A-66A  CA\_2A-48A  CA\_48A-66A  CA\_5A-66A  CA\_5A-48A  CA\_2A-5A | 2 | Yes | Yes | Yes | Yes | Yes | Yes | 130 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 48 | See CA\_48D Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |

#### 7.10.1.2 Co-existence studies for LTE-A inter-band UL CA band 2 and band 66 and DL CA band 2 and band 5 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.10.1.2-1.

Table 7.10.1.2-1: Co-existence study for UL CA band 2 and band 66 and DL CA band 2 and band 5 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | **3700** | **3820** | **3420** | **3560** |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 200 | 70 | **3560** | **3690** |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1920 | 2110 | 1510 | 1710 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5410 | 5600 | 5270 | 5470 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 3770 | 4020 | 3220 | 3490 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7260 | 7510 | 6980 | 7250 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 140 | 400 | 7120 | 7380 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 5270 | 4930 | 5930 | 5620 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 8690 | 9030 | 9110 | 9420 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1640 | 1310 | 2310 | 1990 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 8830 | 9160 | 8970 | 9290 |

#### 7.10.1.3 Co-existence studies for LTE-A inter-band UL CA band 2 and band 48 and DL CA band 2 and band 5 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.10.1.3-1.

Table 7.10.1.3-1: Co-existence study for UL CA band 2 and band 48 and DL CA band 2 and band 5 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3820 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1640 | 1850 | 5400 | 5610 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 0 | 270 | 5190 | 5550 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 7250 | 7520 | 8950 | 9310 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | **1850** | **2180** | 8740 | 9250 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 9100 | 9430 | 12500 | 13010 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3700 | 3280 | 10800 | 11220 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 12950 | 12290 | 4090 | 3700 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 16050 | 16710 | 10950 | 11340 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7400 | 6830 | 1370 | 1850 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14350 | 14920 | 12650 | 13130 |

#### 7.10.1.4 Co-existence studies for LTE-A inter-band UL CA band 48 and band 66 and DL CA band 2 and band 5 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.10.1.4-1.

Table 7.10.1.4-1: Co-existence study for UL CA band 48 and band 66 and DL CA band 2 and band 5 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1710** | **1780** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3560 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5340 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | **1770** | **1990** | 5260 | 5480 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 280 | 10 | 5320 | 5690 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6970 | 7260 | 8810 | 9180 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1430 | 1790 | 8870 | 9390 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 8680 | 9040 | 12360 | 12880 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 3980 | 3540 | 10520 | 10960 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 13090 | 12420 | 3570 | 3140 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15910 | 16580 | 10390 | 10820 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 7680 | 7090 | **1760** | **2270** |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 14070 | 14660 | 12230 | 12740 |

#### 7.10.1.5 Co-existence studies for LTE-A inter-band UL CA band 5 and band 66 and DL CA band 2 and band 5 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.10.1.5-1.

Table 7.10.1.5-1: Co-existence study for UL CA band 5 and band 66 and DL CA band 2 and band 5 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **824** | **849** | **1710** | **1780** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | **3420** | **3560** |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 5130 | 5340 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 861 | 956 | 2534 | 2629 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 132 | 12 | 2571 | 2736 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 3358 | 3478 | 4244 | 4409 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 692 | 837 | 4281 | 4516 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4182 | 4327 | 5954 | 6189 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 1912 | 1722 | 5068 | 5258 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 6296 | 5991 | 1686 | 1516 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 7664 | 7969 | 5006 | 5176 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | **3692** | **3432** | 873 | 1088 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6778 | 7038 | 5892 | 6107 |

#### 7.10.1.6 Co-existence studies for LTE-A inter-band UL CA band 5 and band 48 and DL CA band 2 and band 5 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.10.1.6-1.

Table 7.10.1.6-1: Co-existence study for UL CA band 5 and band 48 and DL CA band 2 and band 5 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **824** | **849** | **3550** | **3700** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 10650 | 11100 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 2701 | 2876 | 4374 | 4549 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | **2052** | **1852** | 6251 | 6576 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 5198 | 5398 | 7924 | 8249 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 1228 | 1003 | 9801 | 10276 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6022 | 6247 | 11474 | 11949 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | 5752 | 5402 | 8748 | 9098 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 13976 | 13351 | 154 | 404 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 15024 | 15649 | 6846 | 7096 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 9452 | 8952 | 4553 | 4928 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 12298 | 12798 | 9572 | 9947 |

#### 7.10.1.7 Co-existence studies for LTE-A inter-band UL CA band 2 and band 5 and DL CA band 2 and band 5 and band 48 and band 66

For 4 bands DL with 2 bands UL, own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were analyzed in Table 7.10.1.7-1.

Table 7.10.1.7-1: Co-existence study for UL CA band 2 and band 5 and DL CA band 2 and band 5 and band 48 and band 66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1850** | **1910** | **824** | **849** |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | **3700** | **3820** | 1648 | 1698 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5730 | 2472 | 2547 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 1086 | 1001 | 2674 | 2759 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 2851 | 2996 | 262 | 152 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 4524 | 4669 | **3498** | **3608** |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limit (MHz) | 4701 | 4906 | 562 | 697 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limit (MHz) | 6374 | 6579 | 4322 | 4457 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limit (MHz) | **2002** | **2172** | 5348 | 5518 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limit (MHz) | 1546 | 1386 | 6816 | 6551 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limit (MHz) | 5146 | 5306 | 8224 | 8489 |
| Two-tone 5th order IMD products | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limit (MHz) | 1153 | 1348 | 4082 | 3852 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limit (MHz) | 6172 | 6367 | 7198 | 7428 |

#### 7.10.1.8 MSD

When uplink CA (band 2 and band 66) is paired with downlink CA (band 2 and band 5 and band 48 and band 66), the 2nd order IMD product by band 2 and band 66 falls into the own Rx frequency band 48. The MSD value from 3 DL band 2 and band 48 and band 66 / 2 UL band 2 and band 66 can be re-used for 2nd order IMD product.

When uplink CA (band 2 and band 48) is paired with downlink CA (band 2 and band 5 and band 48 and band 66), the 4th order IMD product by band 2 and band 48 falls into the own Rx frequency band 66. The MSD value from 3 DL band 2 and band 48 and band 66 / 2 UL band 2 and band 48 can be re-used for 4th order IMD product.

When uplink CA (band 48 and band 66) is paired with downlink CA (band 2 and band 5 and band 48 and band 66), the 2nd and 5th order IMD products by band 48 and band 66 falls into the own Rx frequency band 2. The MSD value from 3 DL band 2 and band 48 and band 66 / 2 UL band 48 and band 66 can be re-used for 2nd and 5th order IMD products.

When uplink CA (band 5 and band 66) is paired with downlink CA (band 2 and band 5 and band 48 and band 66), the 5th order IMD product by band 5 and band 66 falls into the own Rx frequency band 48. The MSD value from 3 DL band 5 and band 48 and band 66 / 2 UL band 5 and band 66 can be re-used for 5th order IMD product.

When uplink CA (band 5 and band 48) is paired with downlink CA (band 2 and band 5 and band 48 and band 66), the 3rd order IMD product by band 5 and band 48 falls into the own Rx frequency band 2. The MSD value from 3 DL band 2 and band 5 and band 48 / 2 UL band 5 and band 48 can be re-used for 3rd order IMD product.

When uplink CA (band 2 and band 5) is paired with downlink CA (band 2 and band 5 and band 48 and band 66), the 3rd order IMD product by band 2 and band 5 falls into the own Rx frequency band 48. The MSD value from 3 DL band 2 and band 5 and band 48 / 2 UL band 2 and band 5 can be re-used for 3rd order IMD product. When uplink CA (band 2 and band 5) is paired with downlink CA (band 2 and band 5 and band 48 and band 66), the 4th order IMD product by band 2 and band 5 falls into the own Rx frequency band 66. The MSD value from 3 DL band 2 and band 5 and band 66 / 2 UL band 2 and band 5 can be re-used for 4th order IMD product.

#### 7.10.1.9 ∆TIB and ∆RIB values

The requirements of low-order combination from TS36.101 can be applied.

7.11 LTE-A inter-band CA: Band 2 and Band 14 and Band 30 and Band 66 DL with 2 bands UL

7.11.1 List of specific combination issues

7.11.1.1 Channel bandwidth per operating band for CA

**Table 7.11.1.1-1: CA configurations under study**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA configuration / Bandwidth combination set** | | | | | | | | | | |
| **E-UTRA CA Configuration** | **Uplink CA configurations** | **E-UTRA Bands** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Maximum aggregated bandwidth**  **[MHz]** | **Bandwidth combination set** |
| CA\_2A-14A-30A-66A | CA\_2A-14A  CA\_14A-30A CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 30 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-2A-14A-30A-66A | CA\_2A-14A  CA\_14A-30A CA\_14A-66A | 2 | See CA\_2A-2A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | | 80 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 30 |  |  | Yes | Yes |  |  |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-14A-30A-66A-66A | CA\_2A-14A  CA\_14A-30A CA\_14A-66A | 2 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 14 |  |  | Yes | Yes |  |  |
| 30 |  |  | Yes | Yes |  |  |
| 66 | See CA\_66A-66A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

7.11.1.2 Co-existence studies for LTE-A inter-band CA 4 bands DL CA\_2A-14A-30A-66A and 2 bands UL

From the lower order fallback CAs, CA 2A-14A-30A, CA 2A-14A-66A, and CA 14A-30A-66A, the IMD issues are identified in the following.

* For 2 uplink CA\_2A-14A, there is 4th IMD to DL band 66.
* For 2 uplink CA\_14A-66A, there is 4th IMD to DL band 2.

7.11.1.3 MSD

The requirements of low order combinations CA\_3BDL\_2A-14A-66A\_2BUL\_2A-14A and CA\_3BDL\_2A-14A-66A\_2BUL\_14A-66A can be applied.

#### 7.11.1.4 ∆TIB and ∆RIB values

The ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 7.11.1.4-1: ΔTIB,c

| E-UTRA CA Configuration | E-UTRA Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_2-14-30-66 | 2 | 0.5 |
| 14 | 0.3 |
| 30 | 0.3 |
| 66 | 0.5 |

Table 7.11.1.4-2: ΔRIB,c

| E-UTRA CA Configuration | E-UTRA NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_2-14-30-66 | 2 | 0.4 |
| 14 | 0 |
| 30 | 0.5 |
| 66 | 0.4 |

# 8 LTE 5 bands DL/2 bands UL Inter-Band Carrier Aggregation: Specific Band Combination Part

## 8.1 LTE Advanced Carrier Aggregation: Band V and Band W and Band X and Band Y and Band Z DL with 2 bands UL

**[Editor Note] It will be updated in future**

Annex A: Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| 2018-08 | 3GPP RAN4#88 | R4-1810260 |  |  | TR skeleton for x bands DL (x=3,4,5) with 2 bands UL inter-band CA in rel-16  -Approved TPs in RAN4#88  **R4-1809797, “**TP on the general part for x bands DL (x=3,4,5) with 2 bands UL inter-band CA in rel-16”  **R4-1810166,** “Draft CR for introduction of CA\_4DL\_1A-3A-42C\_3UL\_CA\_1A-42C and CA\_4DL\_1A-3A-42C\_3UL\_CA\_3A-42C into TS36.101”  **R4-1810255,** “TP on summary of interference studies for new x bands DL (x=3,4,5) with 2 bands UL inter-band CA combinations in rel-16”  **R4-1811503,** “Revised WID for x bands DL (x=3,4,5) with 2 bands UL inter-band CA in rel-16” | N/A | 0.0.1 |
| 2018-10 | 3GPP RAN4  #88BIS | R4-1812215 |  |  | Updated TR 36.716-03-02 for x bands DL (x=3,4,5) with  2 bands UL inter-band CA in rel-16 | 0.0.1 | 0.1.0 |
|  |  |  | Approved TPs in RAN4#88BIS  **R4-1812213, “**MSD test results for new x bands DL (x=3,4,5) with 2 bands UL CA in rel-16”  **R4-1812214**, TP on summary of self-interference analysis for new x bands DL (x=3,4,5) with 2 bands UL CA in rel-16”  **R4-1813773,** “TP for TR 36.716-03-02: CA\_3DL\_3A-11A-18A\_2UL\_CA\_3A-11A\_BCS0”  **R4-1813774,** “TP for TR 36.716-03-02: CA\_3DL\_3A-11A-26A\_2UL\_CA\_3A-11A\_BCS0”  **R4-1812219,** “Revised WID for x bands DL (x=3,4,5) with 2 bands UL inter-band CA in rel-16” |  |  |
| 2018-11 | 3GPP RAN4  #89 | R4-1814768 |  |  | Updated TR 36.716-03-02 for x bands DL (x=3,4,5) with  2 bands UL inter-band CA in rel-16 | 0.1.0 | 0.2.0 |
|  |  |  | Approved TPs in RAN4#89  **R4-1814793, “**MSD test results for new x bands DL (x=3,4,5) with 2 bands UL CA in rel-16”  **R4-1814930**, TP for TR 36.716-03-02:LTE inter-band CA 3 bands DL with 2 bands UL CA in rel-16”  **R4-1814932,** “TP for TR 36.716-03-02: LTE inter-band CA 4 bands DL with 2 bands UL”  **RP-182301,** “Revised WID for x bands DL (x=3,4,5) with 2 bands UL inter-band CA in rel-16” |  |  |
| 2019-02 | 3GPP RAN4 #90 | R4-1900224 |  |  | TR 36.716-03-02 update: LTE-A inter-band CA x bands DL (x=3,4,5) with 2 bands UL in rel-16 | 0.2.0 | 0.3.0 |
|  |  |  | Approved TPs in RAN4#90  **R4-1900197**, “Updated summary of inteference studies for new x bands (x=3,4,5) DL with 2 bands UL inter-band CA in rel-16”  **R4-1900199**, “TP for TR 36.716-03-02 LTE-A inter-band CA 3 bands DL with 2 bands UL”  **R4-1900206**, “Revised MSD result on LTE-A inter-band 3 bands DL CA\_5A-46D-66A with 2 bands UL CA\_5A-46A”  **R4-1900568**, “TP for TR 36.716-03-02: CA\_4BDL\_1-3-41-42 with 2 bands UL”  **R4-1900570**, “TP for TR 36.716-03-02: CA\_4BDL\_1-3-42 with 2 bands UL”  **R4-1900776**, “TP for TR 36.716-03-02: CA\_4DL\_1A-3A-8A-38A\_2UL\_1A-3A”  **R4-1900777**, “TP for TR 36.716-03-02: CA\_3DL\_1A-3A-38A\_2UL\_1A-3A”  **R4-1900778**, “TP for TR 36.716-03-02: CA\_4DL\_1A-3A-8A-38A\_2UL\_1A-8A”  **R4-1902122**, “TP to TR 36.716-03-02 CA\_3DL\_2A-12A-66A\_2UL”  **R4-1902124**, “TP on summary of self-interference analysis for new x bands DL (x=3,4,5) with 2 bands UL inter-band CA in rel-16”  **R4-1900226**, “Introducing CR on new x bands (x=3,4,5) DL with 2 bands UL inter-band CA in TS36.101 rel-16”  **RP-190150** ,“Revised WID on x bands (x=3,4,5) DL with 2 bands UL inter-band CA in rel-16” |  |  |
| 2019-04 | 3GPP RAN4 #90BIS | R4-1903041 |  |  | update: LTE-A inter-band CA x bands DL (x=3,4,5) with 2 bands UL in rel-16 | 0.3.0 | 0.4.0 |
|  |  |  | Approved TPs in RAN4#90Bis  **R4-1903035**, “TP for TR 36.716-03-02 LTE-A inter-band CA 3 bands DL with 2 bands DL”  **R4-1904517**, “TP for TR 36.716-03-02: 1A-1A-3C-5A\_BCS0”  **R4-1904889**, “TP for TR 36.716-03-02: CA\_3DL\_3A-8A-38A\_2UL\_3A-8A”  **R4-1904890**, “TP on summary of self-interference analysis for new x bands DL (X=3,4,5) with 2 bands UL inter-band CA in rel-16”  **R4-1904910**, “TP for TR 36.716-03-02: CA\_4DL\_1A-3A-8A-38A\_2UL\_3A-8A”  **R4-1904924**, “TP for TR 36.716-03-02: 1A-1A-3C-28A\_BCS0”  **R4-1904970**, “MSD test results for new x bands DL (x=3,4,5) with 2 bands UL CA in rel-16” |  |  |
| 2019-05 | 3GPP  RAN4  #91 | R4-1906051 |  |  | update: LTE-A inter-band CA x bands DL (x=3,4,5) with 2 bands UL in rel-16 | 0.4.0 | 0.5.0 |
|  |  |  | Approved TPs in RAN4#91  **R4-1906053**, “ Introducing CR on new x bands (x=3,4,5) DL with 2 bands UL inter-band CA in TS36.101 rel-16”  **R4-1906042**, “MSD test results for new x bands DL (x=3,4,5) with 2 bands UL CA in rel-16”  **R4-1906043**, “TP on correcting MSD of x bands (x=3,4,5) including Band 46 with 2 bands UL CA in rel-16”  **R4-1906854**, “TP for TR 36.716-03-01: 1A-1A-3C-28A\_BCS0”  **R4-1906228**, “TP for CA\_1A-3A-42D with 2UL CA for TR36.716-03-01”  **R4-1906467**, “TP for TR 36.716-03-02: CA\_1-3-3-7 and CA\_1-3-3-7-7 xDL/2UL combinations” |  |  |
| 2019-08 | 3GPP RAN4 #92 | R4-1908686 |  |  | update: LTE-A inter-band CA x bands DL (x=3,4,5) with 2 bands UL in rel-16 | 0.5.0 | 0.6.0 |
|  |  |  | Approved TPs in RAN4#92  **R4-1908687,** “ Revised WID on x bands (X=3,4,5) DL with 2 bands UL inter-band CA in Rel-16”  **R4-1908688,** “Introduction of LTE-A inter-band CA Rel-16 for new x bands (x=3,4,5) DL with 2 bands UL to TS36.101”  **R4-1908724,** “TP on summary of self-interference analysis for new x bands DL (X=3,4,5) with 2 bands UL inter-band CA in Rel-16”  **R4-1910213,** “TP for TR 36.716-03-02: CA\_1-3-3-8, CA\_1-7-8 and CA\_1-7-7-8 xDL/2UL” |  |  |
| 2019-10 | 3GPP RAN4 #92BIS | R4-1911427 |  |  | Update: LTE-A inter-band CA x bands DL (x=3,4,5) with 2 bands UL in Rel-16 | 0.6.0 | 0.7.0 |
| Approved TPs in RAN4#92Bis  **R4-1911428,** “ Revised WID on LTE-A inter-band CA for x bands (x=3,4,5) DL with 2 bands UL in Rel-16”  **R4-1911438,** “Introduction of LTE-A inter-band CA for new x bands (x=3,4,5) DL with 2 bands UL to TS36.101 in Rel-16”  **R4-1911289,** “TP for TR 36.716-03-02 to include 3 bands DL with 2 bands UL band combinations”  **R4-1912585,** “TP for TR 36.716-03-02 to include 4 bands DL with 2 bands UL band combinations”  **R4-1911304,** “MSD test results for new x bands (x=3,4,5) DL with 2 bands UL CA” |  |  |
| 2019-11 | 3GPP RAN4 #93 | R4-1913961 |  |  | Update: LTE-A inter-band CA x bands DL (x=3,4,5) with 2 bands UL in Rel-16 | 0.7.0 | 0.8.0 |
| Approved TPs in RAN4#93  **R4-1913962,** “ Revised WID on LTE-A inter-band CA for x bands (x=3,4,5) DL with 2 bands UL in Rel-16”  **R4-1913963,** “Introduction of LTE-A inter-band CA for x bands (x=3,4,5) DL with 2 bands UL into TS36.101”  **R4-1913285,** “TP to TR 36.716-03-02 for 3DL/2UL CA\_1A-7A-20A”  **R4-1913286,** “Draft CR for 3 DL/2UL CA\_1A-7A-20A”  **R4-1913943,** “TP on summary of self-interference analysis for new x bands (x=3,4,5) DL with 2 bands UL”  **R4-1914535,** “TP for TR 36.716-03-02: CA\_1A-7A-20A with tow UL bands”  **R4-1913287,** “Draft CR for 4 DL/2UL CA\_1A-3A-7A-20A”  **R4-1913854,** “TP for TR 36.716-03-02: CA\_1-3-7-8, CA\_1-3-3-7-8, CA\_1-3-7-7-8, CA\_1-3-3-7-7-8 xDL/2UL combinations”  **R4-1914536,** “TP for TR 36.716-03-02: CA\_1A-3A-7A-20A with two UL bands” |  |  |
| 2020-02 | 3GPP RAN4  #94-e | R4-2001040 |  |  | Update: LTE-A inter-band CA x bands DL (x=3,4,5) with 2 bands UL in Rel-16  Approved TPs in RAN4#94e  **R4-2001041,** “ Revised WID on LTE-A inter-band CA for x bands (x=3,4,5) DL with 2 bands UL in Rel-16”  **R4-2001169,** “Introduction of LTE-A inter-band CA for x bands (x=3,4,5) DL with 2 bands UL into TS36.101”  **R4-2001237,** “TP on summary of self-interference analysis for new x bands (x=3,4,5) DL with 2 bands UL”  **R4-2001238,** “MSD results for new LTE-A CA band combinations in Rel-16” | 0.8.0 | 0.9.0 |
| 2020-04 | 3GPP RAN4  #94Bis-e | R4-2003220 |  |  | TR36.716-03-02 v0.10.0 LTE-A inter-band CA for x bands DL (x=3,4,5) with 2 bands UL in Rel-16  Approved TPs in RAN4#94-bis-e  **R4-2003221**, “Revised WID on LTE-A inter-band CA for x bands (x=3,4,5) DL with 2 bands UL in Rel-16”  **R4-2003222**, “Introduction of LTE-A inter-band CA for x bands (x=3,4,5) DL with 2 bands UL to TS36.101”  **R4-2005166**, “TP on summary of self-interference analysis for new x bands (x=3,4,5) DL with 2 bands UL”  **R4-2003244**, “MSD results for LTE-A inter-band CA for x bands DL (x=3,4,5) with 2 bands UL in Rel-16”  **R4-2005040**, “TP for TR 36.716-03-02: CA\_1A-18A-41A and CA\_1A-18A-41C”  **R4-2003245**, "TP on 3 bands DL and 2 bands UL CA in Rel-16”  **R4-2003246**, “TP on 4 bands DL and 2 bands UL CA in Rel-16” | 0.9.0 | 0.a.0 |
| 2020-05 | E-mail approval after RAN4 #94-e-bis | R4-2005871 |  |  | TR36.716-03-02 v0.11.0 LTE-A inter-band CA for x bands DL (x=3,4,5) with 2 bands UL in Rel-16 | 0.a.0 | 0.11.0 |
| 2020-06 | RAN4 #95-e and e-mail approval | R4-2006723 |  |  | TR36.716-03-02 v1.0.0 LTE-A inter-band CA for x bands DL (x=3,4,5) with 2 bands UL in Rel-16  Approved TPs in RAN4#95-e  **R4-2008333**, “TP to TR36.716-03-02 on 3DL/2UL CA\_2-14-66”  **R4-2008334**, “TP to TR36.716-03-02 on 4DL/2UL CA\_2-14-30-66”  **R4-2006792**, “TP on summary of self-interference analysis for new x bands (x=3,4,5) DL with 2 bands UL”  **R4-2008331**, “TP to TR36.716-03-02 on 3DL/2UL CA\_2-14-30”  **R4-2008332**, “TP to TR36.716-03-02 on 3DL/2UL CA\_14-30-66” | 0.11.0 | 1.0.0 |

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| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-06 | RAN#88 |  |  |  |  | Approved by plenary – Rel-16 spec under change control | 16.0.0 |